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Detection and Prevention of Wormhole Attack in Wireless Sensor Networks

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***Abstract*—A fundamental problem when transmitting a significant message via a wireless connection in a wireless sensor network (WSN). Attackers can use this to get into the network and launch a few possible attacks to intercept or change actual data. As a result of network sensors' lack of routers, every node that is part of the network must use the same routing protocol to facilitate the transmission of packets. It presents some security challenges in compounded topology, where its unguided existence frequently leaves it vulnerable to attacks against protection, especially when unguided. The wormhole is a well known example of an attack that poses the most significant risk due to the difficulty in finding and stopping it. In this paper, a brand-new routing technique that aims to provide a secure path for data transmission is presented. Wormhole attacks are taken into consideration in research, and the method used to do so aims to find and stop attacks of the type that have been identified. The suggested procedure is validated using specific performance-related WSN parameters. The generated results are evaluated based on metrics such as energy efficiency, end-to-end delay, and packet delivery ratio. These results are then compared to those of other recent techniques in the same field, and it has been determined that the exhibited research is the most effective among the methods mentioned for the parameters under consideration.**

***Index Terms*—AOMDV, WSN, Cluster, LNCA, Detect, Prevent, Malicious Node.**

I. Introduction

In the WSN, a number of sensor nodes are used to monitor large geographic regions, and they are designed with features such as low bandwidth, storage, and power usage to sup- port environmentally friendly forecasting technologies. Sensor nodes collect data and are distributed to WSNs in different regions. When used within a WSN, sensor nodes can process signals, sync data with the base station, and verify routes using a minimum number of resources. Wireless sensor networks are thought to be helpful in various settings, including control overthe environment, defense and military applications, deployment of robotics, and many more. WSNs are now vulnerable to various assaults as a result. These threats are alleged to involve a wormhole attack, which is a type of denial-of-service attack that utilizes both in-band and out-of-band networks. Wormhole attacks are classified as harmful attacks in a wormhole link or tunnel is a type of connection in which malicious and attacker nodes are interconnected through a fast channel connection speed. Wormhole attacks involve at least two malicious nodes, also known as attackers. The attackers take control of the network to access the data, and intruders are able to monitor wireless activity. In Mobile Ad-hoc Networks (MANETs), all nodes are mobile and able to move, but because WSN nodes have a fix protection issue for mobile, Ad-hoc networks are still useful [1–4]. Network security is complex, while the sensor nodes mobilize their locations. In a MANET, a node is a device that communicates with other nodes without the use of a central base and often serves as a point of communication between nodes. These medium nodes function similarly to multi-hop radio networks when used with routers connected wirelessly and ad-hoc networks do not require pre-existing networking infrastructures in order to function.

II. Existing System

WSN clustering is essential to minimize energy usage and maintain the consistency of the device. Clustering is a well known and widely used technique in wireless sensor networks. Clustering is currently being implemented over a distributed approach to address problems such as network lifetime and resource availability. Clustering into sensor nodes is crucial to addressing many issues, including those with sensor networks' lifetime, scalability, and energy consumption.Algorithms that cluster data limit connectivity within domains and only sendnecessary data to the rest of the system via forwarding. A cluster consists of many nodes, and the local communication among the nodes are measured by the cluster's head (CH). The set typically interacts with its participant cluster to gather data. The cluster heads form one more layer of groups between themselves before they reach the drain [7,8]. The implementation of a cluster-based architecture requires extensive work. The benefits of clustering are numerous, but sensor networks also have their restrictions, issues, or challenges. In this section, we discuss some specific design and deployment issues that were addressed in the development of the network architecture based on clusters.

A. Node Mobility

Nodes in the network are often assumed to be stationary when the network is designed. However, frequently it becomes necessary to advertise the adaptability of base

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stations or CHs.As a result of node mobility, clustering is observed to be more complex because node membership can change dynamically [9].

B. Traffic Load

Sensors monitoring events can either be intermittent or persistent. Traffic will increase due to regular and continuous monitoring and tracking, which generates traffic when the relevant incident is observed. Events that occur intermittently forthe CH chosen from the sensor's population require. Loading of cluster members in an irregular manner and rotation of cluster member's position. However, intermittent events do not require periodic sensing, so the CH is not affected.

C. Overlapping Clusters

CH may have been pre-designed by the network's designer or selected by its sensors. If the eventual option is chosen,it is likely that one cluster member will join another CH. Cluster overlapping in architecture problems must also be considered. For optimal organization between groups, detecting overlap- ping clusters in order to develop the perfect structures is crucial to avoid gridlock, hunger, or unfairness during the competition for resources [10].

D. Load Balancing

It is crucial to balance the placement of sensors in sensor networks. Sensor nodes need to be distributed evenly among the available CHs, as malfunctioning CHs may overwhelm others and cause the S. Singh, H. S. Saini 1 3head loss. Creating equal-sized clusters in these situations is crucial fora good balance.

E. Dynamic Cluster Control

A node of a grouping device that is self-configured is required. Initial clusters are created by clustering processes and need to confirm their surroundings. They are produced based on various metrics, including the data's usefulness, nodes' capabilities, network bandwidth, etc. A significant challenge for any clustering Programme is the requirement that the cluster members evaluate each node's contribution asthe process progresses. According to [10], The CH should be selected in a new round of head elections when the target is outside its sensing range.

F. Inter-cluster Coordination

To achieve the desired outcome, CHs needed to connect. Toexchange knowledge and work as a team, they must cooperate.A different cluster head or base station in the network can request additional data collected by one cluster. The self- configuring grouping process must be able to accommodate coordination overheads between groups.

G. Data Aggregation

The cluster head must aggregate or transfer data from cluster nodes to the CH, which requires more resources.Therefore, due diligence should be exercised when deciding on the CH. Switching positions between various nodes regularly makes it possible to maintain the CH's energy. Another option is to obtain an effective node that can handle the additional energy requirement as the CH.

H. Failure tolerance

Failure tolerance can maintain uninterrupted sensor network functionality in the face of sensor node faults. Some sensor nodes may fail or become blocked as a result of power outages, physical harm, or environmental interference.Possible failed nodes include a CH or a piece of the cluster. Such failures shouldn't impact the overall mission or analyzing sensor performance network. Therefore, having a system that can react to these types of errors is crucial

I. Scalability

The number of member clusters in a cluster that was initially created should be changeable by CH, either increasing or de- creasing. The membership of a group can fluctuate fora variety of reasons. An environmental threat, for instance, could cause a cluster participant to fail. During this time, the CH can react to a drop in membership. Instead, under certain circumstances, the number of participants may increase in search of new nodes installation, the present CH may malfunction, etc. There must be consent from the sensor network. The number of clusters should be increased or decreased.

J. Number of Clusters

Cluster numbering, or the total number of clusters, is a crucial architecture problem that needs to be resolved. To maintain overhead control and minimise network complexity, the cluster count must be at its maximum. To create an energy- efficient network, the ideal number of clusters would be built.

K. Cluster Formation Time

The network's initial clustering time should be brief. Events like selecting the cluster count option, gathering CHs, and assigning cluster members to a CH should be completed as soon as possible.

L. Single hop vs Multi hops Network

Multiple-hop communication can be used in clustering as well as single-hop communication. Because transmitting energy varies by square size, a multi-hop network is also ideal for energy conservation. [11]. The Multi-Hop Network presents architectural issues with topology management and media access control.

M. Node Heterogeneity

Some sensor applications require deploying a complex mixture of different types and capabilities of sensor nodes. Networks may be subject to a variety of service quality constraints and follow a variety of data reporting models. Various sensors can produce data at varying rates. The heterogeneous model would be unable to cluster, making CH's task more difficult.

N. Cluster Formation

When forming the cluster, many factors must be taken into consideration, such as whether it will be centralized or decentralized, how many groups will be included, and more. Topics such with sensor network architecture can be resolved by routing protocols that Centre on clusters. Unexpectedly, every sensor in a group is now the cluster head, dividing the energy load equally among the sensors. A

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network's predetermined CH allocation is made by the builder.

O. Self-Configuration and Reconfiguration

One of the primary phases of cluster development is the self-organization process. Clusters ought to be able to adapt automatically to their environment. The ease with which the network can self-organize concerning the functional unit ispart of the wireless sensor network's main drawbacks. Tomaximize network lifetime, self-organizing process is expected to be energy efficient and reconfiguration or replenishment. The self-organizationmechanismis reconfigured. When new sensor nodes are added or removed [12].

III. Challenges in Existing System

Networks become vulnerable to wormhole attacks; it receives data packets without knowing their source, draining the node's power and interfering with packet delivery. Additionally,processing received packages to a node that has never been included in the network, the wormhole in the network impacts the WSN's overall performance. The system that can anticipate the wormhole path avoids the crucial need, and a hole-free route for data transmission is projected after studying the literature on wormhole assault detection and the clustered WSN. By creating wormholes in the network, packets are received without knowing where they hail from, consuming energy and interfering with packet delivery.WSNs suffer from performance problems caused by packages sent to non-WSN nodes that have never been included in the network. It is crucial to think of the system in a way that can predict the wormholes in the path and the hole-free path for data transmission.

IV. Literature Survey

Simulation results refer to the common EEHRCP that focuses on the wormhole, whereas the proposed EEHRCP targets the wormhole. The wormhole attacks employ the round path length and have been added to the EEHRCP algorithm, and the simulation results refer to the common EEHRCP that targets the wormhole. According to the simulated results, performance can be increased by[26]. The authors used distributed trust models to isolate the misbehaving nodes. Routing has been successful using a multi-facet routing scheme. The authors improved the energy effectiveness of the network. According to Mehetre et al., a trust-based routing method might be used to ensure secure routing by using encryption. [27]. A two-stage security system was used to secure the data packet at the node selected by the authors. A cuckoo search algorithm was used to choose stable routing routes. Based on the activation function,[28] suggested a reliable set of neighbors. The purpose of this plan was to increase network security. Based on energy restrictions, the authors evaluated the significance of confidence. An additive measure was used to estimate the node, preserving the reliability of nearby nodes as well for WSNs, Deepa and Latha [29]. A hierarchical secure routing protocol was proposed by him in a hybrid routing protocol focused on clusters. Selecting the coordinator's head uses an algorithm that considers a different hierarchical group. Using an algorithm to define negative nodes, the authors selected the coordinator's head or coordinating node. When danger nodes were detected, the data was transmitted along the shortest path. Energy-aware systems based on trust were proposed by Zahedi and Parma [30]. The authors enhanced the routing functions metrics by including the node'sindirect and absolute confidence values also the energy conservation issue. The authors distinguish between the malicious nodes and the regular nodes using the measured confidence values. Mohajeran and Gharavian [31] proposed a routing method derived from the imaginative optimization of an ant colony. The writers of WSN wanted the network to last longer. With this approach, the authors achieved balanced transmission, further enhancing the energy efficiency route. In their proposal to identify malicious nodes using a multi- attribute trust protocol, Ram Prabha and Latha [32] YurongXu proposes that neighboring nodes detect distributed wormhole attacks based on the number of leaps determined by the node by analyzing the importance of trust with measurements like accuracy, node elapsed time, and development in messages, etc. The quickest method is to build an auxiliary graph in that case. Local map deformation is set up in an attempt to identify the wormhole hazard. Define the black hole relation using the diameter feature. The wormhole pinpoints the threat automatically when the diameter of the network reaches a certain level. The simulation's conclusion indicates that the suggested technique's identification rate is only about 80% and is not very accurate [33]. In response to Rupinder Singh's hybrid wormhole detection model, a packet is used for every hope, drop, and delay. After estimating the node's packet loss probability using the deteriorating chance of existence, whichis calculated concurrently with path discovery, a probability of packet damage is calculated for the entire route. The type of attack through a wormhole is determined using these likelihood criteria [34]. Every node preserves information with the aid of the routing method protocol for almost every one of its neighboring nodes as part of the defence against wormhole assault, according to the suggestion by Parmar Amish et al. If the route information cannot be identified, the node drives a response packet while waiting for a response. Routing table is developed with the current route map, a target node determines a path that takes the same direction to reply to the sender of the data packets. If the sender receives multiple answer packets, it recognizes them:" Out there, there are many roads."When the round period (RTT) is less than the limit, the sender node defines a wormhole attack, estimates and compares the RTT to the limit, and drops specific routes [35]. A wormhole discovery approach using a critical methodology and packet leash was established by Mousam A. Patel et al. A promising method involves a watchdog node that continuously monitors the network, inspects packets submitted by a source, and then forwards them while covertly monitoring their transit. To assist the sender node in locating wormholes in the network environment, packet straps need to be aware of the node's spatial orientation and the node's way [36].

V. Methods and Proposed System

A. LNCA Outline

Phase I: Make a cluster where each step is finished through- out the study of a specific period

Step 1: Readings obtained from data interchange.

- Information is collected from the site by each node.

DOI: rp-9788770040723.001

- Notifies its nearby neighbors of the information. In return, the same node party sends data, which the node collects.
- A node evaluates its reading in relation to the receiving node when it has access to information from its immediate neighbours. When the measurements are comparable, the transmitting node increases the “degree of node” by one.
- The transmitting node id is kept in the neighbour node list by the receiving node.

Step 2: Graduation Node Exchange.

Each node informs the neighbours in its immediate area of its “remaining energy” and ”node degree”. In return, the node collects the data sent to the nodes in a group that is similar to itself. In the list of adjacent nodes, each node’s” node degree” matches that of the divisions. As the cluster’s representative, the node chooses itself. When a node chooses a CL as the cluster head, it has higher residual energy in G and shares its degree with the nearby node population (let’s say group G) ifit has the most significant degree of nodes (CH). Nearby nodes have the same residual power or full node degree if a tieis resolved by a node ID group. When a node has the lowest node ID, for instance, the cluster leader chooses itself.

Step 3: Statement from the cluster head.

- Announcements were sent by the cluster heads (CH) chosen for their local neighbours in Stage 2. In CH announcements, the TTL3 is set to a large number.
- If the “neighbouring node list” of the cluster head node contains the final hop node from which the package was created, the cluster head node receives the CH post.Node tests Receiving node: If the acquired CH note’s TTL is reduced by one if the last-hop node is found in its listof nearby nodes. If the TTL is less than zero, the node broadcasts the CH notification to its neighbours. Theparameter ”received” 4 has been verified
- If “Cluster - head Received” is set to false, the source node - a root node that generated the Cluster - head notice - is declared the cluster head, and “Cluster - head Received” is set to true. Messages the cluster header to finish the “registration” process. 5 If “Cluster - head Received” at a node’s endings for Step 3 is still ”wrong,” that node should be chosen as a ”directed cluster head,” rather than a Cluster - head.

Step 4: Cluster formation in the end:

In the event that a cluster is produced, the Cluster- Head adds the provided node ID to the “member node list” and receives a “registration” request.

B. *Proposed System*

This section discusses the recommended wormhole detection algorithm. The CH (Cluster Head) performs a crucial role inner the network. The two-layered approach is utilized to lessen the CH node’s load. Every node of a sensor is distributed randomly within the ocean. The sensor nodes’ job is to detect and convert the data to CH. The CH aggregates all the data it collects, which is subsequently sent to buoys on the ocean floor. The buoy on the ocean floor communicates with the base stations that analyse the detected data. LNCA is a possibility for cluster formation. The following might be used to explain LNCA clustering. A cluster head election process is achieved by randomly deployed nodes, regardless of size. Each node transmits a physical value to the number it is closestto. Node degree computation is the process of calculating all numbers of nearby neighbors. Sensor nodes with the highest node degree are designated as cluster heads.

C. *System Architecture*

We propose a specific method for the detection of the wormhole attack in the clustered network. Sensor nodes are immediately established, or various routes from the source to the AOMDV routing protocol are used to construct destinations. LNCA is one of the research methodologies that is frequently used to cluster the nodes for which similarity between the nodes is considered to be a significant concern. Additionally, at the initial phase of the node’s deployment, cluster formation is taken into consideration. The routing protocols table contains information such as RTT, ETD, Th, P Sent, P Received, etc., which is calculated using the hop countand some initializations. Each node in a cluster needs accessto this information. The system architecture shows howthe method operates in stages as it looks for network worm- holes.

D. *Steps of Proposed Technique*

Step 1: Organization of nodes; LNCA technique used for cluster formation.
Step 2: K numbers of paths are generated in accordancewith the AOMDV routing protocol.
Step 3: When the tp1 timer is triggered, a DP (Detection Packet) is sent from S to D
Step 4: P Sent is equal to P Sent plus 1.
Step 5: After receiving an assessment packet from D, S ends the timer by computing. To determine ETD, subtract tp1 from tp2.
Step 6: Each node maintains an estimate of the parameters such as RTT, ETD, Th, P Sent, and P Received in the routing protocol table.
Step 7: A timer td1 will be set once the link is established, and S will begin sending packets of data. The process starts at td2 and ends at that time, assuming the FP is received there.
Step 8: RTT is calculated as td2 minus td1.
Step 9: A RTT will occur if: the ETD follows.
Step 10: Then CH Using this formula, P = P Sent(S, D) -P Received(S, D).
Step 11: By dividing the average RTT by the total number of leaps, a threshold is determined.
Step 12: It follows that if P ¿ Th
Step 13: Alert CH to any malicious behavior
Step 14: CH advises S to take the alternate route by joining D and for going that path
Step 15: End.

DOI: rp-9788770040723.001

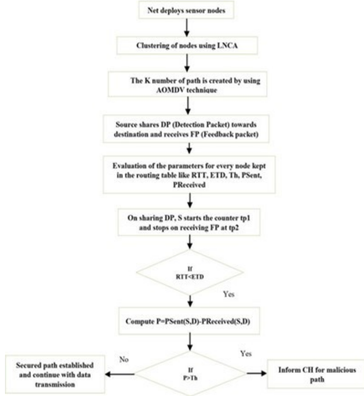

Fig. 1. Working architecture of the research methodology

VI. Results and Discussions

It predicts the hole-free data transmission method based on the path's wormhole. The network is vulnerable to wormhole attacks; it receives data packets without knowing the source, draining the node's energy and interfering with packet delivery.

Receiving packets are forwarded by the network wormhole to an outside node that has never joined the network, affecting the WSN's overall performance. In clustered WSNs, an essential requirement is to consider the literature just like that to avoid wormhole attacks. Using the wormhole present on the path, it forecasts the hole-free path for data packet transmission. Figures depict network formation following. The research methodology was simulated in NS2. The graphs represent the transmission of data between nodes orfrom a CH to lower-level nodes. Two different communication paths are shown in Fig. 5 and 6, and in Fig. According tothe methodology, the 1red line shows where a wormhole is located. As shown in Fig. 13, the packet considers path two after detecting a malicious or wormhole-containing direction. The blue line represents data transmission.

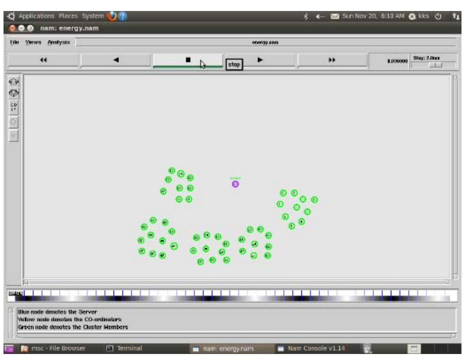

Fig. 2. Research methodology working architecture

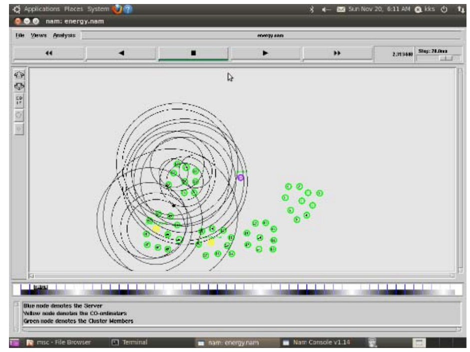

Fig. 3. CH Invention

Energy Consumption

Prior to choosing the best path, each free-path attacker's total energy must be calculated. In addition, the total energy in the attacker's free direction is calculated by adding theenergy levels at all intermediate nodes. This can be examined as.

Energy Consumption =Total Energy - Remaining Energy

Energy Efficiency = Remaining Energy Duration of the delay from beginning to end

The length of time it takes for each packet to leave the sender node and travel to the destination is defined as delay.

Delay = Received Time – Transmitted Time / Number of Packets

Fig. 4. Network communication between nodes

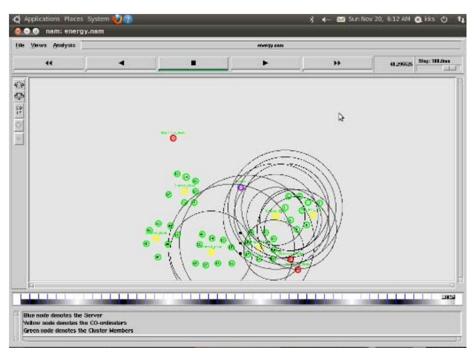

Fig. 5. Wormhole Detection

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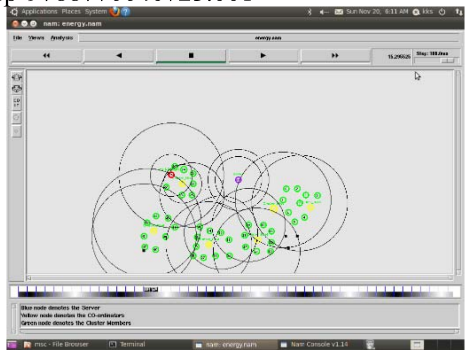

Fig. 6. Discover all Wormhole nodes

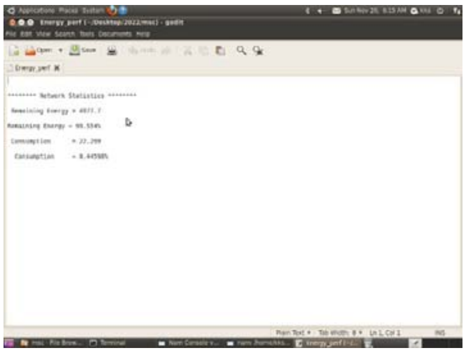

Fig. 7. Efficiency and Consumption Calculation

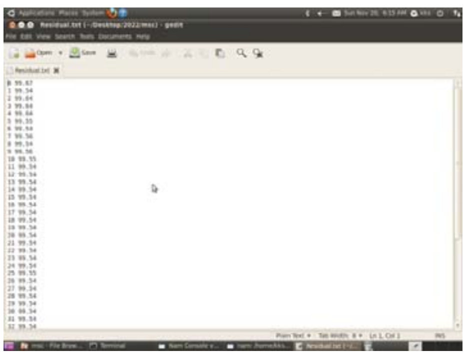

Fig. 8. Residual Energy of all Nodes

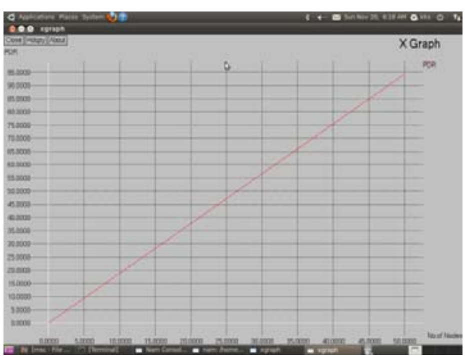

Fig. 9. Delay graph

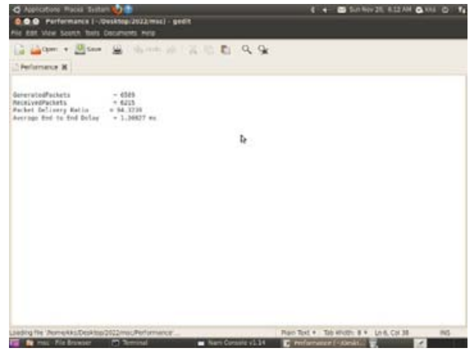

Fig. 10. Performance Calculation(PDR and Delay)

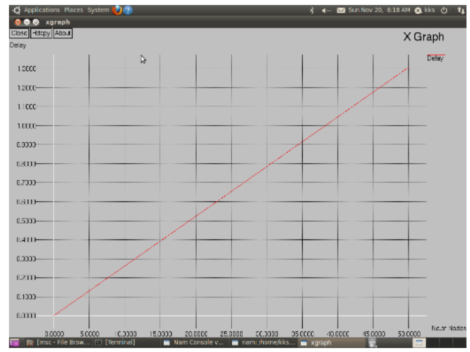

Fig. 11. PDR graph

Packet Delivery Ratio

The proportion of all packets created by the client node to all packets obtained by the end target.

PDR = Received Packets/Generated Packets * 100

When the comparison study considers both the EEHRCP and the AD-PSO in addition to the advisedmethod, and after results for all of the techniques taken into consideration were evaluated, it was found that the suggested technique (i- AOMDV) had a higher delivery rate for all network sizes.

VII. Conclusion and Future Work

A. *Conclusion*

The methodology is used here to detect wormhole attack on clustered networks. Sensor nodes and different routes are deployed in the early stages. AOMDV allows sending and receiving ways to be created. The LNCA technique, which organises the nodes into clusters, with the degree of similarity between the nodes being of paramount importance; is employed with regard to the study design, grouping the nodes during their initial deployment stage. Cluster formation is alsotaken into consideration at this stage. The performance assessments of the suggested technique based on variables like point-to-point delay are shown in graphs in the analysis section. Packet dropped ratio and energy consumption.

B. *Limitations of the Work*

- Prevention is a big challenge in this work.
- Wormhole detection is only possible.

DOI: rp-9788770040723.001

- We can't detect other attacks such as black-holes, vampire

C. Future Work

Integrate detection and prevention mechanisms to find malicious nodes and deliver more packets. Using the neighboring node's address as the bait's target address instigates RREP to bait the malicious node and respond, thereby tracking down the malicious node and preventing the attack. Use the Network Simulation Tool (NS2) to perform experimental simulations under various network conditions and evaluate performance metrics concerning packet delivery rate, delay, overhead, throughput, and energy.

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An Survey E-Examination Framework for Visually Challenged People Using a Voice Synthesizer

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***Abstract*—A Online Exams for the Blind is a software product that allows certain foundations of exam planning, administration, and administration to be done online. Either the Internet or your local network environment can be used for this. The exam software evaluates the answers given and results are available as soon as the exam is completed. The online exam system offers visually impaired students the opportunity to operate the system conveniently. Creating online exams is a big obstacle for individuals who are blind. The initiative created additional features to aid those who are visually challenged in their employment in order to prevent such issues. Here are the two types of languages he has implemented for creating questions. These are Tamil and English. The system allows traversing/navigating the stack of questions, makes it easy to submit answers, and maintains simplicity and confidentiality. Or, if desired, double-check all submitted responses prior to submission and using a voice synthesizer, the system will notify the candidate of the 'time left' increase. There is a lot of noise and confusion for other students when numerous visually impaired individuals take tests at the same time. Such disturbances will be reduced as much as feasible with the support of this project.**

Key Words: Visually Challenged, Examination System, Tamil, Traverse/ Navigate, Confidential, Voice synthesizer, Disturbances.

I. Introduction

Machines can be trained to interpret images in the same way that humans do, and to examine an image's features in greater detail than humans do. Face recognition on mobile phones and other apps to assure high level security, spotting and identifying objects and patterns in photographs and videos, and other modern technologies are all made possible by artificial image processing intelligence. Currently, image processing is widely used in a number of industries, including surveillance, law enforcement, gaming, biometrics, self-driving cars, and medical visualization.

Using visualization, which displays processed data in a way that is understandable to humans, provides visual representations of simple things that aid in decision-making, picture retrieval, which aids in image-based search, and image sharpening and restoration, which raise the caliber of processed images. Object detection, a technique for identifying things in images, Pattern recognition categorizes items, determines where they are located, and recognizes the hidden pattern in an image.

One of the necessities of daily existence is now the internet. The Internet is widely used by all people to access knowledge and information. However, accessing these text resources and using any online service can be challenging for those with visual impairments.

The development of computer-based accessible solutions has greatly expanded the range of opportunities available to those who are blind or visually impaired. The screen readers, an audio feedback- based virtual world, have greatly aided blind individuals in using online apps.

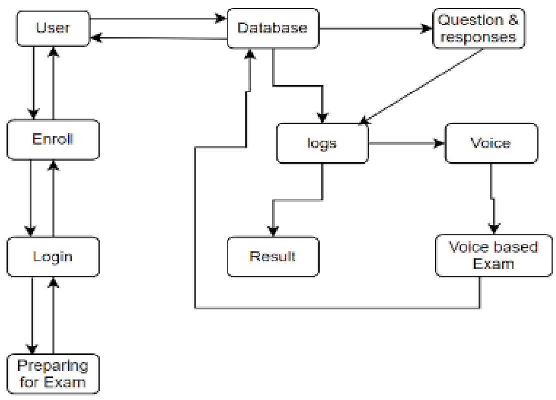

Fig: 1.1 Flow Diagram

The system is attempting to implement an exam system that would be beneficial for those who are visually impaired. It will prompt numerous questions and then obtain the response as the response with the help of keys that are integrated into the system. This will not only help each other to become more independent instead of relying on others' assistance. There are various systems like Voice Synthesizer (text-to-speech), image processing, Machine Learning with python which use the functions of Training Dataset, speech recognition (speech-to-text) and it will be necessary to get input from the students in the form of their voices in order to recognize the images for regulating and sustaining the system's flow. The key advantage of this system is that it only uses the user's voice when absolutely necessary, thus it won't need a strong or constant Internet connection. The user will be given voice prompts from the system asking them to carry out specific actions, and they will comply.

II. Literature Review

The pre-requisites for the proposed system have been predicted using current knowledge or approaches that may be appropriate after reviewing finished and ongoing research. The descriptions of the research publications would be as follows.

[1] **“**University Examination System for Students with Visual Impairments”Konstantinos Papadopoulos, ZisisSimaioforidis, KonstantinosCharitakis,andMarialenaBarouti - University of Macedonia, Thessaloniki, Greece

This paper “University Examination System for Students with Visual Impairments” by Konstantinos Papadopoulos, ZisisSimaioforidis, KonstantinosCharitakis,andMarialenaBarouti in this text is the creation of a web-based application, a complete application for university entrance exams. It is easy to use for visually impaired students and allows them to familiarize themselves with the established examination system with little effort. A user interface for those who are blind or visually impaired is built on the idea of intelligible text that students must read and write for tests. The N-print test dataset was used in this study to test 24 Greek lowercase letters and the numbers 1-9. Character and line breaks were also tested and assessed using it. The heads of 363 individuals were distributed in an unusual pattern and positioned 30 cm away from the screen

Advantages

1. Enables visually challenged pupils to choose from a variety of predefined settings for the presentation of digital text.
2. Depending on your preferences, you can choose what to do before the exam.

Disadvantages

1. Lacks timesaving, auto-tagging and reporting features.
2. A necessary part of rate grading and reporting, but also an administrative burden.

[2] “E-Examination Using Voice Interface for Visually Impaired Students” Aswathy M S, LijiSameulSree Buddha College of Engineering, Ayathil, Elavumthitta, Pathanamthitta, Kerala, India

This paper “E-Examination Using Voice Interface for Visually Impaired Students” is Aswathy M S, LijiSameul. This paper is all about developing an Open Distance Learning voice-based expert system for online tests for visually impaired students. It uses tools and methodology such as Java expert system, Shell, Voice XML, MYSQL, Voice User Interface and Voice Command Device, and K-Means cluster and shuffling Algorithm. Voice Xml is a key component of VUI systems and enables users to navigate a speech system. The database was updated using MySQL

Advantages

1. Accessible to all types of children, regardless of their handicap.

Disadvantages

1. ODL technology is entirely text-based and graphical. Thus, visually impaired individuals cannot do it.

[3] “Voice and Speech Recognition In Tamil Language” R. Kiran, K. Nivedha, S.Pavithra Devi, Subha.T Department of information Technology, Sri Sai Ram Engineering College, Chennai-44, Tamil Nadu.

This paper “Voice and Speech Recognition In Tamil Language” by R.Kirani, K.Nivedha,S.Pavithra Devi, T.Subha is a well-liked technological development that enables user contact with current technologies. It is often referred to as "computer speech recognition," "automatic speech recognition," and "speech to text". Tamil voice and speech recognition on smartphones has not received much attention. Automatic Speech Recognition (ASR) includes Dynamic Time Warping (DTW) Machine Learning techniques,Neural Networks (NN), Support Vector Machines (SVM), and Decision Trees (DT). Statistical Pattern Matching methods are divided into Gaussian Mixture Models (GMM) and Hidden Markov Models (HMM). ASR has achieved the highest word recognition accuracy possible, providing 86.5 and 92% during testing and training processes.

Advantages

1. Text messages make communication simpler for both sender and recipient, and audio data in Tamil is converted into Tamil text by mobiles' voice recognition systems.
2. Tamil is frequently used in speech recognition software, which raises its usage and raises public awareness of it.

Disadvantages

1. Indian smartphone users have found it difficult to use voice recognition software because of the lack of development in local languages. In this technical process, people who feel using these systems in a foreign country can be challenged instead of their own tongue.
2. The language barrier restricts the use of these applications, and there is no flexibility for native users.

[4] “Voice-based Online Examination System for Visually Impaired” ThajunNajaah, Samsudeen, ThowfeekAhamed Digital Mobility Solutions Lanka (Pvt) Ltd, Sri Lanka Institute of Advanced Technological Education (SLIATE) - 2021

This paper “Voice-based Online Examination System for Visually Impaired” by ThajunNajaah, Shamsuddin, ThowfeekAhamed is about information technology that has a great impact and life is easier in the development of fast-expanding technologies and applications. Voice-based online test systems enable students to take exams online using speech synthesis and speech recognition. This helps visually impaired people with developing their careers. The methodology used is the Correlation coefficient, which reduces the difficulty and increases the irony between visually impaired education and establishes the societal environment. The correction of spelling from the student answers is done using the generation of a word set together along with the production of raw and semantic vectors. The correction of spelling from the student answers is done using the generation of a word set together along with the production of raw and semantic vectors.

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$$Vi = Si * \mathrm{I}(mi) * I(ni)$$

mi - a word in a word set ni - the generation word in answers. I (mi) and I (ni) are the information content of mi and ni, respectively.

Advantages

1. It enables the student to attend the exams without disturbance from their surroundings. It is fully controlled by voice commands.
2. They can check for the answered and not answered questions.

Disadvantages

1. No noise filtering technique is added to this system.
2. Applicable only to the English language, not to other languages.

[5] "Development of an Examination Based System for the Visually Impaired Persons" Chukwuemeka[1], Ituma[2], Oyiga[3], Samson[4], Ebere[5], Department of Computer Science, Ebonyi State University, Abakaliki, Nigeria,Enugu State Polytechnic Iwollo, Enugu, Nigeria, Destinet Smart Technologies, New layout, Enugu, Nigeria

This paper, "Development of an Examination Based System for the Visually Impaired Persons" by Chukwuemeka, Ituma, Oyiga, Samson, Ebere, the main motive behind this paper is to make it easier for those who are blind or visually impaired to access high-quality education and in order to remove the barriers. The applications using this system are Examination Registration, Admin Registration, Training, Speech Recognition, Results. The dataset used here is the MySQL dataset and techniques like filters, photonic analyzers and voice synthesizers were used to achieve this. These were developed using universal modelling diagrams, and their implementation required MySQL and a Visual Studio Tool. Background noise hindered the overall system performance when it was examined. This performance is made possible by using an earpiece and mouthpiece to cancel out outside sounds. This resulted in students to able to successfully participate in the exam and getting the final score.

Advantages

1. The performance was hampered by background noise, but an ear and mouthpiece were employed to cut down on it while maintaining a high level of performance.

Disadvantages

1. Lack of independence.
2. Lacking the ability to compute results in real time, findings may be manipulated as a result of delays.
3. Lack of intellect or social skills to instruct the blind students on how to proceed, hence the mentor must be present during the exam to assist the student.

[6] "Online Examination System for Visually Challenged" MukulChowdary, ReshmaPriyanka, Srinivas, Rajesh, N. Leelavathy - Student, Professor, Department of Computer Science and Engineering, Godavari Institute of Engineering & Technology, Rajahmundry, AP

This paper "Online Examination System for Visually Challenged" - MukulChowdary, ReshmaPriyanka, Srinivas, Rajesh, N. Leelavathy is feasible on a local network or on the internet. The results are made accessible right away once the student submits their answers to the inquiries on their examination using a computer. This helps them to easily interact with the online system because of its accessibility features. For internet connection problems, this system has a feature which helps them to prevent them. Although it is possible to convert speech into text and convert text into speech, the capability currently available might be enhanced. Without the internet, this system's accuracy would be substantially lower. In this system, particular keys are employed to keep system flow in check. The student's voice should be given as input and that uses speech to text to sustain system flow. The system can navigate through the question stack and submit the answer with ease by integrating the keys, retaining simplicity and secrecy and students can relist to the question, alert the answers as needed using the designated keys. The tools and methodologies have the capacity to translate voice to text, and the ability to translate text to speech is constructed with the aid of libraries in Python to provide them with greater functional support. The applications included in this system are use of the keyboards and prompting the microphones.

Advantages

1. At the result of the test, the user may easily review all the questions they have already answered as well as any ones they haven't.
2. There is no need for a recorder during the examination

Disadvantages

1. No offline packages are available.
2. Users can't choose between the different sections - what they prefer to do.

[7] "Voice Operated Tool- Examination Portal for Blind Persons" - Akriti Vats, - Tandon, - Sinha, 2016

This paper ""Voice Operated Tool- Examination Portal for Blind Persons" by Akriti Vats, Tandon that the usefulness of speech recognition software is increasing these days. There are numerous interactive speech-aware programs. The need for embedded systems demands is growing, making the voice recognition system accessible on future embedded systems effective. In order to avoid the need for any support when administering a multiple-choice question test, the program for desktop computers is called the Examination Portal for Blind Persons. This system is a Web- based application and mobile application which is for native users. These system tools and methodology include computer speech recognition, Automatic speech recognition and the methodologies include Voice operated tool, Google voice and Siri. These applications include uplifting of blind users, handling different modules - question bank, candidate details, result analysis and the intelligence of blind people.

Advantages

1. One may simply control a computer network by speaking commands rather than clicking keys on keyboards.

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2. The people who can't use their hands or can't seem to give exams by just using their voices.

Disadvantages

1. No recognition of voice and speech is widespread as more and more applications are now being made using speech recognition tools.

[8] "A Voice-based E-examination Framework for Visually Impaired Students in Open And Distance Learning" Dr. Ambrose Azeta, ItorobongInam, Dr. OlawandeDaramola Department Of Information Technology Cape Peninsula University Of Technology Cape Town, South Africa

This paper "A Voice-based E-examination Framework for Visually Impaired Students in Open and Distance Learning" - Dr. Ambrose Azeta, Itorobong Inam, Dr. OlawandeDaramola. This system is a user's voice-based system that can access internet information through a voice interface. This Open Distance Learning e-examination system employs a speech interface but does not provide evidence of an intelligent type of evaluation. The framework that will guide the development of an ODL voice-based e-examination expert draws on the achievements of prior research. In order to determine the system's level of usefulness, this system is tested using datasets like user satisfaction survey questions, which is developed using a variety of technologies including rule-based reasoning, server-side scripting, voice-based system development, data administration, and system design. The algorithms include Fisher yates Shuffling and UML diagrams and the validation tools are Voxeo Prophecy - Speech Engine and HTTP Service. According to the usability test findings, the application achieved an overall usability rating of 3. 48 out of 5. This shows that perhaps the voice-based e-examination system may enhance the present web-based online assessment technique and provide them with considerable benefits with regard to distance.

Advantages

1. How to Create a Voice-Based App as a Verification Guide.
2. Enhance Examination Connectivity for Individuals with Visual Impairment Participating in Distance Learning.

Disadvantages

1. The program was not properly secured, and caller encryption using an email address and passcode was not used.
2. It lacks the capability of user voice recognition access control.

[9] "Online Examination System" Muna R. Hameed, Firas. A. Abdullatif Information Technology and Communication, Baghdad, Iraq International Advanced Research Journal in Science, Engineering and Technology (ISO 3297:2007 Certified Vol. 4, Issue 3, March 2017)

This paper "Online Examination System" Muna R. Hameed, Firas. A. Abdullatif is one that uses a computer system to administer exams online, either over an intranet or the internet. The benefit of this online test system is to thoroughly and efficiently evaluate the student using a fully automated method that not only cuts down on the required time but also produces results that are quick and precise.

It is a web- based application that uses web-based online applications like CBTS - Computer Based Text System and executed with inbuilt PHP packages and database. It also includes Student Management, Question Addition and Question deletion.

Advantages

1. More secure and more flexibility.
2. Demonstrating each system to overcome challenges framing the conduct of examination and to support the examination process.

Disadvantages

1. Each subsystem can't be handled separately without an influence on other systems.
2. It required more time to be programmed.

[10] "VQA-Machine: Learning How to Use Existing Vision Algorithms to Answer New Questions" Author: Anton van den Hengel, ChunhuaShen, Peng Wang, Qi Wu Year: 2017

This paper "VQA - Machine: Learning how to use Existing Vision Algorithms to Answer New Questions" by ChunhuaShen, Peng Wang, Qi Wu. In light of this, it is suggested that the latest VQA model expands the cross system to a higher level that can handle questions, visuals, and facts simultaneously. It has the capacity to flexibly combine a wide range of commercial CV techniques to get answers. Using these CV algorithms on the image, we can produce a range of data that we refer to as image facts. Naturally, a large portion of this data would not apply to the specific topic posed. This is implemented using VQA Visual Genome Dataset, which uses algorithms like Artificial Intelligence, Computer Vision and Natural Processing Language and Methodologies like Neural Turing Machine (NTM) and Validation tools like Joint Embedding and Modular Architecture with Memory Networks and these applications like Answer Prediction and Reason Generation.

Advantages

1. Even though the model is based on many data sources and activities, it advantages from employing a variety of off-the-shelf CV approaches.
2. The system functions better when more information is provided. It can use a CNN model that has already been built.

Disadvantages

1. By comparing the user factors with the prototype factors, the human approvals are calculated.
2. Only the best reason connected to the question being answered had to be chosen. They were instructed. Any of the reasons mentioned here may turn out to be helpful.

[11] "Cross-Modal Attention with Semantic Consistence for Image-Text Matching" - Author: Tan Wang, Xing Xu, YangYang Year: 2020

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This paper "Cross-Modal Attention with Semantic Consistence for Image-Text Matching" - Author: Tan Wang, Xing Xu, Yang Yang is one that uses Flickr30k and Microsoft COCO (MSCOCO). The benefit of this paper is that this online system is thorough and effective in the proposed CASC in preserving global semantic consistence along with local alignment.

And the datasets used here are two different datasets to do CASC. This is implemented using the Flickr 30 software, where it is a web-based application where it uses the application of Cross-modal attention for local alignment and multi-label prediction for global semantic consistence.

Advantages

1. It immediately extracts semantic labels from available sentences.
2. It also adds a global similarity constraint.

Disadvantages

1. Two datasets were the only ones used to test CASC. It was not tested whether CASC could operate with various datasets.
2. The key challenge in image-sentence retrieval is how to precisely gauge the semantic similarity between visual and textual input.

[12]"Embodied Question Answering"- AbhishekDas, SamyakDatta, Georgia Gkioxari[2], Stefan Lee, Devi Parikh, DhruvBatra

This paper "Embodied Question Answering" - AbhishekDas, SamyakDatta, Georgia Gkioxari, Stefan Lee, Devi Parikh, DhruvBatra, talks about an agent is randomly placed in a 3D environment and is then prompted with the question "What color is the car?" The agent must ask the question ('orange') and then intelligently navigate to explore the environment and gather data using egocentric first-person vision.

This is implemented using the algorithm of AI Skills – active perception, language understanding, goal-driven navigation, common sense reasoning, and grounding of language into actions. The dataset used is the EQA dataset. The applications used here are Question Answer Accuracy and Navigation Accuracy. It is used to construct the Embodied QA environments, end-to-end trained reinforcement learning agents, and evaluation protocols.

Advantages

1. The navigator (PACMAN+Q) suggested by the model performs best when compared to other baseline models by achieving
2. The smallest distance to target at termination (dT), which causes the model to achieve the highest answering accuracy.

Disadvantages

1. Most possible Embodied QA questions do not require a natural or "correct" navigation path to be answered.
2. The agent moves further away from the target than they did at the beginning. This demonstrates that Embodied QA is a challenging issue.

[13] "Learning Rich Image Region Representation for Visual Question Answering" Author: Bei Liu, Jianlong Fu, Zhicheng Huang, ZhaoyangZeng, Zheyu Chen Year: 2019

This paper "Learning Rich Image Region Representation for Visual Question Answering" Author: Bei Liu, Jianlong Fu, Zhicheng Huang, ZhaoyangZeng, Zheyu Chen to improve the representational capacity of both visual and text features as well as the ensemble of models in order to increase VQA by utilizing more potent feature extractors. Some detection methods are used for visual features to enhance the detector. We use BERT as the language model for the text feature and find that it can significantly enhance VQA performance.

The dataset used is Visual Genome as Object Detection, which uses the algorithm or validation tools known as NLP, BERT, GPT, ELMO& VQA Model. And the applications used here are Ablation Experiments and Comparison with Others and this requires that, using the input image, our model responds to.

Advantages

1. A single model is accurate to 72.79% on the test-dev split, and the ensemble of 20 models is accurate to 74.71% and 74.89% on the VQA test-dev.

Disadvantages

1. Performance is impacted by training large-scale datasets for feature extraction on object detectors.

[14] "Is an Image Worth Five Sentences? A New Look into Semantics for Image-Text Matching" Author: Ali FurkanBiten, Andres Mafla, Lluis Gomez Year: 2021

This paper "Is an Image Worth Five Sentences? A New Look into Semantics for Image-Text Matching" Author: Ali FurkanBiten, Andres Mafla, Lluis Gomez is about image-text matching. Representations from various modalities are mapped onto a single joint visual-textual embedding. The datasets used here are MSCOCO and Flickr30K are actually image captioning datasets that provide only a very small number of ground-truth and notations for relationships.

And the algorithms used here are Semantic Adaptive Margin (SAM) formulation and image captioning metric. Applications used here are the process of Effect of Temperature and Samplings. When using the entire training set, the performance on the annotated image-caption pairs is maintained while improving on other non-annotated relevant items. We'll release the code containing our metrics and our adaptive margin formulation.

Advantages

1. Evaluation of an item's semantic relevance is done separately from its annotated binary relevance.

Disadvantages

1. Image-text matching task is lacking in annotations. Only one image was deemed appropriate given a sentence query.
2. It's possible that the dataset also contains a large number of additional pertinent pictures or captions.

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3. The performance and efficiency are a little bit distorted because of the increased dataset requirement.

[15] “Roses Are Red, Violets Are Blue. But Should VQA Expect Them To? “- Author: Christian Wolf, CorentinKervadec, GrigoryAntipov, MoezBaccouche 13 Year: 2021

This paper “Roses Are Red, Violets Are Blue... But Should VQA Expect Them To?” - Author: Christian Wolf, CorentinKervadec, GrigoryAntipov, MoezBaccouche. It introduces distributional shifts in the test and validation splits that are specific to each question because they are based on question groups. We carried out large-scale research and we experimentally showed that a number of cutting-edge VQA models, even those created especially. This is done with the dataset known as GQA-OOD Training Dataset and the algorithm used here is LXMERT pre-training, LM hyper-parameters, Visual Studio. And it is used to train hyper-parameters, Question Diversity, Prediction.

Advantages

1. The advantages of the questions' synthetic nature far outweigh their drawbacks.
2. This specifically provides better control over the data and eliminates unmodelled external knowledge, which improves

Disadvantages

1. The proposed benchmark is based on the GQA dataset, whose questions were generated automatically.
2. As a result, the GQA dataset has a constrained vocabulary (covering only 70% of VQA2 answers), and it use synthetic syntax.

III. Drawbacks of Existing System

1. **Time delay** - Cased using speech-to-text for answering questions.
2. **Minimal accuracy**
3. A **Manual Monitoringprocess** is necessary.
4. **Independently** - Students who are blind must rely on others to acquire resources.
5. **Long word** - the student's long word is muted by noise suppression.
6. The voice entered in a seamless manner; these can be **discrepancies.**
7. They might not feel comfortable with the **assistance** of the blind people if they speak a unique language rather than English.

IV. Proposed System

The database network and Speech-To-Text conversions for this technology would be made feasible via internet access. With the support of text-to-speech, this approach was only recommended in order to lessen the pressure placed on the visually impaired students when writing an exam. Every component of the system has been integrated with it, and students can easily navigate through it with the help of the buttons and can choose their preferred language (Tamil or English) and even the codeword is provided to do the authentication process before the exam starts. The system also provides time alerts for students who want the most flexibility possible when taking exams.

V. Architectural Diagram

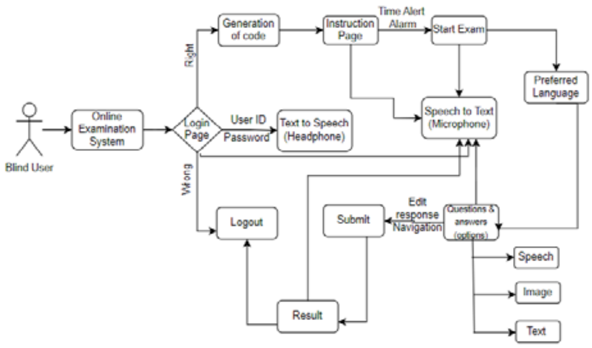

Fig. 2. Architectural Diagram

VI. Experimental Results & Output

6.1 Authentication

Fig. 3. Home Page

Login Page *Codeword*

Fig 3. Login &Codeword Page

Buttons

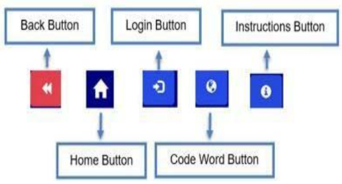

Fig. 4. Button description

6.2 Google to Text Speech

Code

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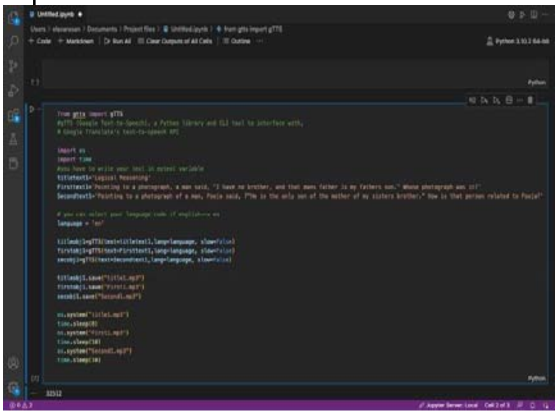

Fig. 5. Text to speech code

Output

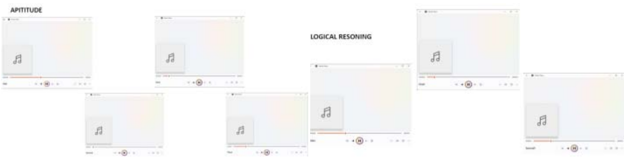

Fig. 6. Text to speech – output

6.3 Speech Recognition

Code

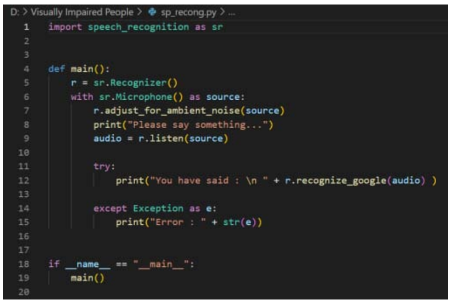

Fig. 7. Speech to text code

Output

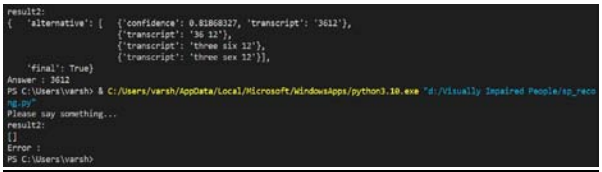

Fig. 8. Speech to text - output

VII. Conclusion

In this paper, we discussed how people who have trouble seeing could put in extra effort to test their internal aptitudes via a web exam. Navigating the question stack as the user interface for individual users. The initiative makes it possible for visually impaired people without any assistance of human intervention. It completely avoids voice synthesis, speech issues with recognition, noise suppression and mismatch errors. This system reduces ambiguity which prompts a given microphone. The user can hear alert messages that indicate "how much time is remaining" to submit the exam and can be easily navigable by users.

Before finishing the test, the users have the same access to all of the answered and unanswered questions that humans have. Due to the combination of activities offered by all of them, a blind person may now take a virtual test to determine their own skills.

The main goal of this project is to give users complete usability, supportability, profitability and feasibility to take an online test as a regular person. A person with a disability is permitted to take part in any competitions held by organizations through the internet. This could help to improve the percentage of visually impaired people who participate in any test that is competitive. Therefore, visually challenged impaired people can take exams just like any other person without any problem.

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Patient Diagnostic System Using Binary Logistic Regression

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***Abstract*—Medi-tracker is a web application using machine learning. Medi-Tracker serves doctors, medical representatives as well as patients to help understand their health condition after a blood test or after a diagnosis. Medi-Tracker was built with the intent to serve common people with an easy to access and understand user interface and reduce their cost to visit a doctor or stand in long queues to get the conclusion from their report. With an accuracy rate of 94% using Binary logistic regression Medi-Tracker is a python-based web application. According to a report even in 2022 many people can't afford a doctor's visit, so with the help of this just by undergoing a blood test they can have an AI based consultation at their fingertips. Our model is user-friendly and an end-to-end system for prediction. Our main purpose is to serve general people with easy medical assistance.**

Index Terms – Machine Learning, binary logistic regression, deep learning, .

I .INTRODUCTION

A. Artificial Intelligence

Artificial intelligence is the human-made intelligence for devices and machines. AI works as a helping hand for humans to perform tasks and help keep track of day-to-day activities in their lives. The term artificial intelligence was coined previously to defy machines that could mimic and perform human-like activities like "decision making" and "problem- solving". Artificial intelligence has come a long way in the present world of technology. Just giving a simple task to a machine and letting it finish the task with the desired output has saved a lot of time and manpower. Today a lot of sectors use artificial intelligence as their helping hand. From traffic control to weather prediction, vehicle manufacturing to cruise control, and autopilot in vehicles. From assembling small parts in a mobile device to making calls or setting reminders artificial intelligence has come a long way.

B. Machine learning

Machine learning, as illustrated in Fig.1, being a subset of AI (artificial intelligence) that deals with training a machine to perform a set of tasks based on the training data. Machine learning is a process to help machines to learn and provide solutions by predicting and performing simple statistical calculations. Machine learning is crucial in training machines and computers based on datasets and lets them perform actions and predictions based on the data. A machine is first trained with a dataset and after the training period is over the machine is given inputs and based on the training it can predict the output for the input received. In several fields machine learning algorithms are employed to execute tasks that would be difficult or impossible to perform with conventional techniques.

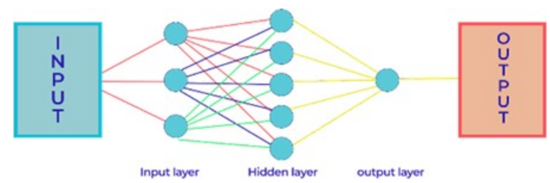

Fig. 1. Machine Learning

C. Deep Learning (DL)

DL or deep structured learning, as illustrated in Fig.2, is a broader part of machine learning. Where machine learning simply works with one hidden layer of the trained dataset, deep learning has more than one layer of the dataset to predict and perform tasks precisely. Deep learning is machine learning using artificial neural networks and representation learning.

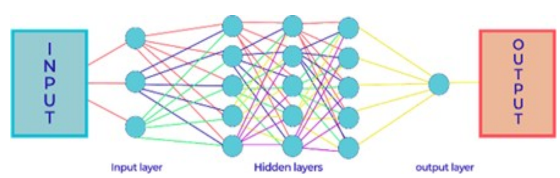

Fig. 2. Deep Learning

D. Artificial neural network (ANN)

ANN consists of a connection formed by interconnected nodes similar to neurons of animals(humans). As neurons transmit data from one part of the body to the brain and direct output to the preceptors an artificial neural network performs a similar task by sensing the environment and transmitting the data from the sensors to the processing unit and then from the processor back to the actuators to perform the output. An artificial neural network forms a network of interconnected nodes to share information and perform specific tasks layer by layer. Each layer is responsible for different tasks and duties. An artificial neural network is a neural network made artificially, these are a group of multiple preceptors or neurons at each layer that solves the tabular data, Image data, and testdata.

An Artificial neural network is capable of learning non-linear functions, it uses universal function approximations.

An ANN faces a few challenges such as -

- The number of trainable parameters increases, so does the size of the image.

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- It shows vanishing and exploding gradients.

AI is powering personal devices in our homes and offices similarly to electricity. AI will be the next big thing after the electricity that will hugely impact our daily life.

E. Medi - Tracker

The name of the project is **Medi-Tracker** as its main function is to track and predict whether a patient is having or has the chance to get a particular disease or not. This project uses Binary Logistic Regression to forecast the likelihood of disease in various organs of the body like the liver, kidney, heart, etc.

This project uses the datasets from Kaggle and other sources to train and link users via HTML forms and landing pages.

- Breast Cancer: Wisconsin Breast Cancer Dataset
- Diabetes: Pima Indian Diabetes Dataset
- Liver: Indian Patient Liver Records
- Heart: Heart Disease Dataset
- Kidney: Chronic Kidney Disease Dataset

II. Related Work

Patients have to consult a doctor each time they undergo a blood test or they have been through a diagnosis. Normal people are not able to understand what all these readings mean and how they are normal or not. So after each step or regular blood test patients or their family members have to consult a doctor just to understand the report. The existing process of undergoing a predicting diagnosis was a bit tiring and costly. Also, other patient diagnostic systems are not user-friendly, and accessing them for normal people is nearly impossible. The end-users so far were always doctors and medical representatives. Still, in 2022 many people will not be able to get proper healthcare services because of not the wide reach of doctors and hospitals. Using AI people can have a personal doctor at home. There is a scarcity of professionals like technicians, nurses, doctors and infrastructure. According to a World Health Organization report (WHO), there is only a 0.76:2.09 doctor to nurse ratio per 1000 people. Thus it can be said that there is an acute shortage of hospital beds is being faced by Indian Healthcare. Physical access to hospitals remains a significant barrier to both preventive and curative health care. High medical costs are incurred in India by approximately 63 million people and they face poverty due to the same. Using technology in a better way, healthcare can be made affordable for everyone.Previously, various studies were conducted for disease detection based on specific symptoms using various ML algorithms. Montoet. al. developed a SAS Statistical Analysis Software version 6.12 for influenza disease prediction [1]. A study of influenza patients with fever and at least two additional flu symptoms was conducted in the clinical trial, which involved a total of 3744 unvaccinated adults and adolescents. Eventually, the lab found that 2470 of the 3744 individuals were infected with influenza.. The model's accuracy rate was 79 percent. Karayilan et al. [2] devised a model for the heart disease pre- diction based on ANN and Backpropagation Neural Networks, two of the most prevalently used ANN learning techniques. 13 clinical features were fed as input and then trained with the help of backpropagation algorithm in order to decipher any heart disease with an accuracy of 95%. Chen et al. [3] streamlined a number of ML algorithms to accurately assess the chronic outbreak of disease. The amount of data gathered for training purposes was grossly inadequate. A latent factor model was being used in order to overcome this. A new multimodal disease risk prediction model (CNN-MDRP) based on convolutional neural networks was created. The algorithm's accuracy was roughly 94.8%. This study makes use of the actual hospital data taken from the hospital dataset. Chae et al. [4] analysed 80 infectiousdiseases using four different DL models: DNN, OLS, LSTM and ARIMA. All other models tested were outperformed by the DNN and LSTM models. Resul et al.[5] built an ensemble-based methodology to diagnose heart disease using SAS enterprise miner 5.2 in their study. Experiments on the heart disease dataset were carried out in order to fully automate the diagnosis of heart disease. Three independent neural network models were taken into consideration in order to create the ensemble model. There was an increment of neural network nodes of ensemble model, but further performance improvement wasn't noticed. The results of the experiment can be used to diagnose heart disease with an accuracy rate of 89.01%. Four ML algorithms are employed to process the input dataset: Naive Bayes, Random Forest, SVM and Simple CART. A classifier model is trained and tested for each algorithm, and the results obtained from them are compiled. SVM has the highest precision value of 0.784, while Random Forest has the lowest precision value of 0.756. With a higher accuracy of 79.13%, the SVM model outperformed the other methods in [6]. In this case, the "Pima Indians Diabetes Database", obtained from the "National Institute of Diabetes and Digestive and Kidney Diseases", is the dataset under consideration. Khourdifi et al. [7] employed the KNN model to predict and classify heart diseases. He used the UCI heart disease dataset and an accuracy of 99.7% was achieved. Sriram et al. [8] achieved a 90.26% accuracy with the in- corporation of the Random Forest model. The "Parkinson's disease voice dataset" was obtained from the "UCI Machine Learning repository at the Center for Machine Learning and Intelligent Systems". Parthiban et al. [9] applied automatic learning methods to diagnose cardiac related diseases present in patients diagnosed with diabetes. WEKA has been used to implement the Naive Bayes and SVM algorithms. The Chennai Research Institute's data set of 500 patients has been used. The Naive Bayes algorithm has an accuracy 74% whereas SVM has the highest accuracy of 94.60%. To detect heart disease, Chaurasia et al. [10] proposed using data mining approaches. The algorithms used in this case are bagging, Naive Bayes and J48. A data set on heart disease with 76 attributes is available from the UCI machine learning laboratory. Prediction is based on only 11 attributes. Naive Bayes achieved an accuracy of 82.31%. J48 provides an accuracy of 84.35%. Bagging yields an accuracy of 85.03%. Thus, on this data set, bagging has been able to provide a higher classification rate. Vembandasamy et al. [11] made use of the Naive Bayes algorithm for detection of cardiac diseases. The information used came from one of the Chennai's most renowned and

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leading diabetes research institutes. The dataset consisted of 500 patients. WEKA tool is used and 70% of the Percentage Split performs classification. Naive Bayes has an accuracy rate of 86.419%. A study waspresented by X. Liu et. al. [12] using a hybrid classification system devised upon the RFRS method in order to help in heart disease diagnosis. There are two subsystems for the proposed system: an RFRS featured selection system along with an classification system with an overall classifier. The maximum classification accuracy for the given model is of 92.59%. Maniruzzaman detected the diabetes disease by using certain ML algorithms [13]. The diabetes risk factors were identified using the Logistic Regression (LR). The model performed with an accuracy of 90.62%. Mohan et al.[14] put in place an effective heart disease prediction system. An accuracy of 88.4% was achieved using the HRFLM upon The Cleveland dataset. Daghrir et al. employs three ways to arrive at a conclusion on a given system: KNN, SVM, and CNN. Because of its efficiency and versatility, it outperforms KNN. Although an SVM classifier performed quietly, the CNN is regarded as a more strong and resilient classifier, giving an accuracy of 85.5%.

III. PROPOSED METHOD

Here we are proposing the solution to overcome long hospital cues and cut the costs of doctor visits just to know your health status after a blood test or diagnosis. Nowadays a blood test is easily available at the doorstep and the results are delivered via email or door to door. But reading and understanding the result data. We proposed a solution where anyone can easily access our web application for free and check for any potential harm they possess as per the blood report or not.

Our webpage is simple with an easy user interface. Any user with a little bit of knowledge can check the status of a patient or even the patient can check the status of his/her health via our web application.

Patients just have to put their data in their respective fields and click on predict to get their results in simple language. Our model is much more user-friendly than the previous models. Our model is an end-to-end system for prediction. Our main purpose is to serve general people with easy medical assistance. Our backend does not store the data of any patient so we don't ask users for their names or mobile number. The sole purpose is to help people and that is served through this model. By making use of web technology and AI people in remote areas can also get access to health care. Using technology in a better way, healthcare can be made affordable for everyone. We have used a light ML model that can load within no time without compromising the accuracy of the prediction. Light models quickly load which helps in better response to the page. This Web-App provides a wide range of predicting the contamination of multiple infectious diseases as in Diabetes, Kidney disease, Liver Infection, Heart Disease & Cancer. Though this app provides a wide rangeandhighspeedtheaccuracyhasnotbeencompromised.

Hyper-parameters have been selected very carefully so that the accuracy is not hampered.

As shown in Fig.3, Our system is always active and patients need not wait for doctor's visits or wait in queues. They can easily put in their report values and get the prediction for their health.

[start
{
Read details from html form
Process the details and check with the machine hearing model.pkl
Predict it is '0' or '1'
Check the value for '0' or '1' Send the output via html static
}
end]

Helping others is the only goal, and this methodology does that. People in faraway locations may now receive healthcare thanks to web technologies and AI. Healthcare may be made more accessible and inexpensive for everyone by utilising technology effectively. We have employed a quick-loading, lightweight ML model without sacrificing prediction accuracy. Light models load rapidly, improving the page's responsiveness.

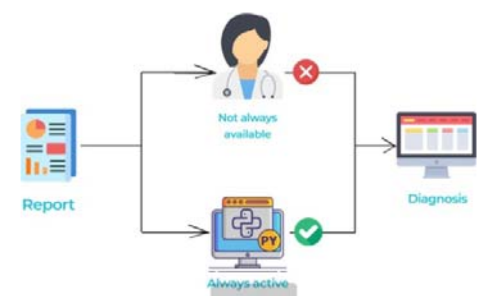

Fig. 3. Our model ideation

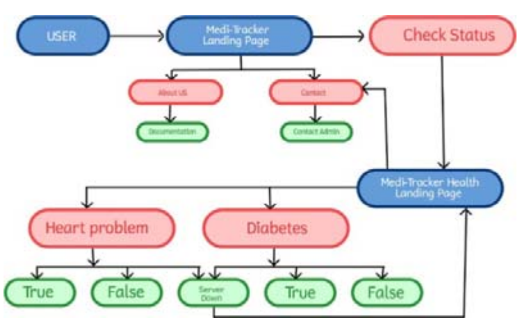

Fig. 4. Working of Model

We are using binary logistic regression, as shown in Fig. 4, to predict our patient's and user's health status.

In binary logistic regression, the predicted outcome has only two values (1 or 0) or (Yes or No)

It is the most utilized regression model where the value is either 1 or 0. Unlike fuzzy logic it has only 2 discrete outcomes.

If 32◦C is considered to be hot and any temperature below that is termed as cold then binary logistic regression would distinguish it as -

- 29◦C - Cold
- 31◦C - Cold

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- 31.9◦C - Cold
- 32◦C - Hot

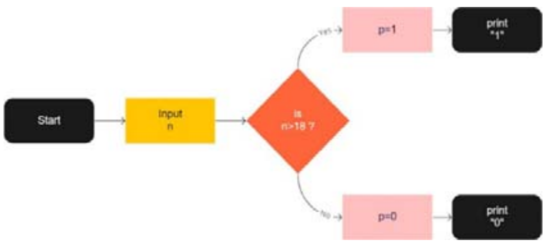

Fig. 5. Flow of Work of binary logistic regression

B. *Accuracy*

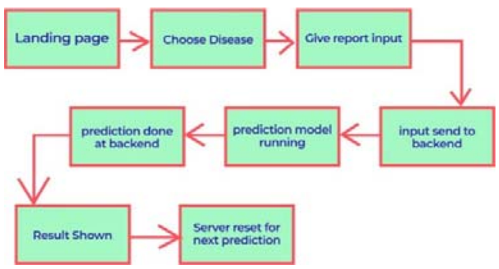

Fig. 6. Flow of Model

IV. Experiments

A. *Training Details*

The Patient Diagnostic System, that is, Medi Tracker, was trained using logistic binary regression which gives discrete results as True or False, we gather data to and forth an HTML page in the form of a form, connected to the Python virtual environment in the background.

B. *Metrics*

1) *Accuracy:* The accuracy of the model is calculated by comparing the prediction of the model to the ground truth. The mathematical calculation of the overall accuracy is done using True Positives, True Negatives, False Positives, and False Negatives as the parameters.

$$Accuracy = (TP+TN)/(TP+TN+FP+FN)$$

C. *Experimental Results*

The dataset used was extracted from Kaggle to train the prototype, based on the trained process. When the input is given, the data has been successfully validated for the potential occurrence of the diseases with an accuracy of 96.97%.

V. Conclusions

All the previously developed machine learning algorithms and models could predict only one disease and had a low accuracy rate. In our study, we have attempted to retain a high accuracy while removing one significant flaw seen in earlier models used for the diagnosis of patient diseases- the low accuracy rate of predicting the patient's disease. We have incorporated one singular platform for all the diagnosis of a wide range of diseases, which increases the efficiency and convenience of use by regular people, with an accuracy of 95.62%.

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An Exploratory Study On The Acceptability of Artificial Intelligence (AI) in Healthcare in India

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***Abstract*—Purpose- Artificial intelligence (AI) is growing at an exponential rate in healthcare, and a variety of applications have been created to help solve some of the biggest challenges facing health organizations. Some of these applications include artificial intelligence in diagnostics and treatment planning, while others are designed to improve communication and collaboration between health professionals. Virtual assistants that are powered by AI in healthcare applications can help people to live healthier lives, learn more about topics they're interested in, and change their behavior if needed. Artificial intelligence (AI) is a software that emulates human psychological development. This is being done through the use of healthcare information and advanced analytics techniques. This is having a major impact on healthcare, as it allows for better care for patients. Artificial intelligence (AI) is used to help doctors make better predictions about the health of patients who are having surgeries. This helps to reduce the amount of time needed for them to make a decision about what to do next. This information is used to improve the quality of care for patients. This includes techniques like natural language processing for unstructured data, current deep learning, and machine learning algorithms for structured data, like support vector machines and neural networks. AI is used for illnesses like cardiology, neurology, and cancer. Health authorities need to be aware of the current state of AI technologies and the potential applications they could be used for in the healthcare industry. This would allow for better value-based care to be achieved.**

Design/Methodology- For the research work, five cities were chosen, Delhi, Mumbai, Kolkata, Chennai, and Hyderabad. These cities were selected as a study focus primarily because these cities attract both international and local visitors because of their highly qualified doctors and excellent medical facilities that use AI technology. These cities are home to top-notch healthcare facilities, super-specialty hospitals, and research and diagnostic centers, making them the fastest-growing locations for receiving medical care.

In order to conduct this research study, structured questionnaires were used. The data was gathered using the convenience sampling method. The sample size for the data collection was 500, and it included men and women from a range of age groups, economic levels, and occupational backgrounds.

Findings - From the study, four factors emerged which have been labelled as "Perceived awareness", "Perceived accuracy", "Anonymity", and "Convenience". Furthermore, it has been found that factors "Perceived awareness", "Perceived accuracy" and "Convenience" have a significant influence on Consumer Trust. This study examines the acceptability, potential benefits, and challenges of using artificial intelligence (AI) in healthcare, as well as the potential implications on the healthcare system as a whole.

Keywords — Artificial Intelligence, Healthcare Service, Chatbot, Convenience

I. INTRODUCTION

Artificial intelligence (AI) is described as machine intelligence as opposed to the intelligence of individuals. [14]. Artificial intelligence refers to any agent or piece of technology which can reconstruct human behavior in educating, reasoning, and decision-making by observing and understanding its environment and implementing the measures required to optimize its possibilities of success. AI and associated technologies are becoming more popular in business and society [8]. It is bringing a radical transformation to healthcare because of its ability to harness the power of big data. An AI system extracts relevant information from an extensive clinical setting to assist in the development of real-time inference for potential risk detection and health diagnosis [16]. And enhance evidence-based clinical decision-making [5], and deliver value-based care that can be utilized to enhance the efficiency, safety, and access of health services spurred by increased accessibility of healthcare data and the speedy proliferation of analytics tools [10]. Supporting the digital transformation of healthcare is prompting a public dialogue over why AI will potentially substitute healthcare professionals [15]. We suspect that robots, will not surpass medical professionals in the coming years [11]. AI will enhance the effectiveness of healthcare provision by facilitating the lives of patient practitioners, and nursing personnel by undertaking jobs that would generally be performed by individuals, with less effort and for a significantly lower price [4].

Artificial Intelligence can support practitioners in making optimal clinical judgments and potentially replace verdicts in certain areas of healthcare [6]. That enables healthcare systems to deliver more effective treatment to more patients and helps doctors improve the workflow of healthcare practitioners enabling them to devote greater effort to delivering personal attention to patients and reducing burnout by taking human judgment into account in specific healthcare areas, including radiography, and by making better clinical judgments overall and minimizing the unavoidable diagnostic and treatment blunders that occur in human clinical practice [19].

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The feasibility, possible advantages, and difficulties of using artificial intelligence (AI) in healthcare are examined in this paper, along with any potential effects on the healthcare system as a whole. The goal of healthcare is to become more interactive, anticipatory, customized, and proactive.

II. Review of Literature

Recently, there have been a lot of advances in data science and artificial intelligence. There's a new phase of AI that's different from earlier ones, but research in artificial intelligence for a variety of applications has been ongoing for a few decades. This is because recent AI applications and technologies, like healthcare, are more efficient because of the way they use computers, have a lot of data, and are populated by a large number of skilled people [12].

There is general agreement that artificial intelligence (AI) tools will help to improve human labor in healthcare settings, rather than replacing healthcare professionals. Healthcare workers may benefit from AI's ability to assist with a range of activities, from operational processes to hospital records and patient contact. Specialized services like image processing, medical equipment management, and patient monitoring may be especially well-suited to AI [2]. There are many different opinions about the best ways to use artificial intelligence (AI) in the healthcare industry. The most crucial sectors, according to Forbes, would be administrative processes, image processing, telerobotics, chatbots, and making decisions about patient care [13].

AI is desperately needed in the medical field to diagnose diseases. A number of fascinating advancements in this area have made it possible for medical professionals to detect a variety of ailments earlier and with greater accuracy [18].

There are many potentials uses for artificial intelligence (AI) in diagnostics. AI can help doctors diagnose colorectal cancer more quickly and with better accuracy. This can help improve a patient's chances of surviving the disease. Additionally, various limits of ML in diagnostics have been discovered by scientists and they've made recommendations on how to lessen the impact of these downsides [7]. As a result, AI still has a lot of potential in diagnostics.

Natural language processing (NLP) is the study of how computers can understand and respond to human language. This can involve things like chatbots, which are computer programs that can talk to people like a human [9]. Healthcare chatbots may help make doctor-patient and clinic-patient interactions more accessible, help people keep track of their medication adherence, or help people have teleconsultations with doctors. This technology is still in its early stages of development, but there are many potential benefits to be had [3]. The chatbot technology helps you do things like surveys about your health, create reminders for you, communicate with healthcare teams, schedule appointments, access and analyze health data, or translate diagnostic patterns based on what you know about your health [1]. In spite of the fact that the majority of doctors in a US survey of 100 doctors thought chatbots might help with making doctor's appointments, finding medical centers, and delivering information about medications, more than 70percent also said they couldn't cater to all patients' requirements, displayed emotion and may put patients at risk owing to improper self-diagnosis [17].

III. Objective of the Study

To identify the factors influencing Consumer Trust toward Artificial Intelligence in healthcare.

IV. Figures And Tables

KMO and Bartlett's Test

Kaiser-Meyer-Olkin (KMO) measurements of sample adequacy have a scale from 0 to 1, with values closer to 1.0 being considered ideal and values less than 0.5 being considered inadequate. A Kaiser – Meyer – Olkin value of 0.887 was obtained from our findings. This indicates that there is a substantial quantity of data overlapping or that the variables have a high coefficient of determination. As a result, factor analysis is possible. The results of Bartlett's Test of Sphericity is substantial since the significant value is less than 0.05. (0.000). These tests provide the minimum conditions that must be met before doing factor analysis when taken into consideration.

Total Variance Explained

Each component represents a quality score, known as an eigenvalue underneath the title 'Total' of 'Initial Eigenvalues.' Parameters having an eigenvalue higher than one are selected for deeper examination as they solely reflect actual value.

Factor 1 which has been classified as **"Perceived awareness"** reports 38.748% of the total variances.

Factor 2 which has been classified as **"Anonymity"** reports 16.031% of the total variances.

Factor 3 which has been classified as **"Convenience"** reports 6.515% of the total variances.

Factor 4 which has been classified as **"Perceived accuracy"** reports 5.400% of the total variances.

Rotated Component Matrix[a]

From Rotated Component Matrix, we have labeled factors:

Factor 1: Perceived Awareness

The Variables associated with the factors are as followed.

V1: AI is being used in healthcare in the development of predictive models- **(.785)**, **V2**: AI has the potential to enhance patient outcomes while lowering costs and boosting productivity- (**.769)**, **V3**: Healthcare professionals make better decisions about patient care by using artificial intelligence to develop personalized treatment plans- (**.753)**, **V4**: AI is being used in healthcare is in medical imaging- (**.721)**, **V5**: An artificial intelligence algorithm can analyze medical images to detect potential health issues- (**.713)**, **V6**: The complexity of AI technology and the jargon used to describe it can be

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a barrier to its widespread adoption in healthcare- (**.690)**, **V7**: Many people don't know what AI terms mean, and it can be difficult to understand how they're being used in healthcare-(**.644)**, **V8**: There is a potential for AI to reinforce existing biases in healthcare, which could lead to increased inequality-(**.641)**, **V9**: AI algorithms are merely as good as the training data they are given, and if the training data is prejudiced or uneven, the algorithms may end up confirming those prejudices- (**.637)**.

Factor 2: Anonymity

The Variables associated with the factors are as followed.

V10: AI can be used in healthcare while protecting the privacy of patients by anonymizing data-(**.872)**, **V11**: The researchers and healthcare professionals are working together to use AI without compromising the privacy of patients-(**.816)**, **V12**: One way to protect patient anonymity is by using secure data transmission and storage practices- (**.814)**, **V13**: Healthcare providers and researchers can use secure data transfer protocols and encrypted storage to protect patient data from unauthorized access-(**.813)**, **V14**: AI is used in healthcare to help patients, but it is important to make sure that their privacy is protected-(**.728)**, **V15**: Healthcare providers can use artificial intelligence (AI) to help them diagnose and treat patients while maintaining their privacy-(**.699)**.

Factor 3: Convenience

The Variables associated with the factors are as followed.

V16: The automation of repetitive tasks, faster medical diagnosis and treatment, and more individualized care are all possible with AI-(**.795)**, **V17**: Chatbots and virtual assistants can provide access to medical advice and support, such as symptom checking and medication reminders, 24/7-(**.726)**, **V18**: AI can be used to monitor patients remotely and provide real-time updates to healthcare professionals-(**.672)**, **V19**: AI can be used to analyze patient data and predict potential health risks or complications-(**.666)**.

Factor 4: Perceived Accuracy

The Variables associated with the factors are as followed.

V20: AI algorithms can often perform at a level comparable to, or even better than, human experts-(**.833)**, **V21**: AI algorithms are properly developed and trained to avoid biases or inaccuracies-(**.784)**, **V22**: AI has the potential to improve the accuracy of healthcare diagnosis and treatment by providing training and oversight-(**.665)**.

H0: There is no relationship between Consumer Trust and the factors, “Perceived Awareness”, “Anonymity”, “Convenience”, and “Perceived Accuracy”.

H1: There is a relationship between Consumer Trust and the factors, “Perceived Awareness”, “Anonymity”, “Convenience”, and “Perceived Accuracy”.

TABLE 1: MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.82[a]	.66	.659	.6910

Predictors: (Constant), Perceived Accuracy, Convenience, Anonymity, Perceived Awareness

The above Table 1 shows that the R-square value is 0.66 indicating 66% of the total variation in Consumer Trust which can throw light by the factors, “Perceived Awareness”, “Anonymity”, “Convenience”, and “Perceived Accuracy”.

TABLE 2. ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	199.148	4	49.787	104.275	.000[b]
	Residual	400.266	495	.477		
	Total	599.414	499			

Dependent Variable: Consumer Trust

Predictors: (Constant), Perceived Accuracy, Convenience, Anonymity, Perceived Awareness

Table 2 shows that the p-value is less than 5% which came as 0.000 in the results which means that the model is acceptable.

TABLE 3. COEFFICIENTS[a]

Model		Standardized Coefficients Beta	t	Sig.
1	(Constant)		69.188	.000
	Perceived Awareness	.785	19.651	.000
	Anonymity	.055	1.389	.166
	Convenience	.140	3.511	.001
	Perceived Accuracy	.163	4.085	.000

Consumer Trust = 3.268 + 0.785*Perceived Awareness + 0.163*Perceived Accuracy + 0.140*Convenience.

The impact of the factor **Perceived Awareness** is found to be the highest. And the factor **Perceived Accuracy**, and **Convenience** has a significantly low impact compared to **Perceived Awareness**.

V. CONCLUSION

Artificial intelligence (AI) has brought in many changes in medical practice, which include digitalizing data acquisition and analyzing the treatment techniques of various diseases and finding out possible ways to prevent them. Artificial intelligence systems are used to help doctors make better decisions about patients' health. They are used to help diagnose problems, train health workers, and research new ways to improve health care. Over time, AI systems will become better at doing all of these things on their own, without our help. Furthermore, the main challenge we are facing is not the lack of technology itself, as it is rapidly evolving and uncovering various new areas of its use, more so the legal framework requires appropriate regulation and political and financial transformation in the healthcare sector.

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Using Harmonic Progression Convergence Model and Hyperlink Induced Topic Search Prompted For Page Ranking

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***Abstract*—Using the Web's inherent link structure, the Hyperlink-Induced Topic Search (HITS) algorithm identified and ranked sites based on their relevance to a search query. However, it solely considered the hyperlink structure and overlooked the contents of web sites and the reality that various hyperlinks on the Web may have varying degrees of value. In this research, we offer a unique page ranking method that integrates the hyperlink using the triadic closure theory, considering both the Vector Space Model (VSM) as well as the TrustRank algorithm, in an effort to counteract the aforementioned subject drifts. The approach initially determined the degree of relevance between two arbitrarily selected websites by comparing their subject matter and the number of references they shared. Then, a new eigenvector was built on top of that model to iteratively determine each page's authority and hub value. Following this, we used the trust-score technique to determine how trustworthy each page in the first group actually was. With our proposed Web page ranking algorithm against three traditional HITS-based methods, including the Web Page Topic Resemblance, Conventional Benchmark Degree, and Trust-degree algorithm. Based on the experimental findings, it is clear that our suggested method is superior than the other four traditional enhanced techniques and the HITS methodology.**

***Keywords* — HITS, trust degree, vector space model, hub value, web mining.**

I. Introduction

The usage of a web search is ubiquitous in the pursuit of knowledge on the Internet. Search engines take a user's keyword input, then utilise ranking algorithms to order results and send them to the user.Three common approaches are used to categorise the relevant information for search engine page rankings.Two well-known algorithms are used to analyse the structure of hyperlinks [1].

They leverage the interconnected network of links between pages to its maximum potential, abstracting the relationships into a knowledge graph and iteratively determining a rating for each page.In order to determine how these search engine results pages are ranked, page rank as well as HITS are extensively used metrics.Using a combination of co-link analysis, social network analysis, and a semantic clustering algorithm, Yang presented a Web site ranking model for identifying subject communities among academic websites (SNA) [2].

Page Rank as well as HITS algorithms have flaws that are becoming more obvious as they are used more widely in search engines.To address these issues, researchers have developed several enhancements for HITS.Using a vector space algorithm to determine the resemblance between the web links and the user requests, Jones's probability ranking and an ontological selection ranking model determined the cardinality for internetpages of search engine results [3].An all-encompassing probabilistic framework for WPSS (web page scoring systems) has been created.

To rank websites for Web crawlers, we used the cell-like transmembrane computing optimization technique (CMCFC), which considered not only the main text of each page but also the content of any anchor links, page titles, and paragraphs immediately around them.Combining the hyperlinks and the word distribution across online pages, using formal concept evaluation to build the concept context graph, and then rating the web sites based on this, is what the semantic ranking does.

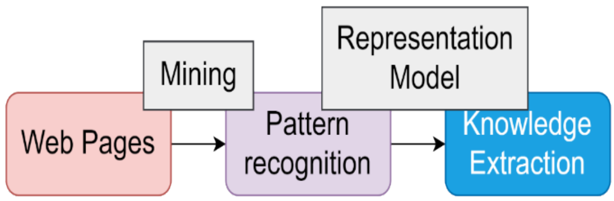

Fig. 1. Overview of web mining process

By examining the semantic relationship between Web sites, a relevance context graph was built from link (hyperlink) context graphs, allowing URLs with the same subject to point to each other.The rankings values for the specified webpages may be predicted using the relevance context graph.In order to direct Web crawlers, the idea context graph coupled the interlinking of web sites with the addition to online pages to create a concept ranking of web pages.HITS, a traditional scoring method, is widely used and successful websites between them. Overview of web mining process is shown in Figure 1.

In this case, the content material on the hub sites is relevant to the authority website that is directed to by those hub pages.The authoritative websites are linked to using hypertext from the hub page.In the HITS method, the values of the hub and authority pages are positively correlated; that is, a high-quality hub page will link to many high-quality authority sites, and a high-quality authority page will be linked to by many high-quality hub pages [4].

The HITS algorithm, on the other hand, simply uses the internal and external link counts of the correspondingly ranked web pages to determine rankings.

As a result, the symbiotic nature of host- and topic-drift connections will become problematic.Some studies and methods have been developed to address the issue.By giving website content from the same server significantly less weight, they suggested the BHITS(Bharat's enhanced HITS) algorithm.The issue of mutual reinforcement was nearly fixed.

To improve their capacity to anticipate the relevance of web sites, Zong et al. devised the P-HITS (Probability-based HITS) method, which uses probability to choose URLs from a list of URLs and incorporates the meta data of hyperlinks.They proposed the SALSA algorithm, which combines the query-related features of the HITS algorithm with the random walks employed by PageRank.The XHITS model was suggested on the basis of the HITS-hub and authority degrees of web sites, both of which allow for the concealment of semantic knowledge within hyperlinks [5].

The model introduced a unique machine learning technique for calculating web page rank scores, extending previous work on hubs and authority to include additional feature ideas.These techniques, however, rely only on the structure of the links themselves.Some integrated methods based on hyperlink and content analysis were developed to address topic drifts.Results show that including semantic text into the HITS algorithm improves its performance.In contrast, there are additional algorithms that make use of data gleaned from things like user comments or Web server logs.

In this paper, we present a unique ranking algorithm on the basis of HITS by combining the harmonic progression convergence theory with the TrustRank algorithm, which considers both the page content and the links between pages (R-HITS).The testing findings confirmed the efficacy and superiority of our suggested algorithm, demonstrating a decrease in topic drifts and an improvement in the quality of retrieval [6].

II. Literature Survey

Web page rankings are determined by HITS and HITS-based algorithms. Three issues that these algorithms have yet to address are the filtering of irrelevant hyperlinks, the prevention of subject drift, and the existence of mutually reinforcing ties across Web pages [7]. Here, we introduce the original HITS method and various updated versions of the algorithm for ranking Web sites, and then we critically examine their performance. HITS is an algorithm that just analyses links; it does not consider the text of web pages and cannot determine whether connections are more important than others.

For this reason, once Kleinberg published the HITS algorithm, several academics investigated it and offered many enhanced algorithms for addressing the various application criteria. HITS calculate a page's hub value as the total of the authority values of all pages that connect to it. A page's authority score is calculated by adding the hub scores of all the pages that link to it. For this reason, a hub page that links to numerous low-authority pages would have a larger hub weight than one that links to fewer high-authority pages [8].

Borodin et al. presented the Hub-Averaging method to address this shortcoming. At first, Lempel and Moran attempt to merge the best features of Page Rank with the HITS algorithm, creating a system that takes use of HITS's strengths where they pertain to the user query's topic and also incorporates Page Rank's random walk model. In reality, several experimental data demonstratethat SALSA provides superior search results to Page Rank and HITS [9].

Today, it ranks high among the most effective algorithms for link analysis. The Hub-Averaging algorithm is a combination of the HITS and SALSA procedures. This is an operation that can be performed using the algorithm. The purpose of ARC is to collect quantitative a set of credible web sites on any subject [10]. The core of the system is an algorithm that analyses text and links locally before reaching a "global agreement" on the finest resources available.

The HITS algorithm has been implemented by a wide variety of systems for the purpose of categorising websites. As a result, Teoma was able to apply a similar method to rank websites. It has been claimed that these methods can produce more relevant results in a search than either text-index search engines like AltaVista or directory-index search engines like Yahoo. Despite the fact that several trials have demonstrated that HITS yields useful search results over a broad spectrum of query topics, this approach may run into the following issues due to its utter disregard for textual contexts throughout its implementation [11]. It is often accepted as true that a website's pages and links are all the work of a single contributor or group.

A single "user's" opinion on quality is all that should be reflected in them. But HITS algorithm doesn't take that into account when determining a page's importance and authority. Unfortunately, it is not uncommon for many pages on the first host to all refer to the same page on the second site, p1.In each of the examples above, one "person's" perspective lends disproportionate weight to the respective website.Tools that create web pages sometimes include extraneous hyper connections like navigation links, commercial links, and other regularly created useless links.However, HITS do not include in how closely the page's content relates to the subject matter of the user's inquiry.Furthermore, it gives equal weight to all hyperlinks, despite the fact that the relevance of numerous hyperlinks may vary [12].

As a result, the HITS algorithm unfairly prioritises the less-relevant or irrelevant hyper link (links).The most popular authority (hub) websites have nothing to do with the subject matter of the user's search [13].Distraction from the

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original topic might occur for two main reasons.There are a couple of possible explanations for this: first, it's possible that the basic set B was obtained by include irrelevant or less relevant web page(s) in the root set R expansion process, and second, hub web sites contain several themes [14].

HITS algorithm might give more weight to the TCK page if it detects a cluster of unrelated web sites.In this research, we use HITS and the traditional HITS-based algorithms to propose that the degree of subject similarity between web sites, the degree to which they share references, and the degree to which they can be trusted are all crucial in determining where on the web each page should be ranked [15].Web page concept resemblance is a semantic feature used to prevent subject drift and filter irrelevant pages; a higher degree of shared reference can increase the value added by a common web page(hyperlink) while decreasing the impact of a mutual hyper link on a page's rank.A higher trust level may eliminate certain unhelpful connections [16].

I. PROPOSED SYSTEM

A targeted crawler's primary objective is the rapid indexing of as many relevant web pages as feasible. We need to give a more efficient means of locating pertinent websites. The adjacency matrix's building blocks are believed to be these connections that have some level of significance. In this research, we examine how three factors - web page subject similarity (brief as PTS), common reference degree (brief as CRD), and Trust Rank of Web Page - affect the relevance between any two given web pages.

Crawled websites need to be analysed so that keywords may be extracted from the complete text, title, anchor text, and surrounding paragraph language. There is now widespread usage of the Vector Space Model (VSM) in the conventional information retrieval sector, and manysearch engines utilise similarity calculations relying on this approach to rank websites. The following is a breakdown of how VSM is used to determine the degree of similarity between a web page's content and the subject matter of a user's search query as:

$$\vec{e_y} = (x1j, x2j, x3j \ldots\ j), \vec{r_k} = (r1, r2k, r3k \ldots\ rnk) \quad (1)$$

where$\vec{e_y}$ represents the web page and $\vec{r_k}$ defines the query initiated by the particular user. $xnj$and rnksuch that $1 \leq l \leq n$where these are the relative importance of the terms ulon web page $ej$and subject rkin the user's query, and $n$refers to total elements on script $ej$and topic rk. The Maximum - likelihood Document Frequency formula is used to assign relative importance to individual words in a corpus such that:

$$x_{lj} = ueg_{lj} . je\ lj\ \frac{gl}{gmax} . log\ \frac{O}{ol} \quad (2)$$

Where $O$is the cumulative quantity in documents over$C$regarding the manipulatorrequest discussion, olrefers to quantity of scripts such as ul, ugl. and$jeglj$. are the term intensity and reversetext recurrence of the descriptor ulin ejor a request response issuerk, respectively, and $gl$is the happenings of the term ulin web page ejor the query response context rk. User query subject phrase weights are also calculated.

Cosine likeness is used to calculate the degree of similarity between the topics covered on the web page $ej$and also the user's query subject rksuch that:

$$S(\vec{e_y}, \vec{r_k}) = \cos(\vec{e_y}, \vec{r_k}) = \frac{\sum_{i=1}^{n} xlj.xlk}{\sqrt{\left(\sum_{i=1}^{n} x_{lj}^2\right)\left(\sum_{i=1}^{n} x_{lj}^2\right)}} \quad (3)$$

If page Phas a link to page Qthat reads $qP \rightarrow qQ$, then page $Q$is being promoted by page P. Furthermore, it indicates that the writer of qPendorses the ideas expressed in qQ. As a result, we may conclude that the contents of $qP$and $qQ$are highly comparable if there is a hyper connection $qP \rightarrow qQ$between them. Let's suppose that the likeness among $qP$and $q$is $tP$and that the resemblanceamong$qQ$and manipulatorrequestissue$q$isqQ.

We may therefore interpret the sum of $qP$and qQas the degree to which propositions $P$and $Q$are same in terms of q. In this work, we refer to this similarity as the subject similarity between websites. It's seen as a potential component that impacts the significance of a pair of seemingly unrelated pages. The significance of the hyperlink $qP \rightarrow qQ$increases as the degree of topic similarity between the two web pages increases. Without such context, the connection is irrelevant.

So, thelikenessamong web pages $qP$and qQbuilt overrequest$r$is derived as the result of multiplyingtjandtk, where $tj$and $tk$are the similarities of web pages tjandtklinked to the query q. The similarity between web pages is represented as follows:

$$S(qP, qQ) = \begin{cases} tj\ .\ tk\ ,\ if qP \rightarrow qQ (qP \neq qQ) \\ 1, & qP = qQ \\ 0, & otherwise. \end{cases} \quad (4)$$

Here, we'll incorporate the concept of triadic closure into our study on social networks. Please begin by explaining and critiquing the concept of triadic closure. There is a higher chance of friendship between two people in a social network if they share a friend or two in common. This is the first and foremost rule of triadic closure.

When two nodes Y and Z share a friend X, the resulting edge between them forms a triangular shape in the social network, with edges coming from and connecting all three nodes X, Y, and Z. This triangle "closes" at its third edge, which connects points Y and Z. If we take two pictures of a social network, one after theother, we will often uncover many new edges connectingpeople who had a shared neighbour in the first image dueto triangle-closing.

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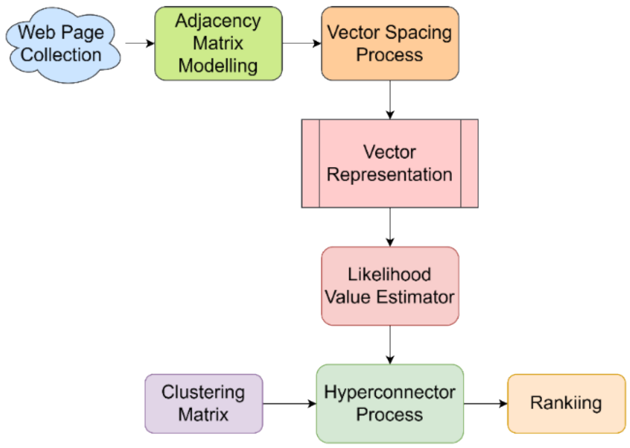

Fig. 2. Process flow of proposed model

The theory of harmonic progression is extended by two theorems. The initialleewaydeduction may be stated as follows: if a set of people has a large number of mutual friends, then it follows that the chances of those people becoming friends themselves increase. There are only two people who both person X and person Y know in common. All three of Yand Z's mutual pals are named A1,B1, and C1. The following inferences can be made with little effort.

The likelihood of A1 and B1 becoming friends in the imminent is developed that of A and B. As an illustration of the second extension theorem, we may say that the likelihood that two people will become friends increases if their common friends have deeper ties with one another. The web itself may be seen as a directed graph, as is common knowledge. Hyperlinks between websites are represented by edges in a directed graph, while nodes represent individual pages.

We already established that if page P has a hyper link to page Q, then P endorses Q. By including a link to another work, the author of work P implicitly endorses the work in question. If we think of the Internet as a social network and each webpage as a person, then the friendship between two websites is analogous to the friendship between two people. In particular, if two nodes P and Q are connected by an edge may both signify the friendship between the two people in the social network, and the hyper link between the two web pages in the web network. The process flow of proposed model is shown in Figure 2.

Because of this, the theorem proving the applicability of triadic closure theory in social networks may be applied to the World Wide Web. Here's a more in-depth explanation: Web sites P and Q seem to be more likely to expound on the same topic if the ordinary in-degree between them is bigger and the unusual in-degree between them is lower. The evidence suggests that websites P and Q may be more pertinent. Consequently, the degree of common reference is another aspect that impacts the significance of any two pages chosen at random.

In order to identify spam websites, the TrustRank algorithm described by Gyongyi et al. was implemented. A website's credibility on the Internet is determined by the algorithm. The basic premise of this technique is that more trustworthy pages will have their trust scores slightly lowered but remain extremely high if they are linked to from a page with a higher TrustRank. The TrustRank algorithm was at first created to help identify spammy websites. However, TrustRank was more commonly utilised in the search engine ranking algorithm. Websites' overall rankings are frequently impacted by this.

Values of TrustRank are often calculated at the level of the domain in the search engine ranking algorithm. The more the host's trustworthiness, the greater the aggregate ranking's strength. Like the PageRank algorithm, the TrustRank algorithm relies on a massive amount of information available on the World Wide Web. For this reason, Asano et al. suggested a trust-score method based on the TrustRank algorithm. A trust-score is assigned by the trust-score algorithm to every page in the HITS basic set Q.

For the vast majority of user query themes, Asano et al. conducted exploratory studies, discovering that more than half of the root set of web pages are credible and relevant to the particular algorithm also relies on this premise: This leads to numeroussides in the underlyingcause set v is a trustworthy; and if page v is connected from many dependable, then page v is a dependable authoritative web page. Denote these sets by their initials: $R$for the collection of roots, Was vertices, and $F$for the edges.

We present a ranking system that considers a web page's trustworthiness in addition to its topical similarity and degree of shared referencing. The suggested approach offers two improvements over the HITS algorithm. By merging the page topics that are comparable and the degree of common reference, a new clustering matrix is formed. The updated adjacency matrix is then used to calculate the core and authority values. The second is calculating the credibility of each website in the B. To determine a page's rating, we consider both its core or credibility value and its trust-degree. First, we create the new transformation matrix B by linearly combining the matrixes article theme resemblance and common evaluation level. Also, we can denote as:

$$B = \mathrm{P} + \gamma \text{where } 0 \leq \mathrm{P} \leq 1, 0 \leq \mathrm{P} \leq \gamma \text{ and } \mathrm{P} + \gamma = 1. \quad (5)$$

In this approach, the parameters and define how adaptable the resulting adjacency matrix $B$is, whereBmn = $\mathrm{P}mn$ + $\gamma mn$is a matrix element. Next, the new transitive matrix $B$is used to determine hub and authority values. Also, the entire technique of calculating is identical to that used by HITS. This is how the new iterative formulae are written:

$$b = B^T i \quad (6)$$

$$i = Bb \quad (7)$$

$$bj = \sum k \in (j)\ Bnmik = \sum k \in JK(j)(\mathrm{P}mn + \gamma mn\ )ik \quad (8)$$

$$ik = \sum k \in (j)\ Bnmbk = \sum k \in PM(j)(\mathrm{P}mn + \gamma mn\ )bk \quad (9)$$

In this approach, the parameters and define how adaptable the resulting adjacency matrix $B$is, whereBnm =

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$Pmn + \gamma mn$is a matrix element. Next, the new transitive matrix $B$is used to determine hub and authority values. Also, the entire technique of calculating is identical to that used by HITS. This is how the new iterative formulae are written.

II. Results and Discussion

Here, we examine the proposed system to three traditional advancing algorithms based on HITS and choose a large number of subjects with MAP, F-Measure, and DCG to evaluate the algorithm's performance. The experimental data shows that compared to three competing algorithms, our suggested approach for ranking web pages yields much better results.In our trials, we compare our proposed method to the HITS algorithm and three other well-known enhancement algorithms (BHITS, SALSA, the Hub-Averaging, and ARC).You may shorten their names to HITS, SAHITS, and ARCHITS.

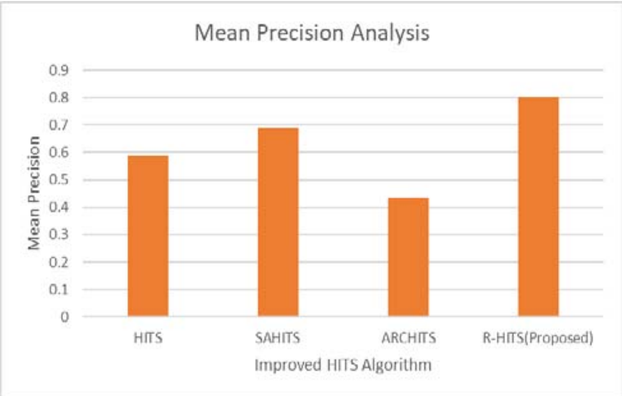

Fig. 3. Mean Precision Analysis

Virtualization, wall climbing, drinking, the Olympics, the railroad, the kayak, the yard, cheddar, Hepatitis, and the Kabuki theatre are only ten of the numerous categories from which we selected user query topics to showcase the experimental outcomes.Our investigations make use of root sets Bs that are composed of the top 200 results from a subject.For example, the ARC method's group B includes webpages that are link-distance three separate or less from at minimum, but in the HITS algorithm this was done just once.

We discovered that 20 iterations is a good number to utilise in tests since iteration quickly converges.Using indices such as MAP (Mean Average Precision), F-Measure, as well as DCG, the effectiveness of the aforementioned six algorithms may be assessed (Discounted Cumulated Gain).For each algorithm, in particular, the average value across all user query subjects represents its precision.

Accuracy is how many highly relevant results an algorithm returns in comparison to how many results are found in the top 10 for a given algorithm.The recall measures how many of the most relevant results returned by an algorithm are included in its top ten list.If the VSM-calculated similarity among the page's subject and the query response topic is more than the threshold value of 0.5, then the page is considered relevant.DCG's key notion is that a page's score should be deducted if it has a better grade than one that is higher in the ranking.

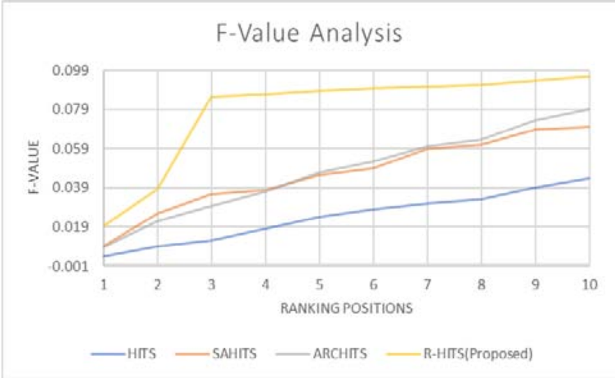

Fig. 4. F-Value analysis

First, the proper relevance degree is assigned to the website that falls inside the Top10 websites discovered by each algorithm.In particular, the page receives a score of 0 if the likeness between the homepage and the user querytopic falls within the range [0.0, 0.25]; if the range [0.25, 0.5] is crossed, the page receives a score of 1; if the range [0.5, 0.75] is crossed, the page receives a score of 2; and if the range [0.75, 1.0] is crossed, the page receives a score of 3.In this case, n is set to 10, which indicates that we are analysing ten different web sites for this result rank.

We calculate themes for each method in the tests.It's easy to spot similarities between the three figures:Compared to the other five methods, the values of the proposed method are clearly greater.In particular, the HITS method has a MAP of 0.6716, the BHITS algorithm has a MAP of 0.5107, SALSA has a MAP of 0.8258, Hub-Averaging has a MAP of 0.7043, and the suggested approach has a MAP of 0.9609.

Based on these results, it can be concluded that the suggested method has a higher MAP value than the HITS algorithm (by 43.0%), the BHITS algorithm (by 88.2%), the SALSA algorithm (by 30.9%), the Hub-Averaging algorithm (by 16.3%), and the ARC algorithm (by 36.4%).Overall F as well as DCG scores of the proposed method show clear superiority over the RC algorithms over a range of search engine rankings.When x = 0.5, they display how the proposed algorithm's values vary with varying.Each of the three characters shares some traits with the others.

Nonetheless, the MAP (F and DCG) values develop at varying rates, with the highest rates occurring when = 0.On the other hand, when = 0, the values are practically identical.Furthermore, the smallestvalues occur at = 0, while the largest occur at = 1.Examples like these shows how subject similarity across web pages may significantly improve a page's position in search results.When = 0.5, they illustrate how the suggested method performs in terms of MAP, F, and DCG.

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Fig. 5. Performance analysis for different ϑ values

The values of MAP (F and DCG) in all three figures tend to decrease as x increases, which indicates a common denominator.When going from x = 1 to x = 1, however, the rates at which the values decrease are quite large.Values are also maximal at x = 0 and minimal at x = 1.These examples show that t(vi), the trust degree, had a minor impact on the ranking of websites.Indicating that the suggested algorithm is superior in its capacity to place high-quality websites at the top of search engine results.In addition, they validate our contention that the subjectsimilarity of websites is a significant factor in the suggested website rank.

III. Conclusion

Using harmonic progression closure concept, vector space models, and the TrustRank algorithm, we provide a new page ranking system in this study. Subject similarity, degree of sharedorientation, and are all defined. To iteratively determine authority and hub values, a novelmodel is built according to the subject similarity of web pages and the sharedorientationgrade. In addition, by integrating the trust-score method, we establish the degree of confidence we have in each website in the baseline collection. Last but not least, the score has been derived by combining thehub value along with degree of trust. Experimental findings reveal that our suggested page ranking method locates higher-quality Top10 websites than the HITS, BHITS, and ARC algorithms. In the past, there may have been some theme drifts, but HITS can help fix that. In conclusion, we have created a HITS-based algorithm that successfully returns the top 10 web sites that best answer user query subjects.

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Survey on Melanoma Skin Cancer Disease

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***Abstract* — Skin cancer is one of the most dangerous types of cancer. Deoxyribonucleic acid (DNA) damage left unrepaired in skin cells results in genetic flaws or skin cancer. Early diagnosis of the condition is essential due to the rise in skin cancer cases, high mortality rate, and pricey treatments. Researchers have created methods for the early identification of skin cancer after realizing the severity of these issues. From the detection of skin cancer and melanoma, different factors like symmetry, color, size, and shape are understood. This study offers a thorough, systematic discussion of machine learning methods for skin cancer early detection. We examined research on the detection of skin cancer that was printed in credible peer-reviewed journals. This paper offers a summary of a computer-assistedanalyticalmethodfordiagnosingmelanoma.Itwillalsointroduceanoverviewofautomaticskincancerdiagnosisbyimageanalysisusingimageprocessingtechnologybasedonmachinelearning.This review's objective is to give researchers whodecidedtoimplementmachinelearningforcancerdiagnosticsas anopportunitytolearnthelatestdevelopmentsfromscratch.**

***Keywords*—Melanoma, ANN, Neural Network Melanin, Machine Learning**

I.INTRODUCTION

Skin cancer is one of the most dangerous varieties of cancer. Skin cancer is as a result of unrepaired deoxyribonucleic acid (DNA) in pores and skin cells, inflicting genetic defects or mutations with inside the pores and skin Due to the growing range of pores and skin most cancers cases, excessive mortality,and comfort treatment, early analysis of the circumstance is necessary. Recognizing the seriousness of these problems, researchers have advanced techniques for the early detection of pores and skin most cancers. Different parameters alongwithsymmetry, color, length and form are acquainted to pores and skin most cancers detection and cancer identification. In this paper, we provide a detailed systematic review of machine learning techniques, a prominent area of research aimed at building devices that mimic human intelligence for fitness maintenance. The application of ML in fitness does not currently update doctors, but it can provide a better path to health issues. So take a look at these work Specific strategies for early detection of cancer are mentioned correct diagnosis of this disease Skin cancer that develops inside melanocytes is known as melanoma ,which can be cells inside the outer layer of pores and skin (epidermis). Melanocytes produce a pigment known as melanin, which offers color to pores and skin. Melanin offers the pores and skins its tan or brown color and protects the pores and deeper layers of the pores and skin from the dangerous consequences of the sun turns out to be anomalous, developsout of control, and actively invades the surroundings organization. Melanoma can also affect the pores and skin, or spread to other organs and bones through the blood and lymph flow. Melanoma is the most prominent form of most cancers of the skin. Melanoma can be cured if treated early, but if left untreated, most melanomas expand to different components of the body. Surgical intervention and early detection to eliminate cancer and successfully cured the largest number of cancer cases. However, it is often irreversible in later stages. Melanoma can be diagnosed using four parameters (ABCD).

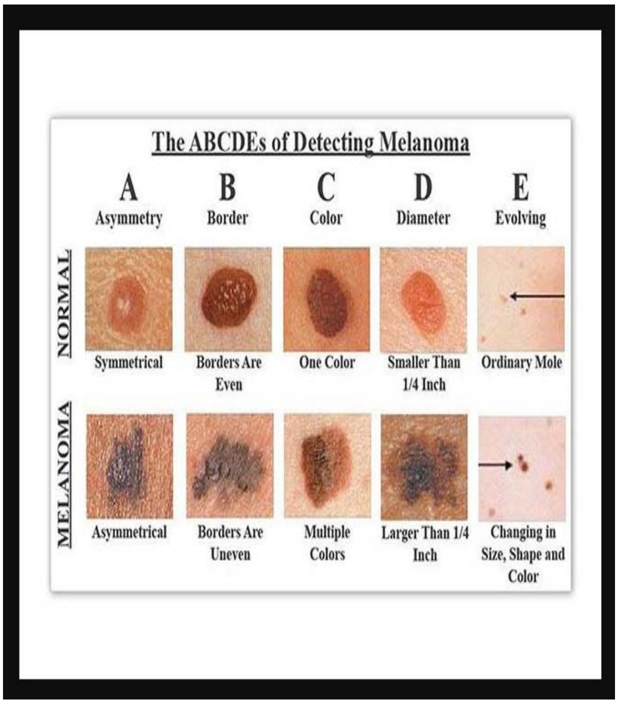

Fig 1.Detection of Melanoma

Figure1showsthedifferencebetweennormaldiseaseandmelanomadisease.Asymmetrymeansthattheshapeisirregular,andwherethereisirregularityintheshape,themarginiscalculatedbasedonthatshape.Whendiscerningthecolor,iftheshape(largerthan1/4diameter)ismelanoma,thedifferentcolorscanbediscernedandthediametercanbedetermined.Theseparametersareusedtodetermineiftheskinisaffectedbymelanoma.Varioustechniquesareusedtodetermineiftheskinisaffectedbymelanoma.Therefore,thiswhitepaperreviewsdifferenttechniquesusedtoidentify

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skincancer

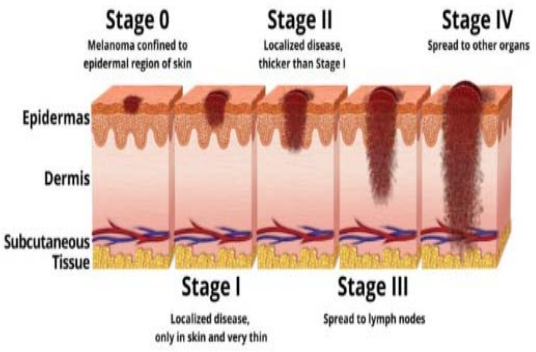

Fig 2.Stages in Melanoma

Figure[2]showsthestagesofmelanomaidentifiedintheskin ofanindividual.

Stage 0: The malignant tumour in stage 0 melanoma is still contained to the top layers of the skin. Cancer cells have not penetrated deeper than the epidermis, which is the top layer of the skin.

Stage 1: The majority of cancer cells in Stage I cancer are found in both the dermis and dermis. 2mm thick or less

Stage 3: Cancer in stage II is characterised by ulceration and dense tumours there are most of the dermal and epidermal carcinoma cells

Stage 3: Melanoma that has reached one or more local lymph nodes or developed melanoma deposits in the epidermis or dermis is considered to be in stage III.

Stage 4: In stage IV melanoma, the cancer has migrated to more distant sites than the initial tumour site and local lymph nodes to more distant areas of the body.

II.LITERATURE SURVEY

ManjunathRaoetal.[1]proposedbinarypatternsusingSVM classifierstoknowcancerefficiently,andfurthermore,itcanbeexpandedwithLBP(LeastBinaryPattern)forearlycancerdetection ..

MdShahinetal.[2]proposeddeepfold theneuralnetwork(DCNN)versionislargelybasedonDeepHisknowledgetechniqueforaccuratelyclassifyingbenignandmalignantporesandskinlesions,buthasalongerrunningtime.

Dascaletal[3]mayimprovetheperformanceofradiologists. relativelyslow

SameenaPathanetal.[4]useadecisiontreethatiseasytointerpret.TheriskofoverfittingwithSVMisverylow.AdaBoostseemssensitivetonoisydata

A very accurate system that can identify skin lesions was created by Hassan El-Khatib et al. [5] using a deep learning-based approach. They suggest brand-new classification schemes based on a variety of classifiers, including neural networks and feature-based approaches. Depending on its computed accuracy, each classifier (method) assigns a specific weight to the final decision system, enabling the system to make better conclusions. First, they developed a neural network (NN) that can tell benign from malignant melanoma. During the training process, evaluation is used to analyse the NN architecture. Some biostatistics parameters, such as accuracy, specificity, sensitivity, and Dice coefficient are calculated and classification was done by using a support vector machine

According to Teck Yan et [6] dermoscopy images were used to predict the prognosis of skin cancer using a modified version of the Particle Swarm Optimization (PSO) set of rules for function optimization. The proposed PSO set of rules is used for function optimization because determining the most significant distinguishing characteristics between benign and malignant skin lesions plays a significant role in the diagnosis of strong skin malignancies. It now also includes multiple matrix representations to prevent premature convergence of the original PSO set of rules, in addition to subswarms, nearby and mutation-predicted nearby exploitation. To put it another way, distant swarm that show health but low function proximity are utilized to guide the subs warm-based search and to enable the investigation of more different look for areas. It is also suggested to use modified speed updating techniques to allow the debris to follow multiple swarm bellwethers and avoid the local and ecumenical worst individuals, partially (i.e. in arbitrarily designated sub-dimensions) and (in each dimension), with the goal of searching for ecumenical optima. Use probability distributions and dynamic matrix representations to diversify your hunting strategy. The UCI database, several unimodal and multimodal reference functions, and proposed PSO variations examined with multiple skin lesions point to superiority.

IsmailElansaryetal.[8]proposedEfficientNet-B6,amethodforclassifyingskinlesionsinpatientsasmalignantorbenignusingconvolutionalneuralnetworks(CNNs).Thefindingsshowedthattheproposedsystemaccuracyratioof97.84%iscomparabletoothermodels.

Mohammedetal.[7]proposedaneuralnetworktechniquefordetectingmelanoma.NeuralnetworksaspartofAIalgorithmsareincreasinglybeingconsideredinimagingapplicationsassupportsystemsfordiagnosingSLanddetectingMelanoma.NewDBrankandSLrankchallengeswillalsoappear.Forthisreason,weareinterestedinimprovingtheseclassifierstodetectandtrackSLevolutionveryaccurately,evenfromadistance.ThebestresultswereobtainedusingmultipleNNsforfusionofdifferentfeaturesanddecisions.Giventhegrowingtrendtouseneuralnetworksformelanomadetection,thisareaof interestandproblemsolvingisaveryinterestingtargetforintegratingartificialintelligenceintomedicine.

An artificial neural network classifier (ANN) classifier that categorises specific datasets as malignant and non-cancerous based on their attributes was proposed by Christo Anant et al. [9]. Malignant melanoma can be distinguished from benign melanoma by specific characteristics. Using feature extraction techniques, these features are extracted. The 2D wavelet transform and 3D designated by K feature extraction techniques are employed. An procedure known as back propagation is used to train the ANN. You will receive the feature estimate and its actual output in this way. Initialization of inputs is random. The inputs are adjusted throughout each cycle in an effort to reduce the error between the desired output and the actual yield. The application of predicted ANN classifiers to decision-making and pattern recognition is effective.

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Enakshi Jana et al. [10] focus on different methods that can be used for segmentation. Commonly used segmentation algorithms include feature extraction from the segmented image, such as k-means, histogram thresholding, and image of the feature set extracted from the segmented image. there is. Various demotion algorithms are available for this purpose. The latest skin cancer detection techniques descend using machine learning and deep learning based algorithms. The most commonly used demotion algorithms are support vector machines (SVMs), feed forward artificial neural networks, and deep convolutional neural networks. This paper provides a study and analysis of current skin cancer detection techniques and a brief comparison between state-of-the-art algorithms.

The deep CNN model proposed by Neema M et al. [11] can classify melanoma types into benign or malignant classes. In this work, a less complex model was used and an accuracy of about 70% was achieved. Future extensions of this work include modifying the prediction accuracy by adjusting parameters and redesigning the network for cases with multiple classes that can detect different categories of skin lesions. The proposed system is a highly effective tool that contributes to timely and diverse assessment of disease. The system also has a built-in use cordial, using her GUI in explainable form.

Barataet al.[12]revealed that a great deal of work has gone into developing a diagnosis tool for the most deadly type of cancer, melanoma. The Global system, local feature, and bag-of-feature are the two separate systems that are discussed in this research for melanoma detection in dermoscopy images. Skin lesions are categorized using a global approach. Melanoma is classified using a classifier that uses either a bag-of-features or a local feature. Additionally, it contrasts the colour and texture features in lesion classification to see whether set of features is more discriminating. Both strategies produce excellent results when the colour feature is used alone

Satheesha, T. Y. et al. [13] highlighted the use of artificial neural networks, receiver operating characteristics (ROC), and non-invasive computerized dermoscopy to evaluate images and diagnose melanoma. Melanoma, a dangerous illness, currently has a greater fatality rate among skin cancer patients. The highest death rates are among the middle-aged and elderly. Due to the fact that it has developed notably past the dermis of the skin, it has been judged to be dangerous. The algorithm consists of these three steps: The initial lesions are obtained using a Self Generating Neural Network (SGNN). Using the feature extraction formula, the second feature description of the tumor's size, texture, and boundaries is extracted. Using a support vector machine, portions of the third lesion are categorized according to their phases (SVM). Images from non-invasive computerized dermoscopy display lesions that are visible due to their size. Due to its improved sensitivity and precision, the recommended system will be more efficient than the present computerized dermoscopy method. Compared to the current system, the suggested one is more accurate. Using multiple photos, the algorithm was successfully tested and delivered accurate segmentation.

III. CONCLUSION

Early detection of melanoma allows for effective treatment. Dermoscopy image processing and machine learning methods will be extremely affordable and widely accessible. Some dermoscopy equipment for computer analysis can be utilized in clinics and even at home. Getting the right diagnosis and treating the anomalies at the key stage of skin cancer requires expert advice and the use of the appropriate techniques. For a person's well being, proper consideration should be given to identify the disease using classification, feature generation, lesion segmentation, and feature segmentation

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MNIST Digit Classification using Machine Learning Algorithm

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***Abstract*—During these modern days everything revolves around technology, thus everything is getting digitized. From teenagers to working age groups use technology, so it is important for computers to classify digits based on handwriting. Many of them have different handwriting which sometimes cannot be identified by humans themselves, so what we have to do is by using machine learning we could make the computer read with an accuracy of 95%. This will surely benefit the process of storing old documents without retyping everything as it will consume a lot of time, instead they can take a picture of the documents and upload into the system which will in turn go through it and show it in text form. On this topic we have done our share of research, and also we have implemented it practically. All types of handwritten documents can be read with a high percentage of accuracy, which makes many people's lives easier. The project is still in its development and early stages, but once it reaches its destination it could be very useful.**

***Keywords*— Artificial Intelligence, MNIST Dataset, convolutional Neural Networks, digital reading, Machine Learning, Deep learning**

I. INTRODUCTION

MNIST digit classification using a machine learning algorithm for handwritten digit recognition has a great importance in recognition of the optical character , not only that this digit classification can also be used in theories as a test case and not only that they can also be used for machine learning algorithms. The digits that are handwritten are first preprocessed, which includes both normalization and segmentation So that it is possible to compare recognition results on some common basis and reduce their work for the researchers.Not only machines but even humans have a problem reading few types of handwriting as they are unique and different but nowadays everyone are opting for the digital technology.Retyping all the handwritten documents manually into the computer is a very difficult and tiring job .Artificial intelligence computer vision techniques had made it very easy because of which everything can be digitized and not only that, it will also make it easy for the teachers as students answer script can be corrected directly with the help of machines, just by uploading the scripts and marks. Also can be easily updated in the computer with ease .That is why conventional neural networks was developed so as to read whatever type of

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handwriting more than 95% accuracy.This type we can see in google lens that is currently used by many people .This

also can be implemented in account and finance department for both private and public sectors in which they can upload a number of querie. This will be of tremendous benefit to us as it reduces the chance of human error and also can reduce time consumption and make our lives easier .So it reduces human error and also saves time. One more thing is that it as the main method in schools are paper and pen mode there will be many documents from which they are supposed to be digitized every year and manually doing that will take them forever so the best method would be to upload it and that should be digitized by the help of AI which will make their work easier . Our final goal is to make as much as accuracy while predicting handwritten dataset with the help of Convolutional Neural Network and machine learning. One of the most essential data sets for evaluating the effectiveness of the convolutional neural networks and learning algorithms is indeed the MNIST handwritten character recognition classification data set. Learning algorithms such as k-nearest neighbors (KNN), random forests, svm (SVM), and simple neural network models may easily achieve 97%-98% accuracy on a test set of 10,000 photographs when using 1 million photos as the training set. Convolutional neural networks (CNN) improve this accuracy to over 99% with fewer than 100 misclassified photographs in the test set. The last 100 photographs are becoming more difficult to correctly identify. More complex models, careful tuning of hyperparameters such as learning rate and batch size, regularization methods like batch normalization anddropout, and so on. augmenting of training data are required to enhance accuracy after 99%. We obtain a model capable of achieving extremely high precision on the MNIST test set without the requirement for sophisticated structural elements or learning approaches. One of the most frequent model designs is a collection of convolution layers followed by a completely linked layer at the end. We employ fundamental data augmentation strategies such as translation and rotation. We train three different models with comparable architectures and use majority vote to choose the best model.The final forecast The designs of the three models are identical, but the kernel sizes with in convolution layers change.Experiments demonstrate that merging images with various kernel sizes

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improves precision more than mixing models with a similar kernel size.

II. Literature Review

[20]MNIST (Modified National Institute of Standards and Technology) is a classic dataset used in the field of machine learning for the task of image classification. It consists of 70,000 images of handwritten digits from 0 to 9, with each image being a 28x28 grayscale image. The MNIST dataset has been widely used as a benchmark dataset for evaluating the performance of various machine learning algorithms, including deep learning models, for image classification tasks.

In this literature survey, we will review some of the recent studies on MNIST digit classification using machine learning algorithms.[19]Authors compared the performance of various deep learning models, including Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Autoencoders, for MNIST digit classification. They found that CNNs outperformed the other models, achieving an accuracy of 99.35%. The authors also showed that data augmentation techniques, such as rotation and translation, could improve the performance of the models.[2]Few other authors have also investigated the effectiveness of transfer learning for MNIST digit classification. They compared the performance of various transfer learning approaches, including fine-tuning and feature extraction, using different pre-trained models. The authors found that transfer learning could significantly improve the performance of the models, achieving an accuracy of up to 99.7%. Usage of some deep learning and neural networks for us to get a image representation is high on demand in this modern era.Image processing has a huge number of publications already.In our paper we are going to show how to classify images based on using CNN. The fashion domain also uses classification of digits and it has a lot of benefits .It also has a lot of work that was published on it. All humans have a different handwriting which is very unique so the computer finds it very difficult to understand each type of handwriting.For us to improve the accuracy to over 99% then we have to view complex methods like some careful tuning For some like learning rate and batch size which have few regulations such as training data augmentation and normalization of batch is need for hyperparameters .MNIST test accuracy is approximately 98% accurate on a few papers .In this paper we will produce a model that can be achieved which has a higher accuracy on MNIST test which will also be very simple.The model also uses convolution layers which have fully connected layers at the end. ,these are one of the commonly used model architectures .Basic data augmentation schemes,translation and rotation are used .Three models which have similar architectures and also use majority voting between the models to obtain some final prediction .They have architectures which are similar but have different kernel sizes .we can give better accuracy by combining different kernel sizes more than combining different models.We present a model that achieves very good precision here on MNIST testing sample without the use of sophisticated structural elements or learning approaches. One of the most frequent model designs is a collection of convolution layers followed by a completely linked layer at the end. We employ fundamental data augmentation strategies such as translation and rotation. We train three models with comparable architectures and then use majority vote to get the final prediction. The designs of the three models are identical, but the kernel sizes in the convolution layers change.Experiments demonstrate that combining models with different kernel sizes improves accuracy more than combining models with the same kernel size.

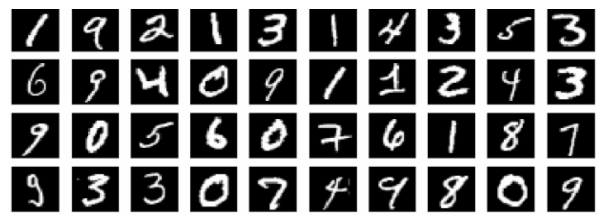

Fig. 1. Image used for testing the digit classification

III. Previous Advancement

This section discusses the most modern strategies for handwritten numeric digit categorization, as well as the benefits and drawbacks of each methodology.

Shulan et al. introduced a cascade CNN which has two stage with outstanding performance. Here a cascade CNN approach is based on complimentary differentiation of few objectives between Stage I and the consecutive next stage. By feeding directly poorly recognised training samples, learning is little discriminative which is added to train Stage II. Experiments were carried out on the highly competitive MNIST handwritten digit database. Their cascade model outperformed all others in terms of performance. The drawback of this approach is that it takes more time than other procedures.

Hubert Cecotti studied the influence of several parameters and pre-processing methods of a distance based on picture distortion models on accuracy. One major problem is to lower the processing time of closest neighbor classification by taking rejection criteria and adaptive distances into account. The author evaluated the efficacy of this single character identification algorithm on three datasets of Indian handwritten numbers, one for each common Indian plot: Bangla, Devanagari, and Oriya. The authorsdemonstrated that extracting information relating to four orientations improves accuracy significantly. This method makes use of GPUs and high-performance clusters to deliver cutting-edge results.

The clustering algorithm used gives great performance but takes longer to cluster the input and construct the feature.Khedidja and Hayet studied the application of various differentiators or as we say classifiers which help in the identification of printed digits by describing the digits in a novel manner utilizing hybrid feature extraction. The study comprised three separate features estimated from extraction,cavities, zonal extraction, and retinal representations, and also nine distinct predictors, K-Nearest Neighbor - KNN - with varied distance measurements, SvmClassification - decision tree, and linear svm

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classification - LDA.-. Majority Voting takes into account classifier combinations. Experiments were done out on a dataset of printed numbers with multiple fonts and sizes. This approach has only been assessed for printed databases; it has yet to be analyzed and reviewed for handwritten digit databases.

Few people suggested a novel hybrid classification strategy for identifying printed numerals in their paper .To extract features, object region perimeter assessment, Fourier Descriptors, and a Chained code-based approach were utilised. A unique curve tracking Chain code based approach (CTCC) was introduced to recover curve knowledge from digit photos. Few multi layer and Dynamic programming employing a back propagation approach were used to achieve recognition (MLP-BP). The accuracy was increased to 99%. Although confined to printed digits, the proposed methodologies were simple, with higher identification accuracy and decreased time complexity.

Gattal et al. studied the use of several statistical and structural factors in the detection of solitary handwritten digits, a classic pattern recognition challenge. By merging multiple representations of non-normalized handwritten numbers, the authors attempted to enhance identification rates.

Some of these characteristics include statistical information, moments, feature and projection-based characteristics, and features derived from the contour and skeleton of the digits Some of these characteristics are taken from the whole picture of the digit, while others are retrieved from various sections of the image after the image has been subjected to uniform grid sampling. One-against-all SVM is used for classification. Experiments on the CVL Single Digit Database yielded high recognition rates similar to state-of-the-art approaches in this field.

Alkhateeb and Alseid introduced a Handwritten Arabic digits multi-class classification approach utilizing Dynamic Bayesian Network (DBN), with technological details provided in 3 parts: pre-processing, feature extraction, and categorization. The digits are first pre-processed and their sizes are standardized. Then, using the discrete cosine transform (DCT) coefficients technique, features are reconstructed from each normalized digit, and even a set of additional handwritten characteristics are added. digits are provided. Finally, theseTo develop a deep neural network for classification, attributes are employed. The proposed method was successfully evaluated on a Handwritten arabic digit database (AD Base), which had 70k digits produced by 700 different authors, as well as the results were encouraging and promising.

El et al. compared the efficiency To capture discriminative characteristics of handwritten digits, four feature extraction techniques based here on Discrete Cosine Transform (DCT) were developed. Upper left corner (ULC) DCT coefficients, zigzag DCT coefficients, and block-based DCT ULC coefficients and block-based DCT zigzag coefficients are the techniques. To assess the performance. The parameters of the each DCT variation are used as data input for the Svm Classifier. Their objective was to identify the optimum feature extraction strategy for enhancing classification accuracy while speeding up learning algorithms. The data demonstrated that perhaps the block-based DCT zigzag extraction of features performed well in terms of accuracy in classification and reduction rate. outperforms its competitors.

Babu et al. introduced a novel solution to off-line handwritten digit detection based on structural characteristics that eliminates the need for thinning and size normalization techniques. For digit identification, they employ four distinct kinds of structural features: number of openings, water tanks in four directions, optimum profile distance in 4 directions, and fill-hole density. To identify minimal distances, a Euclidean minimum distance criteria is utilized, and a k nearest neighbor classifier is used to categorize the digits. The MNIST database is used to train and test the system. A total of 5000 numerical pictures are evaluated to validate the suggested approach, with a high identification rate.

Singh and Lai [9] proposed a method for digit recognition based on a single layer neural network classifier and Principal Component Analysis (PCA). The created model minimizes the characteristics in order to decrease computing needs while accurately classifying the digit into ten groups (0 to 9). The developed system is a backward propagation (BP) neural network that has been trained and tested on the MNIST dataset of handwritten digits. On the MNIST 10K test dataset, the suggested approach achieved good accuracy. They took into account not just accuracy, but also training time, recognition time, and memory needs for the whole process.

They have also discovered the digits that the system misclassified.

IV. Algorithm

The CNN is a learning technique which is deep and where it automatically classifies input . The past few years CNN has been good at classifying images and also it is being used in many domains like healthcare and academic domain . One of the most reliable algorithm was indicated that it was CNN which is good at automated prediction from start to end. CNN also extracts very important features from the given input that makes it easy for us.Data entry professionals devote hundreds of hours to typing handwritten data into computers. It is a very time-consuming activity that also necessitates a high level of precision and fast typing due to the large number of entries that must be input.Various organizations spend tons of money transferring their documents from one format to another.Deep learning and machine learning are critical components of computer technology and artificial intelligence. Deep learning can minimize human effort in identifying, learning, predicting, and many other areas. As a result, we developed a Convolutional Neural Network System capable of automatically converting handwritten pictures to digital format with a 93% accuracy.

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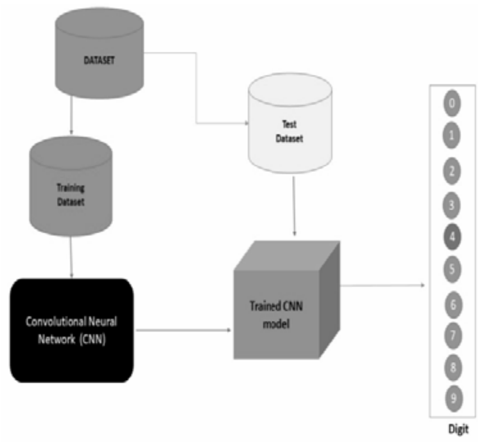

Fig. 2. CNN model

[1] It has very high features from few input data which are passed onto the other layer which is a feature map. This is the conventional layer.

[2] The data dimensions are reduced by feature map pooling,where dimensions are reduced by generating new feature maps.PL takes average or it might take maximum,this is done at Pooling Layer.

[3] FC layer completes the task of classification.Softmax function is where for each class the Probability scores are calculated and labeled a popular activation function.

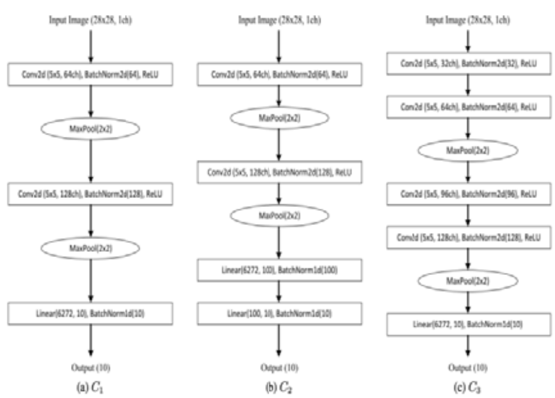

Fig. 3. Network model used for classification

V. Dataset

MNIST digit classification dataset is being used .The keras is in Python and MNIST as an API which is a dataset that is provided by the API. 60k -10k training images are available in it. This is a great way to individuals who need to go through pattern recognition just in a minimal amount of time.

The Keras API have four values returned namely- *x_train, y_train, x_test, and y_test*.

VI. Loading Dataset

The language used here is python. We used googlecolab for doing this python code. We can also use jupyter notebook or vs code

The steps that we followed :-

1. Add and create a googlecollab notebook.
2. Then we load the necessary libraries, we must load the MNIST dataset

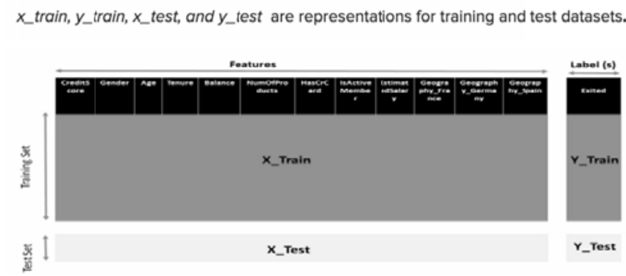

Fig. 4.dataset into training and test set

VII. Processing the Dataset

To improve the quality of the data it should be rectified,cleaned and processed .The best form of dataset has no null values and all numeric values are scaled.So in order for the data to be good for CNN we will be training the dataset .If we write X_train[0] we get images between 0-255. The output is a 2-dimensional matrix. writey_train[0] we will get 5 as output. The 0th image of this training dataset represents the number 5. Training and test datasets .we convert the 2-d matrix to a 1-d array after scaling.

VLII. Convolutional Neural Network Being Trained and Created

For the above code the input layer follows two hidden layers and a output layer.The activation function make key decisions if they should move forward or not.In CNN it has many neurons which are based on activation functions,the neurons fire up and the network moves forward. 'relu' is a activation function.The model is compiles and fit after it been created.The relations are viewed in the dataset during fitting. They will learn throughout the process as many times as has been defined. For every mistake it makes it learns and gets better accuracy each time.At the end of the epoch it gets the highest form of accuracy .A image has three dimensions: width, height, and channel. The MNIST dataset is a monochromatic image with the dimensions 28x28. In the shape parameter, we set the sample size to -1 so that it adopts the form of both the attributes ["x"]. The advantage is that the batch size may be tuned to hyperparameters. The first convolutional layer seems to have 18 filters also with kernel size of 7x7 with equivalent padding. The same padding has the same height and width for both the output and input tensors. TensorFlow then adds zeros to the columns and rows to guarantee that they are of the same size.Following the convolutional is the pooling process. This pooling computation will shorten the data's extension. With a dimension of 3x3 and a stride of 2, we can employ the max pooling2d module. We use the previous layer as input. The output size of the second CNN is precisely 32 filters. The convolution operation has the same size as before, and output shape is [batch_size, 14, 14, and18].to define the completely linked layer Before combining with the thick layer, the feature map must be compressed. With a size of 7*7*36, we may utilize the module reshape.

The thick layer will link neurons. We can and will implement an activation feature for Relu. A dropout regularization term will be added which has 0.3 as its rate, implying that 30percent of the weights are 0. Dropouts occur only during the training time. The mode input to the classification algorithm fn() function specifies if the model should really be trained or evaluated.

TABLE 1: OTHER ALGORITHM

Rank	Model	Percentage Error	Accuracy	Paper	Year
1	Heterogenous ensemble with simple CNN	0.09	99.91	An Ensemble of Simple CNN models for MNIST DigitRecognition	2020
2	Branching/Merging CNN+Homogenous Vector Capsules	0.13	99.87	No Routing Needed Between Capsules	2020
3	EnsNet (Ensemble learning in CNN augmented with fully connected subnetworks	0.16	99.84	Ensemble Learning in CNN Augmented with fully connectedsubnetworks	2020
4	Efficient CapsNet	0.16	99.84	Efficient CapsNet: Capsule Network with Self-AttentionRouting	2021
5	SOP CNN	0.17	99.83	Stochastic Optimization of Plain CNN with Simple Methods	2020

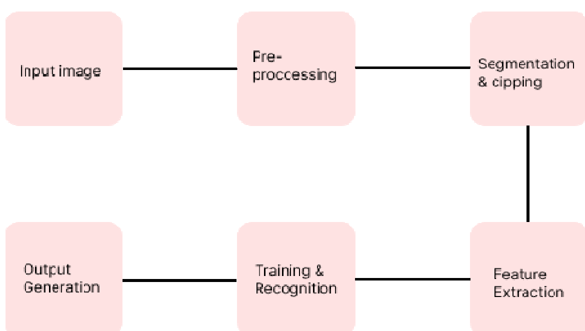

Fig. 5. Architecture of CNN

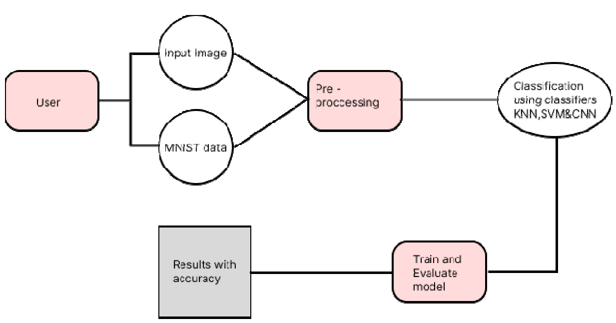

Fig. 6. Data flow Diagram of the system model

IX. MAKING PREDICTIONS

The test dataset has some predictions that are made and then they are stored in the data frame which is called the y_predicted_by_model . Calculation will be done for each dataset to see the probability score. The prediction made by the model is the highest probability score. We must define a tensor with the data's shape. We may accomplish this by using the reshape module. Here we must specify the tensor in order to shape it. The first for this argument is a data characteristic that is defined in a function argument.

X. CONCLUSION

In this paper we see how a dataset is divided and trained.MNIST was taken to make predictions using CNN algorithm and TensorFlow .The predictions were made to train the model and make an accuracy to upto 99% for digits 0-9.Using an aggregation of heterogeneous and homogeneous network models might improve performance up to 99.91percent of overall test accuracy, which is among the best available.

Studies using diverse configurations reveal that great performance is attained by a combination of approaches such as batch normalization, data augmentation, and ensemble methods, rather than by a single methodology or model design.

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Mental Health Condition and Sentiment Based Chatbot

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***Abstract*—In today's hectic lifestyle, over time, has arisen the need of looking after one's mental well being. However, many medical, social, financial and personal issues have turned out to be obstacles in timely detection and treatment of mental health diseases which may even cost the life of the sufferer. The presented work proposes a transformer-based mental health condition classification model and a sentiment-oriented response system to interact with the patient, giving human-like replies. Although numerous chatbots have been developed, very few have concentrated on the issues of mental health but that too with irrelevant responses. This approach aims at delivering positive chat system to the patients, using specific Reddit datasets for each category. The classification model resulted in an accuracy upto 93% and the response system has proven to be quite sensible and relevant.**

***Index Terms*—mental health, artificial intelligence, natural language processing, chatbot, transformers, sentiment analysis**

I. Introduction

During and after the Covid-19 pandemic, the social media caught its attention on a topic existing much before people knew about it and has been more important than people have believed it to be - mental health. While depression and anxiety are the two known conditions, there exist many more mental conditions which may arise due to emotional or psychological reasons and even due to irregularities in habits and lifestyle. Due to very less awareness about mental health issues and their signs and symptoms, the people suffering from many such diseases often become preys to prolonged mental illness, disorders and even suicides.

Due to such reasons, it is quite important to make people aware of their mental well being and so far it has been done by psychiatrists and psychotherapists. However, due to un- availability of a sufficient amount of professionals in this field and the unaffordable consultation fees and treatment charges have restricted people to get a cure of their mental issues andillness. Hence, in this running world of an hectic race, there is an urgent need of educating people about their own psychology and protecting them from the abstract wounds in a feasible manner. With the evolution of Artificial Intelligence and the introduction of chatbots, many individuals and organizations have aimed at providing aid to tensed people who have got a place to put their thoughts down without hesitation and feel a lot relaxed with their problems. However, there are several limitations with the response systems of these chatbots.

Firstly, almost all of them are oriented towards tackling depression and anxiety, putting no light on other mental health conditions. This leaving out leads to low efficacy of these chatbots and the users may get irrelevant responses which may not help them with their issues. Secondly, the way chatbots are designed becomes an obstacle in an interactive conversation and gaining actual feelings out of the users. As mentioned in the Wired article [1], chatbots like Woebot and Wysa though have claimed of being compassionate response systems, do not hold any proper survey report in the first place. Woebot is based on a guided chat system, does not allow the user to type his own words and instead provides input options. Although it is designed well, lacks human inputs and personalized response to each message. Wysa, on the similar ground, presents two different approaches of treatment- self-care and online consultation with a doctor, charging fees for both. Hence, although there are interactive chatbots to tackle mental health patients, their medical accuracy and user satisfaction turn out to be the major limitations. The presented approach, as shown in Figure 1 first classifies the patient into one of the 8 chosen mental health categories and then asks the user for inputs and giving them responses based on their categorized condition as well as the specific message, with a positive sentiment.

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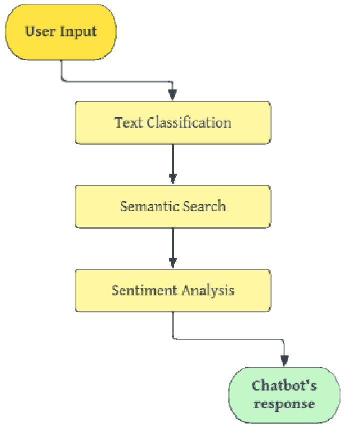

Fig. 1. Structural flow of the proposed work

II. Related Work

As rightly said in the Medical Device Network article [2], most of the mental health chatbots, instead of doing good, turning out to be harmful for their users, their market is unregulated and they do not have government's approval due to the lack of empirical evidence to back their efficacy and usage. The review paper by Alaa et.al. [3], concludes that the majority of the chatbots concentrated on depression and autism. However, there are many other major mental conditions and illnesses which the people should be aware of and the chatbots need to put light on. The presented work aims at dealing with 8 such categories and present an approach so that many more can be added.

Haoet. al. [4] in their work concluded that self-help chatbots helped university students in dealing with depression in a com- paratively better way than bibliotherapy which uses literature to cure the suffering. They further state that the process of conversation matters more than the content and have used statistical methods to illustrate their point. Their chatbot turned out to be much natural one as it involved emotion recognition and Natural Language Understanding(NLU) for interpreting user inputs and then used Natural Language Generation(NLG) with a response database to reply to that input. However, their chatbot was still based on the conventional dialogue management system that involves the user to choose from given options to give his inputs. A major aim of this workis removing this step of dialogue management and generate responses only on the basis of the user inputs, so as to give emphasis to every single input message.

Falguni et.al. [5] in their paper, have presented a chatbot that identifies the user's emotions based on text inputs and classifies each of them as one of the 8 chosen classes, namely joy, happy, shame, disgust, sadness, anger, fear and guilt. Further based on the negative emotions, the user is classified as normal, stressed or depressed. This classification and response system is a result of a pipelined process which involves ISEAR dataset for training and detecting emotion. Next in the pipeline is the classification step which uses CNN, RNN and HAN for categorizing the text into emotion labels and providing corresponding responses. This work takes up a similar approach but instead of categorizing text into emotion labels, classifies the user into one of the 8 mental health conditions based on his initial input.

In the review paper by Nick Boettcher [6], 54 studies and 425 abstracts were screened which dealt with Reddit data collection, focus on mental health conditions, analytics and practical implications. Approximately 63% of the studies based on practice implications suggested the use of Reddit data for professional practice related to human mental health. Some studies even suggested future applications of Machine Learning classification algorithms to help Reddit users access their mental health. As Reddit data appears to be a consid- erably good source of developing models and applications in the field of mental health [7], the Reddit community posts and their corresponding comments were scraped and manipulated to create a dataset for response generation.

Kim et.al. [8] in their paper, have presented a deep learning model to use social media user content and detect mental illness. They have used Reddit community data associated with each of the 6 mental illness classes, namely depression, anxi- ety, bipolar, bipolar disorder, autism and schizophrenia. They have used both XGBoost algorithm and CNN to accomplish the task of binary classification for each class and check if the illness exists or not. For depression they obtained upto 75% accuracy, 78% for anxiety, 90% for bipolar and BPD, 94% for schizophrenia and 96% for autism with their CNN model. The presented work too works on extracted Reddit dataset for the chosen conditions but has taken a step further by categorizing input into 8 categories and instead of binary classification that just checks the presence and absence of an illness, has used a category detection approach.

Anca et.al. [9], in their work have used the SMHD dataset[10] for mental health conditions and employed three deep learning models namely, BERT, RoBERTa and XLNET for disease classification. Similar to the previous paper, they have incorporated binary classification to detect the presence of 9 different conditions, namely depression, schizophrenia, OCD, eating disorder, PTSD, anxiety, BPD, ADHD and autism. Using this approach, they obtained accuracies ranging between 70-80%, each category holding its best accuracy in this range. The proposed approach has used BERT base (uncased) pre- trained model for categorical classification and has got muchbetter overall accuracy.

Taking insights from the cited literature, a novel approach is presented for creating a mental health chatbot involving multiple steps like condition classification, semantic similarity matching and sentiment analysis [11] along with database manipulation and querying. The proposed work aims at creating more personalized chatbot responses and make them motivational at the same time to reduce psychological illness at the grass-roots level itself.

III. Proposed Work

The presented work is divided into two sections - mental health condition categorization and sentiment-based response generation. Both the sections involve data extracted from Reddit communities, each dedicated to one of the 8 selected conditions namely Attention-deficit/hyperactivity disorder (ADHD), Anxiety, Asperger's Syndrome, Bipolar Disorder, Depression, Obsessive-compulsive disorder (OCD), Post-traumatic stress disorder (PTSD) and Schizophrenia.

A. Mental Health Condition Classifier

This stage of the presented work deals with classifying the user into one of the eight chosen categories of mental health conditions. For this purpose, a dataset of 7995 Reddit posts is used, which is a combination of around 1000 posts extracted using PRAW (Python Reddit API Wrapper) from each category's Reddit community. This dataset is cleaned during the preprocessing step and all the unavailable posts records are removed. These Reddit posts, at the time of extraction, are the top 1000 posts of their respective subreddits which makes them reliable enough to provide relevance to the training data as well as for responses generated using their comments.

Along with the posts data, corresponding comments are also extracted with their number of upvotes, post-link ID and their text body. In the later stages of the work, these comments are queried from the comments data table using post-link ID as the foreign key, hence mapping each comment to its subreddit post.

In the next step of this stage, the Bidirectional Encoder Representations from Transformers(BERT) base uncased model[12] is used which is a pretrained model trained on a large dataset of English language book corpus. This transformers- based model [13] takes in input ids, token type ids and attention mask [13] which are derived by applying the tokenizer method of this model on the posts body column in the cleaned Reddit posts dataset. The output labels are created as integer values ranging from 0 to 7, each representing a mental health condition. The model is trained on 90% of the dataset, the 10% being the test data, using Adam optimizer, categorical cross entropy loss function and categorical accuracy as the evaluation metrics. Finally, the output of the model is an integer, corresponding to a condition and is fed into the next stage, which is generating responses with respect to the data of this particular condition.

Unlike other works, the proposed approach does not use binary classification as first of all, it achieves an overall accuracy of 93% for category classification and detecting the disease itself is a better approach in case of mental health instead of detecting the presence of disease. This is because, if an input has the textual characteristics of multiple diseases, it is hard to identify the actual dominant illness.

B. Sentiment-based Response Generation

This stage deals with generating a response based on four conditions - class, sentiment, sentiment score and relevance. First of all, the class is the mental health condition taken from the output of the previous stage. So, if the associated class is Depression, the Reddit dataset comprising of two data tables - posts and comments, is looked upon and queried. In order to do so, a semantic search based sentence transformers model all-MiniLM-L6-v2 is used. Once the user has briefed about his condition in a few words, it is taken as an initial input to the chatbot. After condition categorization, this input is fed into the semantic similarity model which matches the input to all the posts of the condition's posts dataset. The best match is chosen and the post id is mapped to the comments table's link ids as the dataset is filtered to obtain all the comments associated with the matched post.

In the next step, DistilBERT base uncased finetuned SST- 2 model is used for the sentiment analysis [14] of all the comments in the filtered dataset. This helps to obtain the comments sentiment and a corresponding sentiment score. Since the approach is to provide consoling and motivating responses, all the negative sentiment comments are removed in order to obtain only the positive sentiment comments. Further, in the following step, the filtered comments dataset is sorted based on the positive sentiment score and the number of upvotes each comment has got from the Redditusers. This helps in getting the most relevant response and that too of a positive sentiment. It is important to note that responding with just the most liked comment can go against the primary aim of consolation as its sentiment can be negative and instead of motivating, can even demoralize the patient.

In this way, results for all the other mental health categories can be obtained and human-like responses can be given to every message as these are the replies given by actual humans, the Reddit users. [15] Furthermore, since these responses comprise of enough information required to respond to a particular message from the user, they can be used in the chatbot in stages while rest of the conversations can be handled using conventional conversational flows for chatbots. For example, if the detected mental illness turns out to be OCD for a patient, he can be redirected to a chat flow asking questions and giving responses based on OCD only. These conversations can then be used for extracting data from user responses and on aggregation, can be fed into the response generation module which provides a structural flow to the chatbot as well as informative responses only at the required stages and not making the conversation boring and question- answer based.

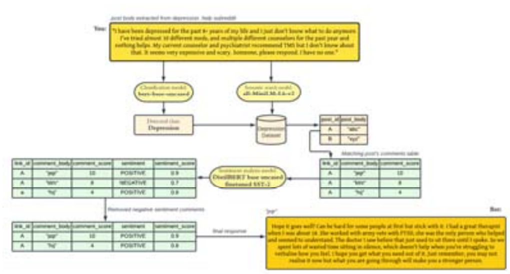

Fig. 2. Complete flow of work presented: a dialogue exchange

TABLE IA COMPARISON TABLE OF PREVIOUS WORKS AND PRESENTED WORK

S.No.	Publication	Mental health conditions	Classification accuracy
1	Falguni	8(emotion labels)	CNN: 75%, RNN and HAN:

	et.al. [5]		75%
2	Kim et.al. [8]	6	75-97% (binary accuracy for each category)
3	Anca et.al. [9]	9	70-81% (binary accuracy for each category)
4	Presented work	8	93% (categorical accuracy)

IV. Evaluation and Results

Upon evaluation of the classification model, the test data is put into play which constitutes the 10% of the Reddit posts dataset. Using categorical accuracy metrics, an accuracy of upto 93% is obtained for categorizing the patient into one of the 8 classes based on his brief about his condition. These results give the required reliability to the response system as the patient is only responded based on his condition. Other than this, this work stands out from other mental health Classification models since it covers more classes than the works done previously and the chosen classes are quite different from one another, which means that the patient does not get same responses in different classes of mental health. A comparative study of the previous works and the proposed work is depicted in the Table I. It can be clearly inferred that this work has more number of categories of mental health and has a sufficiently good enough accuracy in categorizing the patient to one of the eight of these. As illustrated in Figure 2, the initial input gets a relevant response in which the bot is telling its own story to which the user can relate and at the same time get motivated by the phrases used. Hence, the presented approach is able to generatea response to the user input maintaining reliability, relevance and sentiment, all at the same time.

V. Conclusion and Future Work

With the presented work, a chat response system is designed which first asks for an initial brief about the patient's condition and associates his to the corresponding class with an accuracy of upto 93%. On the basis of this assigned condition, a response to the input is generated after querying of Reddit posts and comments dataset based on similarity matching and sentiment analysis.

The work done so far incorporates multiple models for diminishing the limitations of previous chatbots and create a new design for a mental health chatbot. However, as the fields of psychology and mental health are quite vast, such works need regular updates and improvements. For a text-based chatbot, intent based tagging approach can be introduced for a much better interaction. Other than this, although there is a scarcity of mental health dialogue dataset, there is a future scope of creating such corpuses to train conversational models and based the entire chatbot on the basis of psychotherapeutic consultation.

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Student Performance Analysis Using Deep Learning Technologies

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***Abstract*— Learning is a process, in this course of long run it is necessary to measure it's performance on the major people discharging it. Because there is so much data available, using Deep Learning to anticipate what will happen in the future is becoming more and more common. The ability of deep learning to forecast students' academic performance is suggested by this study. At the end of the school day, students either pass or fail. When that happens, it's too late to save the students. To keep kids from failing, it is necessary to predict SAP in advance. When that happens, it's too late to save the students. To stop pupils from failing, it is necessary to anticipate their academic performance in advance. The study of data mining, machine learning, and statistics as they relate to information produced in educational contexts is known as education data mining (EDM). It is all about enhancing learning outcomes by examining data gathered while we lecture. The main goal of this paper is to give an appropriate method of measuring student performance using FNN, DBN, ICGAN-DSVM, LSTM, and BLSTM. This process involves collection of datasets, that is gathered from students' academic dataset which can be further enhanced by ICGAN that increases the data volume. It is discussed how the data were gathered, prepared, and developed. The models are built, trained and applied on the dataset. These results are compared to each other and are classified situationally to the requirement.**

Keywords*— Education Data Mining, FNN, DBN, ICGAN-DSVM, LSTM, BLSTM

I. Introduction

There lies a huge difference between learning, testing and deploying it in a real world. Performance of a student is based on these factors. These factors can be measured with various technologies such as machine learning, deep learning, etc. In the age of the information revolution, mathematics is one of the fundamental cornerstones for numerous subjects, as well as the backbone of scientific endeavor. A difficult activity that might assist students and teachers in monitoring student performance development is measuring student performance. Several strategies have been researched and compared to produce the optimum prediction model in an effort to improve the results of prediction. Learning is affected by various factors such as quantity of information, emotions, mistakes, novelty of the brain, learning styles, social learning, and teaching. Cognitive overload is the term used by brain scientists to describe the state in which a person's brain is overloaded with new information. Cognitive overload is caused by having too much new information, which eventually hinders learning. How might cognitive overload be lessened? There are primarily two methods. The first is the quantitative approach, in which you merely present less novel information. Before introducing new knowledge, you give students time to comprehend the majority of what they have learned. The other approach is qualitative, where you modify how you offer material to make it less intimidating. Research has shown that our emotions have an impact on every aspect of our lives, including how we remember information and how we interpret it. Kids, who are less mature, are especially at risk for this.

Students study a lot throughout the year and are tensed of proving it in an examination. Performance is measured based on testing, but this cannot prove an individual's content learned and applied. Considering various intrinsic values apart from the above ones, such as data being gathered on knowledge gained, skill growth, values clarification, and performance level. For all educational institutions, raising educational standards and student performance is of vital importance. There has been an increase in interest from higher education providers and institutions to adopt machine learning techniques to understand students' behaviors, learning patterns, and drop-out trends in education. However, educational analytics in learning has never been explored as is the case in the health sciences and chemistry.

Deep learning is chosen as a key for the following grounds. For more focused performance that is required to be similar to human activities, deep structures learning, also known as hierarchical learning, or Deep Learning (DL), first appeared in 2006. The capabilities of DL are strong in the areas of prediction, classification, identification, and detection. DL is more popular than other machine learning algorithms due to its ability to process both structured and unstructured data as well as manage large amounts of data. When it comes to prediction, DL has been used to a variety of issues, including the Intelligent Transport System and several economic and educational areas. Learning and higher education challenges have been addressed with DL in a number of studies in the realm of education. DL is effective for classifying, detecting, and identifying a lot of data in addition to prediction. Classifying, identifying, or detecting are examples of four DL tasks that can be combined and used interchangeably in a single study.

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Numerous problems need to be solved in education, particularly higher education. Starting with the most basic model, the Feedforward Neural Network, ICGAN-DSVM is best supported for small datasets, five classes of machine learning algorithms, and the Deep Belief Network (DBN) framework for deep learning were executed and compared.

II. RELATED WORK

Aya Nabil et al. [1] says that one of the significant research questions in the discipline of educational data mining is how to forecast the academic performance of students at a preliminary phase of a **course** (EDM). Subjects like "Data Structures" and "Programming" in undergraduate programs have significant failure and dropout rates because students struggle with a variety of issues. As a consequence, EDM is utilized to evaluate student data collected from different school environments in order to forecast the academic performance of students, which enables them to perform well in next courses. The primary objective of this study is to investigate the effectiveness of deep learning in the area of EDM, particularly in forecasting the academic performance of students and identifying students who are at danger of failing. Using the grades obtained in the courses written in the previous academic year, the K-nearest neighbor, decision tree, deep neural network (DNN), support vector classifier, logistic regression, gradient boosting and random forest were utilized in this paper to create models that would predict academic performance of students in future courses. Additionally, they compared ADASYN, SMOTE, SMOTE-ENN and ROS among other resampling techniques to address the issue of an unbalanced dataset. According to the experimental findings, the presented DNN model outperforms support vector classifiers, K-nearest neighbors, logistic regression and decision trees in predicting performance of students in the course of data structure and identifying students at threat of failing early in a semester. The result is obtained with an accuracy of 89%.

Mohammad Hafiz MohdYusof, et al. [2] proposed that the ideas of precision medicine have been adopted by precision education. It uses machine learning, algorithms, and techniques of data manipulation to make predictions, and will eventually be used to create customized school intervention plans. Numerous applications and themes in precision education research have been studied in this work. After that, a model was created using one of its techniques, deep learning in Malaysia. The purpose of the research is to forecast the performance of students in English. When the proposed deep learning model is tested for folder classification using three test datasets, it performs with 93% accuracy.

PhaukSokkhey, Takeo Okazaki [4] proposed that evaluating performance of students is a difficult undertaking that can assist both students and teachers in monitoring student performance development. One of the fundamental foundations of many topics, mathematics serves as the foundation for every scientific endeavor in the period of the tech revolution. Several strategies have been researched and compared to produce the optimum prediction system in an effort to enhance the results of prediction. In this article, they offered a comparative examination of machine learning (ML) algorithms, statistical analytic methods and a deep learning architecture for forecasting mathematics performance of students. The Deep Belief Network (DBN), a deep learning architecture, five classes of machine learning algorithms, and the statistical approach structural equation modelling (SEM) were used. The same properties from two datasets of varying sizes were employed. Random Forest (RF) was discovered to perform better than other models in predicting the performance of students across the three different datasets.

Kwok Tai Chui et al. [5] say that it's been established that supported learning has been extremely important in raising the quality of education. Tutoring in the classroom and at home offers pupils individualized support and constructive criticism of their learning. Predicting the performance of students, which shows their knowledge of the subjects, is of great interest. To provide a solid basis for upcoming courses and a profession, it is especially important for students to manage their core knowledge. This study proposes an enhanced conditional generative adversarial network-based deep support vector machine (ICGAN-DSVM) technique to forecast the performance of students in learning environments including classroom and home tutoring. Due to the nature of the student academic record, sample sizes are often small. Due to the academic dataset's limited sample size, ICGAN-DSVM offers two advantages: ICGAN increases the volume of data, while DSVM improves the accuracy of prediction through deep learning. The suggested ICGAN-DSVM produces specificity, sensitivity, and area under the receiver operating characteristic curve (AUC) of 0.968, 0.971, and 0.954, respectively, according to results from cross-validation of 10-folds. Additionally, the results indicate that including both home and school tutoring in the model may enhance performance over using just home tutoring or just school tutoring alone. A comparison between ICGAN & DSVM and the conventional conditional generative adversarial network has been done to demonstrate the need for ICGAN and DSVM. Additionally, the suggested kernel design using heuristic-based multiple kernel learning (MKL) is contrasted with conventional kernels including radial basis function (RBF), linear, sigmoid and polynomial. Following the presentation of the forecast of performance of students with and without GAN, a comparison with DSVM and regular SVM is made. In terms of the performance metrics specificity, sensitivity, and AUC, the suggested ICGAN-DSVM performs 8 to 29% better than comparable studies.

Yueh-huiVanesa Chiang, et al. [6] proposed that to forecast student performance in introductory computer programming classes, this paper utilized deep learning algorithms with Moodle logs. Particularly, this study would like to use prediction results to identify potential low-performing students who may need assistance from teachers. The results suggested that deep learning models are promising to predict student performance and identify low-performing students in the researched context. What the prediction results provided by the models can inform teachers in learning settings was also further discussed in this paper.

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DiaaUliyan [7] says that predictive analytics' ability to assist institutions judge performance of students is becoming more widely known. Big data analytics may offer information that supports academic performance and completion rates, like student demographic facts. For instance, analytics of learning is a crucial part of big data at universities and may give strategic decision-makers the chance to analyze learning activities across time. This study involved a two-year retrospective review of student learning data from the University of Ha'il. Bidirectional long short-term model (BLSTM), a deep learning approach, was used to analyze students for whom retention would have been at risk. The algorithm offers a variety of variables that may be used to gauge a new student's performance, which helps with dropout and early retention prediction. Furthermore, every student's label was predicted separately using the conditional random Field (CRF) approach for sequence labelling. The predictive model's experimental findings suggest that utilizing BLSTM and CRF approaches, student retention may be predicted with a high degree of accuracy.

III. Methodology

In this paper, we are discussing the different possible ways in the prediction of performance of students using deep learning technologies. The deep learning technologies that are discussed here are Feed Forward Neural network, Deep Belief Network (DBN), Improved Conditional Generative Adversarial Network based Deep Support Vector Machine (ICGAN-DSVM), Long Short-Term Memory (LSTM), Bidirectional Long Short-term model (BLSTM)and Conditional Random Fields (CRF). But before we apply the model, we need to do some steps which support the prediction. They are Collecting the data, Pre-processing the data, Method to validate the model and finding out the evaluation measures. Let us see each of these steps in detail.

A. *Collecting the Data*

In this step we need to collect the student data. To determine the performance of students with higher accuracy, we might require three types of data. They are Demographic data (Age, Gender, Area of location, Financial Status), Academic data (GPA and CGPA of students, Academic tests, Earlier test scores), and Behavioural data(Activity submission log, Library history).

B. *Pre-Processing the Data*

This process converts the data which is collected in raw format into the required format which is useful in acquiring the required result of predicting the performance.

a. Cleaning the data: In this step, the values which are missing are removed.

b. Data Discretization: In this step, attribute values of continuous data are converted into finite set of intervals. For example, let the student's data has different categories based on marks like Excellent, Very Good, Good, Poor, Fail. We can convert it into two categories called Pass and Fail in this step.

c. Encoding the feature: As the algorithm doesn't understand categorical data, we convert all the categorical data into numerical data. We can use label encoding for this.

d. Handling Imbalanced Dataset Problem: Suppose we have two class labels. They are Pass and Fail. Pass have higher number of occurrence than Fail. So Pass becomes the majority class and Fail becomes the minority class which affects the performance of the algorithm. So we need to use a resampling method to solve this problem. The resampling methods are Over sampling (It increases the count of minority classes. This method is used for small sized datasets), Under sampling (It reduces the count of majority classes. This method is used for large sized datasets), Hybrid (It is a combination of both Over sampling and Under sampling).

e. Feature Scaling: To improve the learning process of the method, the dataset's features need to be scaled so that it has a small range. The most common scaling technique that is used is standard scaler. We need to find out the standard deviation and mean for every feature to standardize the feature.

$$X_{Scaled} = \frac{x-\mu}{\sigma} X_{Scaled} = \frac{x-\mu}{\sigma} \tag{1}$$

C. *Validating the Model*

a. Method of Random Hold-out: We divide the dataset into 80% and 20%. 80% is used in training and the remaining 20% is used in testing.

b. K-fold Cross-Validation: For the dataset with a small size, we can use K-Fold Cross-Validation. This method divides the dataset into equal sizes containing K subsets. All the subsets except one will be used for training the model. One subset will be used for testing.

D. *Deep Learning Models*

a. Feed Forward Neural Network: The simple one among other types is Feed-Forward Neural Network. Here all the neurons are fully connected and does not form a cycle. The neurons are in inputs, output, and hidden layers. Multiple hidden nodes are traversed by the data since it always travels forward but not backward. The Feed Forward Neural network would be executed using the train and test data. TensorFlow may be used as the backend, and Keras as the frontend. Between the hidden layers, the ReLU activation function is utilized, while at the output layer, the softmax activation function is utilized. [2][3]

b. Deep Belief Network (DBN): A subset of deep learning is deep belief networks. It's a multi-layer belief network made up of Restricted Boltzmann Machines (RBMs) that are built on top of one another to create a DBN. A greedy layer-wise learning process is followed by a three-layer DBN that includes the pre-training. Particularly, while one layer is added to the network at a time using the contrastive divergence (CD) method, only the top layer of the network is trained as an RBM. Once each RBM has been trained, the weights were clamped along with the introduction of a new layer to repeat the procedure. In a DBN, there are two phases. Unsupervised pre-training, which is the first stage, teaches features using only input values with no labels. The

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second level of tuning involves employing a label using supervised fine-tuning and an error back propagation method. In order to maximise the benefits of the DBN model, we must build numerous models with varied hidden layer counts, hidden layer node counts, and hyper parameters.[4]

c. Improved Conditional Generative Adversarial Network based Deep Support Vector Machine (ICGAN-DSVM): Since educational datasets often contain modest amounts of data, the majority of machine learning algorithms exhibit a shallow learning approach. ICGAN mimics fresh training datasets to solve the issue of low data volume, whereas DSVM extend the SVM algorithm from shallow learning approach to deep learning approach. As a fundamental distinction from conventional deep neural networks, DSVM excels with limited datasets. In comparison to earlier efforts, the ICGAN-DSVM method increases specificity, sensitivity, and AUC by around 8 to 29%. More performance of student data for training are produced using ICGAN. The prediction model for performance of students is handled by DSVM. To expand the dataset's data amount, GAN is selected. In the training stage, the generator and discriminator strive to reach the Nash equilibrium. In reality, educational dataset which are of small size is usual. In general, it is challenging to collect continuous data at the beginning, while learners are still young. The random noise vector (the generator's input) is unhindered in the original GAN, which might result in disastrous theory corruption. Conditional variables are added to the generator and discriminator to overcome this restriction. The current architectures of CGAN, InfoGAN, and ACGAN are combined to create improved CGAN (ICGAN). ICGAN generates data with less bias. The concepts of (i) adding a conditional variable to the discriminator, (ii) including another network with the discriminator, and (iii) giving a label to each produced sample are all incorporated within ICGAN. The problems of Classification are typically solved by the Support Vector Machine algorithm. We can divide the n-dimensional space into classes using the best line we can draw using SVM, making it simple to classify fresh data points. The best line is called the best decision boundary or hyperplane. Utilizing DSVM architecture, the prediction model to predict the performance of students is put into practice. In general, it has an output layer of SVM and a number of hidden SVM layers. In comparison to many other deep learning architectures like deep neural networks, DSVM has a number of advantages, including the ability to handle the issue of very large input vectors and small training datasets, more flexibility in the design of kernel functions, and strong regularisation power in the output layer SVM to prevent over-fitting. [5].

d. Long Short-Term Memory (LSTM): Long Short-Term Memory (LSTM) is a form of artificial neural network used in deep learning and artificial intelligence. Unlike conventional feedforward neural networks, LSTM has feedback connections. In addition to single data points, a recurrent neural network (RNN) of this type may analyze entire data sequences. Both "long-term memory" and "short-term memory" are compared to a standard RNN. The name of LSTM is obtained due to this reason. This network model can be made using four layers. They are Masking, LSTM, Dropout and Dense layers. Cross-entropy method is used when training the model. Nadam is set as an optimizer. Masking layer was aimed at filtering the missing values caused by data from different semesters and courses with incompletely identical learning activities. The filtered data served as input to the LSTM layer. In each cell, its cell state, hidden state, and input data from 10 time points was processed consecutively one by one through the input gate, forget gate and output gate. The output of the last time point was the LSTM layer output and was sent to the Dropout layer for preventing overfitting. Last, the output was sent to the Dense layer, using softmax as activation function to calculate the possibilities of three classes (i.e., low-performing, average-performing, and high-performing). The highest possibility was the result of categorizing. [6].

e. Bidirectional Long Short-term model (BLSTM) and Conditional Random Fields (CRF): BLSTM includes a variety of elements that may be used to judge the performance of a new student, which helps with early dropout and retention prediction. Furthermore, the condition Random Field (CRF) approach to sequence labelling was used to forecast each student's label separately. One of the most effective artificial recurrent neural networks (RNNs) for time series data categorization and prediction is BLSTM. Using the sequence labelling approach, it may be utilized to process whole data sequences and keep them in compressed form. Additionally, BLSTM excels in a variety of sequence labelling tasks, including handwriting and speech recognition, and with long-term data dependencies. This benefit led us to develop the prediction problem from a sequence perspective. The BLSTM method must be trained over the student features in both directions, specifically forward and backward with hidden states, before concatenating the output from both directions. This follows the stage in which we attempt to describe students using their features. BLSTM has shown its effectiveness in a number of related tasks. Each unit in the BLSTM structure is made up of an LSTM unit. The primary responsibility of BLSTM is to extract and encode specific student attributes. To forecast each label of a student on their own, CRF is utilized for sequence labelling. It may then study the relationships between sets of features and labels using a state score and model the interactions between neighbouring labels using a transition score [7].

E. Evaluation Measures

Some of the evaluation measures are Precision, F1-score, Accuracy, Classification error, Recall, Sensitivity, and Specificity. The most common evaluation measure is accuracy. When the dataset contains the same number of instances for each class, accuracy can be employed. Here, TP - True Positive, TN - True Negative, FP - False Positive, FN - False Negative, N_n – Number of negative samples, N_p – Number of positive samples.

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \quad (2)$$

$$\text{Recall} = \frac{TP}{TP+FN}\text{Recall} = \frac{TP}{TP+FN} \quad (3)$$

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$$\text{Precision} = \frac{TP}{TP+FP}\text{Precision} = \frac{TP}{TP+FP} \quad (4)$$

$$F1 - \text{Score} = 2 * \left(\frac{\text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}\right) \quad (5)$$

$$\text{Classification Error} = \frac{FP+FN}{TP+TN+FP+FN} \quad (6)$$

$$\text{Specificity} = \frac{TN}{N_n}\text{Specificity} = \frac{TN}{N_n} \quad (7)$$

$$\text{Sensitivity} = \frac{TP}{N_p}\text{Sensitivity} = \frac{TP}{N_p} \quad (8)$$

IV. RESULTS

a. *Feed-Forward Neural Network*

This model gives accuracy of 93% in 3 testing folds, 88% in 5 testing folds, and 77% accuracy in 10 testing folds [2]. This model gives an accuracy of around 35% when it is tested for accuracy [3]. This model sometimes predicts the Pass students as Fail and Fail students as Pass. So, this model is far from perfect.

b. *Deep Belief Network (DBN)*

This model generates an accuracy of 75% and 88% [4]. So this model also doesn't meet up the required prediction accuracy.

c. *Improved Conditional Generative Adversarial Network based Deep Support Vector Machine (ICGAN-DSVM)*

The suggested ICGAN-DSVM produces specificity, sensitivity, and AUC of 0.968, 0.971, and 0.954, respectively, according to results from 10-fold cross-validation.

d. *Long Short-Term Memory (LSTM)*

The accuracy was around 60% for the given LSTM model.

e. *Bidirectional Long Short-Term Model (BLSTM) and Conditional Random Fields (CRF)*

For the given method the precision was found to be 89.1%, and recall is 88.5%. Accuracy is found around 90%.

From these results, we can understand that the two methods work well in predicting student performance. They are

Deep Support Vector Machine with improved Conditional Generative Adversarial Network (ICGAN-DSVM)

Bidirectional Long Short-term model (BLSTM) and Conditional Random Fields (CRF)

We can also note that **BLSTM and CRF** give the highest accuracy of around 90%. This is due its long-term memory and its ability to train the student in both directions.

V. CONCLUSION

In this paper, we provided with a detailed method to conduct Student Performance analysis. Here we concentrated on Deep Learning technologies. The initial stages of the analysis include Data Collection, Pre-Processing the data, and Validating the Model. During the Pre-Processing stage, we are performing data cleaning, data discretization, encoding the feature, handling imbalanced dataset problems and feature scaling. The validation of the model is done using the method of Random Hold-out and K-fold Cross-Validation. This paper aims to produce multiple classifiers to investigate the model that can best describe a student's performance. The deep learning models considered here are Feed Forward Neural Network, Deep Belief Network (DBN), Improved Conditional Generative Adversarial Network based Deep Support Vector Machine (ICGAN-DSVM), Long Short-Term Memory (LSTM), Bidirectional Long Short-Term model (BLSTM) and Conditional Random Fields (CRF). By using different evaluation measures, we came to the conclusion that Improved Conditional Generative Adversarial Network based Deep Support Vector Machine (ICGAN-DSVM) and Bidirectional Long Short-Term model (BLSTM) and Conditional Random Fields (CRF) provide us with the best result. This may use to enhance the student's performance by analyzing their results in an earlier stage and to reduce the dropout rate which is at the primary level (Classes 1 to 5) increased to 1.5 percent in the academic year 2021–2022 from 0.8 percent in the previous year, according to the data. Dropout rates have increased at the upper primary level (Classes 6-8), rising to 3% in 2021–22 from 1.9% in 2020–21.

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An Insight into Neural Machine Translation

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***Abstract* — Automatic language translation between two languages has encountered a quantum leap in perspective as of late in the field of machine learning. The term "neural machine translation" was developed in response to statistical machine translation, which relies on various count-based models and long dominated MT research. In contrast to conventional statistical machine translation, neural machine translation aims to build a single neural network that may be mutually changed to maximize translation efficiency. The current NMT models may be traced to previous versions of the encoder-decoder network family as well as to word and sentence embedding in this study. We will conclude with a succinct outline of recent developments in fields like NMT's bidirectional training (BiT).**

Keywords—Statistical Machine learning, Machine translation, word embeddings, Bi directional Training(BiT)

I. Introduction

One of the first objectives of text between languages was the automatic translation. The dawn of NMT positively checks one of the significant achievements throughout the entire existence of MT, and has prompted an extremist and unexpected departure of mainstream research from numerous past research lines. Given the fluidity of human language, machine or programmed translation may be among the most difficult AI undertakings. Earlier, rule-based frameworks were used for this task, but statistical techniques took their place in the 1990s. The field of neural machine translation, appropriately named, has more recently seen cutting-edge results from deep neural network models. The target language's feedforward neural language models were used to rank translation lattices in earlier attempts[1][2][3]. The principal neural models that also took into account the source language were established by using a similar model with bilingual tuples in place of specific linguistic words [4], directly scoring phrase pairs with a feedforward net [5,] or including a source defined range in the neural language model [6]. In this paper, we will discuss the origin of the NMT and try to give a basic overview of the concepts of NMT, Bi directionally training(BiT) it, and other current research in the field.

II. Word Embeddings

One of NLP's models most essential elements is the representation of words or phrases as continuous vectors. A d-dimensional real number vector should be used torepresent the word x. In general, a size d for the embeddinglayer that is noticeably smaller is chosen than the size of the vocabulary (d |Σ|). The following can be used to illustrate how a word is translated into its dispersed representation: a matrix of embedding called $E \in R\ d\times|\Sigma|$ [8]. The word x's d- dimensional representation is contained in the xth column of E,which is designated as E:

x. Embedded matrices are frequently learned along the network as a whole in NMT utilizing back - propagation algorithm [9] and a gradient-based optimizer. Many NLP subfields now make extensive use of pre- trained word embeddings made from unlabeled text[10]. The context in which a word commonly appears is usually taken into consideration by techniques for training word embeddings on raw text. [11][12], or enhance embeddings with cross-linguistic data[13][14]. Contextualized depictions make an effort to use the entire input sentence rather than just one word. In a number of NLP benchmarks, contextualized word embeddings have improved current technology. [15][16][17].

III. EmbeddingsWithin Phrases and Sentences

It is recommended to use phrases or sentences rather than single words when carrying out diverse NLP tasks. By utilising a scattered portrayal of the source sentence, for example, the distribution of the target sentences might be constrained. Reiterated autoencoders were a pioneering method for phrase embedding[18][19]. A phrase is designated as a d-dimensional vector by using [20] A word embedding matrix was initially trained by Socher et al. (2011). They then constructed an auto encoder network that uses the input as the fusion of two child representations to iteratively search for d-dimensional portrayals for 2D inputs. The word embedding chosen by the same auto encoder from two different guardians are the kid representations. A binary tree that can be created greedily controls the order in which representations merge. [20] or created with the aid of an Inversion Transduction Grammar[21][22]. However, in MT, the sentence representation must provide enough information to impose conditions on the objective sentence appropriation, and as a result, it must be higher dimensional than the word embeddings.

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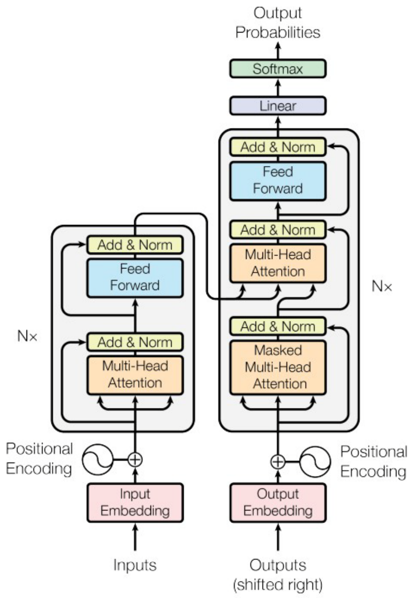
In order to get around the dimensionality issue with recurrent autoencoders, Kalchbrenner and Blunsom (2013)[23] found vector representations of words or sentences using convolution. Recent research finds sentence representations using self-attention much convenient rather than convolution. [24][25][26]. Yu et al. (2018) also looked at the possibility of using (recursive) connection networks. [28][29] which again totals the words in the sentence that are related to one another in pairs. Sentence representation frequently makes use of recurrent structures. It has been discovered that even untrained random RNNs can perform fairly well for a variety of NLP applications[30][31][32][33].

IV. Networks of Encoders and Decoders with Fixed Length Sentence Encodings

The primary authors who shaped the target sentence distribution using a distributed fixed-length representation of the source sentence were Kalchbrenner and Blunsom (2013)[23]. They modelled their recurrent continuous translation models (RCTM) I and II after the class of encoder-decoder systems [34], which is the most effective NMT design at the moment.

V. Architecture of an Attention Model

Sentences of various lengths pass varying amounts of information. Early NMT models had the drawback of commonly producing bad interpretations for lengthy words [35]. [36] Cho et al. (2014a) alluded that this error is due to the fixed-length source sentence encoding. A vector of constant length "does not have enough capacity to encode a long sentence with complicated structure and meaning"[36]



$\frac{1}{\sqrt{d_k}}$ e Transformer – Model Architecture

A. *Stacks of Encoders and Decoders*

Encoder: The encoder is made up of N = 6 discrete layers placed on top of one another. Each layer is composed oftwo sublayers. The first is a multiple-head self-attention mechanism, whereas the other is a standard feed-forward network thatis entirely related with positions. We employ a residual connection and then layer standardization to encircle each of the two sub-layers. For each sublayer, the outcome is Layer Norm(x + Sublayer(x)), where Sublayer(x) denotes the task performed by sublayer itself. Aspect model = 512 produces results for all model sub-layers and the embedding layers that can be used with the remaining associations[37].

Decoder: Similarly, the decoder is built from a stack of N= 6 similar layers. We employ lingering associations surrounding each sub-layer, similar to the encoder, followed by layer normalization. The self-consideration sub-layer in the decoder stack is also modified in orderto prevent positions from caring for resulting positions. The position's expectations due to this veiling and the fact that the result embedding are balanced by one position[37].

B. *Attention*

A set of vectors like key-value pairs, a planned inquiry, and a result can all be used to define an attention function. The weights assigned to each value are based on how well the question fits with its associated key, and the answer is generatedas a weighted sum of the values.

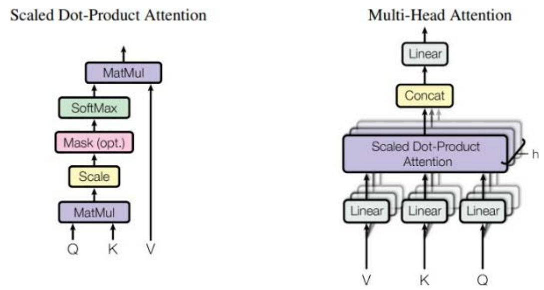


Figure 2: (left) Scaled Dot-Product Attention. (right) Multi- Head Attention consists of several attention layers running in parallel.[37]

C. *Scaled Dot-Product Attention*

As shown in figure 2, the input for "Scaled Dot-Product Attention" consists of queries, keys of dimension dk, and values of dimension dv. The weights for the values are obtained by dividing each key by dk, the softmax function, and the query's product with each key.

We simultaneously register the attention function on many queries that are integrated into a Q matrix. Additionally, the keys as well as values are merged into the matrices K and V. The output matrix is processed as follows:

$$\mathrm{Attention}(Q,K,V) = \mathrm{softmax}(\frac{QK^T}{\sqrt{d_k}})V$$

Additive attention and dot-product (multiplicative) attention are the two commonly utilized attention functions. For greater values of dk, the dot product grows enormous in magnitude, driving the softmax function into areas where it has small gradients. To balance this impact,we scale the dot products by[37].

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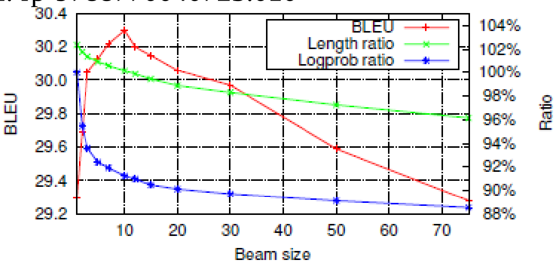

Figure 3: Transform model execution with varied beam widths on the English-German (WMT15) channel. At beam size 10, the BLEU score achieves its maximum, although the length proportion (Length of Hypothesis/Length of Reference) is less than 1. The proportion of the log-probabilities for greedy decoding is shown.

D. *Multi-Head Attention*

Instead of employing a single attention function with model-dimensional keys, values, and queries, we discovered that it is more effective to repeatedly direct project the keys, values, and queries to the dk and dv dimensions. The attention function is then applied simultaneously on every extended queries, keys, and values, producing dv-dimensional output values. Multi- head attention allows the model to process data from many portrayal subspaces simultaneously at various locations[37].

VI. Neural Machine Translation Decoding

Up to this point, we have seen how NMT defines thetranslation probability P(y|x).They do not explicitly explainhow to create a target sentence (y) from a given source sentence (x), despite this being the goal of machine translation. For two reasons, NMT decoding essentially expands significantly with sequence length, the search space first appears to be very large.

A. *Greedy And Beam Search*

To create the sequence outputs of tokens from a neural network model, greedy search and beam search are used. Both methods concentrate on models that go from sequence to sequence. Both algorithms operate simultaneously. A limited subset of the fractional hypotheses that have lengths (up to) j are chosen for extension in the following time step after being matched with one another in each iteration j. After a very large number of cycles have been completed, the algorithms stop, or all or the best of the selected hypotheses contain the finish-of-sentence symbol.

Beam search appears to be more exact, but there is no assurance that it will always lead to an interpretation with a higher or comparable score than greedy decoding. [38] According to Stahlberg and Byrne (2019), beam search has a huge number of searching errors.

VII. NMT Model Errors

In comparison to multi-level SMT systems like Hiero [39], which look at very broad search spaces, NMT beam search seems unnecessarily basic. This hypothesis claims that when the decoder fails to find the translation with the highest score, translation failures in NMT are more likely to be the consequence of search errors than model defects. It's interesting to note that this isn't always the case. Stahlberg et al. (2018), [38]Stahlberg and Byrne, [40]Niehues et al. (2017), [41][42]Stahlberg et al. (2018), and (2019). In particular, [38]Stahlberg and Byrne (2019) showed that the NMT decoding had a substantial number of search mistakes. Although, despite its theoretical advantage, NMT also experiences a variety of model mistakes in practice, as we will demonstrate in this section.

A. *Sentence Length*

Because the translated texts are becoming overly brief as a result of extensive beams, translation execution consistently declines (green curve). The log-probabilities of the found interpretations, as shown by the blue curve, are, nevertheless, declining as the beam size is increased. Anyhow, a big shaft for a bar search keeps the green path, thus it's seen as the more. This is encouraging right off the bat: outstanding translations may now be found with a rapid beam search and a small beam size. However, it indicates that providing search mistakes will fix the model fault of short translations with a thin beam is equivalent to retaliation. This means that any new NMT training approach will need to make adjustments to the beam size, which is another vital boundary.

VIII. Using Monolingual Training Data

The availability of data for concurrent MT training is often limited and costly, in contrast to the abundance of untranslated monolingual data. For instance, the translation grammar in Hiero [39] covers a large range of possible translations but fails miserably to assign points to them. Most of the time, it is the LM's responsibility to select a cohesive and fluid translation from that space. The NMT decoder should be integrated with an independently created RNNLM, according to Gulcehre et al. (2015, 2017). In a similar manner to traditional SMT, they also began combining the outcomes of RNN-LM and NMT using a log-linear model (a procedure known as "shallow fusion"). They demonstrated considerably better performance using "deep fusion," which makes use of a regulator network that gradually modifies the weights between RNN-LM and NMT. There have been a few increases in WMT assessment frameworks as a result of thorough integration and counting-based language models for n-best re-ranking [46][47]. The translation model is trained using the "simple fusion" method [48] to predictthe leftover probability of the training dataset mixed with the presumption of a fixed, pre-built LM.

Leftover probability of the training dataset mixed with the presumption of a fixed, pre-built LM. In the second research line, monolingual text is used to enrich data. By including monolingual data in the intended language, the natural concurrent training corpus will be enlarged. There are other ways to complete the source side of these sentences, including using a single false token[49] or replicating the intended sentence to the source side[50]. Reverse translation is the best method, and it makes use of a separate translation system to produce source sentences for sentences in a monolingual target language in the reverse direction. The performance of the final translation can, however, be significantly improved by improving the reverse system's quality if there are enough computational resources available. [52].

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The amount of interleaving that must be stabilized with the amount of simulated data greatly restricts back-translation. [49][53][54]. So, the back-translation technique can utilize part of the readily available unilingual data. Over- sampling, which involves multiplying real training samples by the size of the synthetic data, can partially correct an imbalance between real and synthetic data. Anyhow, in practice, really high over-sampling rates generally don't perform well. In order The manufactured sentence pairs are used to produce a richer training signal, [55]Edunov et al. (2018a) has recommended adding noise in the sentences that were reverse-translated. Additionally, [56]Wang et al. have confirmed the efficacy of enhancing data in NMT with noise (2018b). These techniques broaden the training data set, which complicates model fitting and ultimately generates additional training signals. By selecting different sentences from the reverse translation model, one can also enhance the number of synthetic sentences in back-translation [57].

To accommodate for monolingual data, the third group of techniques alters the NMT training loss function. As an illustration, According to Escolano et al. (2018), the training goal should include auto encoder words that characterize how well a phrase can be translated into its original form and then reconstructed ([58]Cheng et al. (2016b), [59] Tu et al. (2017), and [60]). Additionally, (unsupervised) parallel learning techniques depend on the utilization of the reconstruction error ([61]He et al., 2016a; [62]Hassan et al., 2018;[63] Wang et al., 2018c). However, it is often expensive to compute and requires approximations to train for the new loss. Alternative methods for combining source-side [64] and target-sidemonolingual data include execute multi-task learning. Starting Seq2Seq training using already-trained encoder and decoder networks is another method for leveraging monolingual data in both the source and the destination languages ([66] Ramachandran et al., 2017; Skorokhodov et al., [67] (2018)). Unsupervised NMT is an extravagant sort of lever-aging monolingual training data since it eliminates the necessity for parallel training data [68][69].

IX NMT TRAINING

Cross-entropy loss and backpropagation [70] are two typesof methods of optimizing like Ad delta 1 [71] are typically used to train NMT models. Recent NMT architectures such as fading gradients are one of the common training difficulties that are addressed by The Transformer, ConvS2S, or recurrent networks combining LSTM or GRU cells [72].

Research on training is still quite active. Now, early shallow models have been replaced with profound encoders and decoders with several layers. Deep architectures, particularly recurrent ones, are vulnerable to disappearing gradients[73], making training them more challenging because additional layers are required to transmit the gradients backwards. In the layer stack, residual connections [74] are quick associations that avoid more complicated sub-networks. Another method to prevent vanishing gradients is batch normalization [75], which uniformly sets each layer's hidden activations in tiny batches to have a mean of 0 and a variance of 1. Recurrent networks benefit most from layer normalization [76], a batch size-independent improvement to batch normalization.

A. *Regularization*

To aid in training, current NMT architectures are severely over-parameterized [77]. The model may be prone to over- fitting due to the huge number of features: The model perfectly matches the training data. Regularizers are techniques designed to stop neural networks that over fit and have too many parameters. The two manageable regularization techniques, according to one argument, are L1 and L2. It is meant to penalize the size of the weights in the network by include words in the loss function. Of course, these fines reduce a lot of variables to zero and make them irrelevant. Accordingly, the potential of the model is essentially constrained by L1 and L2. Label smoothing, early halting and dropout are the three regularization methods used most frequently for NMT. Dropout randomly resets the training exercises for both visible and concealed units to zero. It may be considered an effective regularizer in this way. Label smoothing significantly modifies the training objective, resulting in smoother distributions from the model.

B. *NMT by Bidirectional Training*

Bidirectional training is a quick and efficient pre-training method. The model will be bi-directionally updated at the earlier stage, and then tweaked as usual. The training samples can be reconstructed from "srctgt" to "src+tgttgt+src" to update bi-directionally without requiring any complex model adjustments. The suggested approach can be used in conjunction with current data manipulation techniques including back translation, data distillation, and data diversification. Large-scale investigations reveal that the methodology works as an innovative bilingual code-switcher, obtaining a better bilingual arrangement. Fortunately, with the help of BiT, our system [80] took first place in the low-resource track of IWSLT20218 for BLEU scores. Integrating BiT into our current systems [81][82] and confirming its efficacy in industrial level competitions will be intriguing.

C. *Results*

Outcomes on Multiple Data Scales: Various data sizes were(BiT) collected for 10 language directions, including IWSLT14 EnDe, WMT16 EnRo, IWSLT21 EnSw, WMT14 EnDe,and WMT19 EnDe, in order to test the method's utility. The largest direction has 38M sentence pairs, whereas the lowest direction only has 160K sentences. Table 1 displays the outcomes. The efficacy and thoroughness of the BiT are demonstrated by the fact that it significantly beats the solid standard Transformer in 7 of the 10 dimensions (importance test, p 0.01) and in remaining 3 directions (importance test, p 0.05) of the suggested bidirectional pre-training methodology. One advantage of BiT is that it reduces training time for the reverse direction by one- third. This benefit demonstrates that BiT may be a successful training method for multilingualism, such as multilingual pre training [83].

Table 1: Comparison with previous AT work on several widely-used benchmarks, including IWSLT14 WMT16 En↔Ro, IWSLT21 En↔Sw, WMT14 En↔De and WMT19 En↔De. "‡/†" indicates signific ence ($p < 0.01/0.05$) from corresponding baselines, and this leaves as default symbol in Table 2-6.

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Data Source	IWSLT14		WMT16		IWSLT21		WMT14		WMT19	
Size	160K		0.6M		2.4M		4.5M		38M	
Direction	En-De	De-En	En-Ro	Ro-En	En-Sw	Sw-En	En-De	De-En	En-De	De-E
Transformer	29.2	35.1	33.9	34.1	28.8	48.5	28.6	32.1	39.9	40.1
+BiT	29.9†	36.3‡	35.2‡	35.9‡	29.9‡	49.9‡	29.7‡	32.9†	40.5†	41.6‡

Statistics for Distant Language Pairs: Inspired by [84], we present the BiT findings for the distant language pairs Zh'en and Ja'en, which are members of various language families. This clears up any confusion regarding the use of BiT and languages that belong to the same linguistic family, such as English and German.

Table 2: Performance on distant language pairs, including WMT17 Zh↔En and WAT17 Ja→En. To perform BiT on languages in different alphabets, we share the sub-words dictionaries between languages.

Data Source	WMT17		WAT17
Size	20M		2M
Direction	Zh-En	En-Zh	Ja-En
Transformer	23.7	33.2	28.1
+BiT	24.9‡	33.9†	28.8†

Table 2 shows the outcomes as they were observed, compared to baselines, and developed through time as a result oftechnique in all cases. BiT improves on average by+0.9 BLEU over the baselines.

X.Conclusion

The most popular and effective type of machine translation has been neural machine translation (NMT) over the years. In this study, word, phrase, and neural language models were used to reconstruct the history of NMT. We examined the repeat, convolution, and attention building blocks of NMT architectures. We then briefly discussed cutting-edge NMT research areas such NMT By Bidirectional Training

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An Intensive Learning of Deep Learning in Alzheimer's Disease Prediction

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***Abstract*—The senior population is disproportionately affected by Alzheimer's disease (AD), making it the most common form of neurodegenerative disorders. It has an impact on patients' life, causing cognitive capacities such as consciousness, speech, actions, and problem-solving to deteriorate with time.Unfortunately, there is currently no cure for AD, and progress has been slow on finding a cure.However, the focus was on use of current medical information to diagnose the cognitive status of a patient, which in fact shows that a computer can replicate the clinical decision-making process of a physician. These rapid improvements have made it possible to collect enormous amounts of multifunctional neuroimaging data, which has led to the recent deployment of deep learning to the prompt identification and classification of Alzheimer's disease. Computational intelligence study into Alzheimer's disease continues to be in its infancy, but it is expanding rapidly as even more hybrid information sources are being incorporated, and as transparency is increased through the use of explicit strategies that integrate knowledge of specific behaviours and paths associated with the disease. This finding can be further understood by comparing multiple data-driven methodologies based on large-scale organization healthcare information from AD risk stratification, which may one day lead to improved selection of people at risk for AD in clinical laboratories or early identification of AD in clinical studies.**

***Keywords*—Alzheimer's illness, Disease progression, Deep learning, Cognitive deficiency.**

I. INTRODUCTION

Alzheimer's syndrome is the neurodevelopmental disorder characterized by brain atrophy (shrinkage) and cell death. It is a common type of dementia, and it is marked by a gradual loss of capacity of the individual to operateindependently. Dementia is by far the most common kind. Early indicators of the condition include losing details about recent events or talks. With the progression of the disease, people living with Alzheimer's will develop serious memory impairments and become incapable of performing daily duties.Medicines may improve symptoms temporarily or slowly. These treatments can sometimes contribute to maximizing functioning and maintaining independence in people with Alzheimer's illness [2].

Alzheimer's disease patients and carers can benefit from a variety of programmes and services. Alzheimer's ailment, a degenerative brain disorder, currently has no effective treatments or cures. Infections resulting from significant brain losses — such as dehydration, starvation, or infection — result in death as the disease progresses. Alzheimer's disease is caused by an unknown factor. The functioning of brain proteins, on the other hand, triggers a cascade of damaging events in brain cells, disrupting the brain's workings (neurons). Damaged neurons lose their connections and finally die [7].

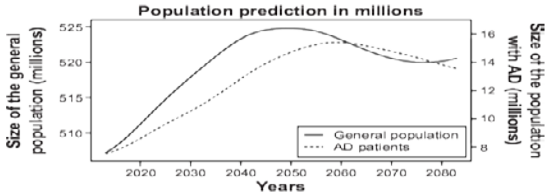

Fig. 1. Prediction of Population Vs AD patients

II.EASE OF USE

Genetic alterations cause Alzheimer's disease in less than 1% of cases, essentially guaranteeing that a person would get the condition. These unusual occurrences frequently result in mediaeval diseases.The damage usually begins in the memory-controlling area of the brain, although the initial symptoms do not occur for years. Neuron loss spreads to other parts of the brain in a predictable fashion. The brain had shrunk greatly during the late stages of the disease. Preclinical testing of Alzheimer's disease patients can lead to earlier detection of the disease and improved treatment options to delay its onset.The current AD biomarkers necessitate the acquisition of specimens or imaging data. E-health data, such as clinical records or organizational health data, on the other hand, do not require any additional time or effort to obtain. Furthermore, with the advent of digitization, the amount of such data has exploded [10].

Primary healthcare characteristics (maturity level, sexual orientation, profession), culture (physical exercise), midlife health- related risk factors (modest hypertension, body mass index, and total cholesterol), and cognitive assessments are often utilized to determine Alzheimer's illnesses. In clinical settings, evaluating whether these basic models, which are based on a small number of variables, can adequately account for the numerous etiologies of multifactor AD is a major challenge.In actuality, multi-factor modelling predicts the best disease risk, according to a meta- analysis research, however single-factor modelling does not reveal that successful AD risk prediction demands a wide range of factors.Here the magnitude is tested to which a data driven deep learning framework collects significant data from huge healthcare data that contain thousands of health records and predict the risk of AD individually [14].

To address these issues, the field of large-scale and high- dimensional analytical pictures is receiving a lot of

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interest in the developing field of deep learning, which customs underdone neuroscience facts to build functionality over "on-the-fly" training. We have reviewed publications systemically, using deep learning methods and neuroimaging information to detect AD early and predict AD progression [15]. ith this detailed overview, the intention of this learning is to provide readers with deep learning customized for AD and to help researchers to facilitate medical imaging. This work makes the main contribution

1. Introduced by an AI groundwork, AD is affected.
2. A clear road map for the need for deep learning and an analysis of general deep learning models for AD prediction has been provided in AD prediction.
3. Described the related research directions for medical researchers to make deep learning powered AD prediction.

This survey varies clearly from other recent surveys in the above points. It gives as much info as before. Section II discusses the theoretical source of AD to deep learning in AD. Thepaper has the following structure. Section III deals with a general data-driven deep learning model in AD prediction. Section IV lists and describes briefly the related directions of the research in Section V.

III. Theoretical Background

3.1 Artificial Neural Networks, Transfer & Multi-kernel Learning

ANN is used extensively for modeling highly nonlinear data patterns in machine learning models. Conventional learning models use only one domain sample that greatly influences their performance when there are very few samples accessible. Transfer learning is a technique that employs samples not just from the target field, but also from other (related) subdomains. A multimodal multiple regularized transfer learning to help learn the target domain by transferring knowledge from a secondary area. Information from a nearby hospital is transmitted into samples using the TrAda Boost approach. Even when unconnected domains are disregarded, transferring knowledge from all source domains diminishes the model's performance. It's also possible that the sample labels supplied to them are inaccurate [1].

A robust approach has transformed original markings into multi-bit vectors and at the same time has gained common characteristics to identify unconnected domains. To tackle these challenges, The acquisition of data from specimens to local specimens through the subspace method is designed to solve these problems. EEG signals for different artificial neural network variants were used. Numerous variants of the artificial neural network, like the radial basis neural function network and the probabilistic neural network, have been studied and proven to be the best solution for neural vector quantization. The classification approach is developed among several various algorithms including Radial Based Neural Function Network, Best-First Decision Tree, Decision Tree, Labeling, and the Perceptron Multi layer.

A real-life event can't possibly contain all of the data needed to train a model. In these cases, the training system is insufficient. For resource classification, a self-adaptive network assignment classifier is employed. Primary component analysis is used for feature extraction and classification in order to deal with complex data [8]. Longitudinal information from MRI images is combined with a multi-layer perceptron and a two-directional gated recurrent unit. Information from synchronous auditory input is used by the long-term memory network for Alzheimer's disease categorization. With diffusion tensor pictures, a fluffy technique with the Artificial Neural Network is utilised to differentiate ADissues. Data from many modalities adds to the amount of information available to learning algorithms in machines [16].

For that purpose, a multi-kernel learning environment integrated into a common feature space by region of interest and tensor. In order to support classification, a new Laplacian multimodal, regularized smaller squares model is used to support unlisted samples. The selection features separately from each model ignore the strong intermodal correlation between individual subjects that lead to under-optimal performance. A new multi-task learning selection model was developed to resolve this difficulty, which combined sparse features from all modalities were selected. Until now, the various kernel learning methods listed linearly mix many kernels from diverse modalities and are particularly sensitive to each modality's weights. The non-linear combination of data from many modalities is used to solve these difficulties. Using a privileged evidence method, the training is utilised during the training phase. To make use of privileged information, a new restricted Boltzmann machine was proposed. For categorization, an ensemble method was used [5].

3.2 Pathophysiology of Alzheimer's Disease

Aside from the prefrontal, posterior, and parietal lobes, other brain regions contribute to our cognitive abilities, including the serotonin ventral nerve, neurotransmission cytosol, and choline cytosol. The hippocampal, amygdala, neocortex, and cerebral interconnections can all show signs of basal nuclei, neuronal atrophy, and/or illness. The pathogenesis of Alzheimer's illness is depicted in Figure 2.

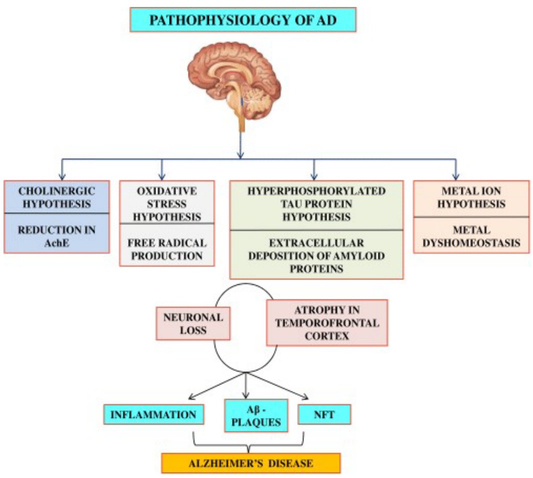

Fig. 2. Pathophysiology of Alzheimer's Disease

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The hippocampal, the cerebral associating regions, the transentorhinal lobe, and the mesencephalon, all of which are influenced by the frontal, parietal, and occipital lobes, tend to develop tangles in a predictable order. The size and location of tangle formation is significantly more strongly associated with the ruthlessness of dementia than the magnitude of the development of senile plaques. Tau protein buildup has been associated to cognitive deterioration and cerebral shrinkage, particularly degeneration of the hippocampus.In Alzheimer's disease neuropathology, the temporofrontal cortex has neurons and atrophy loss, causing tenderness and depositing of amyloid plaques and an irregular cluster of portions of proteins, as well as a bundle of tangled fibres, resulting in an upsurge in the amount of cerebral cortex monocytes and macrophages, as well as stimulating the parenchymatous microglial cells in the parenchyma, resulting in an increase in the number of cerebral cortex monocytes [4].

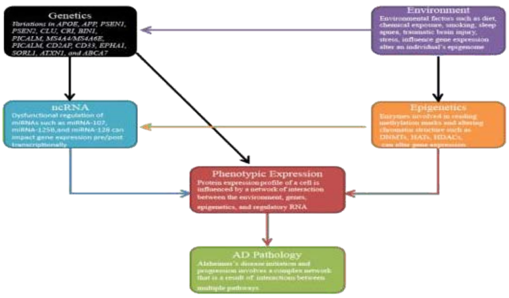

Fig. 3.Genetics, epigenetics and environmental influence - Alzheimer's disease pathology.

Ecological factors include peroxidation, inflammatory, and chemical contaminants. An individual's way of life can be affected by a variety of circumstances, including but not limited to their dietary habits and nutrition, brain trauma, inability to exercising, and smoke. AD pathology can be affected by genetic malfunction, non- coding of RNA and modifications in an individual's epigenome.[17].

IV. MachineLearning and Deep Learning Models for AD Prediction

Furthermore, inter-correlation-aware machine learning (ML) strategies have emerged as a pivotal component of computer-assisted statistical models, and are widely used in the computerized diagnostics and study of neurodevelopmental disorders. Although many differentmachine-learning approaches have been utilized for automated neurophysiological prediction and diagnosis, vector machine (SVM) and deep learning (DL)-based diagnostics approaches are two important avenues for further study. Numerous papers have been written about the application of machine learning techniques to diagnostic imaging. To highlight brain region correlations, functional connectivity (FC) patterns are widely used in contemporary SVM-based diagnostic models. Personalized FC arrangements are developed for paired regions of the brain that have been segregated using standard anatomical characteristics. In addition to its underperformance on original information, SVM has been criticised for the difficulty of obtaining significant features referring to [21].

As opposed to traditional models, DL platforms allow a computer to autonomously evaluate effective feature qualities in a training database using only the raw information supplied as input. The foundation of DL is an end-to-end modeled learning approach. End-to-end knowledge provides the advantage of simultaneously optimising all components of the optimization strategy, potentially resulting in maximum performance.In the realm of Alzheimer's disease prediction; Figure 4 depicts a general end-to-end hierarchy system model. There are four levels in the hierarchy, ranging from one (none) to four (everything) (full).The vast majority of current research uses Level 1 or Level 2 methods to achieve their objectives, which rely significantly on sophisticated software and, in some cases, precise parameter tweaks and manual noise removal. Because of these inter dependencies, those educations only used a part of the raw datasets for performance evaluation, leaving out obvious outliers and making it difficult to make a true enactment comparison. Additional benefit of end-to-end learning is that it allows you to observe how CNN arrived at their classification decision.The explanation aids in the clinician's understanding of CNN activity and the discovery of novel biomarkers. Level 2 explanations are restricted to the segmented area, which may obstruct understanding[22].

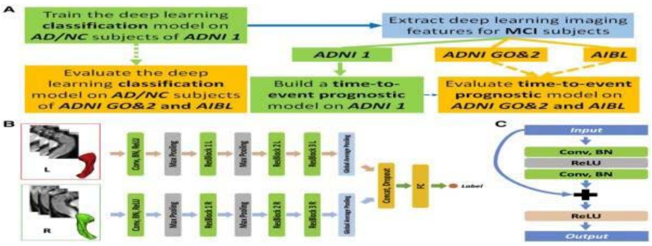

Fig. 4. Illustration of a generic, hierarchical system applicable to the field of Alzheimer's clinical diagnosis

Rather than building separate supervised models to forecast each attribute, a single model that predicts the evolution of numerous qualities can be built. One path to developing tools that can accurately simulate patient progression is to use statistical models based on artificial neural networks. Clinical data poses a number of challenges that are difficult to overcome with current machine learning algorithms. Many clinical datasets, for example, have a variety of data types (i.e., they are "multimodal"), few testing, and a high number of missed discoveries.When dealing with these issues, rigorous preprocessing or the deletion of variables that are too difficult to represent are frequently required. For example, one recent study focused solely on four characteristics that were frequently examined across 100,000 patients in a critical care unit data set on electronic health [13].

Three-dimensional (3D) or four-dimensional (4D) volume data, for example, is reformatted into 1D vector form and fed into DL networks such the limited Bolzmann machine (RBM) and deep belief network (DBN). Data complexity and time complexity, both of which are prominent components of medical data, can be blamed for the reliance on hand-crafted features. The ADNI dataset, for example, has only a few hundred images, yet each one has

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over 10 million dimensions. It's important to remember that past methods misunderstood neighbourhood relationships (spatial proximity) in central nervous system information throughout the feature extraction phase. If spatial connections are not preserved, it is impossible to grasp a reliable description of how the network makes a categorization choice [20][9].

The convolutional neural network (CNN) has been proved to be a powerful DL model for grid-like data such as RGB and MR images. The use of CNNs has spread quickly across a wide range of disciplines, starting with AlexNet's amazing success on the natural picture categorization problem. Early advances in medical image processing were made with 2D pictures like retinal and chest X-rays, which were eventually expanded to 3D images like MRI. The majority of current CNN-based MRI methods are classified as Level 2. After segmenting the grey matter area for the period of pre-processing, several research employment it as a CNN input.Dropout , batch normalization, and residual module are three regularization strategies used in 3D-CNN-based approaches. While the use of effective regularization methods yielded promising results, no unsupervised learning was required. When faced with data shortages and increased dimensionality, unsupervised learning is considered important in the field of deep learning [19].

This represents the first efficient implementation of a volumetric CNN-based framework on MRI data employing 3D-stacked Convolutional Autoencoders for Alzheimer's disease classifications, but the prototype could only be emulated with an exactness of 80%. The models have been created using testing is to ensure data to anticipate temporal information and fine-tuning methodologies. Furthermore, there was little effort taken to justify the classifying choice. The use of Multiple Discourse Modalities in a Learning Environment techniques have tried to incorporate a variety of inputs and DL prototypes in order to address the optimization difficulty of AD.Grad-CAM uses different visual description approaches to demonstrate patchwise prediction inconsistencies in 3D-CNNs. Despite being capable to demonstrate how CNNs attained at their classification result, no endeavour has been through to address the progressive vs. stable MCI classification issue [3].Shifting from variance. Given the complexity and multivariate nature of Alzheimer's disease, it's critical to simulate the evolution of whole patient profiles, including the progression of each sub-component of the ADAS-Cognitive and MMSE ratings, laboratory tests, and their correlations with baseline diagnostic criteria [9].

The development of strategies to overcome these restrictions is a critical step toward more widespread machine learning applications in precision medicine. Precision medicine is especially important for people with complex disorders who experience different disease progression and therapy responses. Alzheimer's illness and moderate cognitive injury (MCI) are both neurodegenerative diseases that cause a variety of cognitive and behavioral issues. To measure the severity of these symptoms, tests like the AD Valuation Gauge are frequently used. The heterogeneity of Alzheimer's illness and related dementia's makes them challenging to diagnose, control, and treat, triggering calls for improved strategies for predicting and tracking disease development, as well as better clinical trial design for AD. Differential diagnosis is also interesting due to the difficulty of distinguishing between similar diseases.

V. Comparison Analysis of Related Research Directions

Clinical evidence and imaging studies have been used to construct a number of disease progression models for MCI and AD. While previous methods for forecasting disease development were effective, they only predicted a specific outcome, such as the ADAS Cognitive score

Title	Classifier	Dataset	ADAccuracy	MCIAccuracy
[11]	RNN	PET	91.2	78.9
[12]	3DCNN	MRI	91.09	76.9
Lu etal.[2018]	DNN	MRI,PET	84.6	82.93
[6]	CNN	ADNI	95.73	82.31
[5]	Lenet-5,AlexNet,ZFNet, and R-CNN	MRI	75-25 crossvalidation and90-10 crossvalidation are97.68% and98.75%	76.54
[18]	DNN	Kaggle	95.32	83.9

Patients with the same condition may experience various symptoms, progress at different rates, and respond to treatment in different ways. The basic goal of precision medicine is to figure out how to predict and treat differences between patients. Computational models of illness development based on machine learning and deep learning are an appealing way for dealing with patient heterogeneity. These computational models may one day be used to guide medical decisions; however, present implementations are limited by both the availability of data and the algorithms' capacity to extract insights from it.

VI. Conclusion

Supervised learning, a state-of-the-art machine learning approach, has surpassed classical machine learning in the area of computer vision by revealing deeper layers in complex, resistant to high. Applying Machine Learning to Predictive Health Care and automatic categorization of Alzheimer's disease (AD) has recently garnered a lot of interest, thanks to considerable advancements in neuroimaging that have yielded large-scale multimodal neuroimaging data. Multifunctional neuroimaging datasets used in conjunction with deep learning techniques for Alzheimer's disease diagnostics categorisation shows steady gains in terms of accuracy. Early-stage deep learning investigation in Alzheimer's disease aims to increase efficiency by using more hybrid types of information, such as -omics info, and boost openness by developing methods that are easy to explain and take into account domain experts' knowledge of the disease's unique features and paradigms. In this study, we analyse and compare different machine learning and deep learning data-driven designs based on massive organisational health information for AD risk stratification with the intention of better selecting

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people at risk for AD in clinical studies or order to diagnose clinical issues at an earlier stage.

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A Study on the Pulmonary Diseases using Deep Learning

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Abstract–*Deep learning current advancements help to identify and classify pulmonary disease in medical images. Therefore, various studies can be discovered in the literature to identify lung illness via deep learning. The present study offers an investigation of deep learning in medical images for pulmonary disease diagnosis. Only two study papers on deep learning focused on the way to the identification of lung illnesses were published in the recent five years. Yet the taxonomy and analysis of the current work trend are not presented in their study. As a starting point, this study intends to present taxonomy of current systems for the diagnosis of deep lung disease, as well as a view of current domain work as well as probable future directions in this subject. It's possible that other scholars will make use of the taxonomy provided to organize their own work. With the given probable future route, deep learning applications that aid in the detection of lung ailments may become even more efficient and numerous.*

Keywords– Deep learning, Pulmonary disease, Taxonomy, diagnosis, lung ailments, Medical Images.

I. Introduction

Disorders of the cardiovascular system, such as those affecting the lungs, can damage the airways and other parts of the lungs. The Lung disorders are such as bronchitis, tuberculosis, and coronavirus illness (COVID-19). The Federation of International Respiratory Associations [1] reports that there are more than 334 million individuals with asthma worldwide, that 1.4 million people are dying annually from bronchitis, and that 1.6 million people die annually from lung cancer. Because of the widespread spread of the COVID-19 pandemic [2], millions of people became ill and healthcare costs skyrocketed [3]. Undoubtedly, lung illness is one of the leading global killers and disablers. Enhancing long-term recovery and survivability prospects requires early identification [4, 5]. Traditional methods for diagnosing lung disease have included skin testing, complete blood count, sputum sample tests, chest X-rays, and computerized tomography (CT) scanning [6, 7]. Furthermore, supervised learning has shwed a significant amount of promise in diagnostic imaging disease detection, notably for respiratory problems.

Most instances of TB are due to a bacteria known as Mycobacterium tuberculosis. Inhalation of germs through the lungs is the supreme communal route of entry [8]. Inflammation of the lungs is a life-threatening illness [9]. Furthermore, early identification and treatment might result in complete recovery. Pneumonia, according to Er et al. [8], is an infection or inflammation of the lungs, most frequently brought on by a bacterium or a viral infection. In addition, ingesting vomit or other foreign things might induce Pneumonia. Asthma is a chronic illness that causes episodes of shortness of breath and wheezing, according to Er et al. [8]. Asthma attacks cause swelling of the bronchial tube lining, which narrows the airways and reduces the amount of air that can flow into and out of the lungs at the same time. COPD is a condition that may be prevented and treated, but the airway restriction is permanent [8]. Tobacco smoking's impact on lung capacity is also cumulative, and it's linked to the tissues' abnormal inflammatory response to inhaled toxins.

Sputum examination, computed tomography (CT), magnetic resonance imaging (MRI), and chest radiography are all frequent diagnostic tools for emphysema. Moreover, the abovementioned operations take a significant amount of time, are sometimes located some distance from the patient, and are typically thought to be expensive. In furthermore, the aforesaid methods are able to detect tumors at a preliminary phase, which is the stage at which a patient's probabilities of survival are quite low. For the most part, researchers are working hard to spot the early signs of pulmonic cancers. The processing of pictures and the use of Artificial Neural Networks improve medical diagnostics research [10]. Medical diagnostics have benefited greatly from the use of image processing and soft computing tools during the last few years.

Build a graphical representation of the current state of deep learning systems for lungdiagnosing; catalogue the recent advances made in this field; list the obstacles still to be overcome; describe potential future strategies for overcoming these issues. The documentation is organized in the following manner. The survey's limitations are discussed in detail in Section 2, which offers related works on employing DL methods to diagnose lung disease. In Section 3, we look at how deep learning can be used to spot lung disease in medical imaging. Detailed explanations of each specific topic are provided in Section 4, which presents the taxonomy. Knowledge about the datasets can be found in Section 5. The development of supervised learning in the detection of lung diseases and the research gaps that exist

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are discussed in Section 6 and 7 of this work. The paper comes to a close in Section 8.

II. Literature Review

To handle small databases and the idiosyncrasies of CT TB images with only anomalies in a few particular places, a 3D block-based residual deep learning structure with depth information injection at every layer (depth-ResNet) was chosen. Methods that utilize deep learning have quickly become a powerful tool for both early detection and accurate diagnosis of ailments. Data-driven feature representations can lead to significant medical advancements in this procedure. In medical imaging, deep learning has been utilized extensively to improve picture analysis. This research takes a deep dive into the field of machine learning, and it summarizes some of the most important contributions and cutting- edge results from this field thus far.

For the diagnosis of many malignancies in chest X-ray images, ShuaijingXu and coworkers [12] present an attention-driven ensemble learningand association context model. The CNN- ATTENTION-LSTM (CAL) network at first integrates a CNN model with a long short-term memory mechanism to identify items in both texts and images [13, 14]. In addition, a mining approach of implicit association intensity guides CAL network training to generate a chest lesion association structure (CLA).

There must be an effective cancer prediction system that utilizes a computer assisted automated detection (CAD) method at the clinical center. Enhanced lung image processing algorithms [15] are being utilized to probe the body's internal workings, recover features, retrieve vital info, and create an informed method for identifying lung disease. Some of the many processing methods utilized for lungs include: preprocessing, injured portion separation, extraction of features, and lung cancer diagnosis. Segmentation is one step in the process since it analyses each pixel in the lung imagery to determine which cells are linked to cancer and which are not, allowing for a more accurate classification of the both.

To enhance tumor categorization, Sarfaraz Hussein et al. [13] recommended different machine learning techniques. The first method relies on supervised learning; deep learning approaches such a 3D Convolutional Neural Network (CNN) and Transfer Learning have demonstrated significant improvements. Then, it is shown how to integrate task-dependent feature representations into CNN architecture via a graph-regularized sparse Multi-Task Learning (MTL) technique informed by radiologists' interpretations of the scans. When labeled training data is scarce, unsupervised learning methods can be utilized to improve medical imaging applications. Multiple instances learning (MIL) is an example of a minimally supervised classification that may prove useful here. One such approach to addressing problems is active in the learning process. Medical imaging problems can only beaddressed with the development of unsupervised learning systems.

Approaches for identifying COPD were proposed by Ran Du et al. [14], who suggested employing deep convolutional neural systems to assess 3D lung bronchial tree branches from the viewpoint of machine vision. CT images are used to extract airway trees, which are then 3D visualized in ventral, dorsal, and isometric views. A Bayesian optimization approach is used to build a single deep CNN model that can identify COPD.

In order to evaluate the effectiveness of medication adherence over time, Xiaohong W. Gao and colleagues [11] looked at how CT respiratory imaging may be used to detect and categorize tuberculosis across five severities.

III. Common Detection System for Pulmonary Disease

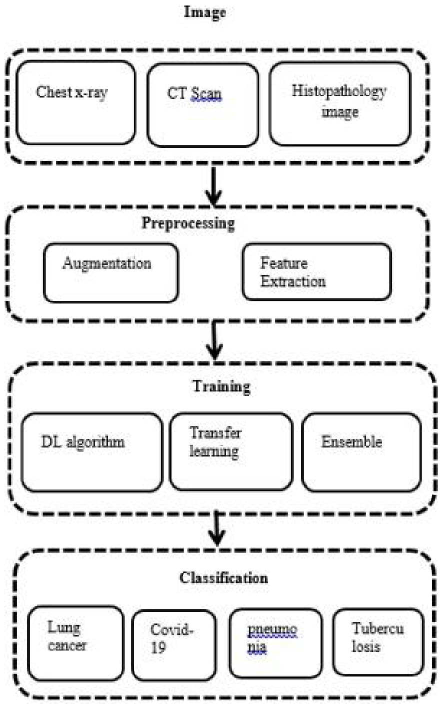

Fig. 1. Common Prediction Framework

1. *Image Acquisition*

The utilization of deep learning to analyze clinical images as a diagnostic tool for respiratory problems has been explained in depth. Two out of the three main processes are learning and classification. It is usual practice in the diagnosis of respiratory illness to characterize images as normal lungs and contaminated lung imagery. Training is necessary for the development of the lung disease classifier, or model. A neural network can be taught to recognize a certain sort of image when it is trained. Classifying images into their respective categories is a task well- suited for deep learning. The first step in applying deep learning to pulmonary disease diagnosis is the collection of imaging modalities of affected lung. Diseases can be identified once the neural network is trained.

Images are the first step. For a computer to create a classification model, it has to learn from its experiences. It takes a lot of photos for the computer to recognize an object. Deep learning models can be trained using a variety of data formats, including time series and speech recordings. Lung disease can be detected using photographs, which are essential data in this paper's context. Some types of images that might be utilized are those obtained via radiograph, CT scan, mucus smears microscope, and histopathological screening. This step generates photos that will be fed into the model's learning process.

2. Pre-Processing

The sharpness of a visual can be improved by enhancement or modification. CLAHE is a contrast enhancement algorithm. The region of interest for lung disease diagnosis can be found by image processing techniques including lung segmentation and bone eradication. Data can also be represented in a different way, and edge detection can help with that. The images might be enhanced to provide more information. Adeep learning model can recognize a specific entity in a variety of ways, including by retrieving relevant attributes from the data set. This stage has resulted in the improvement of these images or the removal of unwanted elements from them.

3. Training

In training, there are three ways to look at it. When deciding on a deep neural network algorithm, it's important to take into account a variety of factors, such as the application of learning algorithms and ensembles. Algorithms learn in a variety of ways. Specific algorithms are better suited to certain sorts of data. CNN excels in using images to convey information. In this case, a deep learning method should be used. In this method of learning, information is passed from one model to the next in a logical chain of reasoning. The phrase "ensemble" refers to the classification of data using multiple models. Learning time is reduced; classification performance is enhanced, and over fitting is avoided by utilizing learning algorithm and evolutionary algorithms.

4. Classification

When an image is presented in a certain way, the trained model will be able to estimate which class it belongs to. According to the model, the likelihood score for the image will be determined. Using the probability score, you may determine how likely it is that an image belongs to a given category. When we nearing the edge of this phase, the image will be categorized according to the probability score that the machine learning strategy assigned to it.

IV. Taxonomy of Lung Disease Detection

Among the many things this study adds to the conversation is a classification of existing deeplearning projects for diagnosing lung diseases. The purpose of the taxonomies is to identify and categorize the most pertinent questions and areas of emphasis in the current scientific literature. The taxonomy's seven characteristics were determined. These traits were selected because they are ubiquitous and can be observed in every object of investigation. The seven aspects of the taxonomies include image classes, attributes, up-sampling, deep learning method types, learning techniques, the ensemble of classifiers, and lung cancer diagnoses. Figure 3 depicts the current lung disease detection taxonomy based on deep learning.

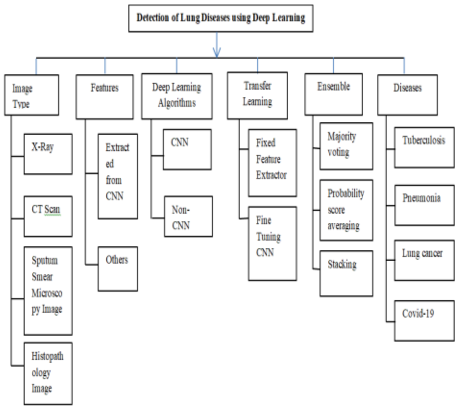

Fig. 2. Distinct Features of Deep Learning for Respiratory Disorders

4.1 Kinds of Images

TABLE 1. Types of Various Lung Images

S. No	Image Type	Description	Sample Image
1	Chest X-Rays [26]	1. Anatomical details such as images of blood arteries and lungs can be gleaned throughthisprocedure.	
		2. In order to examine X-ray images, they must first be processed onphotographic film.	
2	CTScan [25 23]	1. For radiographic imaging that uses computer processing. 2. From photographs taken from a variety of angles around the patient's body, create sectional views of varying depths. 3. It provides more information than X- rays, which are lessprecise.	
3	Sputu m Smea r Micro scopyImages [27]	1. Lungs and airways breathing tubes produce thick fluid. 2. For sputum examination, the illustration is placed on a glass slide witha very thin layer.	
4	Histopatho logy Images [2833,2934]	1. Glass slides are used for microscopic assessment of a biopsy or surgical specimen to study the signs of a disease. 2. One or more stains are used to highlight the tissue's variouscomponents.	

4.2 Methods and Importance of Features

In machine vision, characteristics are numerical measurements extracted from images that canbe employed to address certain challenges. Structures such as points, edges, colors, shapes, or objects can be used to depict features in the image. [16] The categories of images have a logical effect on the quality of attributes. It is possible to generate new features from existing ones by using feature transformations. However, in a different context, they may have a greater ability to discriminate than the original traits did. When transforming features, the purpose is to give a machine learning system for object identification a more usable feature.

4.3 Augmentation

When the number of observations in each category is equal or balanced, deep learning algorithms function best. In order to increase the size of the training dataset, it is not necessary to constantly add new images. Through the process of image augmentation, the source images undergo alterations. The effect is accomplished by employing the use of distortion, revolutions, flipping, translations, and digital zoom. Figure 8 displays a variety of enhanced photos.

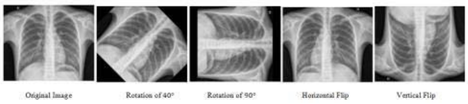

Fig. 3. Augmentation of Lung Images

4.4 Deep Learning Methods

"Deep learning" refers to a subfield of learning algorithms inspired by the structure of the human brain. The strong performance of this method is useful in many different areas, including medical imaging processing. Deep learning methods are used to sift through medical databases for relevant information. The application of deep learning techniques has improved the categorization, delineation, and identification of lesions in medical information. Diagnostic imaging information from MRIs, CT scans, and X-rays was analyzed using deeplearning methods. These discoveries have made it easier to detect and diagnose diseases like diabetes, brain tumors, melanoma, and breast cancer.

4.5 Lung Disease Detection

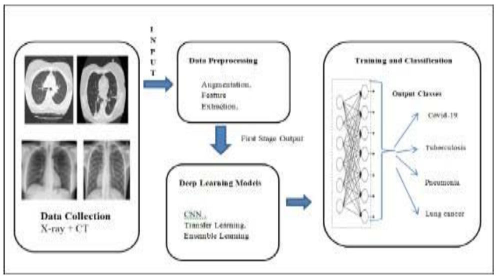

Fig. 4.Common Methodology of Lung Disease Detection using Deep Learning

Deep neural networks (DNNs) can be utilized to address picture recognition difficulties using convolutional neural networks [17]. When it comes to CNN's operation, computers must be able to recognize and interpret images presented as input. In order to make use of the photos, they must first be transformed to a matrix format. On the basis of disparities in picture and matrix, the system identifies what image is associated with what label. These variations in labelling are learned during training, and then applied to new images in order to create predictions.

Convolutional, pooling, and fully connected layers are all part of CNN's three-layer structure. The feature extraction approach includes both convolutional and pooling layers. However, categorization is done in the fully linked layer.

4.6 Transfer Learning

Due of its ability to create accurate models, transfer learning has become an increasingly used technique in computer vision [18]. Withtransfer learning, a model learnt in one field can be applied to another. A pre-trained model or not, transfer learning can be accomplished. Pre- trained models are those that were built to solve a comparable problem. It is preferable to Pre- trained models are those that were built to solve a comparable problem. Starting over with a difficult aspect in consideration is better to starting over with a particular challenge. In most instances, it was found that using a system that had been pre-trained on a different task than the current task improved performance.

Through some kind of series including forward and backward repetitions, the objective of the process of developing a deep learning algorithm is to locate the appropriate weights to apply to the nodes of the network. They are a valuable source of current situation information thanks to these pre-trained models Transfer learning may be applied in two ways as a feature extractor using CNN, which I fine-tune. [19] Some of the weighting in the early levels come straight from the pre-trained CNN model, whereas higher levels require optimizing weights. Typically algorithms can only be trained up at the base level, meaning just the weights at the top of the model are changed. It is possible to use first-layer data for a wide variety of purposes since it contains generic qualities. To acquire more advanced features unique to the specific dataset, it is necessary to educate the model's upper layers. However, CNN employs a feature extractor. The fully- connected levels can be removed, and the network can be used as a fixed feature representation for the new set of information.

4.7 Classifier Ensemble

Ensemble categorization is the outcome of using the outputs of multiple classifiers together. The forecasts of ensembles are much more reliable than those of a unified framework. A sampling of ensemble voting techniques comprises qualified majority, probabilistic score averaging, and stacking. In amajority vote, each system assigns a class label to a test case and then forecasts the class label that gets the most votes [20]. There are some models that have their votes counted more heavily than others when it comes to the majority vote. Probabilistic score aggregating is a statistical method for combining and dividing the predictions from many systems. In its place, weighted aggregating can be used to calculate an average by multiplying the prediction score of each modeling by its weight. [21] An approach called stacking ensembles takes the results of multiple less accurate models and tries to combine them in the best way possible so that the final forecast is more accurate.

4.8 Types of Diseases

This study details the use of deep learning techniques for the identification of TB, bronchitis, emphysema, and COVID-19. People with lung disease are more likely to die from COVID-19 than any of the other three diseases on this list because it's a pandemic that is still going on.

4.8.1 Tuberculosis

The World Health Organization [22] reports that TB is a major killer worldwide. In 2017, 1.6 million individuals all over the world passed away due to tuberculosis. The likelihood of a successful recovery from tuberculosis is greatly increased when the disease is discovered early on. In the literature, CNN has been used to classify TB. Improve the CNN's accuracy by factoring in user-provided age, sexual identity, and bodyweight information. Computer-aided diagnosis (CAD) was used with clinical data to score the chest X-rays. This combination enhanced precision and specificity when compared to using either type of information alone.

4.8.2 Pneumonia

As the most prevalent kind of pneumonia, bacterial pneumonia has more significant indications and requires medical attention.Although bacterial pneumonia can present itself gradually or quickly, the symptoms are often similar. There may be excessive sweating and rapid breathing and heart rate as well as a dangerously high fever of 105 degrees F. Lips and nail beds may turn blue if oxygen levels in the blood drop too low. A patient's psychological condition may be unclear or delusional. Pneumonia is difficult to diagnose because its signs are nonspecific and may be mistaken for those of a common cold or influenza.

4.8.3 Lung Cancer

The most frequent forms of lung cancer are small cell pulmonary cancer and non-small cell lung cancer [23]. Signs of lung cancer have included a persistent cough that produces blood, chest pain, fatigue, appetite loss and breathing difficulties or weakness [24]. The survivability rate increases from 15% to 50% with early identification [25]. Yet, this rate of survival must be raised above its present level. X-rays, CT scans, MRIs, and other noninvasive imaging methods aid in the early diagnosis of lung cancer. CT scanning is the gold standard for creating 3D lung pictures [25]. It is possible to lower mortality rates with early diagnosis and treatment. The method of early identification of cancer is crucial in stopping the progress of the disease cells. The accuracy of current lung cancer detection methods is inadequate. Therefore, it is crucial to find novel means of detecting lung cancer at its earliest stages.

4.8.4 Covid 19

COVID-19 is an infectious disease brought on by the SARS-CoV-2 virus. The majority of persons who contract this virus will have mild to moderate respiratory symptoms and will improve without any particular therapy. Some, though, will become gravely ill and necessitate professional medical care. People over the age of 65 and those who already have illnesses like high blood pressure, hypertension, asthma, ormalignancy are at a higher risk of becoming seriously ill. At any age, someone who has COVID-19 infection has the potential to become gravely ill or perhaps die.

V. Knowledge of Dataset

The LIDC-IDRI image review synthesizes thoracic CT images with annotated lesions for diagnostic and screening purposes. It is a worldwide internet-based resource for the creation, training, and evaluation of computer- aided diagnostic methods for the recognition and diagnosis of lung diseases. Nodular, non- nominal or nodule > 3 millimeters in diameter are all three categories that radiologists assign to CT scans in this initial step (NMD). The datasets utilized to detect lung disease are summarized in Table 2. Only public datasets are included.

TABLE 2. Summary of Dataset for Lung Disease Detection

Name of the Dataset	Image Category	Total Images	Reference
JSRT dataset	X-ray and CT	154 nodule & 93 non-nodule	[11]
LIDC-IDRI	CT	1018	[12, 15]
NIH-14 dataset	X-ray	112,120	[13]
ELVIRA Biomedical Data Repository	X-ray and CT	203	[14]

VI. Challenges and Future Scope

Despite the accomplishments of deep learning technology from a medical and therapeutic perspective, numerous limits and problemsremain. Deep learning usually necessitates the use of a huge volume of labeled data. Medical image annotation faces a significant problem in meeting this need. Radiologists, for example, have extensive domain expertise that is required for labeling medical pictures. An adequate medical picture annotation is therefore labor- and time-intensive [26]. Regardless of the challenges of annotating medical information, a large number of clinical images are stored in PACS for an extended period of time. This results in a large number of images that do not have any labels attached to them. Deep learning algorithms might make use of the unlabeled pictures, saving a lot of time and effort in the annotation process. More training data sets will be used in the future, and the model's parameters will be tweaked to improve speed in the model. Some of the measures' settings will be put to the test as well. To enhance the accuracy, we can run experiments on a pre- trained classic. The representation of deep learning is another problem that needs to be addressed. The application of deep learning in the analysis of medical images is becoming increasingly popular, and additional research is being conducted to get it ready for clinical deployment [27]. Legal openness and interpretability would be required if deep learning applications were widely used in the medical industry.

VII. Conclusion

A current issue of discussion in the fields of medicine and information technology is the application of deep learning to the evaluation of medical images. Consequences of study in these areas are described extensively in this article: Initially, the neural network framework for deep learning was introduced, which was actively investigated. Classical models utilized in medical imaging were also included as part of the network's deep structure. In the beginning, neural networks were used in the treating a wide variety of respiratory illnesses. Analysis and categorization as well as a deep assessment of the framework advancement aregiven in this report to lay a substantial basis for future researchers in deep neural networks for various disease-related jobs. Also included in this work are some commonly used datasets on a variety of disorders, so that others might conduct similar investigations.

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Analysing Twitch Streamer's Success from Twitter

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Abstract— Twitch is a platform that provides live streaming services for videogames; it has created a great environment for people that enjoys both watching and playing games, but with the increase in the number of streamers and games, streamers must find ways to get better recognition and find all points of leverage for better interaction on their streams and content. This paper analyzes the relationship between a Twitch streamer's success with their presence on Twitter

Keywords — social media, social media integration, prediction, random forest; decision tree, Twitch, Twitter, data science, machine learning

I. Introduction

Twitter provides free microblogging and social networking service. Twitter is one of the top 5 social media applications that is used worldwide. Twitter users can broadcast short posts which are known as "tweets", The tweets can be in the form of text, videos, photos, and links. People can get the latest updates and promotions from brands. More than 100 million users post 340 million tweets daily.Since the start of Twitter, academics and businesses have tried to find ways to gain intel and insights from it.

Twitch is a platform that provides live streaming services for video game streaming and other interactions. This paper deals with showing the relation between twitch streamers' presence on Twitter and the success of twitch streamers.

II. Data

A. *Dataset*

The data used in this analysis was taken from Kaggle, "Top 8800 Twitch Streamers" [1]: - The dataset contains information about the top 8800 twitch streamers that are currently streaming on the platform.

This dataset covers some essential criteria that are used to gauge the performance of a streamer.

B. *Exploring the Dataset*

The dataset about the streamers contains the following features as given in Figure 1.

attribute	description
top count	the ranking of the streamer based on watch time (disscussed later)
screen name	name of the streamer
watch time	total number of minutes people have consumed his content
stream time	number of hours he has streamed
peak viewers	number of peak viewers
average viewers	number of viewers the streamer receives on average
followers	number of followers the streamer currently has following his content
followers gained	number of followers gained in the last month
views gained	number of new viewers gained in the last month
partnered	whether or not the streamer is partnered with twitch
mature	whether or not the streamer's content is mature in nature

Fig. 1. All Features and their description

Since the dataset contains a few extra features which are not needed in this project a few features were taken and a few removed as given in Figure 2.

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attribute		reason
top count	removed	since it is not relevant to the analysis
screen name	kept	for sentiment analysis on twitter
watch time	kept	it is a very important feature
stream time	kept	since it is only variable the streamer has a control over
peak viewers	removed	since it is a one-time number and does not affect follower and viewers
average viewers	kept	the most important feature,as it leads to monetization and income for the streamer
followers	kept	to see its impact on average views
followers gained	removed	since it is not relevant to the analysis
views gained	removed	since it is not relevant to the analysis
partnered	removed	since it is not relevant to the analysis
mature	removed	since it is not relevant to the analysis

Fig. 2. All Features and reasons for keeping them

The attribute that decides which streamer is at the highest ranking is the watch time as it generates the mostrevenue and is given more attention by the algorithm,governing a streamer's appearance on a viewer's watch feed.

A variety of aspects affect a streamer's watch time, but there is one which is considered crucial among social media personalities and that is their social media presence, particularly Twitter. This is considered important as it effects how many people they are able to attract to their stream to view their content.

This presence is not direct, that is someone with a positive presence is not necessarily going to have the highest watch time and similarly people with the most negative presence may not have the lowest watch time.

So, in this paper we analyzed this aspect by using data from Twitter using Tweepy [11], the Twitter API. It filters Tweets made about a specific streamer in the past seven days and segregates them into positive, negative or neutral in nature.

III. Related Work

Many researchers have tried to find relations between the entertainment industry and social media, and how their presence on social media affects either their job or their popularity.

In [2] Dr.Rose Catherine aims to accurately predict the box office success of upcoming movies using tweets.

In [3] J. Huang, W. F. Boh, and K. H. Goh investigate the relationships between comments generated from social media and sales using a natural language processor, similarly in [4] and [8] by using meta-data mined from social media such as number of likes on a Facebook page for the movie, follower count of actorson Twitter and the number of likes on the trailer of themovie on YouTube.

In [9] Vasu Jain's analysis tweets about movies to predict several aspects of the movie popularity and covers how movies have a higher rate of success based on the visibility of the movie on social media help in the sales of the movie.

When twitch, a primarily game streaming platform is being considered it is understandable to consider games and their trends. The present technological boom has to lead to a major increase in people that enjoy both playing and watching video games.

In [5] Boris Bankov has written about the impact of social media on video game communities and the gaming industry. It describes the evolution of the gaming industry and the impact of integrating social media subsystems on gaming communities. The study includes a relationship between social media platforms and the gamingindustry.

[12] is a very highly recommended article about the author, Henry Jenkins teaching a course on Transmedia Entertainment and Storytelling, similarly [13] is also an article by the same author discussing the impact social media has on businesses.

[6] talks about trying to make predictions from socialmedia, and points out the many pitfalls, also the past methods used to do so.

In [10] ThienHai Nguyen and KiyoakiShirai build a model to predict stock price movement using sentiments on social media and subsequently describethe relation between the two. Both [14] and[15] analyze Twitter for predicting results of major events with a large crowds, that being Elections and the results of a football match in a league respectively.

IV. Approach

In a broad sense, the approach is to perform sentiment analysis on Twitter data corresponding to the respective twitch streamer and analyze how it impacts the streamers' watch time since it is deemed the most important figure to gauge a streamer's success. The first step is to clean the data. The dataset contains a lot of streamer names in other languages and not in English, hence it is not easy to process. Those names need to be replaced with their respective Twitterhandles.

By performing the sentiment analysis we get the following new columns as given in Figure 3.

attribute	description
positive	number of positive comment about the streamer
negative	number of negative comment about the streamer
neutral	number of neutral comment about the streamer

Fig 3:.New columns to the data

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Before segregating the results of the sentiment analysis to the respective column the columns look as follows:

s no	screen name	stream time	followers	watch time	positive	negative	neutral	average viewers
0	xQcOW	215670	3691010	7333609065	0	0	0	32913
1	Gaules	515595	1966465	6314532585	0	0	0	12254
2	summit1g	216000	5374710	6235007490	0	0	0	25931
3	ESL_CSGO	517965	4195657	4764929775	0	0	0	9249
4	NICKMERCS	131880	4415637	3853252845	0	0	0	29183

Fig 4: Data Frame before sentiment analysis is performed

The data in the new column will be zero as given in Figure 4, sentiment analysis has not been performed, hence these columns are left empty. Sentiment analysis is performed on all the streamer tags and increments the respective sentiment category. In [7] and [8] the type of sentiment analysis techniques is covered.

s no	stream time	followers	watch time	positive	negative	neutral	average viewers
0	215670	3691010	7333609065	8	2	20	32913
1	515595	1966465	6314532585	8	12	80	12254
2	216000	5374710	6235007490	10	22	66	25931
3	517965	4195657	4764929775	26	4	11	9249
4	131880	4415637	3853252845	51	9	40	29183

Fig 5: Data Frame after sentiment analysis is performed

Once sentiment analysis is done there is no need for the streamer tags, hence they can be removed.

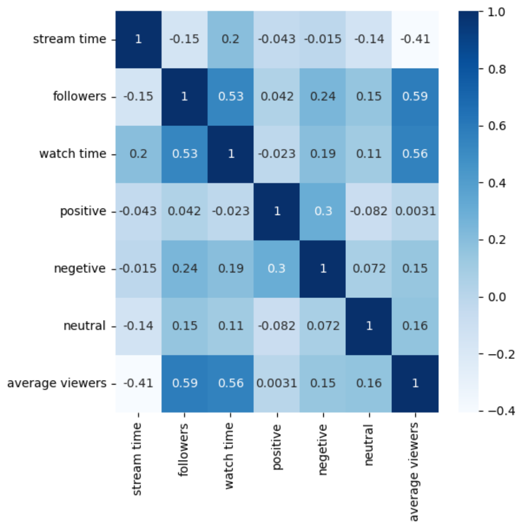

Fig 6: correlation matrix

Since watch time is the most important feature to focus on as it is the feature that determines the success of the streamer, we train a random forest regressor on it, since Random Forest Regression is a powerful and accurate machine learning algorithm that is used for both regressionand classification type problems.

From figure 6 we can understand that followers and Averageviewers are more related to Watch Time out of the three important features (‘stream time’, ‘followers’, and ‘average viewers’). Hence, we train the model on the data described in fig 5 leaving out the stream time feature and leaving out the:

i)positive and neutral features ii)negative and neutral features iii)positive and negative features

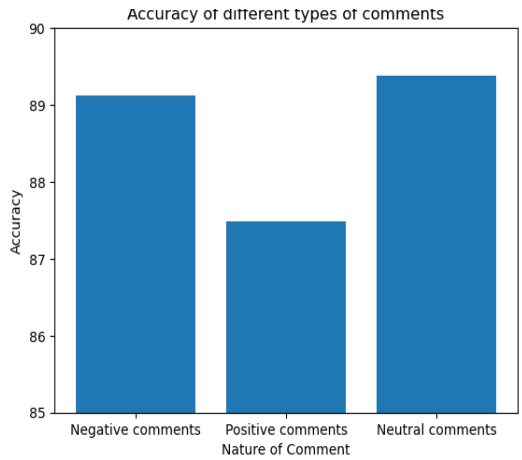

Fig. 7. Accuracy of different types of comments models

Figure 7 gives the accuracy of the random forest regression model trained on the previously mentioned criteria. The model’s accuracy is at a minimum, over 87% for positive type comments, and a maximum, over 89% for negative andneutral type.

IV. Conclusion

In this work, we presented an analysis of the relationship between the presence of a Twitch streamer on Twitter and the streamer’s success, based on how the streamer is perceived on Twitter. We know that a streamer is considered successful based on the streamer’s watch time. We found that the Watch Time is most related to Followers and Average Viewers.We also foundbased on the performance of our model that negative and neutral comments have more impact on the Watch Time.

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Precision Farming Tool featuring Crop Recommendation and Intelligent Fertilization

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***Abstract*—Agriculture is a major economic driver in India but productivity related issues pinpoints to the significance of choosing the right crop under given conditions. Agriculture is in turn intrinsically dependent on the fertilizer industry - one of the eight core industrial sectors in India. However, tackling issues overuse and runoff leakages has been a persistent problem because of a "one-size-fits-all" approach and can be corrected through the principles of Precision Farming. One of the ways of addressing geographical variances in agricultural needs could be by informing cultivators of site-specific required NPK (Nitrogen - Phosphorus - Potassium) ratio for various crops. Underlying this idea, this work pitches a two - dimensional recommendatory ML-enabled tool that assesses soil quality parameters to provide features of (i) Crop Recommendation using ensemble technique built by six classification base learners for greater accuracy encompassing greater number of crops, (ii) Intelligent and balanced fertilization by predicting weather-affected nutrient (specific to macro-nutrients NPK ratio) requirements of a region by calling live weather API.**

Keywords— precision farming, nutrient management, intelligent fertilization, Ensemble Learning, NPK ratio

I. Introduction

The Green Revolution was the harbinger of mass incorporation of fertilizers in Indian agriculture and made the country self-sufficient but also brought forth newer complexes. The sole focus on increasing productivity through High Yielding Varieties (HYV) of crops has still kept optimal and sustainable farming a farsighted goal because of unawareness related to agricultural sciences, fragmented land holdings, dependence on weather etc. Also, the concentration of its success in Punjab, Haryana and the subsequent rice-wheat boom highlights that the framework did not entirely address geographical or climatic variations across the nation. Precision farming introduces smart practices that address these differences.

Precision Farming is a concept that uses tech to ensure crops and soil receive what they need for optimal growth and productivity. It involves site-specific agricultural practices. Experts at the International Society of Precision Agriculture (ISPA) have highlighted the [1] 5Rs that can help attain the goals of Precision Farming are - right place, right time for the right input, in the right quantity in the right manner.

The Indian Council on Agricultural Research (ICAR) and the National Commission of Farmers 2006 concurred that the nation-wide [2] standard ratio of 4:2:1 for primary fertilizers NPK doesn't hold for all the regions of the country. Several studies show that farmers plant an inappropriate crop based on conventional or non-scientific approaches and try to ensure high yield through mindless use of fertilizers.

The aim of this project is to advocate the principles of smart farming by providing accurate crop recommendations and integrating nutrient management (of macronutrients - N, P, K) at a regional scale using weather conditions instead of standardizing it. The presented work is intended to present a prototype for introducing precision nutrient management in a more dynamic and dependable form.

The objectives of the project are : (i) To customize crop-fertilizer management (ii) To advocate for integrated nutrient management in farming (iii) To build a competent advisory service to eliminate unawareness and negligence in agricultural practices regarding fertilizer use inline with recommendations of ICAR and National Commission of Farmers (2006) (iv) Use of machine learning techniques to enhance accuracy and legitimacy.

II. Literature Survey

[3] This work seconds the need for agricultural practices integrated with nutrient management. The optimal nutrient input ratio has been greatly impacted by the large interstate and interregional variability in fertilizer use.

[4] A precision agriculture project in Karnataka used GIS mapping to accommodate spatial variations of soil properties to ascertain yield variability of three crops most commonly grown in three north-eastern regions. This pinpoints the fact that deployment of information technology at micro-level can much better cater to agricultural goals. Climatic conditions however were not considered.

[5] Precision farming practices address geographic and temporal variations in nutrient availability that facilitates better decision making based on the vital gap between plant demand and soil supply. Under this premise, the use of sensors for capturing soil properties, aerial crop images and site maps is not established for nutrient management. Their

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potential remains to be validated under various agro-climatic conditions.

[6] Focus should be on solving productivity related issues by thoughtful crop selection instead of trying to increase the yield of a lesser apt crop for the region. Eradication of problem at the source through better crop and fertilizer management would lead to diversification of crops and reduced fertilizer consumption. fter comparing with other technological frameworks, this work suggests ensembling technique to be best suited for crop recommendation. Three independent base learners have been used to build the recommendatory model, where the advantage in using independent frameworks lies in time efficiency in comparison to dependent frameworks.

[7] SVM, Random Forest have been used for soil classification and crop yield prediction whereas [8] Decision tree, K- nearest neighbor, Linear Regression, Naive Bayes also showed impressive results. The choice of base learners for our adopted ensemble learning framework was guided by the conclusions of these works.

[9] Taking NPK ratio for a single crop (i.e. rice) helps make the following conclusions: climatic factors such as temperature variations and total rainfall, change nutrient concentrations - rainfall in the right quantity can augment nutrient sufficiency but extreme rainfall would lead to runoffs.

[10] The prediction of crops as a function of rainfall in four states of India is determined using a comprehensive evaluation of all regression techniques. This is done predicting crop yield for a given amount of rainfall.

While random forest has been widely used independently for crop recommendation or crop yield prediction, [11] shows the abilities of conditional random forest models to evaluate data to create useful information in fertilization studies and that such techniques can be used in other long-term techniques.

III. PROPOSED SYSTEM

The proposed system emphasizes on the primary fact that climatic conditions and soil properties affect crop production and agricultural practices like fertilization should be attuned to these variations. Two operational modules are taken into consideration

A predictive model based on Random Forest Regression with K-fold cross-validation technique is used for determining nutrient requirement for a crop. The user is required to enter input features of crop (to be harvested) and location. The state and city entries direct the model to the live weather API which accumulates values such as regional rainfall, humidity and temperature to finally predict values of N, P , K requirements.

The second module employs the ensemble technique for crop recommendation across multiple Indian states for 26 crops through independent base classification learners. The N, P, K ratio for a particular location is used to classify crops. The choice of classification techniques is being guided by similar works done on crop recommendation. Entering soil inputs to get best suited crops and finding optimal soil requirements for maximum, sustainable output - the module can work both ways. The system is presented under the assumption that farmers or cultivators have access to nutritional information of the soil like nutrient presence and pH values through their respective soil health cards provided by the government. The use of sensors otherwise for quantifying nutritional values of soil in an IoT based environment, has seen limited on-site implementation and hence lab-based tests become a more dependable source of input data.

IV. METHODOLOGY

1. *Data Preprocessing of raw input*

The most crucial step for an accurate model requires pre-processing that can convert raw, unorganized data into a form that can be understood by computers and used for machine learning models. Mathematical concepts of mean, mode, median are employed along with scaling values to a particular range, data cleaning, data encoding and determining correlations among variables.

2. *Deploying exploratory data analysis*

Exploratory Data Analysis is an essential step of doing initial assessment on data in order to uncover patterns, identify irregularities, test hypotheses, and validate assumptions using summary statistics and graphs. This can take the form of univariate, bivariate or multivariate analyses. PDF, CDF are some instances of univariate analysis and box plot and heat map are forms of multivariate analysis.

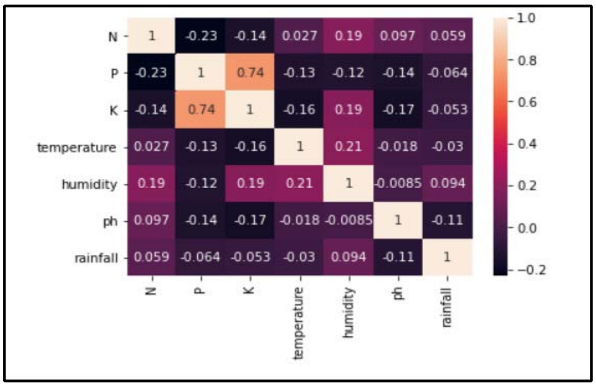

Fig.1. Heatmap-correlation metrics of the dataset for crop recommendation

3. *Data Splitting*

Training and testing datasets are formed on a 80:20 ratio. The 20% data is used to test the model on the unknown data and perform cross-validation to determine the hyperparameter - [13] these are parameters that govern the learning process acquired by a learning algorithm. These are 'top-level' parameters that drive the learning process and other model parameters that come from it.

4. *Training multiple models on the same dataset*

The preprocessed training set is fed onto multiple independent learning models whose results will be accumulated for ensemble technique that will finally give a class label from every classifier. Our choice of classifiers was followed by as assessment of related works, post which the most frequently used classifiers were chosen

a) Decision Tree - as a supervised learning tool based on a tree-like structure, it can be used for both regression

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and classification. [14] A decision tree has a structure similar to a flowchart, with a tree representing attributes and class labels.

b) Naive Bayesian Classifier - the advantage being that it is simple and straightforward and works under the premise that all features are independent of each other.

c) Logistic Regression - classification of a datapoint in an n-dimensional space. It is based on statistical recognition whereas SVM is based on geometrical properties.

d) Support Vector Machine (SVM) - where the main task involves determining the best hyperplane. Each data having n features is plotted onto a n-dimensional space and the hyperplane must segregate any two given classes (in a linear kernel) with the highest margin. [15] SVMs require lesser variables for a similar or higher MCR value

e) XGBoost - in comparison to decision trees, it is a more advanced tree-based approach sed for gradient boosting implementations

f) Random Forest - a miniature of ensembling technique in which multiple decision trees are assessed for maximum depth until nodes split with minimum variability and bias

5. Testing data

A query point is presented to each classifier. A class label is the output of every classification model.

V. Implementation

The dataset has been taken from kaggle and referred from an earlier work [12] because of the presumed ease with data preprocessing. The sample size for this work comprises 2200 crop samples of 22 unique crops. This collection of data had the scope of encompassing multiple features. For the fertilization module, feature selection was used as a dimensionality reduction technique to simplify the model.

Various public datasets about India are augmented and combined in this project, such as weather, soil, and so on. Contrary to complicated features affecting yield of crops, this data is relatively simple and has only a few but useful features. It includes nitrogen, phosphorus, potassium, and pH values. In addition, it contains the humidity, temperature, and rainfall needed for each crop.We have used Pandas library through which we preprocessed our data efficiently. We converted the raw data to mergeable data so that it can be appropriately passed through our model. Libraries used in python are - pandas, numpy, matplotlib, pyplot, seaborn, sklearn etc. The corresponding features are nitrogen, potassium, phosphorus, temperature, humidity using which 22 unique features are predicted.

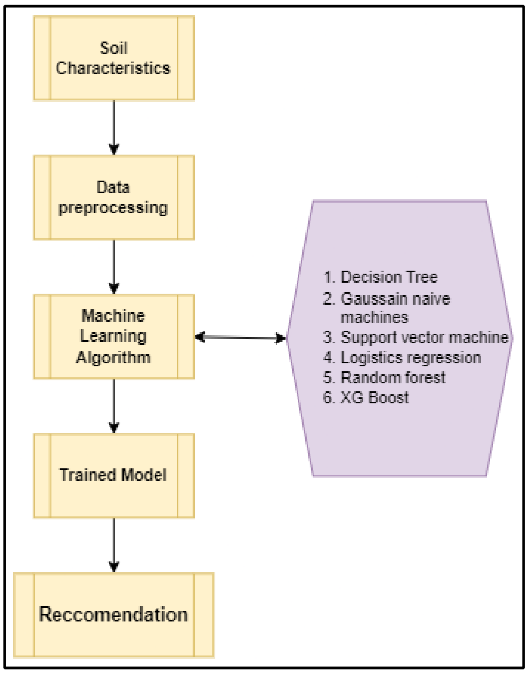

Fig. 2. Flow Chart of steps for Crop Recommendation using Ensembling Technique

The distinct class labels obtained from each classifier are applied to the majority voting technique to produce an ensembled class label as the final prediction.

Ensembling Technique for Crop Recommendation

Ensemble methods is a machine learning technique that integrates numerous base models to create a single best predictive model.The ensemble framework should be used primarily because it offers a classifier that performs better than each of the classifiers learning independently.

[16] Ensembling technique is of two forms - dependent and independent. In the former technique, the result of one classifier is further used serially in the learning process of the consecutive classifier. In an independent model, a class label is generated by each classifier without any input from preceding learners. Here, all classifiers work in parallel. Parallel execution makes it a more time - efficient alternative taking lesser execution time. It consists of the following components: training data (S) , base inducers (learners denoted by I), diversity generator and a combiner. Where the model M, can be represented as: M = I(S).

Random Forest Algorithm for Fertilizer Recommendation

Random Forest algorithm is also a classification algorithm that uses ensembling technique that combines the results of similar models to create a strong model built by multiple decision trees. The training is done via what is called as bagging (form of ensemble method) where the combination of multiple tree-like classifiers, trained on varying subsets of data, increases the overall accuracy. Three different random forests each having 50 decision trees (n estimators = 50), are created for each of the nutrients - N, P, K. The end result is the output of the mean of classes.

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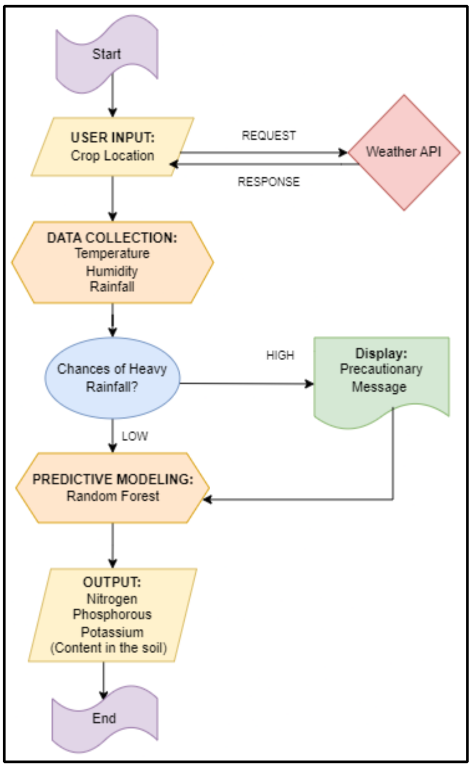

Fig. 3. Flow Chart of decision flow for Fertilizer Recommendation using Random Forest

We see here that the random forest model uses live weather API information to attain humidity levels or probabilistic values of precipitation using which required NPK values are displayed for a particular crop.

Majority Voting Technique

Majority voting is a concept using which the final result is obtained in independent ensemble learning. The labeling of an unknown data is done based on the highest number of votes obtained by a classifier - known as plurality votes. Majority voting is the most commonly used combiner in ensembling technique

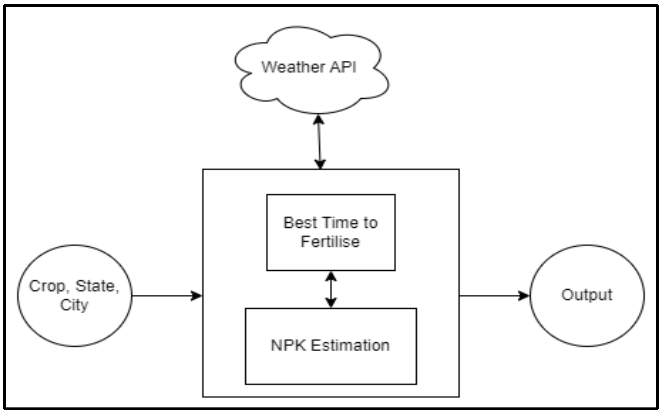

Fig 4. Block Diagram of Proposed NPK Fertilization

VI. Results and Discussion

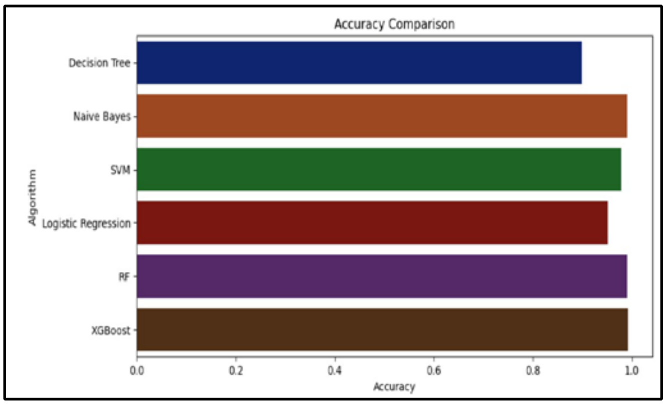

Fig 5. Accuracy comparison of different classifiers used in ensemble learning

Using Majority Voting Technique (MVT) different classifiers have been compared and the one with the highest votes is used to label the unknown data. The accuracy for crop recommendation has been shown to be 99% while required N, P,K ratio is being generated with an accuracy of about 87%

Hence, this project demonstrates how nutrient management can be implemented, through machine learning tools of ensemble learning and random forest with k-cross validation for better decision making in line with recommendation of commissions, that focused on a localized model for agricultural practices rather than a standardized one. A regional model will more comprehensively address the needs

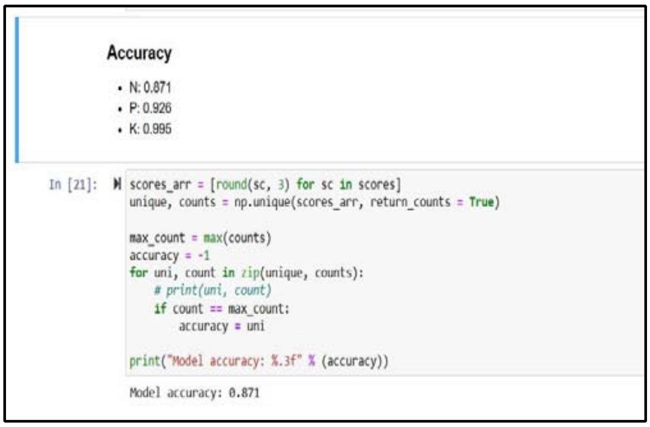

Fig 6: Model Accuracy of Proposed NPK Fertilization

VII. Conclusion and Future Works

A prototype Smart Farming tool has been presented with noteworthy accuracy to aid crop-fertilizer management by considering site-specific conditions of soil properties and rainfall. Fertilizer usage has been optimized through intelligent decision making.

Using crop sensors for soil assessment does allow nondestructive analysis of samples, however their validity has not yet been determined for precision nutrient management. This increases the scope of such a tool that can be deployed with more local information at micro-level for actual implementation as can be said from similar precision agriculture projects in states like Karnataka and

DOI: rp-9788770040723.014

Kerala, where good reviews were obtained. The main concern however with introduction of technology in conventional agricultural practices remains awareness and capacity-building through training etc.

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Vision Based Object Detection Method for Water Surface Garbage Capture Robot

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***Abstract*—The environment is covered with many water resources. The living organism on earth relay more on water. Due to the growth of innovation and Technologies there is a need for protecting our environment. There are many plastics-based materials used in our day today life for packing, storing etc. These plastics pollute our environment and also reduces the quality of water. These pollutant affects the human life and also the aquatic organisms. The biggest challenge is to identify the object in the turbulence of water. In order to remove these various methods are used to detect the pollutants through object detection algorithms. This paper deals with overcoming the challenges of realizing the accurate pollutant detection techniques and provides a best method for real time garbage detection methods and its performance.**

Keywords—Deep learning, Floating Object, Intelligent Robot, Object detection, Water surface Cleaner.

I. INTRODUCTION

Water resources are potentially useful in multipurpose for human beings and other organisms. Water covers 71 percent of the earth's surface, but just 3 percent of that water is fresh. The water is contaminated by many unwanted substances which harms the organisms that relay on water. People relay on water for the purpose of drinking, cleaning, swimming and other essential activities. Although the crucial role automation plays in all industrial applications, properly disposing of sewage from industries and cleaning sewage remains a difficult task. The polluted water may affect the health of the organisms too. The major pollutants of water are industrial waste, oil spills, chemical fertilizers, wastewater and sewage. Humans pollute water in such a way that they throw plastics and other floating waste in water. Over decades, there has been an increase in the amount of water contamination brought on by human error. [1].

For every pollution there will always be several factor affecting it, likewise in case of water pollution the major factors affecting pollution are bacteria, viruses, parasites, weeds, chemicals from industries, food products and containers, and huge amount of plastics. Notably, plastics are the major cause of pollution which affects the lives of aquaticorganisms living in under water. major plastics do not degradeeven for years which affects all the living organisms in wateralso cause major health issues in humans. So this need for plastic removal is mandatory to lead a healthy life nowadays. Removing plastics from water bodies is not an easy task because of several factors affecting it such as some light weight plastics move along with the direction of airflow which is difficult to detect and collect the garbage from water [2]. Some heavyweight plastics which are submerged under water can cause toxicity for the animals and plants living in the water. Also, air flow plays the major role in plastic removalbecause the light weight plastics are carried out by the flow of air which cause hardship for the device to detect and collect the garbage as it should not leave any garbage whether it is static or moving in the water bodies.

The slippery and round shaped plastic bottles is a challenge to collect as the drag force usually makes the plastics flow away from the robot. Second, the robot is tele operated in a pond where Practical tests are used to gauge garbage collection capacity. Thirdly, the impact of matching the robot driving speed to the conveyor belt speed is investigated. To resist the disturbances that involves how to realize the real- time and accurate garbage detection while conduction of vision-based steering and despite the choppy water's surface, to grip the floating trash.

Detection: The moving robot makes a challenge to detect the plastics that flow away in the water surface. The object detection algorithm must be accurate and real time.

Navigation: The unpredictable dynamic factors such as wind and waves in the aquatic environment, that makes it necessary.

Collection: The objects will move on the surface of water due to the dynamic conditions and the robot itself. The plastics will move awayin according to the wind flow.

II. NEED FOR OBJECT DETECTION

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The various pollutants relay on water bodies which destroy the water and other organisms which depends on that water. So, the unwanted waste that float on water should be removed. In water it is difficult to remove waste as easy as possible due to the shaky movement of water. By human intervention activity it is not so easy to remove all those waste in case of large water bodies. Floating object Machine cannot work without any algorithms. We need to feed all the information in that machine in order to make it effective. The Fig 1. Shows the need for object detection. The first step tocollect waste is to detect waste. Therefore, there is a need forobject detection. There are many algorithms which give solution to this object detection with different accuracies. The primary goal of object detection is to identify occurrences ofa preset set of items and to use a bounding box to represent the locations of each object in the image.

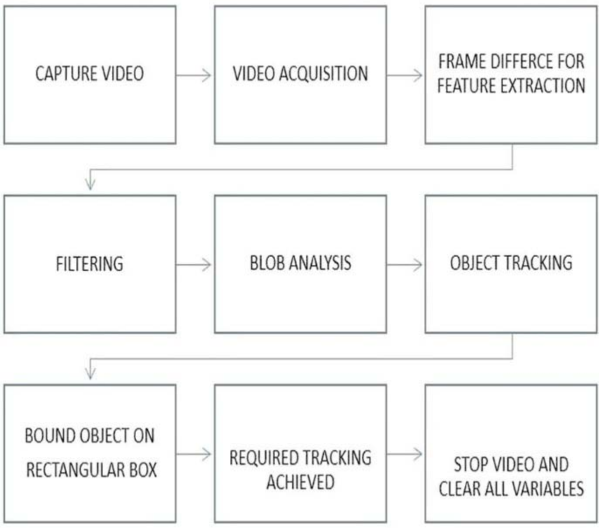

Fig. 1. Flowchart for need of Object Detection

IV. Object Detection

Detecting things in photos, movies, and other media is made possible by computer vision and image processing technology. The figure 2 shows the real time captured frame of image with floating garbage. AI is the fundamental concept behind object detection in this. Data is gathered by computer vision software and input into machine learning or deep. The camera gathers data from photos taken at various angles and transmits it to the image processing unit [4]. The findings are then presented based on the model's training data.

- Unfortunately, due to the saturation of hand-crafted features, object detection has reached a high after 2010. In 2012 the rebirth of convolutional neural and deep convolutional networks where successful at learning robust and representation of the image. The Convolutional Neural Network (CNN) has proposed and broken the deadlocks of object detection in 2014. Object detection has 2 genres: two stage detection and onstage detection.
- A set of object proposal starts with the extraction. The fixed sized image is fed into a pre trained CNN model

may not be in same position for a while, so by using waste boxes or with the hands of human is impossible [3]. So, to overcome these, a machine is to be invented. In case of plastic waste, the water may deposit inside the plastic bags which increases the weight of the waste so the machine needs to be designed which handle the weight of the waste.

to extract features. SVM classifiers are employed to identify object categories and forecast the existence of an item inside that region.

- R-CNN, SPP Net the image is processed at conv space layers for one time while the image is processed with R-CNN for as many times. However, it includes drawbacks like multistage and SPP Net ignores all preceding layers and solely fine-tunes its completely linked layers.
- In R-CNN, it is mostly unable to capture objects which are small. Pyramids can be used to solve this simple image to scale into different sizes. All the predictions can be combined when the detections are detected on each scale.

Fig. 2. Object Detection

IV. Proposed Methodologies

There are many methodologies that defines object detection in in a finer manner with different types of algorithms that detects objects and images. There exist many algorithms for object detection. some are very successful and some resulted in failures and some are still under testing state. Every algorithm has its own pros and cons. In spite of all drawbackssome notable object detection algorithms are also used widely which uses object detection and collection. some of the notable object detection algorithms are listed below:

A. *CNN*

CNN is a deep learning technique that stands for Convolutional Neural Network. Which is widely used in the few past years. It has high accuracy which is because used for image classification and recognition [5]. The computer scientist YannLecun proposed CNN algorithm in late 90's.he also shared that he was inspired from human visual perception of recognizing things. The convolutional neural network also known as artificial neural network; it is specially designed to process data in pixel. It has built in layers through which the high dimensionality of images is

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reduced without losing the information. In simple CNN is a supervised deep learning method and widely used in image recognition and detection [6]. It has 4 layers of network (1) convolutional layer, (2) pooling layer, (3) ReLU correction layer (4) fully connected layer.

Steps Involved:

- The foremost step is to **choose a dataset** which is choosing the image for classification is the initial step.
- Next is to **prepare dataset for training** which mostly deals within creating paths, and categories or labelling and also in resizing the image.
- Third is to **create training** data which contains pixel values from the image list.
- Next is to **shuffle the dataset** and the fifth step is toassign labels and features.
- The following step is to normalize and transform labels to categorical data.
- The CNN model is then defined, compiled, and trained.

The main advantage of CNN is its automatic detection of important features which can be possible without any human supervision is shown in Fig.3. It is also appreciated by learning about the key features by itself. But the encoding the position and orientation of the object is not possible in CNN [7]. It requires lots and lots of training which can take more timeto complete. It lacks in the ability of shifting the input signalto equally shifted output signal.

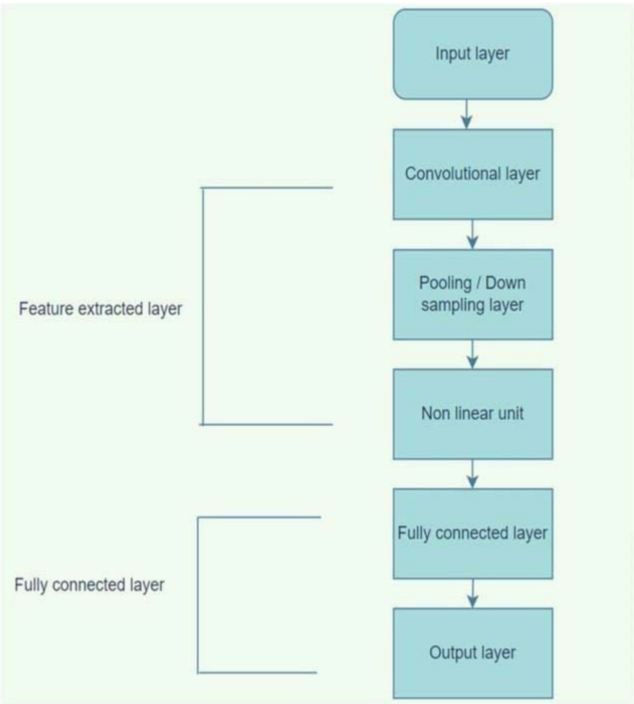

Fig. 3: Flowchart for CNN

B. Histogram of Oriented gradients (HOG)

The Fig 4. Shows the histogram frame works of image. Histogram of Oriented recognition gradients deals with face recognition that uses principal component analysis (PCA) to solve problems based on low accuracy. It is mostly used when the accuracy of the problem is low and it is used under nonrestrictive conditions. Most importantly the gradient orientation deals with the direction of greatest intensity change in the neighborhood of pixel. HOG uses features combined with linear classifier named SVM which is classification algorithm developed by V. Vapnik [8] along with his team. It is based on ideas of optimization and statistical learning. Both linear and nonlinear SVM training models are utilized for face recognition, and it is the primary approach for tackling pattern recognition problems.

Working steps in HOG

- Preprocessing: if a large image of size 720X475 is selected for a patch of size 100X200. The patch is cropped out of an image and resized to 64X128.
- Calculate gradient images: Sober operator is used to calculate the horizontal and vertical gradients
- Compute gradient histogram in 8X8 cells: the picture is divided into 8X8 cells, and the gradient is calculated for each 8X8 cell.
- 16X16 block normalization: A 16X16 matrix has four histograms that are combined to generate a 36X1 element vector.
- Calculate the histogram of oriented gradients feature vector: the concatenated vector is converted into one giant vector for calculation.

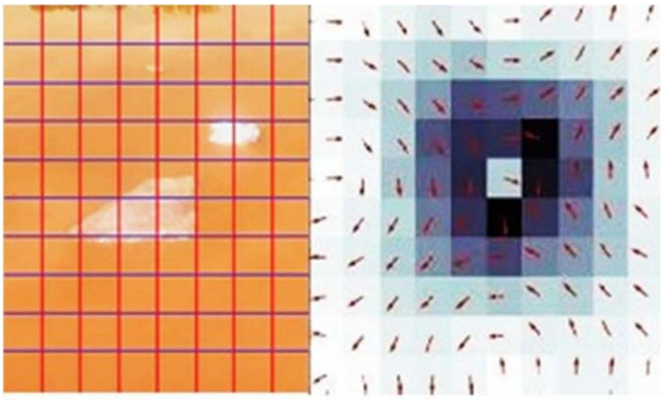

Fig. 4. Histogram Oriented Gradient

C. SSD

SSD stand for Single Shot Multi-Box Detector Single stage object detection method. Most of the object detection method detects the object by dividing it onto sliding windows, but SSD algorithm divides the object into grid cells which is responsible for detecting the object in that region of image. Detection of particular object is done by predicting thelocation of an object within that region. On different tiers of the output region, it employs default boxes of varied sizes, shapes, and aspect ratios. For better coverage of location, it uses 8732 boxes, scale and aspect ratios [9].

The majority of the predictions will be devoid of any item. It discards forecasts with a confidence value of less than 0.01. The main components of SSD are backbone model and SSD head it is shown Fig.5. The backbone model is a pretrained classification of image [10]. It is also like YOLO algorithm but it took only one shot to detect more

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than one object present in an image using multi-Box. To make this algorithm effective, training is mandatory. So, the input to SSD is givenas an input image with ground truth bounding boxes. During training, the default boxes are matched to the ground truth boxes in terms of aspect ratio, position, and scale. The intersection between predicted boxes and ground truth should be bigger than 0.5. Finally, we select the projected box with the greatest overlap with the ground truth. Thus, the object is detected using SSD algorithm.

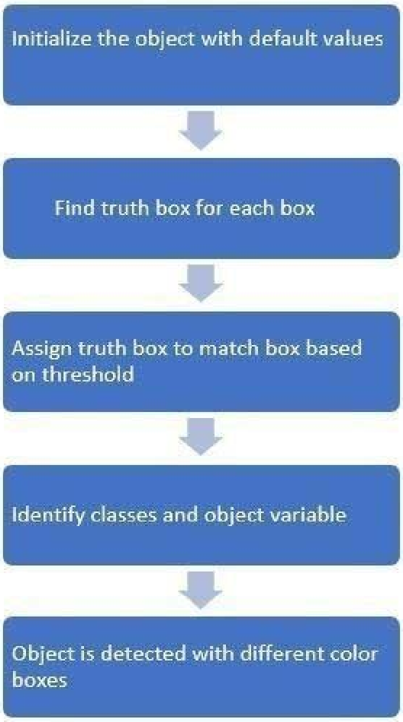

Fig. 5. Flowchart for SSD

D. YOLO (You Only Look Once)

YOLO is the most popular algorithms for the detection of objects and images the processing speed of YOLO is very fast that it is an algorithm to detect real time objects very fast. It produces high accuracy and overall processing speed which makes it popular [11],[12]. YOLO algorithm predicts the object and the location as bounding box of the input image. Using the four numbers it recognizes each bounding box; center, width and height of the bounding box.

Working of YOLO

At first the algorithm divides image into grids like 3x3 or 4x4, with the help of the grid it detects by objects per grid than objects per image, it encodes a vector for each grid to describe that cell. If a grid does not have any object, it is encoded as,

V1,1= (Pc, Bx, By, Bw, Bh, V1, V2) = (0, _, _, _, _, _) (1)

There is a possible that one issue might happen, if the algorithms predicts large number of bounding boxes for one class, to resolve this there is non-max suppression algorithmthat at first the box with maximum probabilityis considered[13] and it is compared with all the other boxes in that class with the use of Intersection Over Union (IoU), shown in equation 2.

$$\text{IOU} = \frac{\text{Area of intention between B1 and B2}}{\text{Area of union between B1 and B2}} \quad (2)$$

If the resultant IoU is exceeds the threshold, the box that has small probability is ignored. This process is continued and repeated until all the boxes are either predicted or excluded. The Fig. 6 shows the grid and cell vectors.

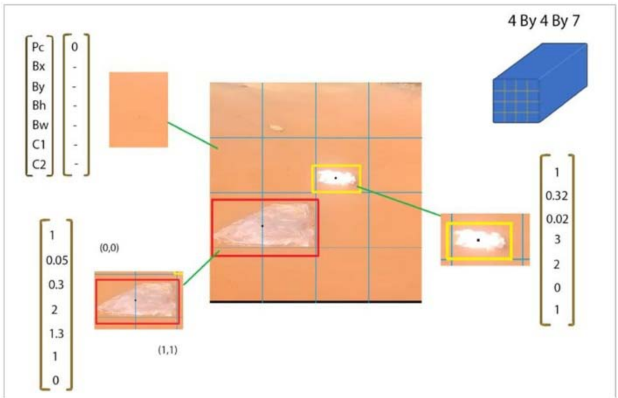

Fig. 6 Object detection using YOLO

V. Comparitive Analysis

Comparative analysis is the basic factor which defines the best among all. It is necessary to conduct comparative analysis to get a clear understanding of the problem or resultant relevant queries [14]. Notably when it comes to object detection, the chosen algorithm must be very effective to detect all the floating garbage's in spite of turbulence like airflow, heavy wind etc., because the algorithm should be trained to detect static as well as moving garbage's in water. In this paper, comparative analysis deals with finding the best object detection algorithm among the selected algorithms like CNN, SSD, YOLO, HOG [15]-[17]. Here the comparison is done based on the performance i.e., speed of the detecting algorithm, accuracy rate which defines how much accurate the algorithm works, and also with the speed of detecting the objects in the water surface. In addition to this analysis, the time taken for training is also a factor which makes this comparison effective.

TABLE 1: Cooperation of Object Detection Algorithms

ALGORITHMS	SPEED	ACCURACY RATE	TIME FOR TRAINING (hrs)	PERFOMANCE (Mb)
CNN	Slow	93.8	18	115
HOG	Medium	90.18	16	200
SSD	Medium	86.60	14	225
YOLO	High	95.02	10	25

Table 1 shows the comparative analysis of the above-mentioned algorithms

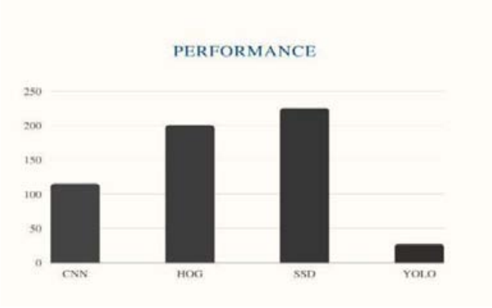

Fig. 7 Performance of Algorithms

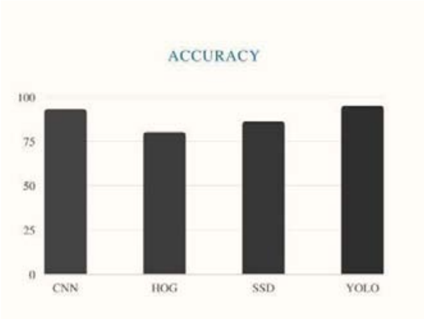

Fig. 8 Accuracy of Algorithms

Fig. 8 Time taken for training

From Figure 7, Figure 8, Figure 9 it is inferred that YOLO and SSD are efficient in comparison with CNN, HOG.

VI. Conclusion

This paper deals with introduction to the algorithms used for detecting objects and clarifies the need for object detection and a comparative analysis is done by comparing different parameters which results in the removal of floating garbage in surface of water. With these measured factors, the final result shows that YOLO algorithm is very effective than the other algorithms mentioned above. Yolo is also widely used nowadays for object detection with updated version releases.

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Using Statistical Properties and Random Forests, Classification Performance Model Evaluation for the Mental Arithmetic Task-Brain Computer Interface

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***Abstract* —Ourobjective is to find an efficient method to classify the subject's mental cognitive workload as good or bad by obtaining features that can describe the continuous and underlying temporal dynamics of electroencephalography (EEG) data during the performance of mental tasks. To develop a BCI model that can forecast mental states like good and bad, we explore the ensemble learning technique using classifiers like the random forest classifier. From the alpha, beta, and gamma bands of EEG, the features like mean, root mean square, skewness, mode, data range, interquartile range (IQR), and three Hjorth parameters are extracted to differentiate a signal before-during mental arithmetic task. Our suggested model's analysis and results demonstrate that, when applying these techniques, accuracy is 96%. This model is further utilized for the application of automation in the Internet of Things (IoT).**

Keywords—Attention*, *Random Forest Classifier, Support Vector Machine, statistical analysis, Feature Extraction, Feature Selection, Electroencephalography, Brain Computer interface

I. INTRODUCTION

Neuroscientists have recently shown an interest in the creation of Brain-Computer Interface (BCI) [1] devices. The Common technique used for analyzing neural activity is electroencephalography (EEG). Additionally, it might be suggested for the treatment of anomalies, behavioral issues (such as Autism), attention disorders, learning difficulties, language delays, etc. [2]. Depending on the type of activity the EEG wave can be separated into beta, alpha, theta, delta, and gamma waves [3]. These frequency ranges are followed by them.

TABLE 1. THE FREQUENCY RANGES OF EEG WAVES

Waveform	Frequency Range	Activity
Beta	13 - 30Hz	Extremely active interactions and brainactivity
Alpha	8 – 13Hz	extremely calm widening the meditation
Theta	4 – 8Hz	drowsy, falling asleep, and dreaming
Delta	0.1 – 4Hz	A sound slumber without dreams
Gamma	30 – 100Hz	excessive brain activity

A typical BCI paradigm starts with the signal acquisition phase, in which analog brain impulses are gathered and transformed into digital values. Signal capture, data pre-processing, feature extraction, and classification are all processes in any standard BCI model [4]. Noise and artifacts are removed after pre- processing the acquired signals. The process of selecting and extracting certain characteristics from the data for categorization is known as feature extraction. These collected traits are sent into a classifier, which then determines which class they belong to.

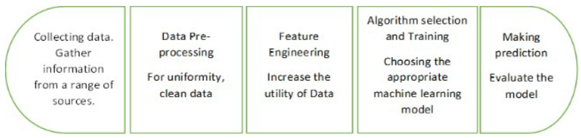

Fig 1. Steps to solve machine learning problems

Classification algorithms can be either supervised or unsupervised, depending on the application. Ensemble learning, as compared to traditionalmachine learning algorithms, is an approach that makes use of several learning algorithms to improve expected outcomes. A group of classifiers is used for learning in ensemble learning, which is a subset of supervised learning. Typically, these ensemble classifiers perform predictions using several straightforward classifiers, such as SVM, naive Bayes, and decision trees and then cast a vote to determine the final class [5]. The classifier used in random forests is made up of several unique classification trees, each of which functions as a separate classifier and is assigned a specific weight in the classification results. By selecting the mode (the output with the most votes) of all the classification outputs from the trees, the overall classification output is calculated [6] The rest of the paper's covers as, in Section II: Related works, in section III: Proposed methodology, which covers details on data collection, features that were extracted, and the techniques that were used to classify. In Section IV, the results and discussion are covered, and the work is wrapped up in Section V.

II. RELATED WORKS

The literature review relates various approaches for EEG signal analysis.From EEG data, Binish Fatimah recovered parameters such as mean, kurtosis, energy entropy, and L2 norms using the rhythms filter [7]. In this

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work, the feature extraction and classification methods were performed using SVM, decision trees, quadratic discriminant analysis, and entropy.

Binish Fatimah [8] described a method for identifying mental arithmetic tasks that require solving math problems (serialized subtraction of two numbers). To understand the brain response from a single lead EEG data, the Fourier transform is used. Men and women between the ages of 17 and 26 took part. Participants' ages ranged from 16 to 21 for women. The decomposed signals were filtered for variance characteristics before being classified using the SVM.

Qiang Wang [9] classified real-time EEG waves using multifractal analysis to identify mathematical workloads. In this study, features including power spectrum density and an autoregressive model were employed. The fractal dimension was determined and the attributes were classified using the Support Vector Machine (SVM).

BiswarupGanguly [10] created a categorization of mental arithmetic problems based on EEG to study brain-computer interaction (BCI). EEG data from 36 subjects were recorded, and eight characteristics were extracted from each electrode. These elements were input into the stacked long-short-term memory (LSTM) architecture to create and enhance the brain- computer interface model. FatemaNasrin [11] provides a method for figuring out the functional connectivity between the frontal lobe and pre-frontal lobe areas when young individuals (aged 16 to 20) perform mental arithmetic using single-channel EEG data (subtraction). He concluded that the precision of the Bidirectional Long Short-Term Memory (BLSTM) architecture was considered based on the results of his analysis. With a mean accuracy of 75.88% over 23 channels, this was able to recognize the proper condition of mental arithmetic in 5 seconds. With a significance threshold of less than0.05 in the states of mental calculation and face repose, HodaEdrisAbadi's [12] novel approach involved the extraction of numerous geometric features from Poincare design analysis. This analysis used the crucial comparison t-test to identify variations in brain activity. An artificial neural network has also been used in the two methods to perform autonomous learning and diagnosis (ANN). Electroencephalogram (EEG) data and Bayesian optimized K-Nearest Neighbor were used by LakhanDev Sharma [13] to characterize the mental load and identify the brain's response to stress stimuli (BO- KNN). Entropy-based feature extraction was followed by F-score-based feature selection to increase classification accuracy.

III. Proposed Methodology

3.1 Overview

Data preparation, feature extraction, and classification are the three key components of our suggested methodology. After the data has been gathered, the first stage is data preparation, which is carried out by the EEG device used for data gathering and involves noise reduction and filters. The next stage is feature extraction, where we take the preprocessed data and extract statistical characteristics like mean, root means square, skewness, mode, data range, interquartile range (IQR), and three Hjorth parameters. The final step involves classifying the obtained attributes using a classifier suitable for the collected real-time data. We propose utilizing a random forest classifier in themodel below, which uses an ensemble learning technique, to categorize the supplied data.

3.2 Data Collection

The 36 subjects in the dataset [7] whose signals were captured make up the dataset. 180 seconds before the mental arithmetic task and 60 seconds during the mental arithmetic task were recorded. According to Fig 2 and 3, there are 21 channels in each recording.

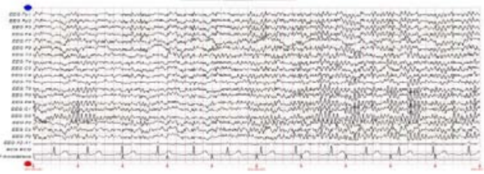

Fig. 2 EEG signals for a 10-second frame of before mental arithmetic calculation

Fig: 3 EEG signals for a 10-second frame duringmental arithmetic calculation

The electrodes are positioned to gather the most signals possible. The job of n-subtraction is given to each participant. Each subject initially receives two variables, x, and y. As many times as feasible, the subject must subtract y from x and recall the outcome. The individual constantly performs this task for one minute. Finally, by computing the remainder, it is determined if the subtraction was performed successfully or not. The sampling frequency was chosen to be 500 Hz

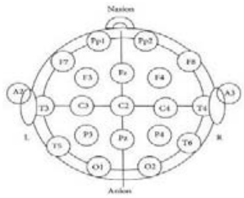

Fig 4. 10/20 International System of electrode placement

3.3 Feature Extraction

A 50 Hz notch filter is used in the pre-processing stage to eliminate the reference DC component. The extraction of characteristics from the alpha, beta, and gamma frequency bands is a step further in the study. Chebyshevbandpass filters with predetermined frequency ranges are used for this. From these filtered data, we have retrieved the features listed below.

1. Mean: The average of all the samples is provided by the signal's mean values.

$$x_{mean} = \frac{1}{N}\sum_{i=1}^{N} x(i) \qquad (1)$$

where N is the signal's overall sample count.

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2. Root Mean Square (RMS): The RMS value of XRMS is calculated as follows for a signal x(t)

$$x_{RMS} = \sqrt{\frac{1}{T}\int_{t-T}^{T} x(t)^2} \quad (2)$$

3. Skewness: The asymmetry of the data distribution relative to the central mean is measured. More data is to the left of the mean if the skewness number is negative, and to the right, if it is positive. It is said that the skewness parameter is

$$S = \frac{E(x-\mu)^3}{\sigma^3} \quad (3)$$

Where the sample's mean and standard deviation are$\mu$and σ, respectively (t). 'E' stands for 'expectation'.

4. Mode: The value that appears the most frequently in a dataset is called its mode, or x(t).
5. Data Range: It gives back the difference between the sample dataset's maximum and minimum values x(t).

$$Datarange = xmax - xmin \quad (4)$$

6. Interquartile Range: The interquartile range of the data samples in a time series object is returned by IQR. IQR refers to the difference between an array of random values' upper and lower quartiles (Q3 and Q1, respectively). The quartile measures the median by considering an even dataset of 2n values or an odd dataset of 2n+1 values. The median of the first quartile's values is in Q1, while the median of the third quartile's values is in Q3.

$$IQR = Q_3 - Q_1 \quad (5)$$

7. Kurtosis: Kurtosis is a term used to describe a measure of a random variable's probability distribution.

$$k = \frac{E(x-\mu)^4}{\sigma^4} \quad (6)$$

8. Hjorth Parameters: A time-domain signal's statistical characteristics are shown by Hjorth parameters. Activity, Mobility, and Complexity are the three different parameters [8]. These variables are quite useful when analyzing EEG signals.

a) Hjorth Activity: It shows the variance of any signal x(t)

$$Activity = v(x(t)) \quad (7)$$

b) Hjorth Mobility: Mobility is equal to the square root of the ratio of the variance of the signals and the first derivative's x(t) signals. This variable is proportional to the spectrum's standard deviation.

$$Mobility = \frac{\sqrt{\mathrm{var}\left(\frac{dx(t)}{dt}\right)}}{\mathrm{var}(x(t))} \quad (8)$$

c) Hjroth Complexity: The degree to which the signal shape resembles a pure sinusoid wave is determined by this parameter. If the signal is more like the sine signal, the complexity converges to unity.

$$complexity = \frac{mobility\left(\frac{dx(t)}{dt}\right)}{mobility(x(t))} \quad (9)$$

3.4 Classification

The classification of brainwaves using traditional classifiers has produced positive results in recent years for all forms of BCI data. Some of these include SVM, naive Bayes, k-NN, LDA, and others. Moreover, working with ensemble learning gives us a new way to learn from real-time data. Our method employs binary categorization, allowing us to determine if a person's count quality is good or bad. Our model includes a random forest classifier for classification that employs an ensemble learning strategy for prediction.

3.4.1 Random Forest

The Random Forest Classifier [9] employs a classification technique known as ensemble learning that employs numerous decision trees during the training phase and produces average predictions ofand 90% of the data for the model's training. The two subsections below provide information on the outcomes and performance of our approach.

Many decision tree algorithms are rule-based and depend exclusively on a collection of rules for making predictions about a set of data. In comparison, random forest classifiers find the root node and split the features randomly, as opposed to using the Gini index or information gain to calculate the root node.

1. Precision: It measures the proportion of real positives to all positives.

$$\frac{TP}{TP+FP}$$

2. Recall: The ratio of true positives to all positively classified samples is how it is described.

$$\frac{TP}{TP+FN}$$

3.4.2 Proposed Approach

When compared to decision tree classifiers, random forestclassifiersoperatesimilarly,butwiththe additionofensemblelearning.Thefirstphaseis building many randomly selected decision trees, each of which predicts a certain class based on the information provided. A voting process is used to determine the final class based on the results of the majority after each tree forecasts a class.

IV. Experimental Results and Discussion

We used 10% of the total data for the model's testing, and 90% of the data for the model's training. The

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twosubsectionsbelowprovideinformationontheoutcomesandp erformance ofour approach.

4.1. Confusion Matrix

A confusion matrix [16] in the form of a table for a collection of real data and predicted data is used to show a classification model's performance. The classification model's resultant confusion matrix

TABLE 2.CONFUSION MATRIX FOR RANDOM FOREST MODEL IN TEST DATA

Class	Good	Bad
Good	17	2
Bad	2	59

Table: 2 tells that the confusion matrix for random forest in taken for test data, where 17 samples accurately categorized the quality of the count as good, compared to 59 samples that were correctly labeled as bad. 2 samples were incorrectly labeled the count quality as good, compared to 2 samples that were incorrectly classified as bad. Hence, we observe that around 96% of the whole data set is projected into the appropriate classes.

4.2 Performance Evaluation

Precision, recall, accuracy, and other performance metrics are used to evaluate classification performance. Table 3 below is a list of a few of these measurements.

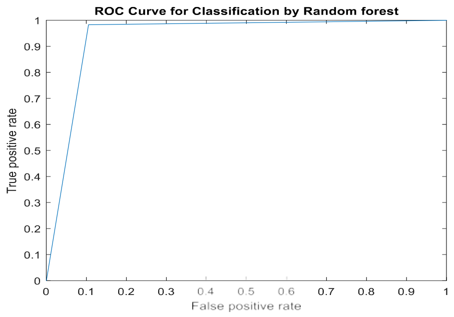

TABLE 3.PERFORMANCE MEASURES

Evaluation Metrics	Values
Correctly Classified Instance	96.20 %
Incorrectly Classified Instances	3.80%
Kappa Statistic	0.8941
Mean absoluteError	0.0380
Accuracy	0.9620
Precision	0.9558
Recall	0.9390
F1- Score	0. 9471
AUC	0.9390

The term "true positives" (TP) refers to samples that were correctly located and anticipated to have high-count quality. The term "true negatives" (TN) refers to samples that were correctly classified as negative and were expected to have poor count quality. False positive samples are those that are mistakenly classified as being good, and false negative samples are those that are classified wrongly as being bad.

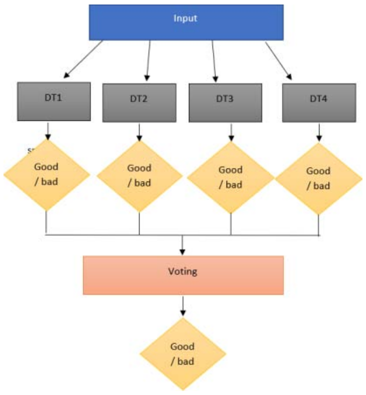

Fig: 5 Structure of Random Forest

The random forest classifier uses an ensemble learning strategy that has a 96% accuracy rate for class prediction.

V. CONCLUSION

In this study, a method for classifying mental states into good and poor categories is suggested. The methodology uses a random forest classifier and statistical feature extraction approach. After attempting to gather EEG data from 36 people, a machine-learning model was created, and the accuracy of this real-time data was 96%. This binary categorization might be used for a variety of things, such in the Internet of Things to turn on and off devices and manage other comparable household equipment by just changing your mindset. The predictive model we developed may be improved and used to control IoT devices more precisely since it gradually learns the users' mental states.

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Backward Random Walk based Source Location Protection in Sensor Network

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Abstract—Wireless sensor networks has expanded its view of applications from personal domains to as wide as asset monitoring domain. Homogeneous sensor nodes are deployed to gather information and inform the base station. However, attackers are on a continuous look out to backtrack and gain the source node location. Location privacy preservation of the assets against passive attackers is crucial. In this paper, we develop a source location preservation scheme based on the combination of backward and forward random walk, to provide security irrespective of the source location in the network. The performance of the scheme is measured in terms of safety period, randomness of the routing length and capture rate of adversaries. Simulation results prove that the proposed scheme provides significant improvement in privacy strength and other metrics as compared to existing approaches.

Keywords—source location privacy, security, adversaries, backward routing, random walk, forward random walk.

I. Introduction

In the fast changing, network oriented digital world wireless sensor networks (WSN) [1,2] play a key role in information processing. WSN is formed by a collection of sensor nodes deployed within an area to sense, process and transmit information by communicating among each other. The information transmitted in packets through multiple hops is directed towards the base station or sink. Sink can be termed as the final destination for all the packets sent by the sensor nodes, Due to the good feasibility and self-organizing structure of sensor nodes, WSN is used for monitoring applications like animal conservation, military, smart buildings and offices etc. [3-5]. In applications where the assets being monitored holds a very high value in terms of their importance to nation or nature, it is essential to preserve their location information from falling in wrong hands.

Location privacy preservation [6,7] is essential requirement in WSN. It is divided into sink location privacy preservation [8] and source location privacy (SLP) preservation [9,10]. As sink is the final destination of all the packet transmission taking place in the network, a successful attack on the sink would render the security measures useless. But it must also be noted that attack on sink is an extremely difficult task as sink is heavily protected to be resistant against all possible attacks. Whereas source location privacy preservation is aimed at securing the location of the sensor nodes that is transmitting information about the presence of the assets. Attackers in order to remain hidden might not interfere with the communication process but carry out passive attacks like eavesdropping, backtracking, network flow analysis, etc. to finally infer the source node location. This revelation can lead to capture of the assets or even loss of their life. Hence, SLP mechanisms must be devised to assure good levels of privacy against passive attacks by adversaries.

In this paper, we propose a routing mechanism named as Backward and Forward Random Walk (BaFRW) that is divided in 2 phases: first phase is where the event packet is randomly sent away from the source node towards the network boundary and second phase is where the packet is delivered to the base station using a previously developed mechanism termed as forward random walk. We discuss the mechanism in detail in Section 4. Major contributions of this work are:

- We develop a robust and randomized SLP mechanism BaFRW that guarantees a higher level of privacy strength against passive attacks.
- We perform an experimental analysis and simulation results depicted in Section 5 prove its efficiency.

The rest of the paper is structured as follows: Section 2 deals with the existing literature study and Section 3 gives an insight on the system models. The proposed scheme is explained in Section 4 while the experimental results are presented in Section 5. We conclude the paper and provide with possible future research studies in Section 6.

II. Related work

Ozturk et al. [11] in their work described about SLP problem through a Panda-hunter model. In this model, sensors are deployed in the network who pick up the presence of panda as soon as it appears within their transmitting radius. Then information regarding the location of panda is sent to the sink through multiple sensors in the path between the source node to sink. The authors suggested use of phantom flooding mechanism for SLP preservation. The packet containing information about the asset's location is sent from source node to a phantom node for a specific Time to Live (TTL) counter after which it is flooded towards the sink. This mechanism used up a lot of energy while flooding thus degrading the network lifetime. Then came a mechanism termed as Phantom routing by Kamat et al. [12]. They suggested a change in the Phantom flooding method by replacing the probabilistic flooding with a single route to sink. This change of flooding phase by a single route contributed to saving on the energy loss and increasing network lifetime.

Chen et al. [13] proposed Forward random walk (FRW) in an attempt to provide SLP preservation. Forward random walk suggests using the close and equal neighbor nodes to transmit information. This mechanism chooses one node randomly from the list containing close and equal hop count neighbor nodes. This process is repeated till the packet reaches the sink.

Manjula et al. [14] proposed a SLP routing based on randomized routes (SLP-R) that consists of 3 phases. In the first phase, the event packet is routed to the outermost ring through shortest path followed by an equidistant routing where packets are routed in the same ring for a specific number of hops. Finally using the shortest path approach the packet is delivered to sink. This mechanism improved privacy levels by increasing the randomness measure of the transmission routes.

Many routing schemes have been proposed that includes circular routing, fake sources injection, phantom routes, geographic routing etc. for SLP preservation. Circular routing by Han et al. [15] proposed selection of number of interference rings to transmit the packet in a circular manner through cluster heads. Then a starting node selected through token system from amongst the cluster heads in the outermost ring carries a dummy packet to the sink through greedy path and as it comes through the event ring, the dummy contents get replaced with the real content. This dynamic routing scheme ensured higher security but led to greater energy loss as well. However, it must be noted that there is always a tradeoff between performance measuring parameters due to which there is always one or the other degradation that increased privacy brings along with it. We aim to develop a mechanism that balances all the parameters along with good privacy strength.

III. System Model

A. Network model

The network model that we consider in this paper is Panda-hunter model. As per the model illustrated in Fig.1, sensors nodes are deployed in the network region to monitor the movement of panda and these sensor nodes keep transmitting information regarding the location of panda to sink. There is an adversary who monitors the wireless transmission between sensor nodes and backtracks in an attempt to get the source location. The packets must follow transmission paths that is difficult for the adversary to backtrack within a specified time interval. We assume the network model to consist of the following characteristics:

- The deployment of sensor nodes in the network region is done with a specific density ‘ρ’. The sensors once set in a place are not allowed to change its location.
- There is only one sink located at the center of the network.
- The network is divided into rings and grids. Each grid consists of a cluster head chosen among the sensor nodes placed in the grid. The grid to grid transmission of packets take place through cluster head.

B. Adversary model

Adversary intend to monitor the transmission to infer the location of source node. He is assumed to have the following characteristics:

- There is a single adversary who monitors the network communication.
- He carries out passive attacks such as eavesdropping, backtracking, traffic analysis, time correlation etc.
- He has access to advanced equipments to monitor the transmission and memory and energy constraints are not a limiting factor for him.
- We consider the adversary to be a local adversary with restricted range of hearing. Global adversaries [16] are far more powerful and tend to have a view of the entire network region. However, our work involves securing the source location against local adversary having the above mentioned features.

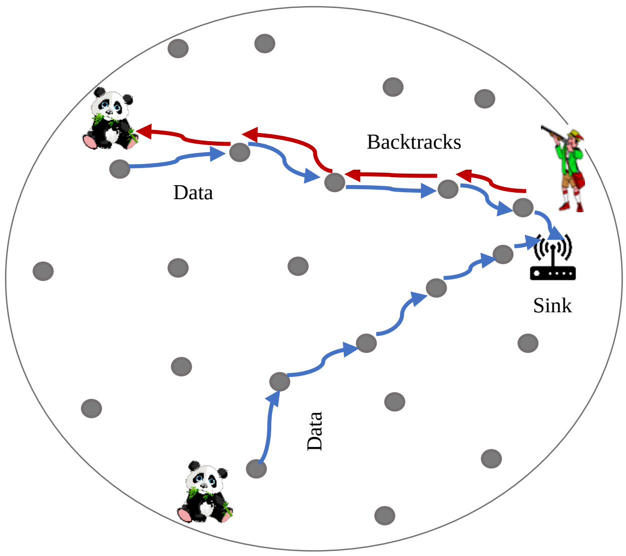

Fig. 1. Panda-hunter model

C. Energy Consumption model

The loss of energy for sensor nodes while packet transmission is computed by the following equations 1 and 2 [17] where equation 1 is for loss while transmitting the packet and equation 2 is the loss while receiving a packet.

$$E_t = l * E_{elec} + l * \varepsilon_{fs} * d^2, \quad d \le d_0 \qquad 1(a)$$

$$E_t = l * E_{elec} + l * \varepsilon_{amp} * d^4, \quad d > d_0 \qquad 1(b)$$

$$E_r = l * E_{elec} \qquad 2$$

The description of the parameters is provided in Table 1.

TABLE 1. System Parameters

Parameters	Values
Distance threshold ($\mathbf{d_0}$)	87m
Distance between source and sink	d

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$\mathbf{E_{elec}}$	50nJ/bit
$\boldsymbol{\varepsilon_{fs}}$	10pJ/bit/ m^2
$\boldsymbol{\varepsilon_{amp}}$	0.0013pJ/bit/ m^4
Packet length (l)	1028 s

IV. Description of BAFRW Mechanism

Before the transmission begins, the sink floods the network with an initial message which is meant for initialization and neighbor nodes discovery. The message contains information about the network range, system parameters, location of the sink and a counter to measure the hop count. The node that receives this message fills its routing table with the information, increments the counter variable and attaches its own id and location before passing it to adjacent neighbors. The neighbor node then updates its routing table with the information received from the packet and is able to identify its neighbors and their location. Then every node partitions its neighbors in 3 groups: close neighbors, far neighbors and equal hop neighbors relative to their distance from the sink with respect to itself. After this operation is performed by every node, the routing transmission begins. BaFRW consists of 2 phases that are described below.

D. *Backward Random walk*

This phase is dependent on the presence of neighbor with the same or more hop count. The source node carries out two functions before transmitting the event packet:

- Selects a random number from the range whose minimum value is the number of hops required to reach the outermost ring and maximum value is double the hop count for outermost ring. This value is attached to the packet.

$$h_{brw} = \mathrm{rand}(R/_{2r} - h_{srcnode} \text{ to } R/_{r})$$

- The source node forms a backward list consisting of nodes from equal and far neighbors group.

The source node selects a node randomly from the backward list and decrements the h_{brw} counter by one before sending the packet to the randomly chosen node. The node that receives the packet again chooses a node randomly from its backward list, decrements the counter and transmits the packet. This process is repeated till the packet reaches the outermost ring or h_{brw} becomes zero. The node at which this phase ends is termed as terminal node.

E. *Forward random walk*

The terminal node forms a forward list consisting of nodes from equal and close neighbor group and then randomly selects a node from it and transmits the packet. Every node that receives the packet follows the same till the packet is delivered to the sink. This phase is aimed at randomizing the route while the packet is delivered to the sink.

Fig.2 depicts the architecture and routing protocol of the BaFRW mechanism.

V. Experimental Analysis

A. *Settings*

We have simulated the algorithm in MATLAB 2018b to determine and compare the efficiency of our proposed scheme BaFRW with FRW and SLP-R. The network region is a circular region with sensors deployed randomly in each grid. The size of each grid is same as the communication radius. The parameters are specified in Table 2. The results are computed to be an average of 50 simulations.

TABLE 2. Network Parameters

Parameters	Values
Network length	800 m
Communication radius (r)	40 m
Initial energy	0.5 J
Network density	0.0015
Number of packets per simulation	100
Number of simulations	50

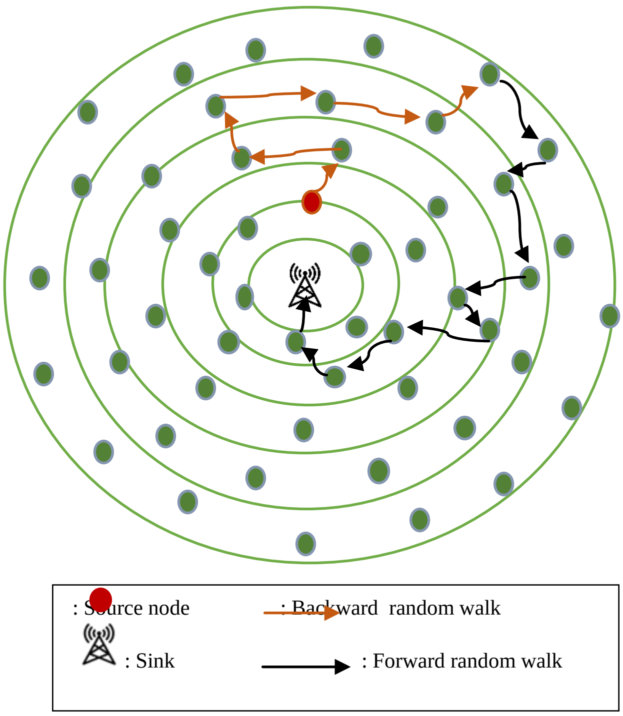

Fig. 2. Illustration of BaFRW scheme

B. *Results*

In this section, we discuss the experimental results of the three mchanisms i.e. SLP-R, FRW and BaFRW in terms of metrics like safety period, transmission delay, energy consumption, capture rate and entropy. Safety period is defined as the average number of packets that the sink receives before the adversary is able to locate the source node. Transmission delay is defined as the average number of hops taken by the event packet while being transmitted towards sink. Average energy consumption measures the loss accrued in the network while transmitting a single packet in each simulation. Total energy consumption is the amount of energy lost in the entire simulation and the loss is measured

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only while the sensor node transmits, receives and processes the packets. Energy loss is measured in terms of Joule. Capture rate depicts the adversarial success in locating the source node with respect to the total number of simulations. It is represented in terms of percentage. Entropy is a measure that depicts the randomness of the routes taken to deliver the packets to the sink.

a) Safety period: The measurement of privacy is done in terms of safety period that is computed on the basis of differing distances of source node from sink. The plot depicting the values for safety period is shown in Fig.3. FRW provides the lowest level of privacy to source node and the reason is the comparably shorter and frequently selected candidate nodes in the route. SLP-R performs better than FRW due to the packets being constantly sent to the outer most ring where further transmission takes place. This routes the packet away from source node and improves the randomness. The proposed scheme BaFRW provides higher safety period than the other mechanisms especially when the source node is located closer to the sink. This can be attributed to the fact that packets follow a more random route while routing the event packets away from source. However, we also observe that as the source node starts moving away from the sink and is located in the outer regions, SLP-R and BaFRW provides nearly the same safety period.

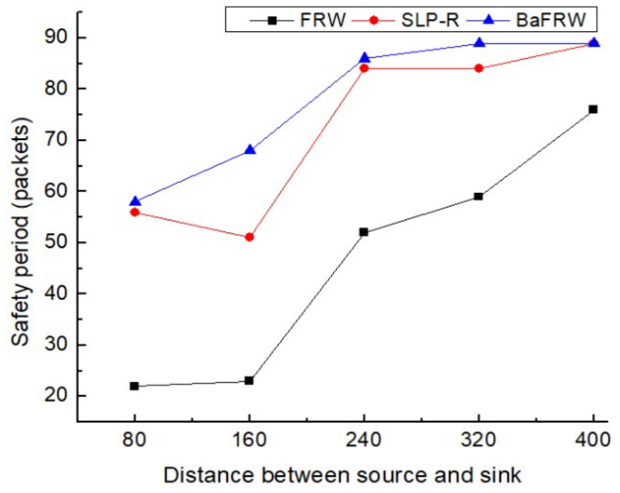

Fig 3. Safety period versus source location

b) Transmission delay: Fig. 4 shows the transmission delay for different location of source nodes in the network. It is the least for FRW as the packets are simply directed towards the base station by selecting the candidates with the same or lesser hop count, leading to a shorter route. We observe that the delay is the highest for our algorithm BaFRW as compared to other schemes. This happens because the hop counter attached with the event packet chooses a random number whose range is set high and moreover, it also combines forward random walk mechanism while routing the packet to sink in second phase. Both of these values yield a higher transmission delay for BaFRW while the source is located closer to sink.

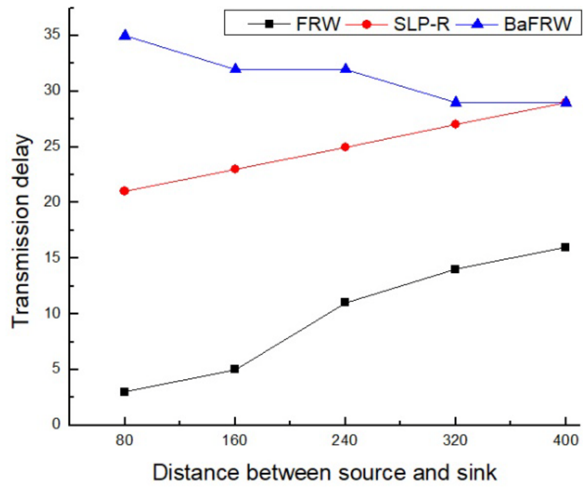

Fig 4. Transmission delay versus source location

c) Adversarial backtracks:The average number of hops backtracked by the adversary while attempting to locate the source node is expressed as adversarial backtracks. Gretaer the number of backtracking hops, higher is the security. Fig. 5 represents the adversarial hops for the three SLP mechanisms where it is clearly visible that BaFRW has the highest backtracks among the existing protocols. This shows that the adversary hasto travel a longer route and longer routes assist in improved security for the source node.

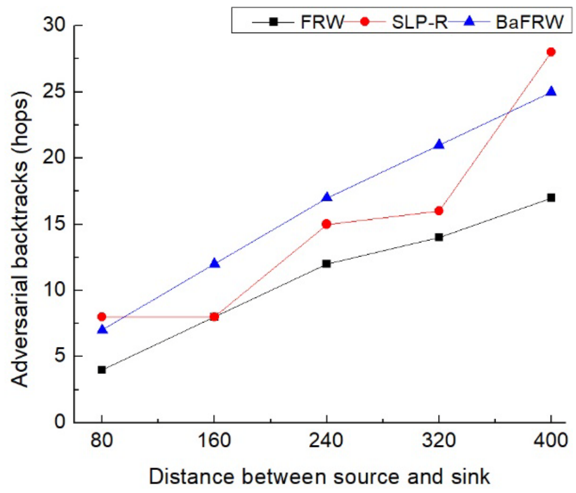

Fig. 5. Adversarial backtracks versus source location

d) Total energy consumption: The plot for representing the amount of energy loss in the simulation is provided in Fig. 6 and Fig.7. Fig 6 represents the average loss of energy per packet per simulation run whereas fig. 7 illustrates the total energy consumption occurred per simulation. We observe that the energy consumption is highest for BaFRW. It is due to the reason that safety period is high denoting a greater number of packets being forwarded and even the higher transmission delay that leads to a longer route. FRW consumes the least amount of energy in the entire simulation.

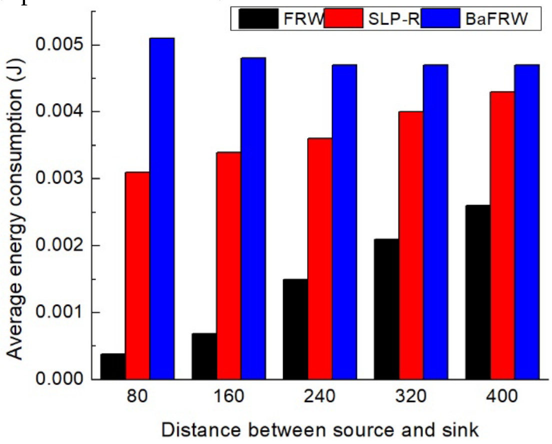

Fig 6. Average energy consumption for different source location

e) Capture rate: Capture rate denotes how well the algorithm secures the location by reducing the adversary's successful attempts at disclosing the source's location. A low capture rate means higher security. Fig.8 represents the capture rate with respect to source's location. The adversarial success rate is maximum for FRW. We observe that for source node locations closer to sink the capture rate is low for BaFRW as compared to SLP-R but for source located near the network boundary, the capture rate is similar.

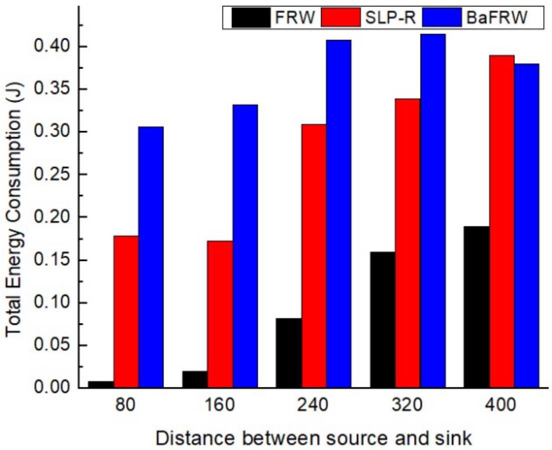

Fig. 7. Total energy consumption against varying source location

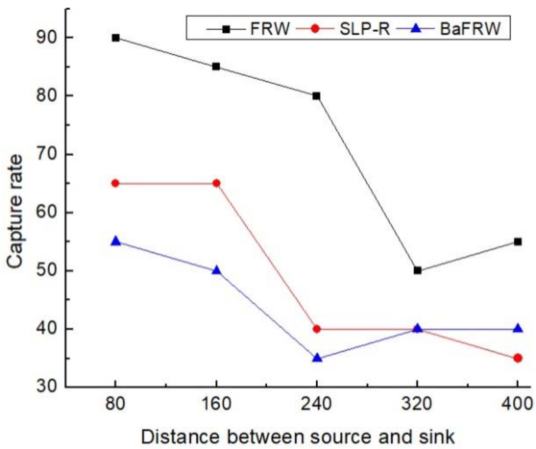

Fig. 8. Capture rate for varying source location

f) Entropy: The relationship between entropy and varying source location is shown in Fig. 9. The randomness measure is lowest for FRW and it represents that the transmission route usually follows through the same nodes to reach to sink. SLP-R has more random routes as compared to FRW. Gigher entropy level assures greater privacy. The entropy level is highest for BaFRW that denotes its efficiency in increasing the privacy.

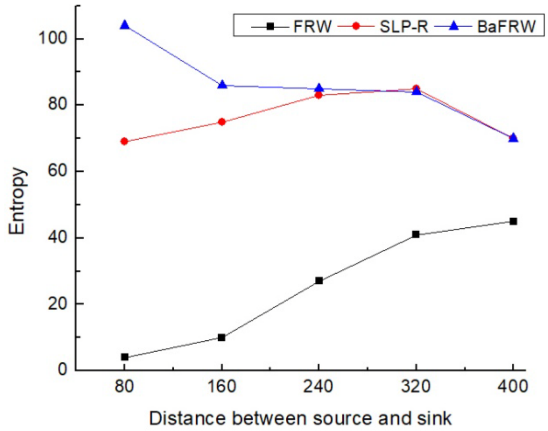

Fig 9. Entropy versus source location

VI. Conclusion

With the intent to secure the location information of source nodes in wireless sensor networks against passive attacks of adversaries, we developed a novel SLP mechanism named as BaFRW. In this, the transmission operation is divided in 2 phases: first phase is where each node forms a backward list and packet is randomly sent to one of nodes from backward list for a specific hop count towards the network boundary and after this phase ends, packet follows a forward random walk approach to route the packet to sink. Through simulated results, we observe that the proposed scheme improves the privacy, capture percentage and entropy for source located near the base station and almost same as SLP-R when the source node is located near the boundary of network. The major contribution is that the proposed protocol enhances the location privacy for assets moving near the sink that is considered a difficult task to achieve. Though the energy consumption is on higher range as compared to other SLP mechanism, it is also to be noted that BaFRW yields better security, lower capture rate and higher entropy. For future research directions, considering the improving strength of adversaries we plan on devising stronger routing mechanisms against global adversaries for securing the location of multiple assets on more practical approaches.

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A Survey on Importance of Network Tools and their Applications

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***Abstract*— This paper emphasizes about the importance of Network tools and their field of application. Understanding the importance of network tools and its applications is very important as far a researcher in network field is concerned. In this research paper an elaborate study of the different network tools that can be used for various purposes in computer networks like network management, monitoring, analyzing, simulating and emulating is done.**

Keywords*— *Network tools, Simulating, Cisco Packet Tracer, Wireshark, Monitoring, Analyzing, Computer Networks.

I. INTRODUCTION

In the world that we are living in today it is impossible to think of a system without computer networks as they play a significant role in our day to day life from education to each and every day to day activities. Due to immense use of computer networks there is a significant rise in network traffic. Computer networks is the base of communication. The nodes or devices connected together in the computer network share resources using some protocols for the network. The nodes or devices are interconnected using some network topologies.

Some of the challenges faced in computer networks are monitoring, maintenance, identification of host, conflicts during configuration, concerns related to capacity, security, more time taken for connectivity and degradation in performance. Network simulation is a tool used in computer network research to simulate the behaviour of a network by computing the interactions between its many components, such as its routers, switches, nodes, access points, and connections as given in Figure 1.

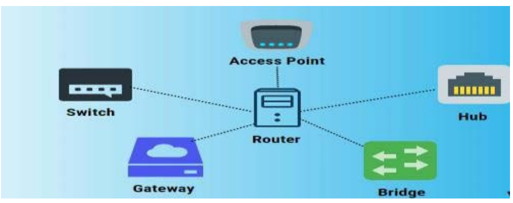

Fig 1. Different types of network devices

II. LITERATURE REVIEW

A review of computer network tools used for various purposes like monitoring, management, simulation, emulation, analysis is done in this section.

A virtual laboratory of computer networks was evaluated in progress by P. Gil et al. [1] using free simulation tools like GNS3 and associated libraries. The students were able to design and simulate topologies and implement as in real time. They were also able to evaluate the performance and study the behaviour of their network devices all for free. Based on the assessment the students were able to understand the subject's fundamental concepts easily. It posed certain limitations to emulate various protocols like Token Ring or WiFi. But, the findings of this study showed that virtualized computer network labs using GNS3 are effective in helping students learn, especially those who are unfamiliar with TCP/IP architecture and computer networks in general.

R. Emiliano et al. [2] demonstrated the reliability of networking lab environments using GNS3, providing a learning environment for both beginning and more experienced students and practitioners to more effectively learn networking topics in the classroom and through independent study. Figure 2 shows the diagrammatic representation of GNS3 simulation platform.

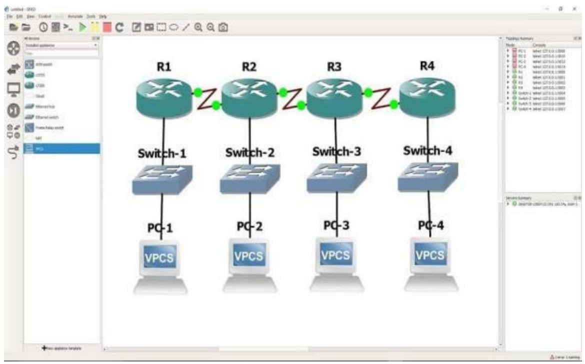

Fig. 2. GNS3 Simulation Platform

A network management simulation was run as a proof-of-concept to demonstrate how Peru could be reconnectedto the region's sophisticated networks via CLARA. In order to obtain a sort of baseline for operating the suggested network, a test comparing SNMP and Syslog was carried out as part of the request. Jose –I et al. [3] developed a GNS3 cloud environment by running emulation in two physical computers connected in a peer to peer fashion to alleviate the problem caused by financial constraints, when employing limited computers.

A really well secure communication protocol is SSH. However, the SSH protocol does not provide mobility management. I.-H. Huang [4] suggested a mobile SSH

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protocol that uses an application-layer handover mechanism to make SSH work in wireless networks. The suggested protocol has been added to Open SSH and Putty as shown in Figure 3. Their experimental findings indicate that the recovery latency is extremely short.

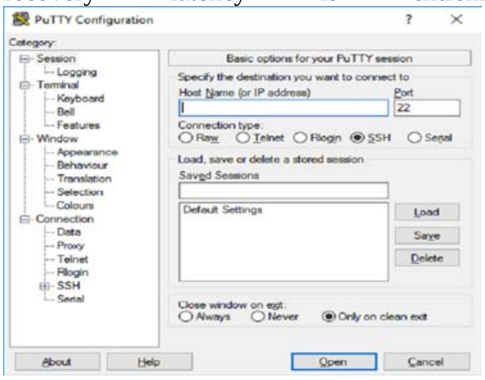

Fig. 3. Putty simulation Platform

The study suggested by Sinha D et al.[5] used several agents to find secure routes with the least amount of network strain. Having used several agents, the source node distributes the secure key to all likely paths. By lowering control packet overheads, these agents ease network congestion. The finalized path is chosen based on the route with the highest weighted trust value. The three phased strategy improved network performance totally and reduced network congestion using an agent based approach. The simulation platform of Secure CRT is as shown in Figure 4.

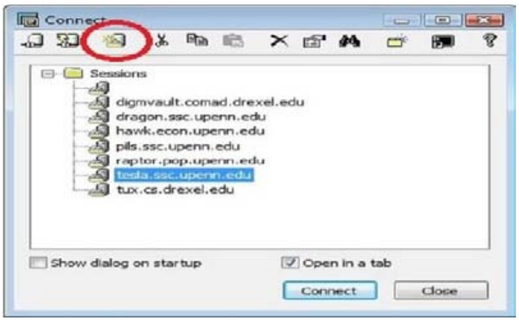

Fig. 4. Secure CRT simulation Platform

The theoretical line loss model was developed by Qiuxia et al.[6] where VBA tool was used and Microsoft Visio 2003 whose simulation platform is given in Figure 5 was the primary development platform . Visio 2003 based line loss computation software for high voltage networks was created which demonstrated that the Visio secondary development process provided a fresh and efficient way to create software for high voltage networks and other power applications that graphically calculates line losses.

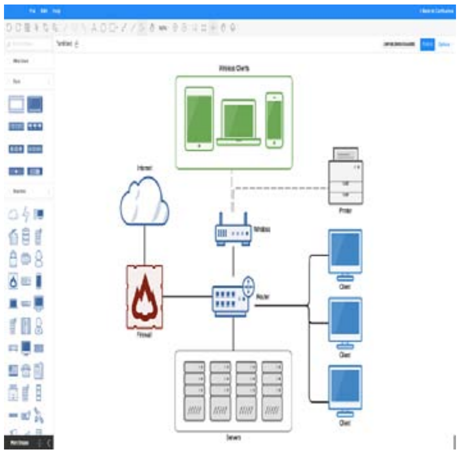
Fig. 5. Microsoft Visio simulation platform

The indemnity of service level agreement (SLA) violations affects the service provider in a cloud domain. W. Hussain et al. [7] proposed SLA violation risk reduction methodology for complex QoS prediction. A minimax disparity strategy is used to weigh the OWA operator in order to manage the risk of SLA breach. By taking into account every potential attitude of the service provider, this approach forecasted deviation in custom prioritisedQoS parameter intelligently and recommended necessity of mitigating action. This study made use of linguistic terms, fuzzy numbers, and interval figures to cope with ambiguous information. The analysed findings using PRTG network monitor whose simulation platform set up is as given in Figure 6 showed how the suggested strategy effectively addressed complicated risk reduction actions.


Fig. 6. PRTG Network Monitor simulation platform

As far as internet is concerned routing is very important. In [8] Ida Nurhaida et al. designed OSPF routing for IP internet networks using EVE and their performance was assessed. The experiment's findings suggested that VPLS over MPLS with VLAN Management can improve the performance of video conferences. According to the TIPHON standard, the measurement of QoS metrics such as packet loss, throughput, latency, and jitter was rated as "Good." A considerable impact was produced by the inclusion of VPN administration and the VPLS over MPLS scenario. Packet loss, delay, and jitter was decreased in video conference services by implementing VPN and VPLS over MPLS. VPLS over MPLS: 0.44% packet loss, 4.637 ms delay, and 4.636 ms jitter, respectively. A thorough evaluation of the VLAN management on OSPF, with throughput values up to 59.6%, packet losses up to 0.32%, jitter, and delays of 4.44 ms, was also provided by the study. The simulation platform for EVE is as given in Figure 7.

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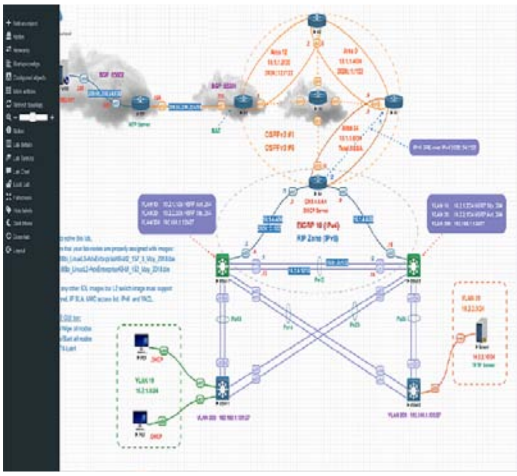

Fig. 7. EVE simulation platform

The 5G mobile communication was designed to meet the increasing user needs, which is summarized as having access to high quality services whenever and whenever they need them. Due to the distinct qualities of satellites, such as increased coverage, reliability, and availability, these demands can be met through the integration of satellites in 5G systems. It has become mandatory that before deploying the new technologies should be tested and improved so as to cut down on time, cost needed and limit blind exploitation of new systems. A great way to assess fresh concepts and put experimental systems to the test is by building a System Level Simulator (SLS). N. Badini et al. [9] described a Network Simulator 3 (NS3)-based open-source SLS (NS3). The simulation platform of NS3 is as given in Figure 8. This tool outperforms cutting-edge technologies and enables simulation of 5G Satellite-Terrestrial Integrated Networks (STIN).

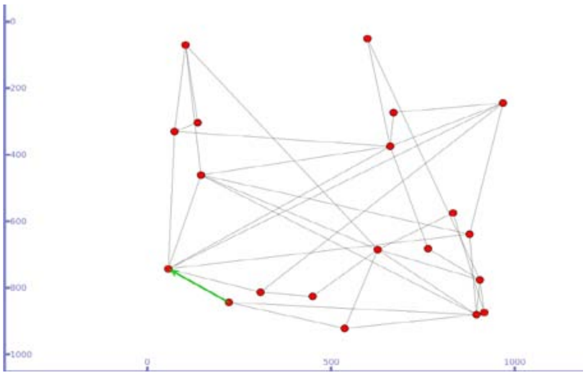

Fig. 8. NS3 simulation platform

According to the study made by Gandotra, R et al.[10], a framework that was created to enable non-intrusive real-time power consumption data gathering from the next generation of networking devices was presented in this paper. The experiment's findings using SNMP Agent simulator as given in Figure 9 suggested that, even in the absence of support for the necessary information models, power consumption data can be collected using non-standard tailored information models, standardised IETF information models, or by abstracting and exposing the data in a uniform format. The suggested methodology is functionally validated, and the findings from this study could be used to inform energy-efficient network management choices.

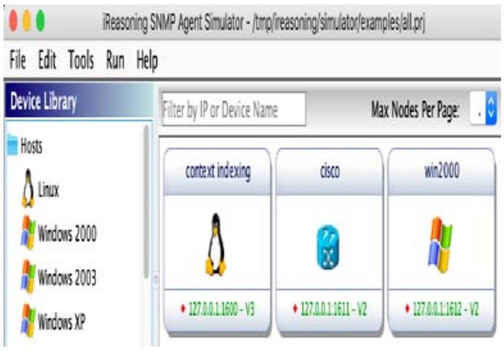

Fig. 9. SNMP Agent Simulator platform

The foundation of a smart city is made up of smart buildings. The IoT-based smart building for a scientific department was proposed in the work by O. K. T. AL sultan et al. [11] offered a variety of services like lighting, fire alarms and smart parks, all of which was remotely controlled via the Internet using either the IoT server webpage or the server static IP address through smartphones from outside or inside of the building, PC's or laptops. Java programming was used for setting up the sensors, gateway, and servers. By using IoT industry standard technologies and networking protocols, standardisations are taken intoaccount in the task. The paper discussed the idea to use the Ninevah University building as a prototype for our IoT smart building simulation utilising Cisco packet tracer v7.3, which offers many components and devices that imitate the real network. The Cisco Packet Tracer Simulation platform is as given in Figure 10.

Fig. 10. Cisco Packet Tracer Simulation Platform

IoT technologies employ sensors and controllers to network and organise devices as a single ecosystem, collect data, and control them. To create a system for a smart environment, IoT developers should experiment with a variety of devices and setups. A potent network simulation tool to test network behaviour is Cisco Packet Tracer. In addition, Packet Tracer can be a simulation environment for IoT development that offers an API for interacting with actual devices. In order to monitor and manage the actual IoT devices, the paper by Y. -C. Chen et al. [12] provided the Packet Tracer user interface.

In [13] A. Utsav et al. proposed a smart irrigation system for the climatic conditions of India utilising Cisco packet tracer software. To control and secure the farms, they

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deployed a variety of sensors, webcams, and other technological devices. In order to maintain efficient use of water and resources, various analyses for various crops (Kharif and Rabi) were described. The software performed accurate simulation for each situation. Security-based simulations were conducted and described in the subsequent section. They also claimed that our farmers can manage and keep an eye on the farms that are not connected to the Internet with its assistance.

In peer to peer networks a large number of risks is involved and it can be determined. The system itself is vulnerable to insider attacks, remotely and probably there can be heavy leakage of delicate and sensitive information when the data is sent over different data centres. In [14] A. Musa, et al. analysed the security of peer to peer networks using Wireshark. The simulation platform for Wireshark is as given in Figure 11. This paper had given a technique to improve the security of peer-to-peer networks using simulation based experimental study which was followed bya summary of prevailing techniques to mitigate possible threats on peer to peer networks.

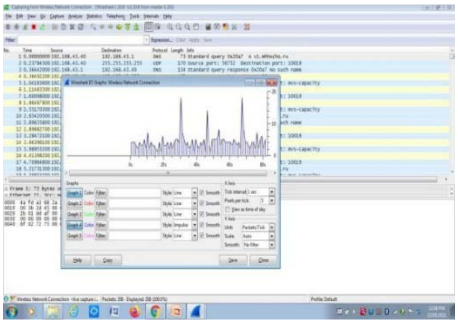

Fig. 11. Wireshark simulation platform

Every day, more people are turning to the internet for various purposes. The expanding and changing needs make it more challenging using the traditional network architecture. Traditional networks also have a complicated architecture and administration issues. To solve the aforementioned network issues, the idea of Software Defined Networks (SDN) has emerged. SDN is a revolutionary network technique that isolates the control and data plane from one another, as well as enabling network programming and responding swiftly to changing events by giving a global perspective of the network, in an effort to get around the limits of today's network infrastructure. The control plane is on top of the load balancer SDN application. Based on a number of factors, load balancers divide the workload between many servers. Using a variety of methodologies, load balancers divide the workload between various servers. unpredictable and some load balancing strategies include round robin. In [15], Ş. Aymaz et al. implemented these two POX controller-based techniques and wireshark analyzed them.

TCP/IP is the most important element of a study of networking aspects. Shaoqiang Wang et al. in [16] had given an understanding about how Wireshark may be used to teach students about TCP/IP protocolsThey showed that Wireshark might result in successful educational outcomes by highlighting how valuable it is for practical usage and widespread adoption.

III. Conclusion

For a beginner in computer network research this paper will be very useful. It gives a clear idea about the different network tools that can be used specifically for network management, monitoring, analysing, simulating, and emulating. It also shows the simulation platform setupfor the different network tools. It is very difficult to test any system physically. With the help of these network tools the tedious work of a network researcher is reduced to a greater extent. A Survey is conducted successfully in this paper which shows how the network tools can be a promising one in future for the next generation when it comes to simulation even from education field to deploying irrigation for our farmers.

IV. Applications and Future Enhancement

The network tools discussed in this paper can be used for taking good decisions related to capacity management which will in turn lead to a wide growth of the network. As future enhancement, deep learning predictive analysis techniques can be used to help telecom industry to predict the growth of the network. Quality of Experience and High Value Customers can help the network administrator get an insight about how to increase network capacity satisfying the customer needs.

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Company Permissibility for Business Activities using NLP

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***Abstract*— As the amount of web pages available on the visible net has increased to billions of pages with trillions of pages available from the invisible net, extracting data from the internet has become a highly essential procedure in the last few years. Several tools and protocols are made available which can extract this information, and these tools have come in great demand in recent times as researchers and surfers want to discover new knowledge at an ever-increasing rate. Investing in a company requires a lot of analysis to be done before plunging in. As part of this process, the analyst manually does a search of a company name in google, reads search results to determine if there are articles negatively impacting the company and based on this research recommends the company of investment. With enormous data available on the interest, this becomes a very tedious process. In this project, techniques like web scrapping and sentiment analysis are being applied. Libraries like beautifulsoup4, scrapy are being used for scraping the data. The web scraping process is automated using RPA (Robotic Process Automation) making the web scraping process easy as well as efficient. Another technique used is the sentiment approach that applies text analysis algorithms, natural language processing (NLP), and statistics to interpret customer sentiment classifying the customer opinions into positive, negative, or neutral categories. NLTK (Natural Language Toolkit) is applied to perform sentiment analysis.**

Keywords—Web scraping, RPA, Sentiment Analysis

I. Introduction

Finding answers to issues through the analysis and interpretation of data is known as data analytics. The procedure entails observing and identifying the issues, addressing the availability of pertinent data, determining the approach that will best assist in fixing the issues, and publishing the findings. The process of organizing, cleaning, reanalyzing, using models and algorithms, and eventually producing the end product is how the data is often divided. Data analytics eliminates hunches and manual effort. Companies can use the insights uncovered by data analytics to guide their decision-making and permits you to adjust client care in accordance with their needs. It also provides personalization and improves relationships with customers. Data analysis can reveal information about the preferences, problems, and more of the clientele. It gives you the opportunity to recommend improved products and services.

The objective of this paper is to extract information from different web pages resulting from a web search. The programming language which will be used here is Python. Python libraries are used to scrape the content from each of the links that result from the custom search. RPA bots will be automating the whole web scraping process. The contents arethen organized, analyzed, and cleaned and then on top of itNatural Language Toolkit is applied to perform sentiment analysis. The end result of the analysis would be stored in a csv file and the output is displayed to the user.

II. Related Works

As there is no specific work-related sentiment analysis for corporate permissibility for business activities utilizing NLP, this section covers information regarding web scraping automation using RPA and sentiment analysis. According to [1]'s authors, text in images can be automatically identified and updated in a target file using text recognition software. The suggested remedy employs a site URL as its information and a web data extraction method to obtain the image or text needed. From a location that the user specifies, the system extracts textual data. Additionally, the retrieved text is classified using Support Vector Machine (SVM) and Naive Bayes Classifier. The output can be saved as an Excel file, CSV file, PDF file, text file, or Google Sheet depending on the user's preferences. UiPath is a brand-new tool that was just recently released to the workplace and is a well-known[3] RPA. This tool functions as a bot that executes predetermined tasks that the user has defined for it by following the directions of a programmed flowchart. This article examines the use of RPA to create learning materials and documents that are used by lots of participants. An RPA was used in the study to test situations involving repeated tasks. It was suggested that automated work management and AI would produce a workflow that was more effective and efficient while lowering the error rate. Web scraping [4] is a technique used to collect data from a website and save the data in files or databases in an organized fashion. The tedious procedure of accessing lists of websites on a regular basis to seek for and store data is automated via web scraping. Manually copying and pasting data into files is a time-consuming and laborious task. An automated web scraping program completes the same task faster. Software for web scraping can be set up to work with any websites or it can be specifically built for a particular website. This study has established a straightforward methodology for analyzing job portals and web scraping information from job descriptions to analyze the needs of the Indian IT sector. [5] the concept of "web design scraping," that basically promotes the idea of extracting, understanding, and modelling website elements and features and so determining the significance of the web design. [6] The method suggested in this study gathers all recipe data using web scraping, after which Python and MongoDB are used to look for recipes that include the specified ingredient. The Python scrappy function is used in online scraping to take the content of a website. Web scraping methods are used to extract relevant information from websites by scanning hypertext elements and gathering the plain text that is encoded in them fromenormous volumes of web data.

Whether you work as a data analyst, developer, or in another profession that requires you to analyze huge datasets, having the ability to scrape data from websites is a vital talent to have. [7] Through cross- examination and information translation, information examination is a technique for locating solutions to problems. Web data scraping and freely supporting are outstanding techniques for regularly creating content on the web. The computer programs that write web scrubbers are set up to thoroughly mine each key piece of information from numerous internet retailers, compile it into the new website, and then publish it. [8] This study describes how web crawler and NLP can be utilized to deliver sophisticated solutions in computer science education. Using online job postings as a tool, they have examined a specific use of data extraction and Analytics to assess factors that may affect CS undergraduates' ability to find employment after graduation.

[10] The paper Web Scraping and application areas discuses about all the different types of web scraping techniques over the period of time. It also reveals various web scraping libraries which can be used in different areas of interest. It also specifies areas where web scraping is very minorly explored. It also gives an overview of different types of approaches, categories and tool used in this field. [11] aims to remove information from various sources with the aid of tool named as the web crawler Scrapy using the Python 3.6 programming language. A database is made that gathers all the unorganized data from different sources, analyses it according to its specifications by assembling, organizing, cleaning, re- analyzing, using models and algorithms, and then outputs the appropriate results. [16] In general, this paper refers to web scraping as the process of extracting data from a website. Web mining will make it easy to retrieve data from a website. By enabling data scraping from numerous sources, this tactic will reduce the amount of manual labour required, free up time, and increase the usefulness of the data relevant. The user will find it simpler to extract information from sites, store it for his needs, and use it however they see fit as a result of this. The information that has been scraped can be used to create databases, carry out analysis, and accomplish a variety of other tasks. [2] In this paper, They recommended a sentiment analysis technique based on deep learning for e-commerce goods review data. Using this strategy, comments are categorized as either positive or negative. The text is broken up into phrases, and the word length and word frequency are combined to train the neural network. In order to train an emotion classifier and mine the strong correlation between a feature set and an emotion tag, we employ a convolution neural network. According to the experimental findings, the model is a useful tool for online review analysis since it can accurately categorize sentiment and extract useful product attributes. [6] have put up an alternative concept known as aspect-based sentiment analysis, which more accurately recognizes characteristics and achieves the best classification accuracy. In actuality, the concept was created as a smartphone application to help travelers find the best hotel in the area. A number of real-world data sets were used to analyze the model architecture, and the findings showed that the proposed model was effective for both recognition and classification. [12] This paper's primary goal is to review existing sentiment analysis algorithms for Twitter data and present theoretical comparisons of the state-of-art approaches. A variety of approaches to Sentiment analysis at both the document and sentence level are also expressed.

Various approaches to sentiment analysis for Twitter are described, including supervised, unsupervised, lexical, and hybrid approaches. Finally, the latter's discussions and parallels are highlighted. [13] paper examines various well-known approaches or proposals for Sentiment Analysis. To add new components to the suggested plan, the pros and cons of the methodologies mentioned are examined. The new method employs a machine learning mechanism at the document level and combines verbs, adverbs, and adjectives. Along with adverbs, adjectives, and verbs, other combinations that are taken into account for analysis include adjectives-verbs, verb endings, adverbs-adjectives- verbs, and adjectives-verbs. Standard classifiers like Naive Bayes (NB), Linear Model, and Decision Trees are used to infer and interpret the findings. [14] This paper's major goal is to help scholars find the high sentiment analysis-based research publications. In this study, reference phrases are used to analyze sentiment on scientific papers using a previously created annotated corpus. To clean the data corpus, noise was eliminated from the data using several data normalization algorithms. They developed a system that uses six distinct data mining algorithms, such as Nave-Bayes. Lemmatization, n-grams, tokenization, and stop word removal are a few other feature selection approaches that are utilized to improve the system's accuracy. Their method increased outcomes up to 9% above the baseline system. On this data set, classification was performed using the Neural Network, SVM, LR, DT, KNN, and RF. The system's accuracy is then assessed using several assessment metrics such as F-score and Accuracy score. [15] Attempts have been made in this study to anticipate the direction of the stock market, determine prospective pricing for a company's stock, and make other financial judgements service this demand, streaming data appears to be a permanent supply of real-time data analysis. Spark streaming was used for data processing, while data input methods such as Twitter APIand Apache Flume were later used for analysis. The general model for sentiment analysis is done using the Stanford Core NLP tool, which aids in correctly identifying the sentiment of each tweet into three distinct classes: positive, negative, and neutral. [17] This study describes the creation and incorporation of a text analysis workflow into the open public cross-media analysis system. They also compared two major kinds of sentiment analysis methodologies prior to integration, namely lexicon-based and machine-learning approaches. They used the Stanford core NLP library, the Recursive Neural Tensor Network (RNTN) model, the Tomcat architecture, and its lexicon-based sentiment prediction method. Overall, RNTN outperforms the linguistic approach in terms of accuracy for favorable, unfavorable, and neutrality comments of varying length by 9.88%. However, when it comes to classifying compliments, the lexicon-based method works better. We also discovered that F1-score values are 0.16 higher than the

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RNTN.[18] In this research, In order to evaluate phrase sentiment analysis for sadness assessment utilizing SVM, NB, and ME classifiers, the author used a vote method and feature selection technique. Two datasets, the Twitter dataset and the20 newsgroups dataset, were used to test the proposed approaches. It shows that SVM outperforms Nave Bayes and Maximum Entropy classifiers in terms of performance. SVM accuracy is 91%, Nave base accuracy is 83%, and Maximum Entropy accuracy is 80%. [19] The objective of this paper is to detect hate remarks on Twitter by categorizingthem as racist, sexist, or neither. They experiment with a verity of classifiers in this research, including Logistic Regression, Random Forest, SVMs, Gradient Boosted decision Trees (GBDTs), and Deep Neural Networks (DNNs). These classifiers feature spaces are defined in turn by task-specific embeddings trained using three deep learning architectures: Fast Text, Convolutional Neural Networks (CNNs), and Long Short-Term Memory Networks (LSTMs). Combinations of CNN, LSTM, and Fast Text embeddings as GBDT features did not produce superior results. Finally, it was discovered that this strategy greatly outperforms the existing methods. The best accuracy values were found if deep neural network model were combined with gradient enhanced decision trees. [20] In order to find the most pertinent and top-notch YouTube videos, this paper proposes a sentiment analysis methodology based on NLP that is applied to user comments. The suggested process involves four steps. In order to set up the subsequent procedure, the comment collection and preparation module first does some linguistic preprocessing on the data (comments) from a specific YouTube movie. Second, NLP-based algorithms are applied to the text after it has been processed in order to create data sets. The positivity and negativity ratings are then computed for the data sets using the sentiment classifier (Sentistrength). The rating was then calculated using the Standard Deviation.

III. Proposed Framework

In this paper, we will suggest an application that will produce the necessary firm facts for the user. Rather than searching for details of a firm website by website, this saves time and yields more efficient results. To carry out the process, we employ tools such as web scraping and sentiment analysis. Web scraping is a software technology that extracts data from web pages. Such software applications typically replicate human internet browsing activities by implementing a low-level Hypertext Transfer Protocol (HTTP) or embedding a full- fledged web browser, such as Internet Explorer or Google Chrome. Web scraping is closely related to web indexing, a practice that most search engines use to index content on the web utilizing web crawlers. Contrarily, web mining focuses primarily on organizing unorganized online data, frequently in Html template, so that it can be saved for subsequent study in a local database or any other type of file structure.

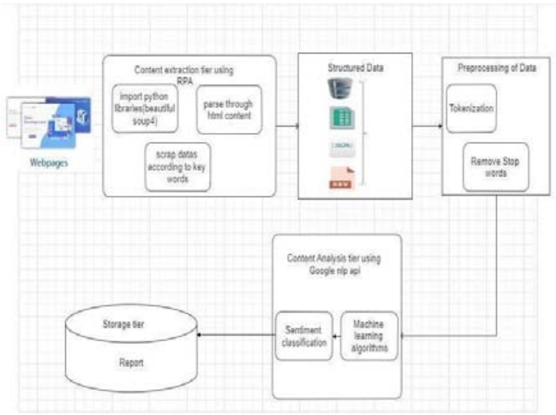

Fig. 1. Architecture Diagram

Robotic process automation (RPA) bots that carry out repetitive operations have automated the entire process. You no longer need to write code each time you gather fresh data from fresh sources. Web scraping is typically made easier andfaster by the RPA systems' built-in features, which also save time. Customer sentiment is interpreted using sentiment analysis, a machine learning technique that combines text analysis algorithms, natural language processing (NLP), and statistics to categorize customer attitudes into positive, negative, and neutral categories. After the content has been organized, analyzed, and cleaned, sentiment analysis will be done using the Natural Language Toolkit (NLTK) to get the sentiment score.

Fig. 1. depicts the architecture of the System. First, the contents from the web pages are scraped in the content extraction tier and the data is stored in the csv file and pre-processing and sentiment analysis are taken place. Then it is displayed in user interface.

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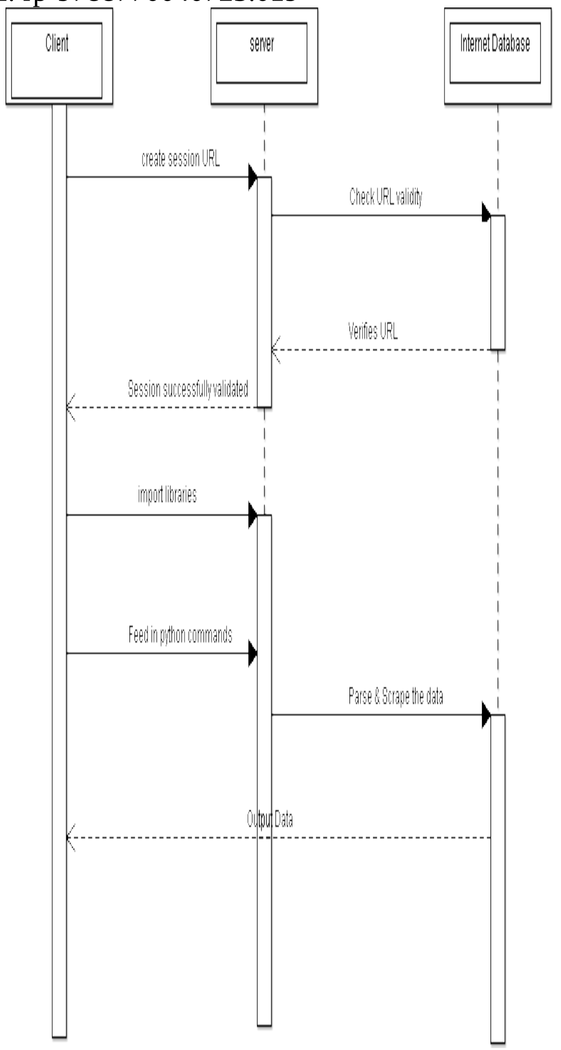

Fig. 2. Sequence diagram for Web Scraping

Fig. 2. depicts the sequence diagram of web scraping where the client creates session url to the server and the server checks the url with the internal database and sends the response back to the client. The interaction between client and internal database is intermediated by the server.

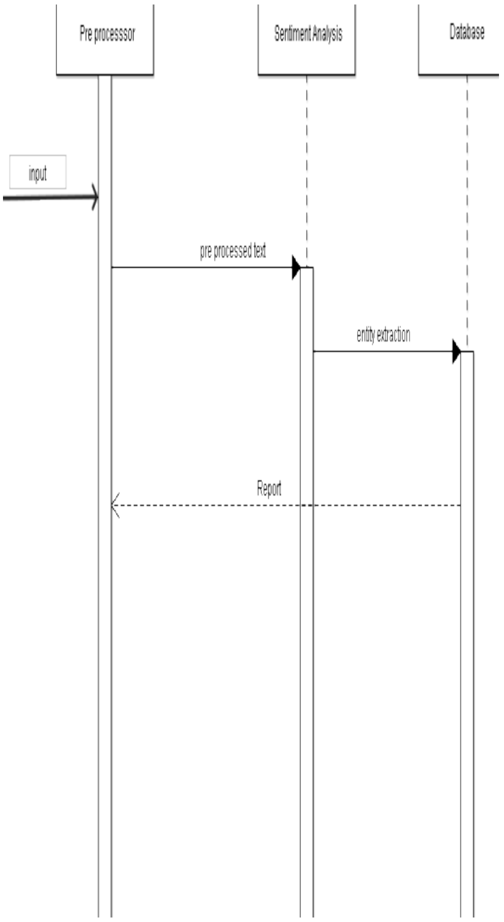

Fig. 3. Sequence diagram for Sentiment analysis

Fig. 3. depicts the sequence diagram of sentiment analysis where the input is given to the preprocessor and the preprocessor cleans and analyses the data and sends it to sentiment analysis tier and result is return to the user. The interaction between client and different tiers are shown in this diagram.

IV. METHODOLOGY

In this work, we'll provide a program that will provide the user with the necessary information about a corporation. Instead of scanning through every website in a company's website directory, this primarily saves time and produces more effective results. To complete the process, we employ methods like sentiment analysis and web scraping. Web scraping is firmly related to web indexing, which is the practice of utilizing a web crawler to index material on the web and is a method that is widely used bymost search engines. Web scraping, on the other hand, focuses primarily on the conversion of unstructured online data—typically in HTML format— into structured data that may be kept for further study in a local database or any other file structure. This whole process is automated using RPA, with RPA there is no need to write code every time you collect new data from new sources. The RPA platforms usually provide built-in tools for web scraping, which saves time and is much easier to use. Sentiment analysis is used to interpret customer sentiment by classifying the customer opinions into positive, negative, or neutral categories. The contents are then organized, analyzed, cleaned and then on top of it

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sentiment is performed. The end result of the analysis would be displayed in the UI. As for this project, it will be focused on the web content scraping and sentiment analysis using python as a programming language and automate the process using RPA.

A. Web Scraping using RPA

A Python package called BeautifulSoup can parse XML and HTML pages. For processed pages, it generates a parse tree that can be used to extract HTML data for web scraping. It provides Pythonic paradigms for iterating, searching, and altering the parse tree on top of an HTML or XML parser. We must supply a document to the BeautifulSoup function Object() in order to parse it. HTML entities are translated to Unicode characters before the page is converted to Unicode. The page is then parsed by Beautiful Soup using the built-in HTML parser, unless you specifically tell it to use an XML parser. The HTML content is transformed into a complex tree of Python objects by Beautiful Soup. Four different types of objects are often used: Comment, Tag, NavigableString, and BeautifulSoup. With a different section for each tag and each string, the prettify() method will convert a Beautiful Soup parse tree into a neatly formatted Unicode string. The goal of prettify() is to help understand the structure of the documents you work with. The whole web scrapping process is automated using RPA (Robotic Process Automation) and Orchestrator is used to schedule the process for specified time. The RPA process is carried out in UiPath.

B. *Sentiment Analysis*

The Natural Language Toolkit, or NLTK for short, is a comprehensive open-source framework for developing applications to handle human language data. It includes with powerful text processing modules for standard Natural Language Processing (NLP) operations including cleaning, parsing, stemming, tagging, tokenization, classification, semantic reasoning, etc. The user-friendly interfaces in NLTK are available for Word2Vec, WordNet, VADER Sentiment Lexicon, as well as other popular corpora and lexical resources. Here, sentiment analysis is performed using NLTK. We used NLTK's SentimentIntensityAnalyzer class and the VADER vocabulary to give each comment in the dataset a sentiment score. The Valence Aware Dictionary and Sentiment Reasoner (VADER), a vocabulary and rule-based sentiment analysis toolkit, focuses on the sentiments present in typical text applications such as online comments, social media postings, and survey replies. NLTKanalyses the text and generates the sentiment score for each review. Here, Sentiment analysis is being performed on all the reviews gives by customers for different companies. As an output, we get the sentiment and score value. In order to express the strength of how negative or good the sentiment is, VADER additionally produces a number score that ranges from negative one (-1) to positive one (+1). This is implemented via the SentimentIntensityAnalyzer class's polarity score method, which is known as the polarity score. A negative sentiment is often indicated by a polarity score between -1 and -0.5. In general, neutral sentiment is indicated by a polarity score of more than -0.5 and less than+0.5. Positive emotion is often indicated by a polarity score in the +0.5 to 1 range.

V. RESULT

Web scraping is performed and after which sentiment analysis is carried out and the company details are displayed to the user as output. As a result, the user enters the company name and fetches the score value which is performed with the help of a natural language processor. Web scrapping can be done with the help of many python libraries like beautifulsoup4, scrappy, selenium etc. These libraries can be imported into Pycharm and scrap data by typing lines of code into it. This method is not very efficient since the program has to be run every time in order to be scrapped. More efficient method is to use UiPath's RPA studio which does not require even a single line of code and can be automated by scheduling the time it needs to be scrapped. There are various approaches to perform sentiment analysis. One such way is by importing the csv file into pycharm and perform the analysis by typing several lines of code. It takes quite a long of time to process the code and the chances of producing error are significantly high. Another method is using UIPath studio which also can perform sentiment analysis but it's a tedious process and takes a longer period to produce the output. We found the Sentiment Analysis using NLTK is hassle free and quick, and also gives an accurate score values.

VI. CONCLUSION AND DISCUSSIONS

Web scraping and sentiment analysis are quite prominent in the technology industry in the recent years. When we combine the idea of automating a search with the help of APIs, extracting the content and then performing some analysis on it, the idea becomes vast with the number of applications being limitless. It reduces the manual work of people browsing through websites page by page. This process when automated can reduce the manual overhead thus saving time and energy. Now that title idea is established for automating the search and performing an analysis on that. It can be extended by introducing a few enhancements such as looking for a specific set of keywords or phrases (KWIC, KWAC, KWOC) that the user is expecting to make a decision based on that. The data which is now stored in a database can be presented to the user as a report or dashboard to show the number of web searches done, their corresponding scores and the types of entities it contained. It can contain a word cloud or a color-coded datatext for better visualization. The search can also be parallelized and done in an asynchronous mode to enable faster processing and results for the user.

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Smart Fish Tank System Using Artificial Intelligence Based Internet of Things

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***Abstract*—In the last few years, peoples were interested in breeding the pets. Fish farming is one among them. The peoples have to spend lot of time in on feeding, changing the water, monitor the oxygen level, managing the lights and temperature in the tank. Hence it is important to automate the above said process by using various recent technologies. In this paper, the smart fish tank system is used to monitor the fish and to control the process inside the tank. It uses artificial intelligence - based internet of things (IOT) technology that is combined along withthe sensors to get real-time operation for controlling the fish tank. This system performs detecting the pH level in water, monitoring the temperature, aeration of the system, as well as water renewal efforts. It improves survival rates of fishes in the tanks. The users able to monitor and control the process with the help of the mobile application. This system also helps the farmers in reducing their manual work which is required for maintaining the fish tanks.**

Keywords: Smart Fish Tank, IoT, Internet of Things, Automatic Fish Feeder, Smart Aquarium

I. INTRODUCTION

The Smart Fish Tank System using Artificial Intelligence is an innovative way to make the lives of fish owners more convenient. It uses AI technology to monitor the water quality and provide automated maintenance for the tank. The system can detect temperature, pH levels, and other environmental factors in order to provide the best possible environment for the fish. It can also maintain a consistent level of food and oxygen in the water, as well as alert the owner when something is off or if the fish needs to be fed. This system will make the lives of fish owners easier and more enjoyable, as they can trust that their fish are being taken care of without having to worry about it.

It is a revolutionary new technology that can revolutionize the way we keep and maintain our fish tanks. This system uses advanced artificial intelligence algorithms to analyze the water temperature, pH levels, and other parameters to provide a healthier environment for the fish. It can also detect and prevent disease, allowing fish to live longer and healthier lives. The system can be set up to monitor the tank and provide notifications when something needs to be changed or adjusted. This system can also be used to provide automated feeding and cleaning schedules, so that the fish can get the best care possible. With this system, we can ensure that our fish are getting the best possible care and are living in the most comfortable environments.

This project aims to create a smart fish tank system that uses artificial intelligence (AI) to monitor and manage the temperature, water level, and other environmental conditions of the tank. The system will use sensors to detect changes in the environment, and use AI algorithms to analyze the data and make decisions to adjust the environment based on the data. The system will also provide feedback to the user, such as alerts if the water level is too low or the temperature is too high. Additionally, the system will be able to suggest food types and feeding schedules for the fish. To develop a smart fish tank system using artificial intelligence. The system will be equipped with sensors and cameras to monitor water quality and the surrounding environment, as well as to monitor the behavior of fish in the tank. The system will use AI algorithms to detect and analyze data from the sensors and cameras, and then use this data to make decisions about the environment and the health of the fish in the tank. The system will be able to adjust the water parameters, such as temperature and pH, to ensure the health of the fish, and will be able to provide timely alerts when the conditions are not suitable for the fish. The system will also be able to suggest changes in feeding and other activities to ensure the health of the fish.

This system will be able to detect and recognize fish, monitor their health, and provide appropriate environmental conditions for their well-being. The system will be able to monitor water parameters such as pH, temperature, salinity, and oxygen levels. It will also be able to detect and identify any disease or other health issues in the fish. The system will then be able to provide targeted treatments and advice on how to improve the fish's health. Finally, the system will be able to provide information on the fish's behavior, enabling the user to better understand and interact with the fish. This project will improve the fish-keeping experience and increase the overall happiness of fish owners.

II. LITERATURE SURVEY

Just lately improvements in IOT have aided in the digitization of fish tanks, where several smart systems are either commercially available or have been published in the literature, allowing for the control and monitoring of various

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parameters inside these systems. onetheless, clever fish feeding practices that efficiently and precisely determine feeding parameters (such as frequency and pellet release rate) have not received considerable research.An earlier study examined the use of fish feeding The use of computer vision in a sustainable aquaculture feeding system was examined [6]. This research looks at the appetites of fish in a fish tank using computer vision to eventually distribute pellets automatically or manually. Another study employed a PIC microcontroller to construct a pellet dispenser system for managing the release of pellets in smart fish tank environments [8].The focus of this study, however, was on the mechanical device of the feeder rather than effective feeding of fish based on fish tank conditions. Furthermore, a previous study proposed an IOT-based fish feeder system that feeds fish at regular intervals at specific times and measures user-specified time parameters using various sensors. [9]. Despite the fact that this food feeder system was discovered to boost feed efficiency and decrease time consumption. An earlier study examined the use of fish feeding The use of computer vision in a sustainable aquaculture feeding system was examined. Similarly, a Raspberry Pi-based fish feeder system was created, with users able to access feeding procedures via a web application [10]. This system's interface allows for manual fish feeding, setting and changing the feeding daily schedule, and a camera that monitors the fish tank and allows the user to verify tank status. In essence, recent time some smart fish feeding systems have been presented in the literature, but there has been a limited amount of work done in fish tanks to integrate the factors of accuracy or specific time to determine the amount of food feed for fish to be released by the fish feeding system. As a result, the gap addressed in this publication is significant to research..In[11] the author proposed a system for monitoring the fish tank environment. In this system, the data of the fish tank environment was monitored by using sensors. The sensors are placed indifferent locations within the fish tank. The sensors are used to sense the light, temperature, pH level, and oxygen level in the fish tank. Hence the data's of the fish tank environment is monitored by the sensors fit in fish tank that display in the webpage where data transmitted from the microcontroller. The microcontroller is used to process the data and sends it to the server. The data are stored in database using server. The data of the fish tank environment is monitored by the sensors and transmitted to the microcontroller. The micro controller is used to process the data and sends it to the server. The server data are reset in the database. The data stored in database can be accessed by the user using the web application. The data of the fish tank environment is monitored by the sensors and transmitted to the microcontroller. The microcontroller is used to process the data and sends it to the server. The user can view and accessed the data in the web application.

III. Methodology

In the proposed system, the water quality from the fish tank and the data from the fish tank is pushed to cloud and the data can be viewed in the web application and android application and other modules work accordingly.

Live Data Accessibility

The sensor collects the data from the water present in the fish tank using the sensors such as DS18B20 to measure water temperature sensor, Analogue pH sensor with Amplifier Circuit to measure the pH quality of the water in fish tank, HC-SR04 Ultrasonic sensor to measure the water level in the fish tank, Turbidity sensor with module to measure the turbidity of the fish tank. The raw data from the sensors is received by the Arduino and process the data and transfer the processed data to the Raspberry Pi through serial port and it publishes the data from the Arduino using MQTT protocol on specific topics. The published data is received by subscribing to the specific topics at the web application and android application. So that the user can view the live data of the fish tank. The figure 1 describes the process flow.

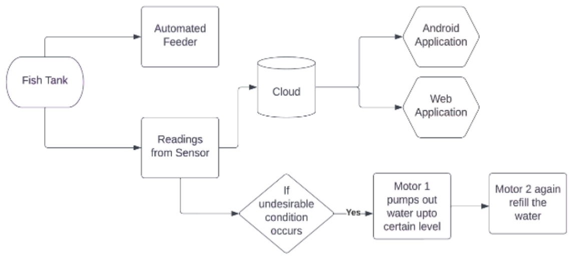

Fig. 1 Proposed System Block Diagram

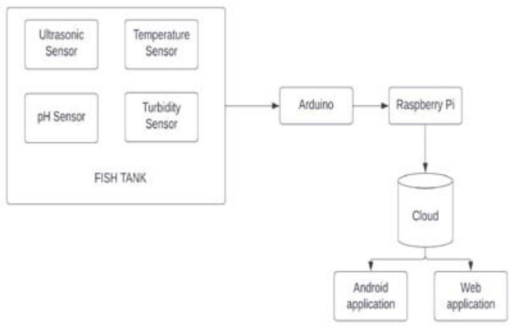

Fig. 2 Live Data View Process

Water Replacer

If the water inside gets contaminated that, if the quality of the water gets changed and it gets nearer to the non-suitable condition for fishes to survive in it. Then the water inside the fish tank is pumped out by the motor 1 to Auxiliary tank 2 the certain level (up to the minimum level in which fishes can survive). After pumping out the water from the fish tank, the fresh water in the auxiliary tank 1 which has suitable condition for the survival of fishes is pumped into the fish tank up to the certain level which is often monitored by the ultrasonic sensor. When the particular level gets reached the pumping process gets stopped. The Figure 3 describes the process of water replacer process. Here we use the 12 volts water submersible motor for the pumping processes in both fish tank and auxiliary tank.

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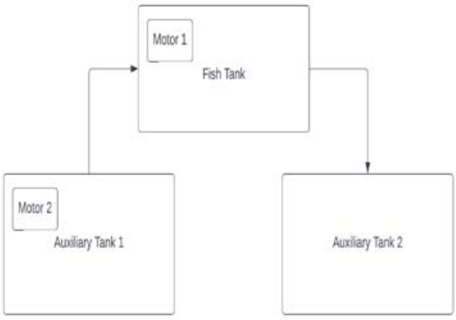

Fig. 3 Water Replacer Process

Automatic Fish Feeder using Artificial Intelligence

The smart fish feeders for IOT driven algorithms are limited. So in that case it is necessary to create the other. The smart fish feed is the essential one to comprehend such as feeding the fish within the fish tank. Various studies were conducted to comprehend the factors, and the key ones are summarized in table 1.

TABLE 1 FACTORS AFFECTING FISH INTAKE

Factors	Effects
Water Temperature	The water temperature increase can induce the increase in food intake like tracking the temperature of the water is critical in determining the amount of feed discharged in fish tank
Oxygen	The aquatic environment need oxygen to survive. If the water oxygen level drops, fish will consume less food and will require more frequent feeding. Monitoring the optimum oxygen level is also important.
pH	Various types of fishes requires different water pH levels but some of the aquatic animals tolerate higher pH level compared to other fishes. If the pH level falls outside of the range, the fish will get stressed, which may lower hatching and survival rates.
Stress	Stress causes discomfort and it results in physiological responses. It has a negative impact on growth, digestion and a change in eating behavior is a symptom of a behavioral response to fish stress. When fish are subjected to stressful situations, their food intake decreases and they grow slowly.
Light	Light influences the intake of fish food to an extent. It is a crucial aspect since an increase in light intensity promotes feeding and a drop in light level discourages feeding.
Ammonia	Ammonia is a harmful chemical that threatens aquatic ecosystems, and its prevalence is caused by overstocking and overfeeding. When the ammonia level in water rises, people consume less food.

The above factors are calculated from the fish tank using sensors though some of them cannot be calculated they can be left for the calculation. Although we can use the manual feeding method in which the feeding parameters such as amount of pellets to be feed, feeding time and feeding frequency. These can be automatically decided using the artificial intelligence based smart fish feeding algorithm. The outlook of the algorithm is

- Derive the values of the Factors
- Get number of fishes
- Adjust the amount of the feed(pellets)
- Adjust the frequency of the feed
- Adjust the time to feed

IV RESULTS

The Figure 4.1(a) shows the Web application's UI. On the left side of the UI we can see the parameters of the water and on the right side of the UI, we can see the value of that parameter which is generated from the sensor present in the Fish Tank. The value is transmitted through the MQTT protocol and the web UI is connected and subscribed to the MQTT by using JavaScript. The Figure 4.1(b) shows the Android application's UI. In the android application the live data is shown in the format of the graph (line chart). The android application also connected to the MQTT protocol and the live data is pushed to firebase so that old values can also be viewed and the graph shows the values of the last ten data inside the graph. Both the web application and the android application also haves the authentication pages and user registration pages for login.

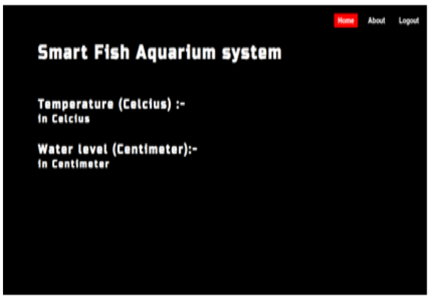

Figure 4.1(a)

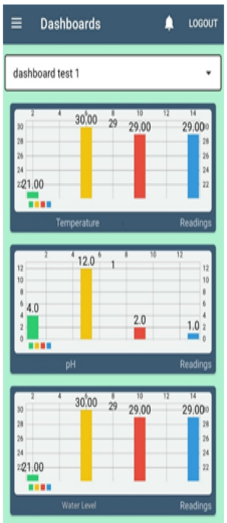

Figure 4.1(b)

V CONCLUSION

The smart fish tank system using artificial intelligence-based internet of things is to develop a system which can monitor the fish tank and provide information to the user about the fish tank. The system is designed using various sensors and controllers. The sensors are used to monitor the water level, temperature, pH level and the concentration of dissolved oxygen in the water. The controllers are used to control the water pump, aerator and the light. The system is also equipped with a camera which is used to take pictures of the fish tank. The system is connected to the internet and the user can access the information about the fish tank from any location.

VI ACKNOWLEDGEMENT

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We acknowledge indicates this work is unique, has not been published anywhere, and is not presently being considered for publication elsewhere

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Prediction of Paddy Crop Diseases Using Transfer Learning

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***Abstract*— Because it meets a vital requirement for every living thing on this planet, agriculture serves as the backbone of human society. In terms of humanity, Paddy farming is significant, especially on the Asian continent. Since we humans are among the most intellectual animals, it is crucial that we preserve the value and productivity of agriculture. The productivity of agriculture has increased to some extent with the arrival of the IT sector. It has made significant contributions to agricultural healthcare. The term "deep learning" is popular in the IT industry. This trendy term has significantly increased agricultural output. The overuse of pesticides and chemicals created by humans has recently resulted in a rise in plant diseases. These plant diseases must be treated since they can develop into serious conditions. Additionally owing to a lack of technical understanding, it can occasionally be challenging to identify certain disorders. So, a model for identifying the disease that is with in paddy crop is presented in this study. The model employs transfer learning, a paradigm for effectively addressing deep learning issues.**

Keywords*— *Paddy crop disease, Deep learning, Transfer Learning, Convolutional Neural Network

I. Introduction

Agriculture development is seen as one of the most effective methods for reducing severe poverty and fostering shared prosperity. Agricultural production aims to support9.7 billion people globally by 2050. The global agriculture industry has a huge impact on earnings of all social strata [1]. However, there are significant hazards related to agricultural expansion, poverty alleviation, and food security. The production of the crops may be severely reduced due to continuous climatic fluctuations and other weather-related issues. In addition to slowing agricultural expansion, climate change also eliminates many farmer job options. A further significant factor in the decline of agriculture is human error, such as the overuse of insecticides and other herbicides. In addition to killing crops, these pesticides jeopardise biodiversity. Disease is one more aspect that has a highly negative impact on agriculture. A plant with a disease is justas serious as a person who has one. If not treated in a timely manner, the plant can eventually perish.

In Asia, the paddy crop has a significant impact on the number of farmers that are employed. In addition to creating jobs, it also contributes to the partial eradication of poverty. The Asian continent eats a lot of rice. In more than a hundred nations throughout the world, it is also regarded as a staple dish [2]. It is typically served with more than one meal each day in most families. It is extremely affordable and offers itself to everyone. It is starchy and heavy in calories. However, recent times have seen some difficulties with the paddy crop. Climate change, such as global warming, and illnesses including fungal, viral, and bacterial infections are making rice cultivation more difficult. The rice plant's potential health problem might lead to an early demise if it is not thoroughly investigated.

The suggested model determines what illness the plant has. There are three different types of ailments that the crop could contract: “Hispa”, “brown spot”, and “leaf blast”. The “Convolutional Neural Network” is used in the model to forecast and categorise the illnesses. “Convolutional Neural Network” was chosen because of how well it handles pictures. Four classifications make up the selected data collection, three of which are related to diseases and one to health. The suggested model enhances the image via image augmentation, then trains on it to get the desired outcome.

II. Related Work

Suraksha et al [3] .'s approach employs “data mining” and “image processing” in order to forecast the illness that the rice crop will contract. In the publication, they provide a model that makes use of “feature extraction” and “data mining” methodologies to identify illnesses that the rice plant is experiencing.

A model for identifying ailments that the paddy crop is afflicted with is provided by K.Jagan Mohan et al. [4]. The features are extracted using the “Scale Invariant Feature Transform”. The characteristics are then used, and the model uses “K Nearest Neighbours” and “Support VectorMachine” classifiers to use the characteristics to detect the illness.

Anuradha B. [5] has provided a paradigm for identifying the illness the plant is carrying. The author's clever edge detection approach was applied. In order to anticipate the illness that the plant has, the author tracked the edge and obtained the histogram value using the clever edge detection technique. The cultivated field is also periodically observed by the model. Early illness detection

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is achieved by the model. Then, training is carried out using machine learning. The model then makes the appropriate choice and foresees the sickness the plant will contract. A method for Rice disease area detection via image processing has been presented by LipsaBarik [6]. The model that the author has suggested also pinpoints the disease that the paddy crop is experiencing, in addition to the area that is impacted. The author employed "machine learning" and "image processing" methods including "Support Vector Machines" and "Nave Bayes" for categorization. After the prediction is complete, the disease's severity is established, and then classified it into several groups.

Using image processing techniques, Jayanthi, G. et al. [7] established a model for the investigation of automated rice blight categorization. Their research provided a thorough analysis of the various picture categorization techniques.

Big data is used in the model proposed by S. Nithya et al. [8]. They developed a paddy crop disease-based recommendation system based on symptoms. Information about illnesses is gathered from a variety of websites and blogs. Through the use of HiveQ, hive tools, and Hadoop the information has been examined.

A model that uses predictive modelling is proposed by Arumugam, A. [9]. This model uses "data mining techniques" to increase the productivity of the rice crop. Their research intends to offer a predictive modelling strategy that would assist farmers in producing rice crops with a high yield. They have employed machine learning methods like decision trees and clustering. They have used the weather data to apply them.

III. Background Study

Predicting the sort of sickness the rice plant is experiencing is the goal of this study. The illnesses that affect the paddy plant are outlined below.

A. Brown Spot

The rice plant's leaves develop black patches, which are indicative of this illness. The signs of this illness, such as the mortality of seedlings, the death of substantial portions of the leaf, and the presence of brown or black spots, can be used to identify it. It belongs to the class of fungi. It results in a loss of both quantity and quality. All throughout South and South East Asia, it results in a 5% yield decrease. By giving the crop the proper quantity of nutrients and preventing water stress, it can be made sure that paddy plant is not afflicted with this illness [10].

B. Leaf Blast

The most severe and devastating disease that affects rice plants is thought to be leaf blast. It may have an impact on the neck and leaves, among other leaf sections. In areas withsporadic rainfall, chilly temperatures, and little soil moisture, this illness is highly common. Leaf explosion can occur in a rice plant at any stage. It is distinguishable because the dots have dark green edges. They can be mistaken for brown patches with ease. It can completely destroy the leaf if it grows. They can be mistaken for brown patches with ease. If the field is flooded as frequently as feasible, it can be controlled. It can also be controlled by dividing the use of nitrogen fertiliser into two or more treatments [11].

C. Hispa

If the grub mining is evident on the leaves, this disease can be detected. The rice fields seem burned if the land is highly infected. The injured leaves of a badly afflicted rice plant wither away. Young plants are typically affected by this disease. A field should not be overfertilized in order to control this disease [12].

D. Sheath Blight

It is a sickness that is classified as a fungus. The main paddy farming regions in tropical and subtropical nations typically experience it. It is present in all regions of rice cultivation and is reducing rice yield, particularly in systems with intensive production. Studies reveal that it reduces tropical Asia's overall production by 6% [13].

E. Bacterial Leaf Blight

The rice plant's leaves can develop bacterial leaf blight, which is easily identified by looking at the yellow and white stripes on the paddy leaf. We can tell whether a plant has bacterial leaf blight by examining the newly grown leaves, which will have a faint yellow colour. By applying less nitrogen fertiliser and tilling straw and stubble into the soil after the crop has been harvested, this disease can be prevented [14].

F. Grassy Stunt

If the leaves are thin, pale green in colour, or yellow in colour, this disease is present. It is a kind of virus. It can also be identified if leaves develop sporadic dark brown patches. It can spread by leaf hoppers. In South, Taiwan, Southern Japan, Southern China and South East Asia, the illness is widespread [15].

These are the several diseases that the rice plant may contract. We have considered Hispa, Leaf Blast and Brown Spot illnesses out of all of these ailments. These disorders can be properly categorised by our approach. The rice plant would be categorised as healthy if it was free from any diseases.

IV. Methodology

A. Dataset

The dataset we used is custom dataset which consists of 9000 images collected from various Bing Search API and Kaggle Datasets. A Python script was used for Bing Search API to find pictures with multiple queries related to "brown spot", "leaf blast" and "hispa" which aids us in data collection. Hence our dataset consists of three classes with 3000 images per each class.

B. Proposed Method

Neural Networks are a collection of intricate algorithms that, by simulating how the human brain functions, identify the main relationship among a group of facts. Neural networks are frequently utilized in business trading, planning and business analysis, as well as for product and medical maintenance purposes. They have succeeded in achieving wide adoption in corporate applications and also

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has a significant part in identifying diseases like diabetes, breast cancer, and brain tumor [16].

Out of all the many variations of neural networks, CNNs are the optimal option for use with photographs. Convolutional neural networks come in a variety of designs, some of which include DenseNet, ResNet, Inception, VGG 16, LeNet-5 and Alexnet. These builds work as a powerful “feature extractor” that may be applied to a variety of sophisticated tasks, including object identification, picture segmentation, and image classification [17].

Because it is highly convenient to deal with a big number of photos, we have chosen the Transfer Learning methodology out of all of these designs. Transfer learning is a machine learning methodology that emphasizes on applying the model's previous experience with other issues to address a new difficulty. In other words, it is a well-known methodology that utilizes a model that has previously been trained on a comparable problem and that addresses issues in a variety of fields which include natural language processing, computer vision, and image processing. Transfer learning may be used in two ways: pre-trained model approach and developed model method [18]. The four crucial phases of the developed model approach are the selection of the source task, the development of the source model, the reuse of the model, and the tuning of the model.

C. *Architecture*

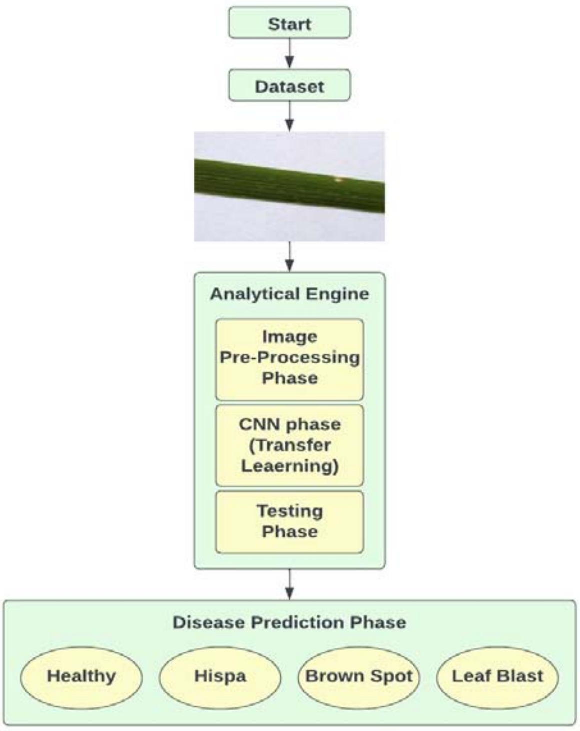

Fig. 1. Architecture of the proposed system

Firstly, we collect the dataset as shown in the architecture diagram in Fig. 1. The Analytical Engine phase of our architecture consists of three main sub phases. The first sub phase is the image pre-processing phase where several pre- processing methods like brightness corrections, segmentation and geometric transformations are applied. In the second sub phase, we train our CNN model coupled with transfer learning which results in faster train times and higher accuracy. In the testing sub phase, we test the performance of our model with other CNN models in order to obtain a comparison among various models. Finally, we employ the best performing model among all the compared models for our Disease Prediction Phase.

V. EXPERIMENTS

We employed the VGG16 architecture for our CNN model with transfer learning. Which means we have 16 layers that have weight. The average pooling technique was used in the pooling layers. We used ReLU and Softmax activation functions were used for the convolutional layers and the dense layer respectively as we have to perform predictions of 4 classes at the end.

A. *Results*

We put our model to the test using several Convolutional Neural Network topologies. We employed a single layer of CNN, two levels of CNN, and the 16-layer VGG-16. Our model has a 91.7% accuracy rating, which is its highest. Compared to the previous models we have employed, the one layer CNN and the two layer CNN—the loss in our model is likewise relatively low. Utilizing transfer learning, we were able to achieve 94.4% training accuracy and 91.7% testing accuracy.

TABLE I.COMPARISON AMONG DIFFERENT MODELS

Model Name	***CNN one layer***	***CNN two layers***	***Transfer Learning with VGG-16***
Test Accuracy	71.8%	76.1%	91.7%

B. *Performance Evaluation*

The model effectively identified the illnesses that the rice plant could have after being put to the test using the test data. We were able to get an accuracy of 91.7% employing the transfer learning methodology. It is a powerful technique for solving complex deep learning problems, especially those that use image-based data. This set of architectures may be quite helpful when we have a difficult problem to solve.

VI. CONCLUSION

In people's life, cultivation is essential. It also offers food for both humans and animals, as well as sources of work for people. Agriculture must be safeguarded and kept since it is necessary for both people and other creatures to exist. Lack of technical expertise and understanding in the agricultural sector may seriously affect the health of plants. The procedure of detecting and diagnosing different lethal illnesses has altered as a result of the substantial involvement of the IT industry in agriculture during the past several years.

Transfer learning, a technique for gracefully and successfully addressing difficult image processing problems, is used in this model. This model uses the transfer learning VGG-16 architecture to forecast illness in rice crops. It takesthe features out of the leaves and determines what kind of sickness the plant is experiencing. The classification and

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detection concept is closely adhered to in this model. This approach has many promising applications and a bright future. It may be implemented in a website and turned into an app. The website or developed app is used by the farmer or individual to submit a carefully taken picture of the plant leaf, and it promptly detects what sort of disease the plant is facing. It will let us know whether the plant is likely to have a disease.

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River Monitoring System Using Raspberry PI

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***Abstract*—To maintain the quality of the River's water, environmental regulations demand that the River's environmental state be monitored. Conductivity, dissolved o2, and microorganisms are measured manually using manual sensors. Additionally, a Secchi disc is used to measure turbidity roughly. Workers would survey the rivers located once a week from May to October to conduct testing. It takes many hours to complete the journey and data collection. Upon finishing, the collected data is sent to a web server. To sample bacteria, water is collected, and it is delivered to a laboratory nearby. Between each of these weekly cycles, there appears to be a lag in time and a danger that data will be misrecorded or lost. Due to these possibilities, the River-Keeper cannot fully assess the current state of the river and has little time to look into and address sources of poor water quality. Therefore, it's crucial to monitor water quality. To solve this challenge, we suggest an embedded technology that continuously checks the water quality and publishes the output data to a web UI, so that the customer can know about the status of the water, whether it is consumable or not.**

Keywords—River Monitoring System, IoT, Water monitoring, internet of things, Message Queuing Telemetry Transport, cloudiot.

I. Introduction

Globally, the problem of water pollution is becoming more and more important, and it is having a serious effect on both the environment and human health. Due to the time and resource requirements of traditional techniques of water quality monitoring, it is difficult to quickly and effectively identify and address water pollution. By providing real-time monitoring of water quality parameters, sensors, and remote sensing technologies offer a possible answer to this issue. Thistechnology can deliver data on water quality that is more precise and effective, enabling the early identification and reduction of pollution.A more thorough understanding of the factors affecting water quality can be achieved by combining remote sensing with ecological water quality modeling, which are both useful techniques. The main causes of water pollution can be found and addressed, as opposed to only addressing the symptoms, by looking at the transfer function between sources of pollution and water quality. The construction of an automated water monitoring system with various pH, conductivity, turbidity, and dissolved oxygen sensors can significantly increase the precision and timeliness of data on water quality. IoT technology can be used in this system to create a widespread early warning system for portable water quality, enabling quick detection and action in the event of water pollution. The protection of both human health and the environment depends on solving the problem of water pollution. It is possible to create more effective and efficient water quality monitoring systems by utilizing advancements in sensor and remote sensing technology and ecological water quality modeling. With the use of these technologies, water pollution's negative effects can be lessened and water resources can be safeguarded for future generations. Water pollution is a serious environmental issue that requires monitoring of various parameters. Manual collection and analysis of water samples are resource-intensive and time-consuming, making sensors a more efficient solution. A multi- sensor real-time water monitoring system can be used to monitor water quality, which varies depending on intended human use and environmental factors. The IoT concept can be used to connect and communicate with other items in the environment to enhance water quality monitoring. Maintaining current quality requirements and protecting fisheries and recreational use are typical water quality regulations.

II. Literature Survey

A water level sensor is used in the proposed system, an Internet of Things-based river quality monitoring system, used for real- time water level detection. The information is kept on a cloud server, and a remote dashboard shows the water levels. This approach might be helpful in disaster-prone places where water levels are a crucial factor in flood forecasting[1]. The mechanism for detecting water quality described in this paper is an Arduino development board with sensors that measure conductivity and water for temperature, turbidity, and pH. Through Bluetooth, the system transmits data to a smartphone and sends alerts for unusual values. Results indicate that the system is reliable and precise, making it a good choice for many water quality monitoring scenarios[2]. In this study, a low-cost approach to determining water quality is presented. It makes use of the signal conditioning IC, three sensors, and the ARM CORTEX M4F Microcontroller-Unit for scaling and collection of data. A microcontroller and Wi-Fi module is utilized and the information is transmitted to a cloud server. The association between temperature and pH is investigated once the sensors are calibrated using a standard solution.For the upcoming water quality research, the measured data is kept in a cloud database[3]. By building a monitoring

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system for water management, an IoT system may be constructed to measure the quality of the water. Remote communication technology can aid in sending the data, and the Raspberry Pi can be utilized as an embedded system to help with the development of the detecting sensor device. The resulting real- time online water quality monitoring system powered by the Internet of Things (IoT) can function as an autonomous surface water monitoring system.[4]. The study suggests a cloud- and deep learning-based river monitoring system that predominantly checks the quality of water in water bodies to guarantee safe water delivery. To measure different water parameters, the system makes use of IoT devices like Node Micro-Controller-Unit and numerous sensors. Predictions about how usable water will be are made using deep learning algorithms. Fighting environmental problems and raising living standards are the goals of the system[5]. Based on the information provided, it appears that the existing system for monitoring water quality is primarily manual and relies on human intervention to take readings and collect samples for laboratory analysis. This approach can be time-consuming, inefficient, and may not provide real-time information on water quality. To address these limitations, an automated system could be implemented that uses sensors and other advanced technologies to continuously monitor water quality parameters and provide real-time data on water quality. This system could be integrated with a central control center, which could receive and analyze data from multiple sensors and devices, providing a comprehensive view of the water quality at various locations within the system. The system could also be designed to automatically detect and alert operators in case of any deviations from acceptable levels of water quality. Additionally, data from the automated system could be used tooptimize treatment processes and ensure that the water meets the required quality standards. Overall, an automated system for monitoring water quality could provide several advantages over the existing manual system, including increased efficiency, accuracy, and real-time monitoring capabilities.

III. Methodology

Our suggested system uses the appropriate sensors to analyze water parameters such as turbidity, pH, temperature, and ambient temperature & humidity. To produce the appropriate output, the above-mentioned sensors are connected to the digital and analog pins of the Arduino UNO. A serial interface, the Raspberry Pi 4 Model B, and Arduino UNO are now integrated. The Pi's serial port is used to access the output data. To read the data sent through the serial port, a straightforward Python script is utilized. The findings are then shown online when these data are sent to the cloud platform. Then we distribute the data to nodes or subscribers who have subscribed to the central node, using the Message Queuing Telemetry Transport server. The broker on the raspberry pi serves as a centralized node by disseminating data to all subscribing devices.

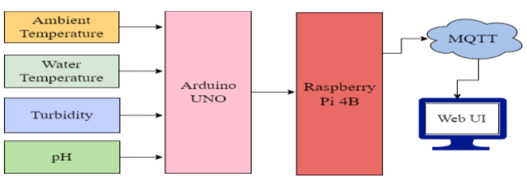

Fig. 1. Proposed system block diagram

Our system includes a Digital Temperature and Humidity11 sensor to gauge the temperature and humidity of the environment, as well as a DS18B20 sensor that analyzes water parameters and provides us with the temperature in degrees Celsius. We determine whether water is drinkable based on the pH sensor's ability to determine whether the water is acidic, neutral, or alkaline. The turbidity sensor measures the water's cleanliness. It reveals if anything is clear, cloudy, or unclean. The digital pins of the Arduino UNO are wired to the data pins of the Digital Temperature and Humidity11, turbidity, and water temperature sensors. Since the data pin of the pH sensor is attached to the analog pin of the Arduino, it is an analog sensor.

The proposed solution of using embedded technology to continuously monitor water quality and publish the output data to a web UI could be an effective way to improve the River- Keeper's ability to monitor the river's environmental state. This solution has several potential benefits, such as:

A. Real-time monitoring: The embedded technology can monitor water quality continuously, providing real-time data on the river's environmental state. This will enable the River-Keeper to detect any changes in the water quality immediately and take necessary action.

B. Improved accuracy: The manual sensors used currently have limitations that may lead to inaccuracies and inconsistencies in the data collected. The embedded technology can eliminate these limitations and provide accurate data.

C. Reduced workload: The proposed solution can reduce the workload of the River-Keeper as they will not have to manually collect data once a week. This will free up their time, enabling them to focus on identifying and addressing sources of poor water quality.

D.Improved accessibility: The web UI will enable easy access to water quality data, allowing interested parties to check the status of the river's environmental state at any time. This can increase transparency and accountability.

E.Cost-effective: The embedded technology can be cost- effective in the long run as it eliminates the need for manual sensors and reduces the frequency of lab testing.

The raspberry pi's Message Queuing Telemetry Transport (mosquitto) protocol is used to publish the output data from the Arduino to the Web UI. The data is uploaded to the Web using a straightforward Python program. Here, the publisher and subscriber concepts from MOSQUITTO were applied. Data is published by Mosquito utilizing topics. To get the data and transmit the data to the web UI, we must subscribe to the same topic on the subscriber end.

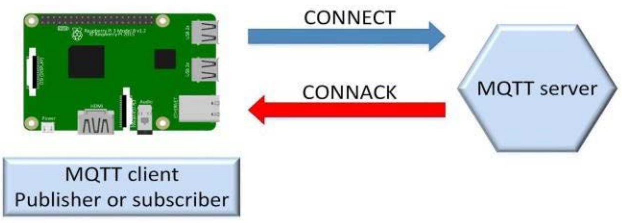

Fig. 2.Message Queuing Telemetry Transport

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An Message Queuing Telemetry Transport client must subscribe to an Message Queuing Telemetry Transport topic to receive messages. Publishing is the process of sending messages in Message Queuing Telemetry Transport. A client is free to publish on whichever subject they like. There aren't any reserved topics at the moment. Brokers may, however, limit access to some topics. If multiple clients subscribe to the similar topic, the published message will be sent to each client. Multiple topics can be allowed only if they are parsed as json payload or single string. The broker will send a message to all connected clients who have subscribed to a topic when a client publishes a message on that subject. The message is taken down from the broker once it has been delivered to thoseclients. The message is deleted from the broker if no customers have subscribed to the topic or if they are not currently connected. Typically, the broker doesn't keep messages on file.

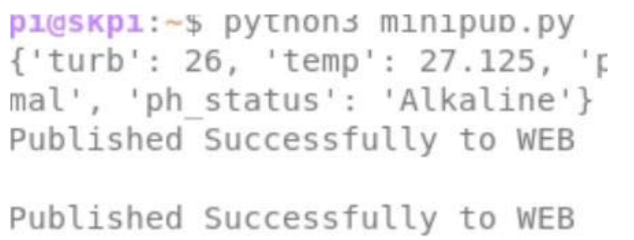

Fig. 3. Message Queuing Telemetry Transport publisher output

IV. System Software

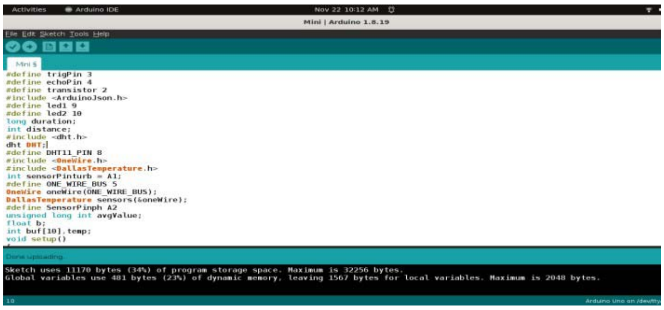

Fig. 4. Arduino IDE simulation window

To display readings from the sensors, we have created a web user interface. We used turbidity, pH, water temperature, and environmental temperature sensors in this instance. The user dashboard presents the data in a card view. PHP is used to retrieve the cards from the database. Here, the data from the sensor was published via Message Queuing Telemetry Transport. Javascript was used to create the publisher and subscriber objects, which send and receive data respectively over Message Queuing Telemetry Transport. Once theconnection has been made, the payload string will be returned when we subscribe to the topic that we published in Message

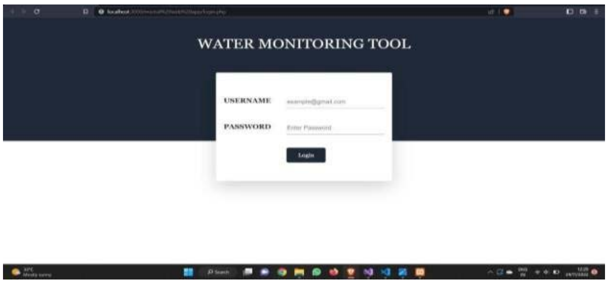

Fig. 5. Web UI login page

Queuing Telemetry Transport. Using card ID, the Message

Queuing Telemetry Transport returned value is shown on the web. The database was queried for the sensor list. The sensor id and its name will be generated at the same time as the dashboard exists. Replace the id with the appropriate sensor value using javascript.

V. Results And Discussion

Our proposed system has been successfully developed to continuously monitor water quality parameters, including conductivity, dissolved oxygen, microorganisms, turbidity, ambient temperature, and humidity. It's also great to hear that the system is capable of analyzing chemicals and impurities present in the water.The use of Message Queuing Telemetry Transport (MQTT) server to deliver data to the targeted system is an effective way to ensure that data is transferred securely and efficiently. The use of Message Queuing Telemetry Transport protocol also allows the system to handle a large number of sensors and data streams simultaneously, making it suitable for continuous monitoring.The web-based UI is a user-friendly interface that allows easy access to the output data generated by the system. This will make it easier for interested parties to check the status of the river's environmental state at any time.It's also great to hear that the suggested system operates continuously, allowing for daily water quality analyses. This will provide the River-Keeper with real-time data to detect any changes in water quality and take necessary action promptly.However, it's important to ensure that the system is regularly maintained and calibrated to ensure accurate and reliable data. Additionally, proper data management is crucial to ensure that the data is properly stored, analyzed, and accessed in a timely manner. Overall, the suggested system seems like an effective solution to improve water quality monitoring and provide accurate, real-time datato the River-Keeper. The system's continuous operation and web-based UI will allow for prompt action to address sources of poor water quality, leading to improved water quality and a healthier environment.

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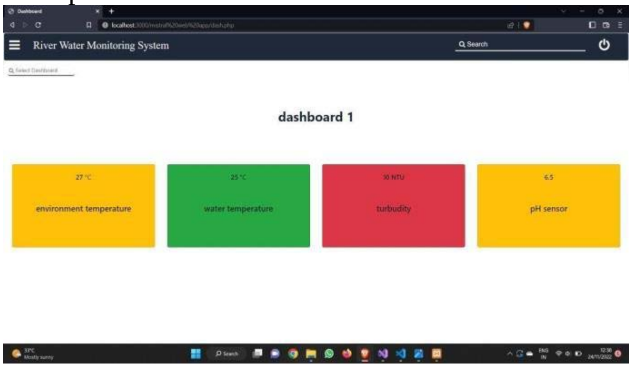

Fig. 6. Web UI output

TABLE 1. History of Sensor Values

Time	**11:00**	**11:10**	**11:20**	**11:30**
Environment Temperature (℃)	26	27	26	28
Water Temperature (℃)	25	27	25	26
Turbidity (NTU)	10	11	10	10
pH	6.5	7	7	8

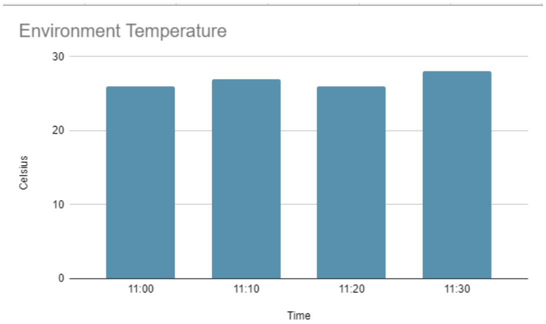

Fig. 7. Environment Temperature graph

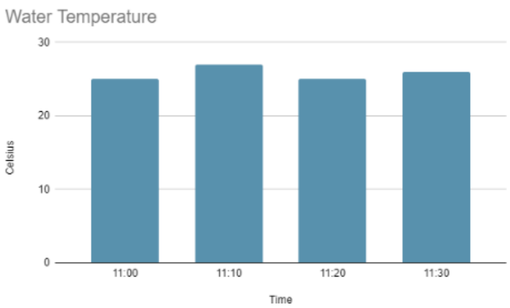

Fig. 8. Water temperature graph

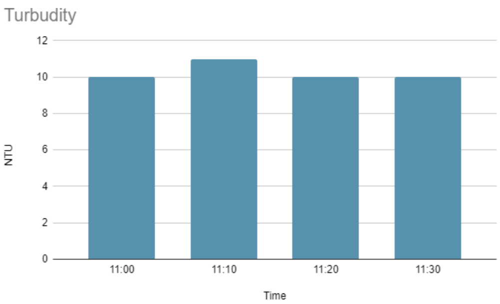

Fig. 9.Turbiditygraph

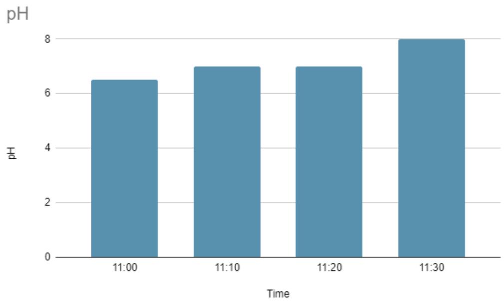

Fig. 10. pH graph

V.Conclusion

The major objective of our work is to constantly evaluate the water quality 24/7 and the data will be sent to the web-based UI. The data also gets stored in the database to review the history. Our suggested system tells whether the water is consumable or not. Our system is more feasible and efficient as it shows more accurate values. In the future, our system can be enhanced with more sensors and we are planning to add a mobile application also.

VI ACKNOWLEDGEMENT

We acknowledge that this work is original and has not been published elsewhere nor is it currently under consideration for publication elsewhere

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Text Categorization on News Headlines Deploying Opinion Mining in NLP

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***Abstract*—This paper provides an overview of the current state of the art in text categorization and opinion mining on news headlines. The task of categorizing news headlines into different topics and determining the sentiment expressed in them is important for a variety of applications, including media monitoring, information retrieval, and content organization. However, the high volume and dynamic nature of news headlines present several challenges for NLP researchers. This paper discusses various NLP techniques and algorithms for accurately categorizing headlines and determining their sentiment, as well as the challenges and limitations of such a task. The paper also presents evaluation metrics for measuring the performance of different approaches and highlights areas for future research. This paper examines the application of text categorization and opinion mining in the field of Natural Language Processing (NLP) for news headlines. The task of categorizing news headlines into different topics and determining the sentiment expressed in them has significant practical applications in fields such as media monitoring, information retrieval, and business intelligence. The paper presents a review of current NLP techniques and algorithms for accurately categorizing headlines and determining their sentiment. The challenges and limitations of such a task are also discussed, as well as evaluation metrics for measuring the performance of different approaches. This paper highlights the potential for continued research and development in the application of text categorization and opinion mining on news headlines. The system utilizes advanced natural language processing (NLP) techniques and algorithms to categorize news articles into different topics and determine the sentiment expressed in them. The evaluation of the news tracker application shows high accuracy in categorizing news articles and determining the sentiment expressed, making it a valuable tool for media monitoring, market research, and business intelligence. This paper highlights the potential of the news tracker application and provides insights into future research directions. The application is user-friendly, easy to navigate, and can be customized to meet the specific needs of different users.**

Keywords—–Natural Language Processing (NLP), News Headlines

I. INTRODUCTION

The field of Natural Language Processing (NLP) has seen significant growth in recent years, with increasing applications in various domains such as sentiment analysis, text classification, and information retrieval. One particular area of interest is the categorization of news headlines and the analysis of the sentiment expressed in them. Text categorization involves assigning a label or category to a given text based on its content. In the context of news headlines, this could involve classifying headlines into topics such as politics, sports, technology, etc. This task is important for a variety of applications, including media monitoring, information retrieval, and content organization. Opinion mining, also known as sentiment analysis, is a subfield of NLP that focuses on identifying and extracting opinions, attitudes, and emotions expressed in text. In the context of news headlines, opinion mining can be used to determine the overall sentiment expressed in a headline, such as positive, negative, or neutral. The combination of text categorization and opinion mining on news headlines presents several challenges and opportunities for NLP researchers. On one hand, news headlines are usually short and lack context, making it difficult to accurately categorize and determine the sentiment expressed. On the other hand, the high volume and dynamic nature of news headlines provide a rich source of data for NLP research and development. In this paper, we aim to provide an overview of the current state of the art in text categorization and opinion mining on news headlines. We will discuss various NLP techniques and algorithms for accurately categorizing headlines and determining their sentiment, as well as the challenges and limitations of such a task. Additionally, we will present evaluation metrics for measuring the performance of different approaches and highlight areas for future research.

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However, the high volume and dynamic nature of news headlines present several challenges for NLP researchers. News headlines are usually short and lack context, making it difficult to accurately categorize and determine the sentiment expressed. Despite these challenges, there has been a growing interest in the application of text categorization and opinion mining on news headlines. Opinion mining, also known as sentiment analysis, is a subfield of NLP that focuses on identifying and extracting opinions, attitudes, and emotions expressed in text.In the context of news headlines, opinion mining can be used to determine the overall sentiment expressed in a headline, such as positive, negative, or neutral. This information can be used to gain insights into public sentiment towards a particular topic or event. News headlines are a rich source of information and are usually short, providing a quick and concise summary of the content of a news article. Text categorization on news headlines involves assigning a label or category to each headline based on its content, such as politics, sports, technology, etc. This helps in organizing and retrieving relevant news articles more efficiently.

II. RELATED WORK

Text categorization and opinion mining on news headlines has been a popular research topic in the field of Natural Language Processing (NLP) in recent years. There has been a growing interest in developing NLP-based approaches to accurately categorize news headlines into different topics and determine the sentiment expressed in them.

One of the early works in this field was conducted by (Cai and Liu, 2005) who proposed a text classification model based on Naive Bayes to categorize news articles into different topics. (Lee and Kim, 2006) presented a sentiment analysis approach based on machine learning algorithms for news articles, showing promising results in detecting the sentiment expressed in news headlines. More recent works have focused on the application of deep learning techniques for text categorization and sentiment analysis. (Liu, 2015) proposed a deep convolutional neural network (CNN) model for text classification, which achieved state-of-the-art results on benchmark datasets. (Kim, 2014) introduced a novel approach to sentiment analysis using a Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN) architecture, demonstrating its effectiveness in detecting the sentiment expressed in news headlines. The development of large pre-trained language models such as BERT (Devlin et al., 2019) and GPT (Brown et al., 2020) has also had a significant impact on the field of NLP, including text categorization and sentiment analysis. These models have achieved remarkable results in various NLP tasks, including sentiment analysis on news articles (Sun et al., 2019).

In conclusion, the literature survey shows a growing trend in the application of NLP techniques and algorithms for text categorization and sentiment analysis on news headlines. Recent works have shown promising results in achieving high accuracy in categorizing news headlines and determining the sentiment expressed, but there is still room for improvement, especially in handling real-world complexities such as language variability, sarcasm, and subjectivity.

III. EXISTING NEWS APPLICATION

The existing system for text categorization on news headlines deploying opinion mining in NLP application is primarily based on machine learning and deep learning algorithms. The following are some of the existing systems in this field:

Naive Bayes-based text classification: One of the earliest works in this field was a text classification model based on the Naive Bayes algorithm proposed by (Cai and Liu, 2005). The system was designed to categorize news articles into different topics, and the results showed that the Naive Bayes model was capable of achieving high accuracy in text categorization.

Machine learning-based sentiment analysis: Another early work in this field was a sentiment analysis approach based on machine learning algorithms proposed by (Lee and Kim, 2006). The system was designed to determine the sentiment expressed in news articles, and the results showed that the machine learning-based sentiment analysis approach was effective in detecting the sentiment in news headlines.

Deep Convolutional Neural Network (CNN) text classification: A more recent work in this field was a deep convolutional neural network (CNN) model for text classification proposed by (Liu, 2015). The system achieved state-of-the-art results on benchmark datasets and demonstrated the effectiveness of deep learning techniques in text categorization.

Combined CNN and RNN architecture for sentiment analysis: Another recent work was a novel approach to sentiment analysis using a combined CNN and RNN architecture proposed by (Kim, 2014). The system showed promising results in detecting the sentiment expressed in news headlines and demonstrated the effectiveness of combining deep learning techniques for sentiment analysis.

Pre-trained language models for text categorization and sentiment analysis: With the introduction of pre-trained language models, such as BERT and GPT, the field of NLP has seen a significant impact in recent years. (Devlin et al., 2019) proposed BERT as a pre-trained language model for various NLP tasks, including text categorization and sentiment analysis. (Brown et al., 2020) introduced GPT, a generative pre-trained language model that has achieved remarkable results in various NLP tasks, including sentiment analysis on news articles (Sun et al., 2019).

In conclusion, the existing systems for text categorization and opinion mining in NLP application have made significant progress in achieving high accuracy in categorizing news headlines and determining the sentiment expressed. The continued research and development in this field will play a crucial role in improving the performance of NLP applications in the real world.

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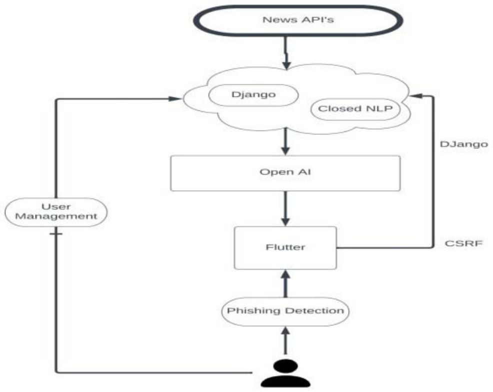

Fig 1. Process of news search system approach

1) Google News: Google News is a free news aggregator service developed by Google. It presents a continuously updated list of articles that are sorted by categories such as world, nation, business, technology, entertainment, and sports. The categorization is done based on the content of the news articles and the topics they cover.

2) Apple News: Apple News is a news aggregator application developed by Apple Inc. It presents articles from a wide range of sources and categorizes them based on topics such as business, politics, technology, sports, and entertainment. The application also includes a feature that allows users to customize the news sources and topics they want to follow.

3) News360: News360 is a news aggregator application that uses artificial intelligence and machine learning techniques to personalize news content for each user based on their interests. The application categorizes news articles into different topics and presents a summary of the article along with its sentiment analysis.

4) Feedly: Feedly is a news aggregator application that allows users to subscribe to news sources and blogs and categorize them based on topics such as business, technology, politics, and entertainment. The application presents a summarized view of the latest articles and also provides the option to read the full article.

These are some of the existing news search applications that use text categorization and opinion mining techniques to categorize and analyze news headlines. The specific details and features of these applications may vary, but they all provide a way for users to search for news articles based on their keywords and topics of interest and stay up-to-date with the latest news and developments

IV. Proposed Methodology

The NEWS Tracker system is going to be implemented for e-NEWS reading. With this app, the user can access interested news and get a quick peek. A news-sharing app helps users find relevant and important news easily every day. For zero-trust security, implementation of Django APIs with advanced flutter system has occurred.

The proposed system for text categorization and opinion mining on news headlines in the field of Natural Language Processing (NLP) would likely involve the following steps:

i) Data Collection: The first step would be to gather a large dataset of news headlines from a variety of sources, such as news websites, blogs, and social media platforms. This dataset should be diverse and include headlines from different categories, such as politics, business, technology, sports, and entertainment.

ii) Pre-processing: The next step would be to pre-process the data to clean and prepare it for analysis. This would include removing stop words, stemming and lemmatizing words, and transforming the data into a format that can be easily processed by NLP algorithms.

iii) Text Categorization: The main task of the proposed system would be to categorize the news headlines into different topics based on their content. This could be achieved using a variety of NLP techniques such as term frequency-inverse document frequency (TF-IDF), n-grams, and machine learning algorithms such as decision trees, support vector machines, and neural networks.

iv) Opinion Mining: The next step would be to determine the sentiment expressed in each headline. This could be done using a variety of techniques, such as sentiment analysis algorithms, lexicon-based approaches, and deep learning models. The system would analyze the words and phrases in each headline to determine its sentiment, whether it is positive, negative, or neutral.

v) Evaluation: The proposed system would be evaluated using a range of metrics, such as accuracy, precision, recall, and F1-score, to determine its performance. The evaluation would help to identify any limitations or challenges with the system and inform future improvements.

vi) Deployment: The final step would be to deploy the proposed system as a web application or mobile app that would allow users to easily access and analyze news headlines in real-time. The system would provide valuable insights into the content and sentiment of news headlines, which would be useful for media monitoring, information retrieval, and business intelligence applications.

vii) News Sorting: Sort the news headlines based on the user's preferences and display the sorted news to the user

viii) Continuous Monitoring: Continuously monitor new news headlines and update the sorted news accordingly.

ix) User Feedback: Allow users to provide feedback on the relevance of the sorted news and make improvements to the system based on the feedback

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Fig 2. Group idea

Each step could be represented by a different block in the diagram, with arrows showing the flow of the process from one step to another. You can add additional details and annotations to each block to provide a more comprehensive representation of the proposed system.

V.EXPERIMENTAL RESULTS

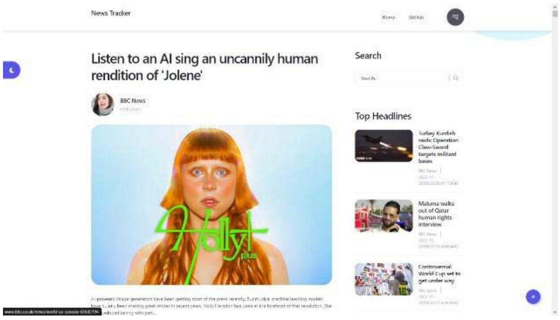

Fig 3.Output Image

VI. CONCLUSION

In conclusion, the combination of text categorization and opinion mining in NLP for news headlines provides a powerful tool for analyzing and understanding the content of news headlines. By categorizing headlines based on both the content of the headline and the sentiment expressed in it, this approach provides a more complete understanding of the news story, allowing for more effective filtering, prioritization, and analysis of the news. The field of text categorization and opinion mining in NLP is rapidly evolving, with ongoing research into developing more effective algorithms and models for this task. A news app that integrates text categorization and opinion mining in NLP can provide a personalized and dynamic experience for users. The app can categorize news headlines into different categories and also determine the sentiment expressed in each headline, allowing users to filter and prioritize news based on their interests and preferences. This can help users stay informed about the latest news and events, while also avoiding news that may be biased or misleading. With the increasing demand for personalized and trustworthy news, a news app that utilizes text categorization and opinion mining in NLP has the potential to be successful and widely adopted by users. The development of such an app requires careful consideration of user privacy, ethical issues, and the challenges of accurately categorizing and analyzing news content. Nevertheless, the potential benefits of a well-designed news app that incorporates text categorization and opinion mining in NLP make it an exciting and promising area of research and development. With the increasing importance of understanding news and public opinion, this field is likely to continue to grow and evolve in the coming years.

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An IOT Enabled Health Monitoring and Work Guidance System for Mine Workers

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***Abstract*—As with any industrial enterprise, underground mining operations require an effective and robust safety system. Underground miners encounter numerous hazards, including working in low-light circumstances, exposure to air pollutants, and the risk of fire and explosion. This project provides a solution by establishing a smart and safe mining system that can monitor the worker's body temperature, heart rate, oxygen saturation level, temperature, and pressure, and release of poisonous gases. There are two nodes in the system. A node monitors the workers' health conditions, while another inspects the work site before workers enter the field. The sensor modules connected to the NodeMCU can detect abnormal conditions based on threshold values. As soon as NodeMCU detects a threshold value crossing, an alert message is sent to the mining control room. For inspection of the site before workers enter, rover equipped with environmental sensors and a camera is used. Using the raspberry pi, an operator in the control room can also view the transmitted live video and sensed information to ensure the safety of workers.**

I. Introduction

The world has an intensively varying natural resources and a huge mining industry. Underground mining by workers could be extremely hazardous, and the risks increase as the depth from the ground increases. Mining is already looking into the future of automation. Digitization might not be a new concept to this sector, but the industry is still trying to find out how to make it the greatest. In the mining industry, workers' safety, proper communication and supervision are very important. Mine fires, explosions, gas intoxications, electric burns are the major causes of disaster in Underground Mines. These regions consists of emissions of Particulate Matter(PM) and gas like Carbon Monoxide(CO), Methane (CH4), oxides of nitrogen and Sulphur which are harmful to health. Different types of mining activities generate PM in various ranges. Methane is highly inflammable which is present in air around 5% to 14%. White damp or CO which is 0.1% can cause demise within a few minutes. To protect the workers from such a risky environment, certain physiological parameters have to be examined. Coronary heart rate and Body temperature are the common health monitoring works. On the other hand, temperature, pressure and amount of gas are the different parameters to check the mining site. In this paper, we present a mobile environmental and physiological IoT system for workers which is applicable for industrial site. This system contains various sensors which are able to communicate with each other. Each worker is provided with a wearable system which can monitor the oxygen and pulse rate. This concept uses mobile hotspot for internet connection and User Datagram Protocol (UDP) for communication purposes. Prior to workersmoving to the site, a rover equipped with a USB camera embedded with gas, temperature and pressure sensors monitors the environment. Depending on the condition, the workers are allowed. The monitored data is compared with current vital sensory values respective to working environmental data. It can guide the workers if any health issue happens and also can avoid unwanted death. If there exists any abnormal condition, the system alerts the workers.

The Internet of Things (IoT) involves linking computer-based technologies with industrial equipment or household appliances over a network to enable teleoperation, workflow management, and data collection through the use of sensors [1]. Users can receive real-time data from the IoT through the browser or mobile applications wherever they are [2]. Wireless Sensor Network(WSN) is one of the foundational technologies for IoT that mainly uses interdependent smart sensors to sense and monitor physiological factors. Currently an emerging technology called Compressed Sensing(CS) is intensively applied for effective information analysis and imposed on applications where gathering data is exorbitant [3]. In addition to healthcare applications, WSNs can also be used to monitor environmental factors like temperature, humidity, and gas for safety purposes. WSNs provide exceptional benefits for a variety of different activities [4]. IoT systems merge and create robust networks that offer several solutions for developing sensible PPE products for underground mining applications due to

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technological immaturity, accidents, and closed systems. Smart sensors in combination with connectivity solutions and data storage are enabling Personal Protective Equipment (PPE) to provide health protection and enhance safety. By using this solution, manufacturers can take concepts from the primary plan to development of prototype Bluetooth Low Energy, also called Bluetooth Smart, which is an advanced wireless technology allowing fast wireless connections and featuring drastically reduced power consumption [5][6].In the automation world, ZigBee plays a significant role as a cost-effective, power-efficient, and low-complexity networking technology. Each ZigBee network has a network coordinator that starts the mesh network and controls the operation of devices to and from the network [7]. Due to the imminent technologies, IoT devices using Lora WAN which can run for several years without any substitution. It contains simple network architecture, strategic designing which is effective in outdoor IoT applications [8]. In wired communication, there exists higher price and higher risk in underground mines especially during gas inflammation or disaster. On the other hand, wireless communication has a low-cost RF transmitter and receiver and doesn’t have any risky consequences [9].

Implementation of robots have been successful in complex environments. The components inside a robot help to assist in control and its movement and a communication system that enables effective data transmission by the camera and the sensors [10]. Alert system is implemented for all workers from different locations within the mining area and sends the alert to the control room. Applicable actions would be taken whenever there exists a dangerous situation [11]

The major contribution of this paper is addressed below

1. To propose a Health Monitoring System which includes the detection of oxygen level and the heart rate.
2. To present the Work Guidance System which includes the recognition of temperature, pressure and type of gas using IoT.

The organization of the paper is as follows. Section II describes the proposed system including a block diagram and a flow chart. Section III elucidates hardware implementation and section IV summarizes results and discussions.

II. Proposed System Methodology

The block diagram shown in Fig. 1 elucidates the health monitoring of mining workers and their safety in the mining field. The proposed system includes two nodes: one is named as the health monitoring node and other node is named as safety node. In the health monitoring node, a wearable device embedded with the MAX30102 sensor monitors the oxygen level in the blood and heart rate of the workers. An alert message “Worker Unhealthy” will be sent if the health condition of the worker is worsened. The safety node has a four-wheel rover setup along with a USB camera integrated with Raspberry Pi to transmit the live video of the mining field to ensure the condition of the environment is fine. The sensors embedded in the rover are used to monitor the level of temperature, gas, and pressure in the work field. All the monitored data will be transmitted and displayed by a local server in the control room.

The flowchart shown in Fig.2 illustrates the mechanism for the health monitoring and work guidance system for mining workers.

III. Hardware Implementation

A. *Detailed description about the components used in this proposed system:*

1) *Raspberry Pi* 4

The Raspberry Pi 4 Model B is a microcontroller commonly used in health nodes, where it is connected to sensors, cameras, motor drivers, and a four-wheel robot setup. This model boasts faster processors and enhanced multimedia performance compared to its predecessors, as well as more memory and improved connectivity options. End users can expect desktop-like performance from this microcontroller, which is comparable to entry-level x86 PC systems. Its high-performance quad-core processor can support dual displays at up to 4K resolution via micro-HDMI, and it can decode hardware video up to 4Kp60. Additionally, it comes equipped with 8GB of RAM, dual-band 2.4GHz/5.0GHz wireless LAN, Gigabit Ethernet, and USB 3.0 ports. The Raspberry Pi 4 Model B is powered via a USB port that delivers 5V(2A).

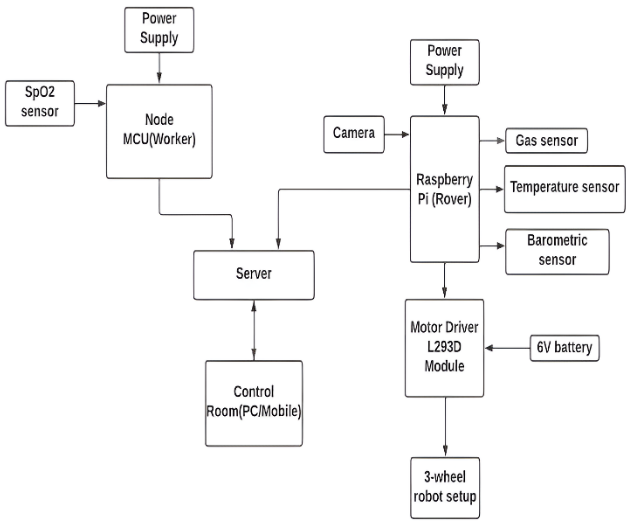

Fig. 1. Block Diagram of the proposed system

2) Power Supply: In order to operate Raspberry pi and Node MCU it is provided with 5v Dc power supply for Raspberry pi through USB port and 5v for Node MCU through USB type B.

3) USB camera: USB camera is used to monitor the work field from the mining control room. It has no built-in microprocessor and no non-volatile memory card, so it does not "remember" pictures because it is designed to capture images and send them right away to a computer. For this reason, webcams have USB cords that start at the back. By connecting the webcam to the computer, and then transferring the digital data taken by the webcam’s image

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sensor back to the computer, the data can be sent to the internet.

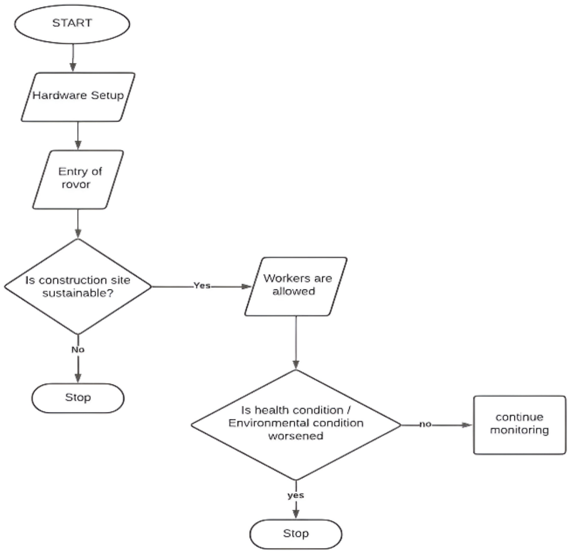

Fig. 2. Flow chart of the proposed system

4) MCP3008: The values sensed from MQ2 and MQ7 sensors are analog. To convert those values from analog to digital MCP 3008 is used. It is a 8-channel 10-bit ADC IC measures 8 different analog voltages with a 10-bit resolution for every channel. It measures analog voltages between 0 and 1023 and sends the measuring values to a microcontroller over SPI communication. Analog voltages are converted into digital values using the SAR method.

5) L293D motor driver: A Motor Driver regulates the speed and direction of the wheels connected with dc motors. Two motors at the same time. This motor driver is made with the L293D IC. It has 16 pins where 8 pins are dedicated for controlling the motor on all sides. There are two INPUT pins, two OUTPUT pins, and one ENABLE pin on each motor.

*6) Motor:*A device that transforms DC electrical energy into mechanical energy and enables the rover's wheels to move is known as a DC motor.

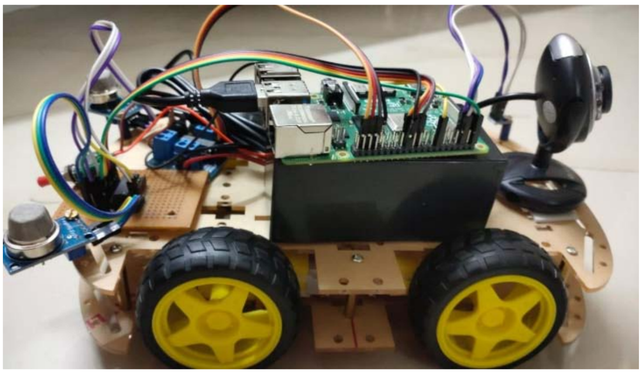

Fig. 3. Hardware setup for Safety Node

7) Battery: Battery is one of the best portable power supply. Since Lead -Acid battery is a rechargeable one and cheap. It is used as a backup power supply for the rover. Sealed lead acid battery provides better battery life.

8) MQ 2 Gas sensor: This gas sensor detects gases such as LPG, propane, methane, hydrogen, alcohol, smoke, and carbon monoxide in the air. It contains a substance which can alter the resistance as it comes in contact with the gases. This MQ2 sensor ranging from 300 - 10000 ppm. Sensors identify these gases by measuring voltage. Each gas has its unique voltages. By measuring the current discharge, it can measure the concentration of gas.

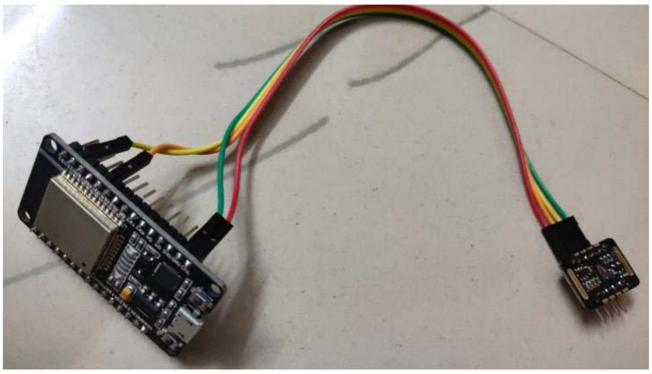

Fig. 4. Hardware setup for Health Monitoring Node

9) MQ 7 Gas Sensor: The sensor detects the carbon monoxide (CO) gas concentration in the air .The detecting range is from 10 to 500ppm.

10) BMP 180 Sensor: BMP180 is an atmospheric pressure sensor used to measure atmospheric pressure and temperature in the environment where it present and convert the findings into an electrical signal. This sensor works based on the weight of the air. The sensor measuring range is from 300 to1100 hpa.

11) Node MCU: Node MCU is used in the safety Node connected with MAX30102 sensor. It is an open-source plat- form that connects and transfers data to other connected devices. It is based on an ESP8266 microprocessor.

12) MAX30102 Sensor: This sensor measures pulse oxime- try and heart rate using analog signal processing and also includes a photodetector and two LED's .It is designed to ease the design-in process for mobile and wearable devices.

13) The complete Hardware Setup for Safety Node and Health Monitoring Node is shown in Figure. 3 and 4 respectively.

IV. Results and Discussion

A. Safety Node

A rover with USB Camera is made to invade the mining field, the movement of Rover could be controlled by using the keys present in the keyboard with the help of Motor Driver L293D Module. The forward and backward movement of the Rover is done by pressing up and down arrows respectively. By clicking the left and right arrow keys, the movement of Rover in left and right direction could be done as shown in Figure. 6. The movement is last for a particular period of time and the continuous pressing of

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keys could be implemented for its continuous movement. Then the rover starts sensing the level of temperature, pressure and presence of toxic gas in the environment and transmit the sensed value to the control room via mobile hotspot. Then the sensed values are displayed in the VNC viewer in the order of temperature, pressure, altitude, CO and CO_2.

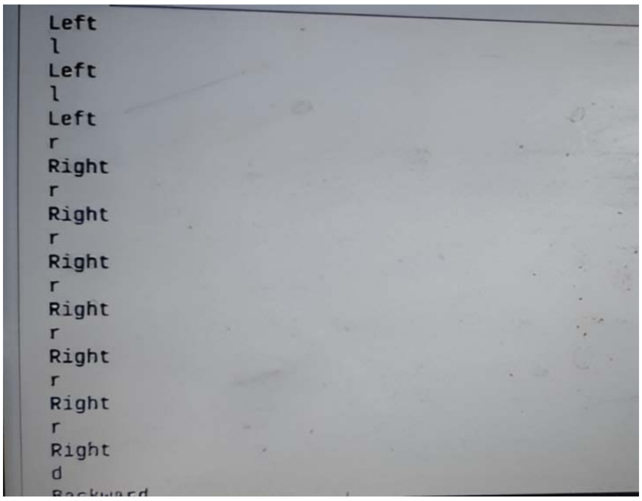

Fig. 6. Movement of Rover

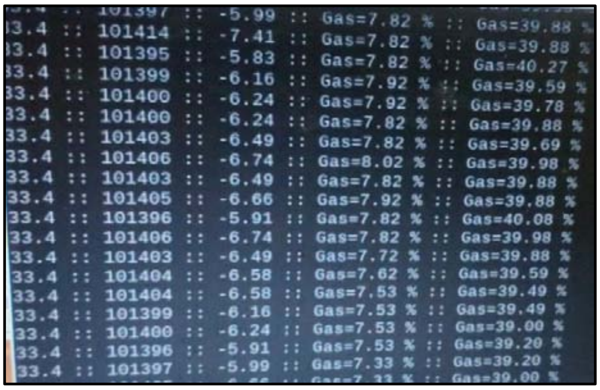

Fig. 7. Sensed data in normal condition

The normal threshold value of pressure is 101400 Pascals, for temperature it is 37°C inside the body and 28°C around the environment and 50% is the threshold amount for poisonous gases. If any of the received sensor value exceeds the threshold value then the alert message “High Pressure/High Temperature/High Toxic Gases” is displayed respectively next to the sensed values in VNC viewer as shown in Figure 8. The result is represented in the form of Temperature(in °C)::Pressure(in Pascals)::Altitude(in feet)::Amount of CO(in %)::Amount of CO2(in %).

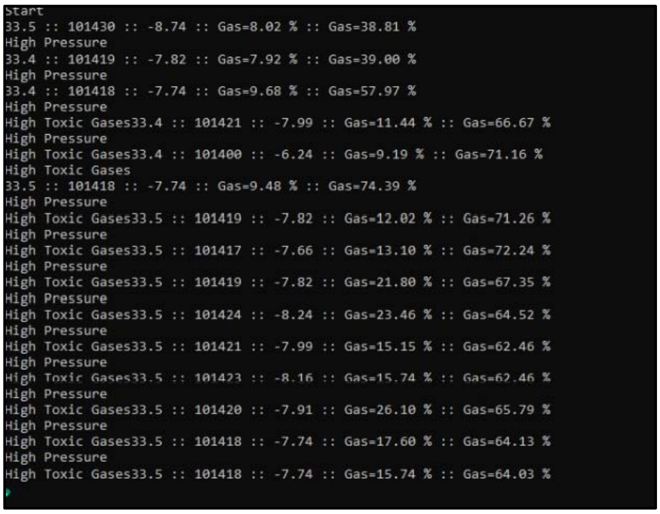

Fig. 8. Sensed data in abnormal condition

B. Health Monitoring Node

After verifying the data’s transmitted by the rover, the workers are allowed to the mining field equipped with a wearable device. The wearable device is embedded with MAX30102 sensor continuously monitors the Spo2 level and heart rate. The threshold value of heart beat rate ranges from 60 to 100 bpm whereas the Spo2 level should be higher than 90 percentage. When the sensor value exceeds the threshold value, an alert message “Worker Unhealthy” will be displayed in the screen. If the device is not properly worn by the worker, an alert message “NO Finger” will be displayed as shown in Figure 9.

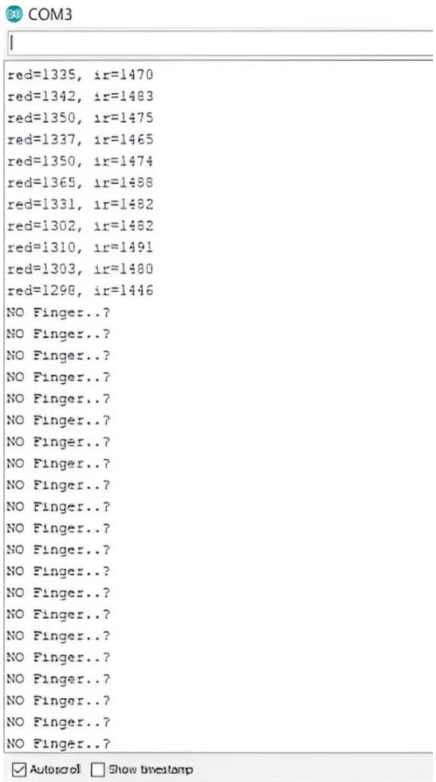

Fig. 9. Alert message for wearing the device imperfectly

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```
red=200637, ir=153922, HR=19, HRvalid=1, SPO2=75, SPO2Valid=1
red=209537, ir=157289, HR=19, HRvalid=1, SPO2=75, SPO2Valid=1
red=216606, ir=159892, HR=19, HRvalid=1, SPO2=75, SPO2Valid=1
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97:75
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Fig. 10. Sensed Data in normal health condition

V. Conclusion

This paper aims to design an IoT based health monitoring and work guidance system for mining workers' welfare in order to monitor their health and safety. The proposed system continuously monitors the health condition of the workers and governs the environmental condition by using rover. With the help of data received from the health node and safety node in the control room, the worker's will be rescued if any of the conditions are abnormal in the mining field. The first component of worker safety in underground coal mining was addressed in this research. This project is not only for coal miners, but also for workers who perform subterranean work. In the future, the system could be equipped with a range of environmental and physiological sensors to meet the specific requirements of various work settings.Overall, expanding the server infrastructure and allocating distinct IP addresses to each server can be a wise investment for the project, allowing for more effective management of vast mining regions, better performance, improved security, and easier troubleshooting.

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Machine Learning Techniques for Real-Time Chronic Kidney Disease Tracking

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Abstract **– The majority of non-communicable disease-related morbidity and death is caused by chronic kidneydisease (CKD), which affects 10% to 15% of the global population. The impact of patient health issues likehypertension, poor nutritional health, mineral bonedisorder, anaemia, acid base abnormalities, andneurological complications is thought to be significantlyreduced by early and accurate detection of CKD stagesand prompt intervention with appropriate medications. Incertain studies, machine learning approaches have beenutilised to detect CKD early. In this assessment, CKD isidentified using the logistic regression technique. To determine which algorithm offers the most accuracy, many proposed algorithms are compared. AI repository containing a great deal of missing traits.**

Keywords **– CKD, Machine learning, SVM, RF, ANN, K-NN, Logistic.**

I. Introduction

Their results in CKD diagnosis have been promising. The models indicated above are based on the disease criteria in the data and fill in missing values using the mean imputation technique. Due to the lack of knowledge regarding the diagnostic implications of a sample, their method cannot be applied in this situation. For a variety of reasons, patients may actually skip many assessments before diagnosis. Aside from that, average imputation statistics, which are employed to fill in gaps in categorical data, may drastically deviate from the actual values. Despite the fact that components with just two categories can have their categories set to 0 and 1, the average value of the variables may lieanywhere between 0 and 1. The models suggested, which are based on attribute selection technology, had their computational costs lowered through feature selection.

A. Chronic Kidney Diseases

A gradual deterioration in renal function over months or years is a defining feature of the kidney failure type known as chronic kidney disease (CKD). Initial symptoms are absent, however later warning signs include confusion and fatigue, nausea, and leg edema. Among the complications are heart failure, elevated blood pressure, bone damage, and anaemia. Polycystic kidney disease, glomerulonephritis, diabetes, and high blood pressure all contribute to chronic kidney disease. One of the risks is a history of chronic renal illness. The diagnosis is established through urine testing for albumin concentration and blood tests to measure glomerular filtration rate. The root of the issue could be identified via an ultrasound or a kidney sample. The utilisation of several severity- based staging schemes. At-risk people should be screened, according to the advice. As a first line of treatment, patients may use medications to decrease cholesterol, blood pressure and blood sugar. Angiotensin converting enzyme inhibitors (ACEIs) or angiotensin II receptor antagonists (ARBs) are frequently used as first-line blood pressure drugs since they lowered the risk of heart disease and delayed the course of renal impairment.

B. Machine Learning

The study of changing computer algorithms over time is known as machine learning (ML). It falls within the heading of artificial intelligence. Even when they are not explicitly trained to do so, machine learning algorithms create a model utilising test data, commonly referred to as "training data," to make judgements or predictions. When it would be difficult or impossible to create standard algorithms, machine learning approaches are typically applied. Examples include email classification and computer vision. But not every machine learning technique involves statistical learning. Machine learning does not always rely on statistical learning, though. Computational statistics, a subset of machine learning, is an area of AI technology that concentrates on computer-aided prediction. Mathematical optimization research advances machine learning by providing methodologies, application fields and ideas. Similar research is done in the discipline of data mining, which concentrates on unsupervised learning for exploratory data analysis. The practise of teaching computers to perform tasks without explicit programming is known as machine learning. In order to accomplish particular jobs, computers acquire knowledge from available data.

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II. LITERATURE REVIEW

A. ANN and SVM for the prediction of chronic kidney disease: A comparative study.

The authors of this study, Njoud Abdullah Almansour, HajraFahim Syed, and others, set out to use system learning methodologies to detect CKD at an early stage in order to help prevent it (CKD). Artificial Neural Networks and Support Vector Machines are employed as teaching tools in this test. In order to conduct experiments, every missing value from the dataset was changed by recommending the relevant attributes. The Artificial Neural Network and Support Vector Machine algorithms' ideal parameters have been established after significant parameter tuning and a great deal of testing. The two recommended tactics' final versions were built based on the attributes and qualities that were most well-liked.

B. Explainable Prediction of Chronic Renal Disease in the Colombian Population Using Neural Networks and Case-Based Reasoning

These studies by Sergio M. Martnez- Monterrubio, Gabriel R. Vasquez-Morales, et al.Following training, In the test statistics set, the model achieves a 95-accuracy rate, enabling its use in disease diagnosis. According to recent research on explainable AI, dual systems should be used, where any other white-field technique that produces results that are broadly consistent with the expected values is added to a black-field system-learning technique. Because to its ability to identify illustrative explanations, case-based reasoning (CBR) has shown to be a very effective supplemental method. It may augment a neural network's prediction with explanations provided by examples. This article puts the NN-CBR dual device that generates CKD prediction logic to the test and evaluates it. This study determined that 3,494,516 Colombians, or 7% of the population, were at risk for developing CKD.

C. A Machine Learning Methodology for Diagnosing Chronic Kidney Disease.

This image reflects the views of ErlendHodneland, EirikKeilegavlen, and others. Renal function gradually deteriorates over time, which is a sign of chronic kidney disease, a dangerous medical condition. In patients with chronic renal disease, the most recent research highlights the effectiveness of photo registration techniques for detecting pathological aberrations. Methods: Nine patients with suspected chronic real illness and ten healthy volunteers underwent dynamic T2 weighted imaging. Results: From biopsy evaluations, it is found that that deformation, normalized extent changes, and strain gradients were all substantially associated with arteriosclerosis. The findings also imply that the sensitivity required to accurately detect minute variations in tissue stiffness is lacking in the photo registration methods now in use. The use of image registration with dynamic time collecting as a tool for invasive measures of arteriosclerosis should be further investigated.

D. Amharic based Knowledge-Based System for Diagnosis and Treatment of Chronic Kidney Disease using Machine Learning.

In their research on developing a self- learning system and experience for identifying and treating the initial three stages of chronic kidney disease, Mohammed and Beshah used machine learning. This study used a tiny amount of data, and they developed a prototype that allows patients to query KBS to learn more about how advice was given. They used a decision tree to generate the rules. It has been stated that the prototype's overall performance is 91% accurate.

III. METHODOLOGY

We built a model to predict CKD sickness for the research subjects. Both the model's overall performance and the effectiveness of particular elements were evaluated. Machine learning classifiers like Logistic Regression, Artificial Neural Network SVM, K-Nearest Neighbor and Random Forest were used to train the model. Each classifier's performance and validation matrices were calculated independently. The following stages were included in this study's procedure: (I) preparing the dataset, (II) choosing the features, (III) applying the classifier, (IV) Using SMOTE, and (V) analysing the classifier performance. A deep neural network and machine learning models were used to compare the results of the two different types of neural networks. This was done using an artificial neural network classifier. Statistical testing, namely the McNemar's test, was utilised in this work to determine the significance of two models.

A. Logistic Regression

By employing supervised learning, the classification technique known as logistic regression forecasts the likelihood of a target variable. Due to the target or dependent variable's dichotomous character, there are only two viable classes.

B. SVM

Using a linear model called the Support Vector Machine, or SVM, classification and regression issues can be resolved. It has several advantageous uses and can solve both nonlinear and linear issues. The SVM method splits data into categories by creating a line or a hyperplane.

C. Random Forest

Both classification and regression can be performed using a powerful machine learning technique called Random Forest. Because ensemble learning is the approach employed, many tiny decision trees, known as estimators, which each generate a different set of predictions, make up a random forest model. To produce more accurate predictions, the random forest model combines estimates from the estimators.

D. K-Nearest Neighbor

Algorithm for Simple Machine Learning the Supervised Learning approach is used in K-Nearest Neighbour. This method assumes that occurrences and existing cases will be comparable, and it assigns new cases to the category that are most similar to previous ones.

E. Artificial Neural Network

Computers are taught to understand data similarly to the human brain using neural networks, which is an example of artificial intelligence. Deep learning employs network of

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nodes or neurons to replicate the layered structure of the human brain.

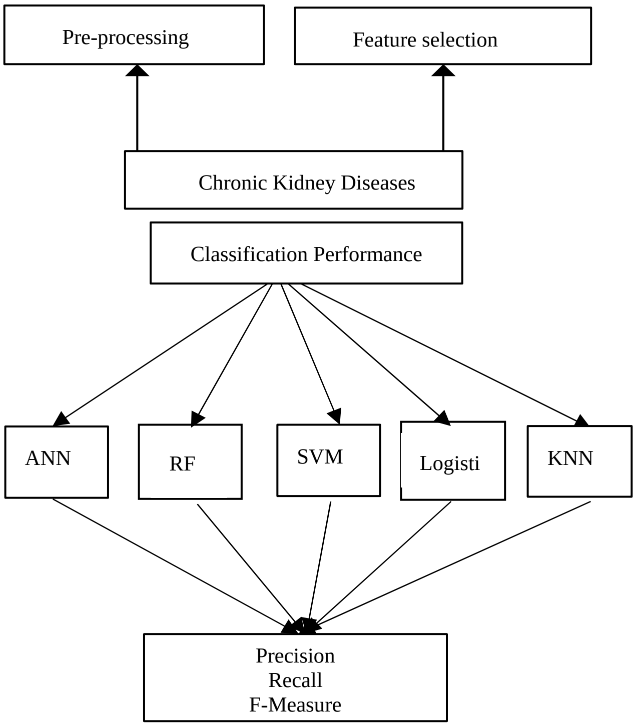

Fig. 1 – Flow Diagram for CKD prediction

IV. Data Description

The dataset from the UCI repository's public chronic kidney disease (CKD) repository was used in this investigation. This dataset includes 400 samples from two distinct classes. 11 of the 25 qualities are numerical, 13 are notional, while one is a category attribute. The dataset includes variables that can be used to anticipate the onset of CKD.

V. Result and Discussion

We feel that this methodology could beused in more complicated circumstances. When analysing more complex data, several algorithms are explored to generate models. Following misjudgement analysis, superior methods that result in diverse errors of judgement are retrieved as component models. Then, by creating an integrated model, the classifier's performance is enhanced.

Because the CKD data set comprises mixed variables, mixed data similarity analysis tools such as the general similarity coefficient could be used to determine sample similarity (numerical and categorical). We utilised EUCLIDEAN distance to determine sample similarity. Therefore, we did not use the techniques for figuring out sample similarity.

VI. Conclusion

The recommended CKD diagnostic methodology is workable with regard to data imputed and sample diagnosis. The model that is integrated was fairly accurate after unsupervised logistic imputation was used to impute empty values from the data set. In this evaluation, to identify CKD, we advocate utilising a Logistic Regression System. As a result, it will be useful to employ this technology in real-world settings to detect CKD. To develop a precise medical diagnosis, this technology might also be integrated with clinical information from other conditions. Unfortunately, the amount of data samples that can be utilised to build the model is rather little, at just 400, due to the restrictions of the parameters.

The generalizability of the model may be constrained as a result. The prototype is also unable to determine the severity of CKD because there are only two different types of data samples included in the data gathering (ckd and notckd). As more compr[illegible] quired to train the model, its [illegible] e will improve in the future. This will enable the model to determinedisease severity. We believe our model will become better as data size and quality grow.

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Automatic Number Plate Detection Using Deep Learning Techniques

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***Abstract*—Automatic Number Plate Recognition (ANPR) is a technique that reads a vehicle's license plate using photographs given to the Deep Learning model as its input. Existing ways to find and identify license plates on cars are severely limited by the low resolution and significant loss of edge data in plate photos. The process of automatic identification of license plates necessitates a high level of accuracy when cars are moving rapidly, and number plate abstraction is a difficult task due to number arrangement and environmental factors. The primary objective of this work is to create an Automatic Number Plate Detector that aims to recognize the text present in the number plates of cars, vans, bikes, trucks, and other vehicles that are either stationary or in motion with good accuracy. The recognition model was created by training it on a large dataset. The deep learning models Faster-RCNN and Yolo were employed to fetch the Region of Interest, followed by OCR for character extraction.**

Keywords*— YOLOv5, RoI, Automatic Number Plate Recognition, Faster RCNN, OCR

I. Introduction

Automatic Number Plate Recognition (ANPR) uses Deep Learning models to read license plates automatically and precisely. For various number plate recognition applications, multiple levels of image analysis are needed, such as recognising the types of objects in the image, locating these objects, and determining the precise boundaries of each object. Number plate recognition systems are frequently used to manage traffic, identify stolen automobiles, regulate access to buildings and parking lots, collect tolls automatically, and determine which advertisements are most effective. This ANPR system is supported by an abundance of documentation and general public knowledge. Nevertheless, there are constraints to consider, such as specific detectors or viewing angles, adequate illumination requirements, recording in a specific zone, and specific vehicle types. In this scenario, Deep Learning (DL) techniques emerged as a useful parameter.

Faster RCNN is superior to both RCNN and fast RCNN. In this approach, a convolutional neural network receives an image as input and produces a convolutional feature map. Then, a different network is used to predictthe region proposals. Following that, the suggested regions are reshaped using a RoI pooling layer. This layer classifies the picture within the region and forecasts theoffset values for the bounding boxes. OCR stands for "Optical Character Recognition." It was first identified as a computer vision problem. A simple OCR engine functions by storingnumerous font and text image templates. The OCR then uses pattern-matching algorithms to compare text images to its internal database, character by character. The proposed work involved working with a manually picked dataset that contains both Indian number plates. The vehicles used here include cars, trucks, bikes, army vehicles, autos, and taxis. The environmental conditions of these photos are either blurred, dusty, clear, or in motion. In this study, the Automatic Number Plate Detection System is divided into 2 processes, namely

i) Number Plate Detection

This is the first phase in which the Region of interest is selected. A bounding box is created to determine the exact coordinates that surround the vehicles' license plates. The construction of this detector will be carried out using the YOLO [1] transfer learning model and Faster RCNN [2],[3]which will be trained on a dataset consisting of a diverse variety of vehicle images, like normal vehicles, taxis, army vehicles, bikes, etc.

ii) Digit Number Recognition

This is the second phase of the model. After the bounding boxes and the coordinates are saved, the digits and characters are extracted from them with the highest accuracy possible. The images will be cropped to the size of the coordinates received in the first phase. This new image is fed to an OCR for digit recognition.

II.Literature Survey

The main task of Automatic License plate Recognition (ALPR) is to localize and recognize license plates in vehicle images. The conventional ALPR has two components, i.e., License Plate Detection (LPD) and License Plate Recognition (LPR). To help readers comprehend the work done in ALPR systems, thefollowing section highlights the reviews of various techniques used for LP detection and LP Recognition in literature. LP detection can typically be divided into two groups: one-stage and two-stage LP detection. Fast R-CNN [4] and Faster RCNN [5], which produce substantial region recommendations in the first stage and enhance them in the second, are the basic works of the two-stage detection networks. A unified framework called TE2E (Towards End to End) in which the model used Region Proposal Network (RPN) for License Plate(LP) detection and Recurrent Neural Networks(RNN) for character recognition. Here, the TE2E framework adopts

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two-stage detection involves the RoI pooling layer and high-quality bounding box proposals method for LP detection and RNN for character recognition. However, their findings revealed that RNNs were ineffective for character recognition [6]. To increase effectiveness, Xu et al developed a CNN-based architecture called Roadside Parking Network (RPnet). However, as the character's finer characteristics are lost, small-size images have a negative impact on recognition performance [7]. Another approach involved image Processing Techniques for plate detection and the OCR algorithm for text extraction. They got a success rate of around 85% in the extraction of the number plates and 80% in OCR. In the next work, the authors utilized a Faster-RCNN model for number plate detection. In that, the contrast operation was performed using Top-hat and Black- hat morphological transformations. They also performed character segmentation and recognition and utilized different optimization algorithms for recognizing the number plate [8].

Next, A region proposal network (RPN) was developed by Ren et al. to provide almost cost-free region proposals by sharing full-image convolutional features with the detection network. Fully convolutional networks that predict object limits and object scores at every place are known as RPNs. The RPN is trained from start to finish to provide high quality region suggestions, which Fast R-CNN uses for detection. They also combined Fast R-CNN and RPN into a single network by sharing their convolutional features—using the pretty popular concept of neural networks with 'attention' methods, the RPN component instructs the unified network on where to look [5]. Another research involved YOLOv3 for plate detection and OCR for image enhancement and recognition. However, their method achieved an accuracy of nearly 90% for number plate detection and 91.5% for number plate recognition [9].

In the next research, the authors combined YOLOv4 and contour methods for detecting and recognizing the number plates. However, the results achieved by the contour model are comparatively low when compared to existing methods. In another research, the authors compared two methodologies - YOLO and Traditional Image Processing for finding a suitable method for number plate detection. The accuracy, recall, and precision for the traditional image processing technique were found to be 72%, 0.92, 0.92 whereas for YOLO it was 90%, 0.91, and 0.92 respectively [10]

Some of the limitations observed in these papers are:

- Most of the images are of cars and not any other vehicle.
- Only vehicles with non-transporting number plates are used.
- Models which were used are outdated.
- Characters are detected wrongly such as 's' as 8 and 'o' as 0. The rest of this paper is organized as follows: Section III describes the proposed architecture while Section IV elaborates on the models used and Section V includes the discussion of obtained results. Section VI concludes the paper with possible scope for further investigations.

III. SYSTEM ARCHITECTURE

The initial stage of the project involved image collection and dataset preparation using a customized dataset. The data collection includes 1160 images that were captured while a car was moving through metropolitan traffic. These images were extracted from 50 distinct videos, each with a frame rate of 40 frames per second (FPS) and a duration of one second (1S). Additionally, the UFPR-ALPR dataset [11] was utilized, which consists of 4,500 completely annotated pictures taken by 150 vehicles in real-world situations. The model was trained with a custom dataset that included 5660 images drawn from both the collected images and the UFPR-ALPR dataset. The annotations in the datasets were converted into different formats depending on the deep learning models used. This dataset is then used to train the model and detect the number plate, given an image of the vehicle at different angles. This research utilized Faster RCNN and You Only Look Once (YOLO) models for detecting the number plate. Although both algorithms are reasonably good, YOLO surpasses Faster R-CNN in terms of accuracy, speed, and efficiency. YOLO is an end-to-end object detection model which predicts the bounding box and probability of each class and classifies the entire image at once. Finally, the coordinates of the number plate will be predicted. Now, this number plate will be extracted from the given image with the help of the coordinates predicted and a new dataset will be created that contains only the digits of the number plate, which will then be fed to the OCR for reading its digits.

1. *Image acquisition and Dataset preparation*

This step involves preparing a dataset composed of 1160 images of different types of vehicles, like cars, bikes, taxis, and army vehicles, with Indian license plate numbers and foreign number plates. To train the dataset on the YOLOv5 and Faster RCNN models, annotations were required for each image. These annotations provided the coordinates of the bounding box that the model needed to detect from an image. The LabelImg tool was used for this purpose, which is a graphical image annotation tool developed using Python and utilizing Qt for its graphical interface (version 0.92). The proposed framework is shown in Figure 1.

In this research, a new dataset was developed that includespictures of cars, heavy vehicles, and buses. A novel framework was proposed that combined YOLOv5 with a modified OCR model which can be trained end-to-end for number plate detection and recognition. Additionally, a comparison was made between the proposed model and a state-of-the-art model in the literature for the detection and recognition of number plates.

2. *Number Plate Detection*

YOLO (You Only Look Once) is a single-shot detection method that detects objects in an image in one go, rather than having to scan the image multiple times or in a sliding window fashion [12]. This makes it much faster than other object detection algorithms, although it may not be as accurate.

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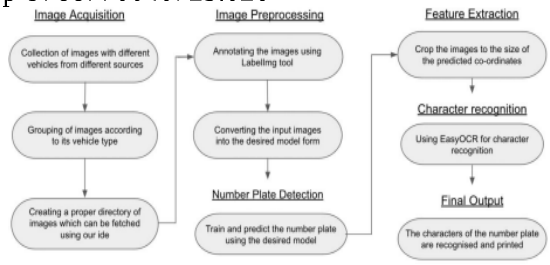

Fig1. System architecture

YOLO divides the input image into a grid of cells and predicts the presence of object-bounding boxes and class probabilities for each cell. If the center of an object falls into a cell, that cell is responsible for detecting that object. YOLO also uses anchor boxes, which are predefined bounding boxes of different aspect ratios, to improve detection accuracy. There have been several versions of YOLO released, with the latest being YOLOv5. YOLO has gained popularity due to its fast detection speed and good performance on a variety of object detection tasks.

3. Optical Character Recognition

OCR (Optical Character Recognition) is a technique that translates printed text into a digital version. The wide variety of typefaces and styles used to write a character in the printed image makes it difficult to recognize the letters. The image must be pre-processed before an OCR algorithm can be selected. The text is straightened, despeckled, and transformed from colour to binary image - an image with just two colours, black and white - in this stage. Following pre processing, the feature detection algorithm detects a character by studying the image's lines and strokes.

The recognition method then examines the character in its entirety and recognizes a textual line by searching for rows of white pixels separated by rows of black pixels. It can also determine where an individual character begins and finishes. It then transforms the character's picture into a binary matrix, where white pixels represent 0s and black pixels represent 1. It, using the distance formula, calculates the distance from the matrix's center to the farthest 1, and then draws a circle with that radius and divides it into moregranular pieces. Figure 2 shows the image character tobinary conversion.

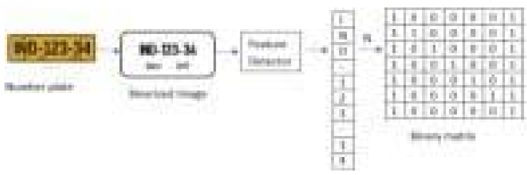

Fig 2. Image character to binary matrix conversion

At this stage, the OCR system will compare each subpart to a database that consists of matrices where each matrix represents a character in various typefaces to determine which character it has the most in common with statistically. Doing this for each line and character makes it simple to convert printed media to digital. Character recognition using feature extraction is shown in Figure 3.

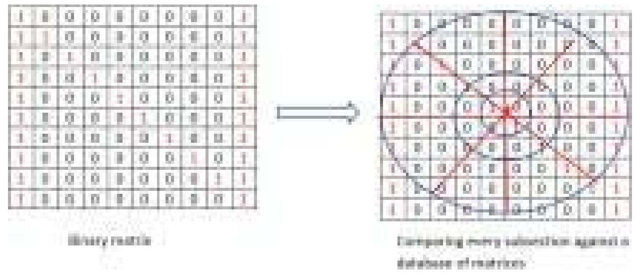

Fig 3. Character recognition using Feature extraction

IV. Models Used

A. Faster RCNN

Early in the 2010s, Ross Girshick and colleagues atMicrosoft Research created the object detection method known as R-CNN (Regions with Convolutional Neural Networks). R-CNN creates a set of features by taking an entire image as input and processing it through a CNN. The image is then categorised into one of several predetermined classes using these features. R-CNN uses a sliding window method, where it moves a window over the image and categorises each window, to find objects in the image. Given that running the CNN numerous times is required, this can be computationally expensive. [13].

R-CNN has been improved, and Fast R-CNN accelerates the object detection procedure. In order to create a set of features, a CNN is used to process a whole image as input. The image is then classified into one of a number of predetermined classes, and the bounding boxes for image objects are predicted using these attributes. Fast R-CNN avoids executing the CNN more than once by using a method known as region of interest (RoI) pooling, in contrast to R-CNN, which employs a sliding window approach. [4].

Faster R-CNN is a type of object detection algorithm and is an even faster version of Fast R-CNN. Feature Network, Region Proposal Network (RPN), and Detection Network are the three neural networks that make up Faster-RCNN. The Feature Network is an image categorization network that has already been trained, similar to VGG but lacking a few top/last layers. The form and structure of the original image are preserved in this network's output. RPNs are typically basic networks with three convolutional layers. Two layers—one is used for classification and the other one is used for bounding box regression—are fed from a common layer. As a result, a few bounding boxes known as ROIs are created. The RPN and Feature Network provide input to the Detection Network, which then uses that information to create a bounding box and the final class. It usually has four dense or completely linked layers. Two layers are stacked on top of one another that are common to both a classification layer and a bounding box regression layer. To make it easier to categorise only the contents of certain boundary boxes, the features are trimmed in line with those boxes. [5].

Faster R-CNN has a number of advantages over other object detection algorithms, but its speed in both training

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and inference is by far its biggest benefit. It is also accurate, making it a popular choice for object detection tasks. The prediction of the Number Plate by the Faster RCNN model is shown below in Figure 4.

Fig 4. Plate detection using Faster RCNN

B. YOLO (You Only Look Once)

YOLO primarily uses Computer Vision for object recognition and picture categorization and it divides animage into an NxN grid and extracts k bounding boxes from each grid. The network generates an offset value and class probability for each of the bounding boxes [12]. The bounding boxes are chosen and used to locate the object inside the image if their class probability is higher than a predetermined threshold value as shown in Figure 5. YOLO outperforms other object identification algorithms by orders of magnitude (45 frames per second). The YOLO algorithm's drawback is that it struggles to pick up minute details in the image. For instance, due to spatial restrictions, it might struggle to recognize a flock of birds.

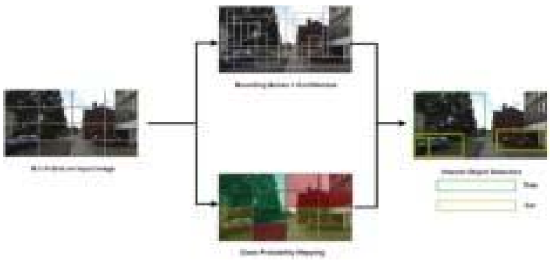

Fig 5. YOLO architecture

There are many versions of YOLO available, out of which YOLOv4 was considered the best real-time object detection algorithm on the standard MS COCO dataset as per the MAP benchmark. On the other hand, YOLOv5 which was introduced in 2020 has high speed, low volume, and high precision. In this research, YOLOv5 will be used to ensure high detection speed and accuracy. The backbone, detection head, and feature pyramid network are the three fundamental structures of the YOLOv5 network model. The feature pyramid network then gathers features from multiple scales and transfers them to the detection network after the backbone network extracts features from numerous images at various sizes. The object bounding box is the result of the detection network using the image features to forecast the item category in the image. [14]. Both YOLO and Faster RCNN require the annotations to be in a specific format so that they can be used as input. For YOLO, the bounding box coordinates of each image have to be in the format: class, x center, y center, width, and height. Each image has its corresponding annotations stored in a text file with the same name as the image file. For faster RCNN, the annotations for all images have to be stored in a text file, with each row containing: file path,x1,y1,x2,y2, and class name, which can be created by using the annotations obtained from LabelImg for YOLO. The prediction of the Number Plate by the YOLOv5 model is shown below in Figure 6.

Fig 6. Plate detection using Faster YOLOv5

C. OCR

OCR stands for Optical character recognition. It is a method that encodes the text that is present in visuals so that a machine can read it. For this purpose, Easy OCR was used. Easy OCR uses CRNN for character recognition. Feature extraction using Resnet, sequence labelling using LSTM, and decoding using CTC make up its three primary parts. The OCR analysis transforms the input, which is a digital image of printed or handwritten text, into a machine-readable digital text format. The digitised image is then broken up into smaller pieces by OCR, which performs analysis to look for text, words, or character blocks. After being further divided into components, these blocks of characters are then contrasted with a Character Dictionary. Figure 7 and 8 show the input image given and the output image detected by the YOLO model. Figure 9 shows the output extracted by the OCR model.

Fig 7. Input image given to Number Plate detector

Fig 8. Output from the Number Plate detector

Fig 9. The result given by OCR

V. Experimental Results

A comparison was made between the transfer learning methods used in this work and other deep learning methods such as Morphological methods [15], Projection Methods

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[16], and Feature salience methods [17]. As shown in Table 1, it can be concluded that not all the transfer learning methods are suitable for this type of problem, as only Yolo is performing well in terms of computing speed with a computing speed of 0.25s and an accuracy of 95%. On the other hand, Faster RCNN did not perform well in terms of accuracy but was still faster than the methods used in [15][16] and [17]. Table 1 shows the comparison of differentnumber plate detection algorithms with existing methods in the literature.

TABLE 1. COMPARISON OF DIFFERENT NUMBER PLATE DETECTION ALGORITHMS AND EXISTING METHODS IN THE LITERATURE

Algorithm	Accuracy	Computation time(in sec)
Morphological methods [15]	90%	0.60s
Projection methods[16]	89%	0.90s
Feature salience method [17]	93%	0.50s
Faster RCNN	86%	0.70s
YOLOv5	**95%**	**0.25s**

TABLE 2.COMPARISON OF DIFFERENT NUMBER PLATE RECOGNITION ALGORITHMS WITH EXISTING METHODS IN THE LITERATURE

Algorithm	Computation time(in sec)	Recognition rate(%)
i-novel [18]	471s	73.1%
Template matching [19]	1000s	93-94%
ANN using featureextraction [20]	75s	92.2%
YOLOv5+OCR	**75s**	**97%**

As shown in Table 2, the model, which is a combination of YOLO and Easy OCR, outperforms the other methods in terms of both computation time and recognition rate. Specifically, it has a computation time of 75s and a recognition rate of 97%, as compared to other methods such as those in references [18], [19], and [20]. Hence, from the above comparison of results, it can be concluded that the best accuracy for number plate detection was achieved using YOLOv5. By applying this model, the license plate of the vehicle can be localized to obtain its coordinates. Then, feature extraction is used to crop the image to the size of the coordinates of the number plate obtained from the earlier prediction so that it can be used as an input to the OCR. For number plate recognition EasyOCR is used which extracts the characters into a string format.

VI. CONCLUSION AND FUTURE WORK

The proposed research utilized YOLOv5 and OCR, to jointly train a network for number plate detection and recognition respectively. The proposed methodology outperformed a few other strategies that have already been published in the literature in terms of computation time and recognition rate. This framework can also be applied to smart traffic, which identifies license plates of vehicles that violate traffic laws, or to optimized parking, which keeps track of the vehicles parked. The advantage of the proposed approach is that it handles all types of license plates with different sizes and shapes. Although the proposed algorithm is efficient in detecting different types of Indian license plates, we also believe that the same model should be applied to other country vehicle databases to detect and extract the number plate effectively.

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Blockchain as a Service for Biometric Authentication

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Abstract— As technology continues to evolve and become more accessible, the need for improved security of data is at an all time high. Biometrics as a form of authentication have been around for quite some time now, but while the technique itself is fairly sound, the way it is implemented can be modified to enhance the system's security. This is where blockchain comes in. By integrating both these technologies, we can minimize the probability of biometric data being leaked or misused while also ensuring that authentication process goes on without any hiccups. Furthermore, offering it as a service will encourage many other services to opt for biometric authentication without having to worry about the security and integrity of the data being stored. By utilizing the concept of smart contracts in our project, we ensure that the project can handle dynamic data and also make sure that the essential conditions are met before the user can utilize our project to enhance the security of their websites. This project will be of immense value to a diverse set of people who need means of providing biometric security to their data but neither have the tools nor the resources to carry it out.

Keywords—Biometrics, blockchain, smart contracts,biometric security.

I. Introduction

Each and every task done by a human today has been taken over largely by technology. Physical devices like calculators, alarm clocks, maps, compass, etc have been integrated into a single smartphone. This is in a way good as the need for having separate things. But the minority people who have visual impairments find it very difficult to adapt to this technological shift. Also we do not tend to make our advancements friendly to use with for visually challenged people.

Biometric technology has become increasingly prevalent in the past few years. From the fingerprint scanners in our smartphones to iris and voice-based authentication.The technologyhasbecome the defactomeansfor authentication.But the storage of the biometric data has been overlooked by many parties, resulting in sensitive data beingstored in less secure manner. Such data falling into the wrong hands can result in disastrous consequences. This is where integrating blockchain and biometrics becomes a viable solution. The security offered by blockchain technology combined with biometrics can ensure that authentication process goes smoothly while also ensuring that the data itself is a lot more secure.

Biometrics as a Service is already implemented by various companies on different scales. Services such as anonymous face recognition exist, but the data is being stored on third-party cloud services offering SaaS solutions. The challenges of setting up and deploying cloud services have been extensively discussed in the literature. In a cloud computing environment, for example, it may be exceedingly challenging to ensure data privacy while providing quick and secure access, especially in a federated or multi-cloud scenario. Blockchain as a storage is a concept that has been implemented a few times, most popular being InterPlanetary File System (IPFS). All computer devices are intended to share the same file system using a distributed file system called IPFS. The founding objectives of the Web are somewhat comparable, however IPFS is more like a single BitTorrent swarm sharing Git objects.

Our system aims at providing a BlockchainAs A Service for Biometric Authentication (BAAS). The issue with current systems is that they are too complex for certain entities to take advantage of, or they ensure the verification part is secure and smooth, but falters when it comes to secure storage of the biometric data in the system. By utilizing blockchain technologies, we ensure that the biometric data does not get stored with a central entity. It enables web developers to integrate biometric authentication since the decentralisation is applied on the biometrics. It empowers the end users to store the biometric in one entity and use it for authentication anywhere. The block chain provides decentralisation and security for data. Thus the biometric data uploaded by the user remains untampered and unmodified.

II. Related Work

[1] The cost and performance tradeoffs that arise when utilizing public blockchain to store biometrics are analyzed and various techniques of storing the biometrics in a secure and efficient manner are deconstructed in this paper. Some of the techniques

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involved include the utilization of smart contracts, data hashing, merkle trees, convolutional neural networks. Storage requirements become very high, thus driving costs up. This is made even more complex by the fact that the value of ether is in constant fluctuation.

[2] A new protocol is put into use that increases the degree of encryption and is "blind," meaning it only shows the identification of a person and no other details about them or their biometric. To achieve this, SVM and neural networks to assign classifier parameters to specific biometric, and authentication is done w.r.t. to that encryption. Multiple communications between client and authentication server, loss in accuracy of biometrics, need for homomorphic encryption scheme increases complexity.

[3] The focus of this paper is to overcome limitations of traditional ballot based voting by uploading user data to the blockchain via smart contract and verifying iris to authenticate into the system. The system complexities are high, given that loss in accuracy of iris data, resulting in users not being authenticated into the system, low success rate due to noise while procuring data from user, variations in data resulting in inconsistencies are present.

[4] Recognition of fingerprint is performed by utilizing Bitmap image and images are converted into templates and then processed. The primary objective is to figure out how biometrics are stored in android device. Trusted Third Party Environment(TTE) is a key component of fingerprint processing in Android devices. The biometrics are encrypted and stored in the isolated environment. But there are chances that if the encrytion key is cracked, then the biometrics can be compromised.

[5] The goal is to implement a facial recognition system that performs face detection and recognition. The color intensity of the image is used for face detection and recognition. The recognition process is performed by implementing geometric features and template matching approaches. Factors such as brightness and contrast affect results, variations based on sensor quality.

[6] A system that eliminates the requirement for a central hub by allowing clients to handle template portions independently and conduct authentication chores on their own. This decentralised strategy makes strong authentication feasible while lowering the likelihood of single-point failures. The first sensor gathers the required biometric information, and then a biometric template is produced. The authenticator assesses if the input and enrolled templates are equivalent, while the administrator manages the registered templates. Each template fragment will be saved randomly selected nodes,not in all nodes.

[7] Despite various security measures being implemented, most of the data are stored in a centralized manner, which can lead to potentially disastrous consequences in the event that security is breached. The cornerstone of this paper is to implement decentralized cloud storage using blockchain technology. This is done by making use of techniques such as IPFS and smart contracts. The sizeof the file and the availability of peers affect how long it takes to upload files.

[8] A novel hybrid model pattern is used to increase the randomness based on the RFID and FingerVein pattern. Thus, they are much more recognisable. They secure the Fingervein and RFID of the patient information using an algorithm and stored in blockchain.

[9] It makes use of a permissioned blockchain technology. Access is necessary in order to join a permissioned blockchain and utilise its functionalities.

[10] It increases the reliability of the data by ensuring that files added to the distributed file system can be tracked and audited. The efficiency, traceability, and security of the IPFS and Ethereum networks are merged in this approach.

[11] A method that provides the iris templates with privacy as well as trust in the calculated output by combining BC technology with encryption. Using Paillier HE in SviaB ensures the privacy of iris templates.

[12] Mitigatation of the security issues prevalent in cloud services by integrating blockchain with the existing service models is done.

[13] A smart contract-based system architecture that combines a multimodal biometric identification system with a permissioned blockchain offers a better form of authentication.

[14] In fingerprint based biometric authentication, the fingerprint data is converted and processed into templates which are split into chunks and stored in the database. During recognition phase the fingerprint template is reconstructed from the broken template and matched.

[15] The major security challenge of blockchain is 51% attacks, where the attackers can rool back the transactions in the side chain and an also hide the information and tractions happening in the main chain. Eclipse attack in the block chain isolates a user from the block chain network, where a attack is performed on user level. The major cause is because a decentralised network does not allow many computers to simultaneously connected all the nodes.

[16] Using a touch-less fingerprint processing chain that reduces the error rate to 1% EER, touchless fingerprints may be compared to those gathered by touch-based fingerprint scanners. FIngerprint scanners work better than mobile fingerprint sensors because of controlled recording condition.

[17] Blockchain can be integrated with the Electronic Healthcare Records (EHRs) to distribute data across healthcare providers thus ensuring the integrity of data. It ensures unique identification of a patient’s records. It ensures security and privacy of healthcare that are exchanged between hospitals and Insurance firms.

[18] Blockchain based storage of EMR(Electronic Medical Records) ensures that the patients records are untampered. Ethereum based smart contracts are used

DOI: rp-9788770040723.027

for data retrieval and viewing permission between patient and the providers.

[19] Blockchain technology can be used in cloud computing to distribute data blocks across clusters of systems. Cloud based mining reduces mining time and at lowcost. Block chain based cloud can be used for payments,data access,etc.

[20] Blockchain Hashing technology can be used for encryption of the files stored in the cloud. The cipher keys are stored and managed in logs similar to ledger in the block chain. It eliminates the presence of the provider in ciphering the files in the cloud.

III. IDEATE

Utilizing biometrics as a method of authentication comes with a few limitations that make the technology in it’s current form susceptible to a series of issues. The following are some of the aforementioned issues.

Security risks: Biometric data is sensitive information and can be subject to hackers and data leaks if improperly safeguarded.

Privacy concerns: Storing biometric data raises privacy concerns as well as questions regarding possible identity theft.

Convenience: Users who do not want to share their biometric data or do not have access to the required technologies may find it difficult to save biometric data on a server.

Such issues are mitigated by the utilization of blockchain. Blockchain has key features that are well suited to tackle the issues we observed. Some of these are:

Security: Data saved on networks using blockchain technology are protected using sophisticated cryptography, making it difficult for hackers to access or alter the data.

Decentralization: Data is held among several network nodes rather than in a single central location in decentralisedblockchain networks, which makes it more difficult for a single point of failure to arise.

Transparency: On a blockchain network, all users may see the transparent, unchangeable ledger in which transactions are recorded.

Traceability: Every transaction that takes place on a blockchain network is documented, giving users access to a history of their data that may be used for a variety of purposes, including supply chain management and financial auditing.

Cost-effective: Blockchain technology can reduce costs by doing away with the need for middlemen.

Interoperability: Blockchain networks are capable of exchanging information with other networks and systems, facilitating data sharing and transaction execution across several platforms.

Self-executing smart contracts can automate processes and do away with the need for middlemen, and blockchain networks can make this easier to implement.

Another key aspect of our project is the integration of blockchain and cloud computing. This allows us to provide the project as a service on a wider scale and also handle the large compute power required by blockchain for the mining process. It also enables us to run multiple blockchains in order to store each chunk independently, thereby enhancing data security and integrity.

The advantages of implementing multiple blockchains inside cloud also include:

Flexibility: Using several blockchains allows a more adaptable and flexible storage solution because individual blockchains may be customised for different data kinds and use cases.

Scalability: Due to each blockchain's ability to function independently, scalability may be enhanced, allowing for the processing of more transactions and the storage of more data.

Interoperability: By utilising several blockchains, it might be able to link different blockchain networks and transfer data between them.

Security: By distributing the data among several blockchains, it can be made more challenging for hackers to access or tamper with the information held on the network.

Privacy: Different blockchains can be used to store different kinds of sensitive data, and access to the data may only be granted to those who are authorised.

Another important aspect of our project is the utilization of smart contracts. A smart contract is a self-executing contract with the terms of the agreement recorded in code. The code and the agreements it includes are present on the blockchain network. Automation of processes is made possible by smart contracts, which are frequently used to hasten, guarantee, and enforce contract negotiation and performance. Advantages of smart contracts include:

Automation: Smart contracts streamline operations by automatically carrying out the conditions of the agreement. This decreases the need for middlemen and boosts productivity.

Transparency: Smart contracts are transparent since all parties can see the contents of the agreement and how the contract was carried out because they are both stored on the blockchain network.

Trust: Because smart contracts are executed automatically and the terms of the agreement are recorded on the blockchain network, there is a potential for increased trust between the parties.

Security: Hackers find it challenging to tamper with the agreement or the contract's execution since smart contractsare secured by the blockchain network and the programming that makes up the contract.

Cost-effectiveness: Smart contracts can lower expenses related to middlemen and manual procedures.

Immutable: Once they are recorded on the blockchain network, smart contracts cannot be changed. This

DOI: rp-9788770040723.027

guarantees the validity of the arrangement and the proper performance of the contract.

Efficiency: Since smart contracts self-execute and don't require middlemen, they can speed up the execution of contracts and transactions.

Proposed system over existing system

Currently, blockchain data is kept in databases that the business may own or buy from third parties. Although though using databases to store data is the simplest option, using databases can sometimes cause problems. Databases are often centrally located and maintained by a single entity. They may therefore be more vulnerable to issues like various forms of centralised control and security breaches. This problem is fixed by the widespread adoption of decentralization in blockchain technology.

The fact that they are managed by a network of participants rather than a single institution reduces the negative effects of centralization. This applies to both private and public blockchains. The private blockchains are also decentralized but the number of people who are able to access the blockchain is heavily restricted.

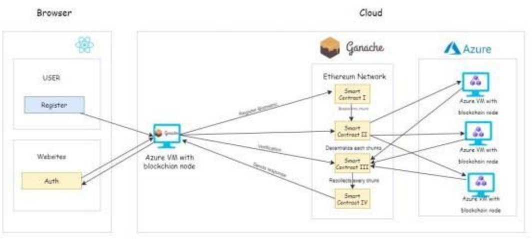
Data integrity issues have plagued databases for a long time. Integrity here refers to the accuracy and consistency of data over a period of time. If the data is not consistent, the system is not trustworthy and dependable. Data integrity in blockchain is ensured by the implementation of Merkle trees. It provides a way to both ensure integrity as well as verify the integrity of the data.

The client has access to the four operations, which are sometimes referred to as the CRUD operations (create, read, update, and delete) in conventional databases. A blockchain is not designed to function similarly to a database. The blockchain technology is related to read and write operations. As the complexity of the system increases, CRUD operations may introduce unnecessary complexity. Such issues are not prevelant in blockchain.

IV. System Design

The project aims at enhancing the security of biometric data by utilizing blockchain to store the data, thereby mitigating a majority of the safety and privacy concerns that exist across multiple alternative implementations of biometric authentication systems.

Architecture



This is the proposed architecture for the project. The system involves maintaining a private blockchain in cloud. Virtual Machines are used to decentralise and maintain the block chain. Biometrics are procured from the user and broken down into chunks. These chunks are decentralised using private block chain maintained across VMs. The developer will be able to integrate the system as service into their websites.

The processes can be divided into two modules. The first module consists of procurement of biometrics. The user registers with the service and enrolls their biometric for storage in the system. The fingerprint is sent to the virtual machine running in the cloud and pushed into the first smart contract, where the biometric is broken down into multiple chunks. These chunks are then pushed into separate blockchains that are isolated from one another and decentralized. This operation is carried out by the second smart contract.

The second module consists of verification and authentication of biometrics. When the fingerprint is required for verification, the client sends a request to the service for authenticating the fingerprint the third smart contract is invoked and fetches the chunks from the blockchain. The chunks are reconstructed into the whole fingerprint template in the fourth smart contract. This is then used to compare and authenticate the fingerprint received from the client for verification.

Smart Contract – 1

The Smart Contract – I takes a biometric template as input and returns encrypted and broken chunks of the biometric template. The broken chunks are given as input to the second smart contract

Smart Contract – 2

This smart contract distributes the data across the virtual machines in the Microsoft Azure cloud. A decentralised private network is maintained across the cloud VMs. Each VM maintains a copy of the blockchain. This smart contract takes each data chunks and stores it in the VM.

Smart Contract – 3

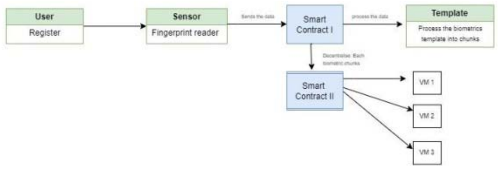
This smart contract fetches the biometric chunks from the VMs. The biometric template is reconstructed from the chunks. The chunks are retrieved based on its hash values. A DTH (Distributed Hash Table) maintains a mapping of the chunk's hash and its corresponding node's address that contains the data chunk. Once the chunks are retrieved the biometric template is reconstructed. The reconstruction is done based the order in which the chunks are stored in the DTH table.Thus the smart contract returns the stored biometric template.

Smart Contract – 4

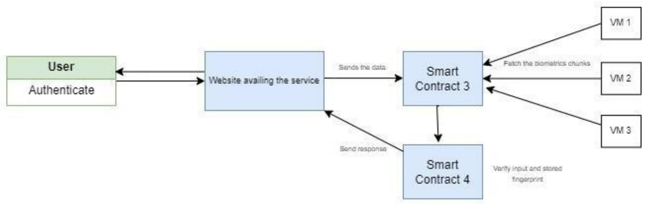
This smart contract accepts the user given biometric and the stored biometric template as input and verifies it. It compares the given biometric against the stored biometric. If the biometrics match then the user is authenticated and a success response is sent to the client. If the biometrics do not match, then the user is not authenticated and a failure reponse is sent back to the client.

DOI: rp-9788770040723.027

System Flow

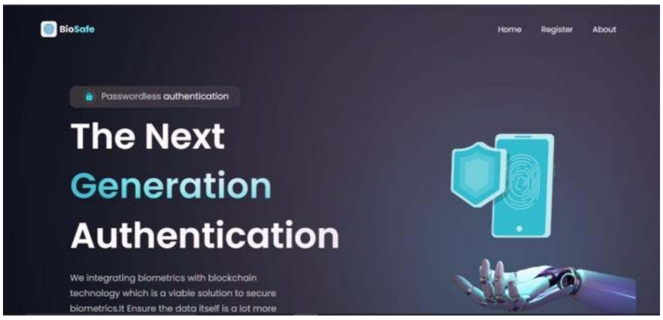


The above diagram showcases the flow of the first module. The user provides fingerprint for registration, and this is forwarded to the first smart contract where it is broken into chunks. Each chunk is then stored in a separate blockchain viathesecondsmartcontract.



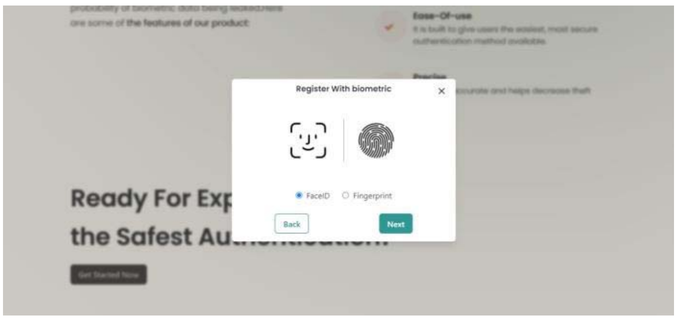
The above diagram showcases the flow of the second module. The client sends the fingerprint to be authenticated. The third smart contract fetches the chunks from the blockchains, and sends them to the fourth smart contract where the fingerprint is reconstructed and used for verification with the fingerprint that was received from the client.

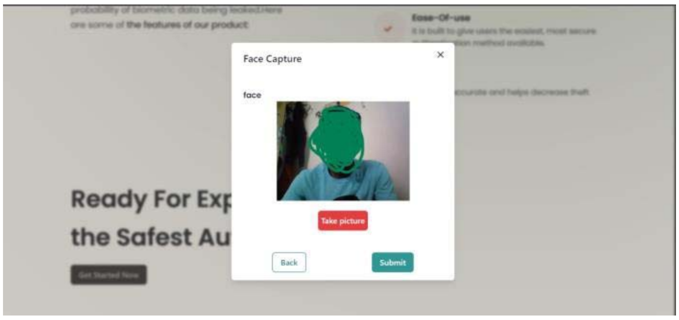
V. IMPLEMENTATION



The home page is where the user can sign up for availing the service by providing their biometric for storage.

After signing up, the user can upload their biometric to the system. The user has the choice between providing facial data or fingerprint data for storage in the blockchain.



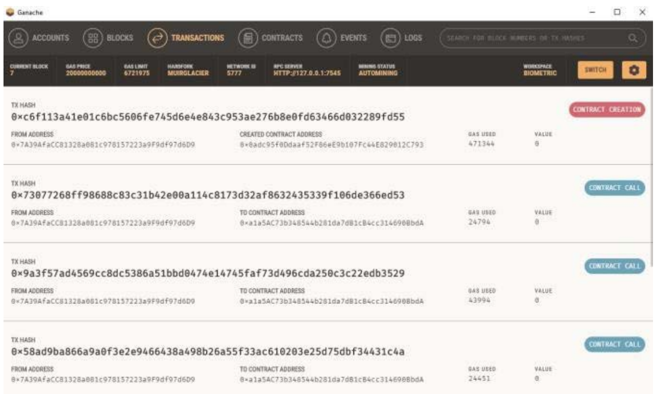


The data is initially supplied to the smart contract when a client delivers a request containing biometric information that has to be validated. A self-executing contract known as a "smart contract" is used to simplify, confirm, and enforce contract negotiations and execution.

As soon as the data enters the smart contract, it is divided into several pieces and stored on several blockchains. It is more challenging for hackers to access or tamper with the data stored on the network due to the decentralisation of data over numerous blockchains, which increases the security and resilience of the system.

Each time a new piece of data is sent, a new block is mined and the chunks are placed inside of it. We keep the data on the Ganacheblockchain, a local blockchain used for testing and development. Both the block's hash and the block that is currently forming are visible. This makes it possible for us to monitor and evaluate the veracity of the data stored on the blockchain.

By segmenting the data and storing it across several blockchains, we can improve the security and integrity of the data and make it more difficult for hackers to access or tamper with it. The Ganacheblockchain also allows us to monitor and verify the accuracy of data.



The biometric authentication system contains an authentication algorithm since it is crucial to the security and precision of the system. Our solution uses a Python-based authentication approach that is run on a Flask server and is created using cutting-edge machine learning algorithms.

DOI: rp-9788770040723.027

When a client wants to utilise the service to authenticate a biometric, they send us a request along with the necessary biometric information. These details are then sent to the server, where they are compared to the data stored on the blockchain. The information on the blockchain is called, put together again, and then compared to validate the user's identity.

A response is delivered to the customer following the conclusion of the verification procedure. The answer will be successful if the biometrics match; otherwise, it will be unsuccessful if the biometrics do not match. This procedure is essential for preserving the security and integrity of the system and for guaranteeing that only authorised users may access it.

VI. Conclusion and Future Work

This paper presented a new biometric authentication system providing a decentralized and distributed authentication based on blockchain. This improves the security and reliability of the existing biometric authentication systems by splitting a biometric template into fragments and managing them based on blockchain mechanism. By implementing both the storage and the authentication of the biometric under the same roof, we avoid the problem of having to send data via the Internet to third party services, which may result in data leakage, putting a huge number of people at jeopardy.

Combining numerous blockchains running on the cloud to construct a biometric authentication system can offer a flexible, scalable, and secure method for storing and managing biometric data. Different types of data can be stored on various blockchains that can be optimised for particular use cases thanks to the use of numerous blockchains. Data decentralisation across several blockchains can increase the system's security and resiliency by making it more challenging for hackers to access or alter the data stored on the network.

Future advancements could use the application of AI and machine learning techniques to enhance the accuracy of the authentication process and to spot and eradicate fraud. Additionally, biometric data can be stored more securelyand privatelyusing zero-knowledgeproofswhilemaintaining the data's opennessandtraceability. Additionally, smart contracts can be used to automatically grant access to the biometric data, ensuring that only those with the right authorization have access to the information. In the future, edge computing can also be integrated into the project. By processing data closer to its source and lowering latency, edge computing can be leveraged to enhance the system's performance and accessibility.

The utilisation of many blockchains operating in the cloud can provide a dependable and safe mechanism for managing biometric data, and this is a promising area for additional research and development.

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An Efficient Pre-Trained Classification of Brain Tumor with Convolutional Neural Networks

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***Abstract* —One of the deadliest malignancies in the world, brain tumors are caused by the brain's cells growing unnaturally. The stage at which the cancer is discovered affects the disease's survival rate. In order to increase the survival probability through effective treatment regimens, it is crucial to precisely identify the tumor area in the brain as well as the tumor type as initial as feasible. The use of magnetic resonance imaging of the patient as being among the primary methods for analysing the tumor is one of the most essential aspects of this process. The vast amount of data being created makes manual procedures ineffective and prone to classification errors. Performing a manual analysis of the magnetic resonance imaging (MRI) pictures might be difficult. As a result, there is a need for computerised methods to tumor diagnosis that are more accurate. Nevertheless, establishing their volume, form, boundaries, size, segmentation, and categorization continues to be a process that is fraught with difficulty. The study comprises two parts: first, an experimental exploration of brain MRI images that concentrates on specific features, and second, a comparative analysis of multiple transfer learning models based on convolutional neural networks (CNNs) for the purpose of classifying brain tumors. Using MRI images of the brain, it reveals how successful deep knowledge approaches may be in the detection of brain cancer. Performance is determined based on how accurately training and testing are carried out. In this instance, a numeric classifier is used, with the classifications no tumors and tumors. Using a range of methods integrating medicinal copy dispensation and artificial idea for improvement, division, and cataloging of brain finding, the goal of our research is to properly identify and categories brain tumors.**

Keywords—GBF, Otsu's Threshold method, GLCM, BWARD, CNN, VGG16, EfficientNetBO

I. Introduction

Brain tumors are regarded as a fatal condition that affects many people's lives worldwide. The World Health Organization (WHO) notes that in 2016, the tumors are classified as low-grade (LG) and high-grade (HG) glioblastomas and gliomatumors, respectively. A benign tumor, commonly referred to as a low-grade tumor, does not significantly harm surround healthy tissues. A malignant tumor, on the other hand, is the exact opposite of a benign tumor; in this case, the tumor cells directly cause the person's death and they are known as high-grade tumors. They are also quickly spread through the surrounding brain tissues. Thus, scanning techniques are castoff to detect tumor cells in the brain earlier in order to avert this fatal occurrence. Excellent resolution, complex soft tissue distinction, and improved contrast are only some of the MRI image processing technologies that may be used to cope with the features of the human brain. [4].

When it comes to monitoring oncologic treatment, one of the most important responsibilities is the accurate and morphological quantification of tumors Popular which the brain tumor is segmented after the MRI pictures have been analyzed. Several image segmentation techniques have been used to separate this malignancy.

Researchers have developed a variety of ways for identifying brain tumors, but because the brain is so complex, these methods still fall short in terms of accuracy. These essential factors served as our inspiration for doing this investigation[5]. The GBF filter is employed for pre-processing to improve the value of the brain image in instruction to get around these problems. These in-depth features can reveal information about the various tumor kinds and are very discriminative. The majority of cancers may now be found early on thanks to the development of scientific theories and imaging technology. This study investigates deep learning methods for MRI-based tumor applications[6].

The subsequent is a list among the most important contributions made by this suggested methodology:

- An upgraded guided bilateral filter (GBF) is used in the pre-processing period to reduce sound and blurring. A GLCM technique is also used to extract features.
- To choose the best features, the (BWARD) algorithm is presented.
- To effectively cluster data for the segmentation procedure, Otsu's Threshold approach is employed.
- In order to classify brain tumors as either normal, benign, or malignant with high accuracy, Convolutional Neural Network (CNN), VGG16, and EfficientNetB0 were utilized. The study is divided into five sections, beginning with a literature review in Section 2, followed by a description of the proposed method in Section 3. Section 4 presents the results and discusses their implications, while Section 5 provides a general conclusion.

II. Literature Review

In this literature, various number of sensor-based wearable health monitoring devices in machine learning with edge has been suggested. Several studies have been developed to use MRI scans to diagnose brain cancer. Many studies were studied, and the methodologies and datasets used were examined. Despite the fact that common datasets were used in numerous analyses, distinct results were

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obtained. The primary reason for this is because the parameters differ even when the same process is used. In one study, existing models were altered and theclassification technique was carried out. Greater accuracy rates were sought in this manner.

he creation of CAD tools for tumor grading using multiple medical imaging modalities is a burgeoning field of study.MRI is the research method of choice in this situation. The main stages involved in CAD tools are preprocessing, segmentation, feature extraction, and classification. Feature selection is a crucial aspect of these tools. AI techniques can be divided into two categories based on feature selection: Machine Learning (ML) and Deep Learning (DL). In classical ML models, features are manually defined and known as "handcrafted features". The characteristics are automatically extracted from the photos in the case of the DL approaches, however, during training. This is a summary of a few of the classic ML-based research for classifying brain tumors.

The image denoising becomes more costly and less reliable as the patient population and the quantity of data that has to be analysed each day continues to grow. A visual issue is presented to the spectator as a result of a number of different characteristics, including the form, dimensions, difference, and high changes with regard to the intensity of the tumor. This necessitates the development of a computer-aided diagnostic (CAD) system that may provide radiologists and medical professionals with further support [7].

It is possible for a computer assisted diagnosis (CAD) program to be an efficient tool that can readily categorise brain tumors, which may aid in successfully following a treatment protocol. The MRI pictures may be obtained from the MRI equipment by such a system as the initial stage in the process. In current history, a number of scientists have suggested and created a variety of automated classification techniques for brain tumors using MRI data. In 2013, Sach deva and colleagues created a computer-aided diagnosis (CAD) system that encompassed picture segmentation, the extraction of features, and the multiclass categorization of six different types of brain cancers. The total quality of classification was found to be 85% [8], which was determined by carrying out three separate tests deploying artificial neural networks.

Emre et al. classified benign and malignant tumors using a procedure called support vector machine (SVM), which is a machine learning approach. With an effectiveness of 91.49%, a sensitivity of 90.79%, and a specificity of 94.74%, this method was able to describe the brain tumors. [9].

The overlap index parameter and Jaccard coefficient are employed to compare the results with manually segmented ground truth ROI images derived from the original images. Praveen and Agrawal proposed a multistage method that involves image preparation processes, feature extraction using histogram and GLCM approaches, and classification using a random forest (RF) classifier. Prior to the categorization process, it is critical to extract relevant components from the available data. To isolate the tumor from segmented brain images, the authors utilized circularity and area characteristics. The authors achieved an average overlap of 72.9% when comparing their segmented images with ground truth images to verify their methodology. In contrast, deep learning, a type of machine learning that does not require the subjective extraction of features, was used to achieve an accuracy of 91.43% in this study.

The latest advancement in machine learning involves enabling computers to recognize the most significant characteristics that accurately capture the data. Deep neural networks, such as the Convolutional Neural Networks (CNN) and Fully Convolutional Networks (FCN), have emerged from thisconcept, which transforms feature-driven problems into data- driven ones. These deep neural networks have found applications in a wide range of areas.

They are specifically employed in medical image analysis as well as general image processing in today's society. Brain Tumor Imaging (BTI) has increased significantly during the past few decades. In particular, there has been a notable rise in the quantity of publications addressing the measurement of brain tumors using MRI scans. Differentiating between tumor-infected and healthy tissues is the goal of brain tumor segmentation (BTS).

The approach of pixel classification is utilized to address the segmentation problem in various brain tumor segmentation (BTS) applications, thereby converting the segmentation problem into a classification problem, ultimately leading to the successful segmentation of brain tumor images. The majority of the academics make use of the benchmark dataset known as Brats 2013. In subsequent years, a number of other categorization schemes for brain tumors based on CNN were presented. Meningiomas, Gliomas, and Pituitary Cancers Were Identified Using One Approach This specific system classified all three kinds of tumors, which resulted in a classification accuracy of 97.3% [12].

Following an assessment of existing systems, it was discovered that there are various research gaps that have yet to be filled. Because brain tumor categorization is one of the more challenging study topics, numerous successful strategies must be combined to generate superior prediction results. However, the time complexity is significantly increased, which decreases overall performance. One challenge is that complex models are computationally inefficient, and models require a substantial amount of input data to yield improved outcomes. To address all research gaps and achieve superior classification results, a new deep learning methodology is introduced in this study. By incorporating more distinct input features, the proposed approach achieves higher accuracy rates.

III. Methodology

The purpose of the future research is to improve the efficiency of the operation of traditional classifiers. These classification methods are useful for computer aided brain tumor identification and classification because they need minimum datasets for training as well as a reduced computational complexity of the algorithm. This makes it

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possible for the computer to identify and classify brain tumors.

When it comes to detection, we advise utilising a Convolutional Neural Network (CNN), namely VGG16 and EfficientNetB0. To differentiate between benign and malignant brain tumors, it is essential to determine the extent of the tumor-affected region. Otsu's threshold approach is initially applied during the segmentation process for MRI images. Gray-Level Co-Occurrence Matrix approaches (GLCM) are utilized for feature extraction, resulting in thirteen characteristics that can be utilized for classification (11). During the course of the present study project, we have investigated the studies of a number of different classifiers, such as CNN, VGG16, and EfficientNet Classifier. In general, it worked to improve performance by using traditional classifiers wherever possible. The functioning of the new implementation that has been suggested is shown in figure 1.

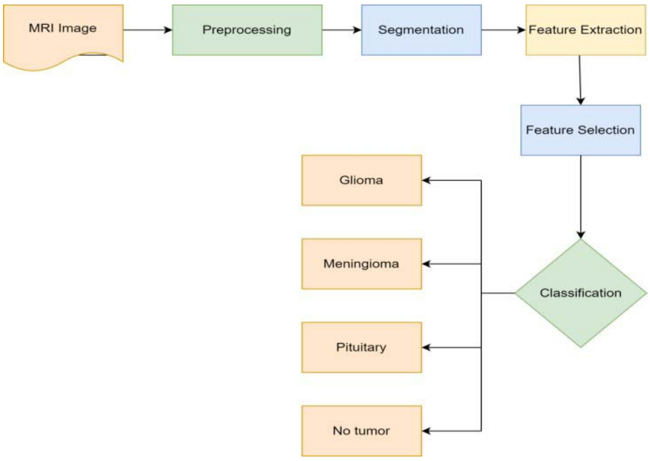

Fig. 1.Process Flow

3.1 *Pre-processing*

Several preprocessing techniques are used to decrease the impact of the noise and blurring. The multiple processes decide whether measurements are of greater quality. In the suggested approach, the GBF (Guided bilateral filter) is a technique used in image processing to enhance the visibility of certain features by removing noise and other unwanted frequencies in the image. It works by convolving the image with a Gaussian kernel, which acts as a filter to pass through only a certain range of frequencies, while attenuating others. This can be useful for tasks such as edge detection and feature extraction. The process of preprocessing an image using a GBF filter involves applying the filter to the image before performing any other image processing tasks.

3.2 *Segmentation*

Segmenting brain tumors using Otsu's thresholding method can be a useful technique. The following steps can be used:

1. Convert the MRI scan to a grayscale image.
2. Preprocess the image by removing noise and other unwanted artifacts using techniques such as Gaussian smoothing or median filtering.
3. Compute the histogram of the grayscale image and find the optimal threshold value using Otsu's method.
4. Apply the threshold value to the image by setting all pixels with an intensity value greater than or equal to the threshold to 255 (white) and all pixels with an intensity value less than the threshold to 0 (black). This creates a binary image with the tumor as white and the healthy brain tissue as black.

It is significant to note that Otsu's thresholding method may not be the best choice for all brain tumor images. It works best for images with bimodal histograms, where the brain tissue and tumor pixels have distinct intensity values. In cases where the histogram is not bimodal, other methods such as adaptive thresholding or region-based methods may be more suitable.

3.3 *Feature extraction using GLCM methods:*

The image processing technique known as GLCM (Gray- Level Co-occurrence Matrix) is used to extract texture information from a picture. The following steps can be used for feature extraction using GLCM methods in brain tumor images:

1. Convert the brain tumor MRI scan to a grayscale image.
2. The grayscale image can be partitioned into smaller regions of interest (ROIs), such as the tumor and the surrounding brain tissue.
3. For each ROI, compute the GLCM by counting the number of times different gray-level values appear in pairs in a specified spatial relationship (e.g., 0, 45, 90, or 135 degrees).
4. Extract texture features from the GLCM.
5. Compare the texture features of the tumor ROI to those of the surrounding brain tissue to identify any significant differences.
6. Utilize the extracted characteristics as input for a classifier, such as Support Vector Machine (SVM), to categorize the ROIs as either tumor or healthy brain tissue.

3.4 *Feature selection*

In the proposed framework, the fourth module involves feature selection, wherein significant characteristics are extracted while insignificant ones are discarded. The fundamental purpose of the feature selection process is to reduce the computational complexity overall by minimising the dimensionality problem. The suggested framework uses a hybrid optimization approach based on meta-heuristics to choose the best features. This paper suggests a new BWARD algorithm to choose the pertinent features and improve classification precision

3.5 *Classification*

3.5.1 *CNN-Based Architectures*

A CNN convolution layer is a kind of system that combines an image with several filters in order to generate feature maps. These feature plots are then sent on to the subsequent complication sheet in order to remove an additional high-level component from the input picture. Within the difficulty sheets, non-linearity equations, in

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conjunction with a down cast probability sampling, are used to accomplish the goals of adding non-linearity to the picture as well as reducing the image's complexity [13]

3.5.2 VGGNet

Some other CNN architecture that also was developed in 2014 was called VGGNet16. This design finished in second position in the competition on the basis of correctness, but it took the top spot in the ILSVRC. All completely linked layers use the ReLU activation function, while fully connected layers employ dropout regularisation.Compared to AlexNet and GoogleNet, the CNN model is computationally more expensive because of the high number of parameters.[13]

3.5.2 Efficient NetworkBO

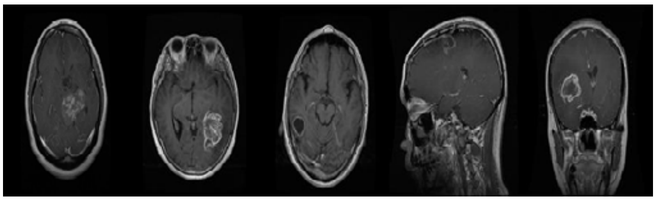
A technique for scaling CNN's depth, width, and resolution is called an efficient network. From EfficientNet-B0 through EfficientNet-7, there are eight categories in the Efficient network. To enhance the overall performance model, Efficient Network scales using a defined and consistent set of coefficients. An example of compound scaling from the baselinenetwork is shown in Figure 3.[14]

IV. Dataset Collection and Description

The Kaggle database's brain tumor dataset includes 2659 T1- weighted, contrast-enhanced pictures. The dataset includes three different kinds of brain tumors: glioma (927), meningioma (373), pituitary (926), and no tumor (433).The files were all saved in.jpg format. Table 1 and image 3 provide MRI dataset samples of glioma, meningioma, and pituitary tumors.

TABLE 1:Representation of MRI Dataset

	Glioma	**Meningioma**	**Pituitary Tumors**	**No Tumors**	**Total No. Of Samples**
Training samples	826	245	827	328	2226
Testing samples	101	128	99	105	433



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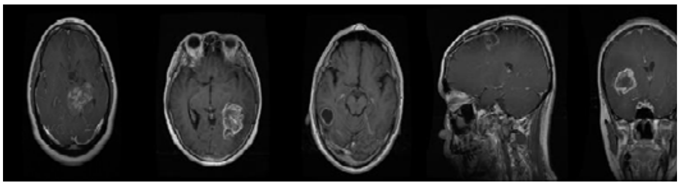

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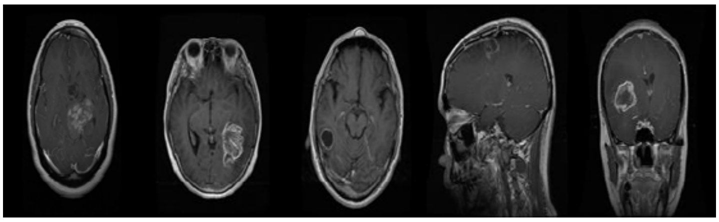

c

Figure 2. MRIDataset Samples of Glioma, Meningioma and Pituitary Tumour

V. Results and Discussion

Edge Metrics and evaluation of performance a classifier's performance can be assessed using a variety of defined performance indicators. The quality index that is most frequently employed is classification accuracy. The proportion of samples that were correctly classified to all samples of data is known as accuracy in classification. The following classification accuracy results were attained in our tests. On the training set, CNN achieves an accuracy of 99.38%, while on the testing set, it only achieves an accuracy of 73.35%. With VGG16, the training set accuracy is 84.75 percent, however the testing set accuracy is just 53.30 percent. For EfficientNetB0, the accurateness on working out set is 99.46%, but the correctness on testing set is 74.37%.

The data shows that using CNN, VGG16, EfficientNetBO to categories the deep CNN features results in better performance. Nevertheless, the dataset that was utilized for the classification issue that was being discussed is not consistent. Because of this, the recommended system has to be evaluated in a more comprehensive manner, making use of additional performance metrics. We made use of confusion matrices in order to assess the efficacy of the system we developed for classifying tumors.

Evaluation Metrics

The efficiency of the suggested system for classifying and detecting brain tumors is assessed by calculating assessment metrics based on the four primary outcomes that are employed and to calculate a test's accuracy, Using the following equations, we determine the total number of instances that were examined and the number of cases that yielded true positive and true negative results:

$$\text{Accuracy} \quad \frac{TP+FN}{TP+TN+FP+FN} \tag{1}$$

Sensitivity is a measurement of a system's capacity to properly categorise brain tumors. It is derived from the percentage of cases in which the diagnosis was correct by using the following relation:

$$\text{Sensitivity} = \frac{TP}{TP+FN} \tag{2}$$

DOI: rp-9788770040723.028

The capacity of the modeling to correctly identify the real kind of brain tumor is referred to as particular, and itmay be calculated as follows

$$\text{Specificity} = \frac{TN}{TN + FP} \tag{3}$$

Precision is the true positive measure and is computed using relation:

$$\text{Precision} = \frac{TP}{TP + FP} \tag{4}$$

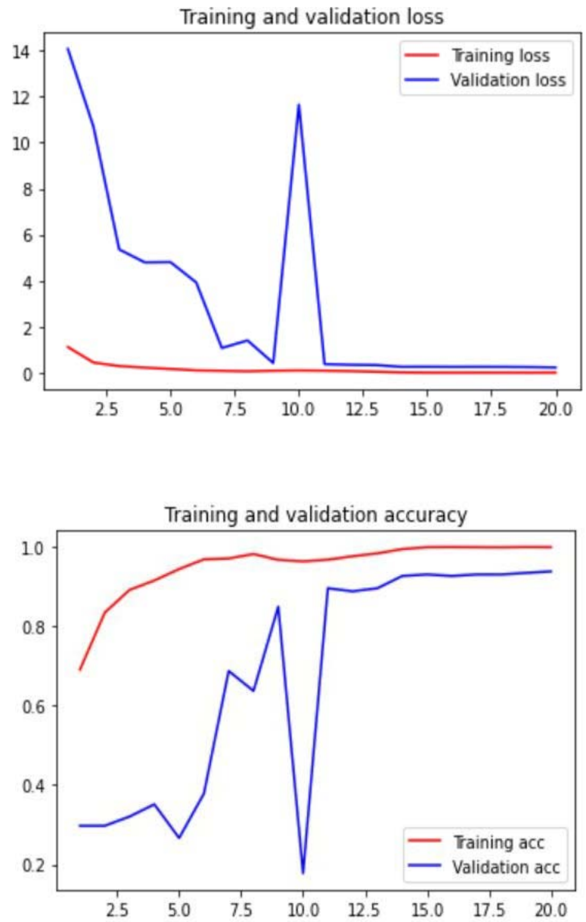

Figure 3.Validation accuracy and loss (CNN)

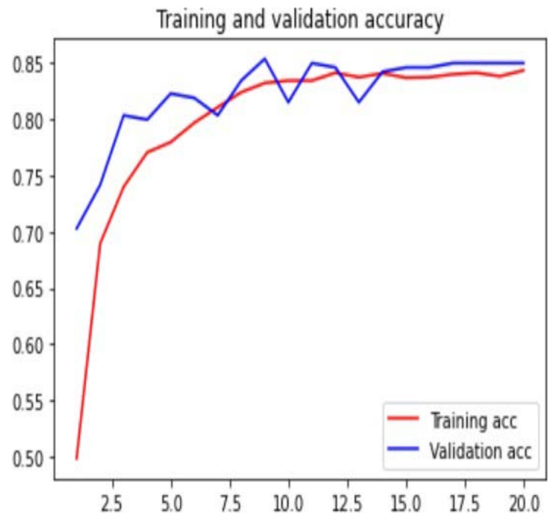

Figure 4.Validation accuracy and loss(VGG 16)

TABLE 2: CLASSIFICATION REPORT FOR CNN

	P	R	F1-score	support
0	0.76	0.16	0.26	100
1	0.76	0.95	0.84	115
2	0.65	0.99	0.78	105
3	0.87	0.81	0.84	74
Accuracy	-	-	0.73	394
Macro avg	0.76	0.73	0.68	394
Weightedavg	0.75	0.73	0.68	394

The effectiveness on the training collection for the VGG16 model is 84.75%, however the consistency on the validation set is just 53.30%.

TABLE 3: CLASSIFICATION REPORT FOR VGG 16

	P	R	F1-score	support
0	0.42	0.18	0.25	100
1	0.53	0.59	0.56	115
2	0.49	0.69	0.57	105
3	0.69	0.70	0.70	74
Accuracy	-	-	0.53	394
Macro avg	0.53	0.54	0.52	394
Weighted avg	0.52	0.53	0.51	394

The accuracy on the training set for EfficientNetB0 is 99.46%, whereas the effectiveness on the validation set is just 74.37%.

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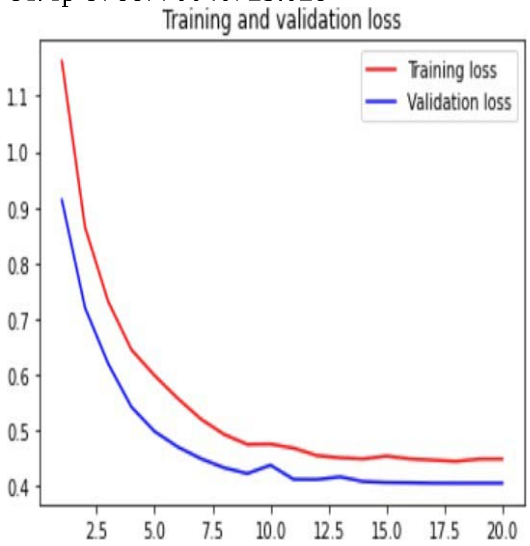

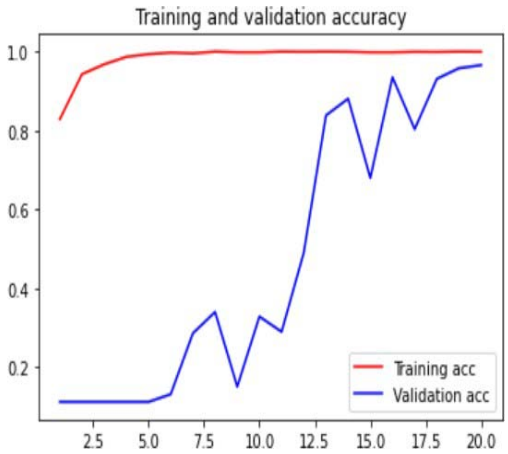

TABLE 4: CLASSIFICATION REPORT FOR EFFICIENTNETBO

	p	re	F1-score	support
0	0.96	0.27	0.42	100
1	0.72	0.97	0.82	115
2	0.65	1.00	0.79	105
3	1.00	0.68	0.81	74
Accuracy	-	-	0.74	394
Macro avg	0.83	0.73	0.71	393.5
Weightedavg	0.82	0.74	0.71	393.5

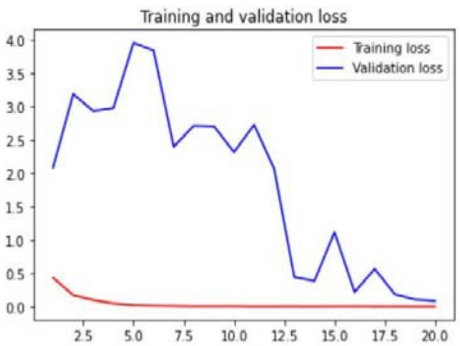

Fig 5.Validation accuracy and loss(EfficientNetBO)

By contrasting the suggested CNN classifier model with earlier neural network techniques, he model's efficacy was assessed. Table 1 displays the performance comparison. With a training accuracy of 99.85% and a testing accuracy of 78.93%, the recommended method outperforms the earlier developed methods.

TABLE 5. REASONABLE INVESTIGATION OF CLASSIFICATION ACCURACIES

Model	Train	Test
CNN	99.38%	73.35%
VGG16	84.75%	53.30%
EfficientNetBO	99.46%	74.37%

VI. CONCLUSION

The proposed study aims to develop an effective deep learning- based brain tumor classification model that provides accurate tumor categorization. The model consists of five primary modules: pre-processing, segmentation, feature extraction, feature selection, and classification. Initially, the MRI images are pre-processed using the GBF filtering approach, and then the tumor regions are extracted using the Otsusthresholding technique. Key texture and edge features are retrieved from the images using the GLCM technique, and the extracted features are reduced using the BWARD algorithm to address dimensionality concerns during classification. Finally, the proposed CNN model categorizes the input features into four categories: glioma, meningioma, no-tumor, or pituitary tumor. Through simulations, the model achieves an overall accuracy of 99.46% on the brain tumor MRI dataset.

In the future, new types of MRI images, such as multi-modal imaging, will be explored to provide more informative classifications. Furthermore, new and hybrid deep learning models will be investigated to deliver more accurate categorization results. In addition to brain tumor classification, there are several other crucial diseases in need of a classification model, and it is expected that these disorders will be prioritized in the near future to reduce mortality rates and improve treatment techniques.

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Machine Learning Methods for Balanced and Imbalanced Datasets to Predict Consumable Water

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***Abstract* – The paper details various machine learning techniquesto identify the best technique to predict consumable water. Being the most essential natural element, identifying drinkable water amidst the deteriorating qualities of drinkable water is yet a worrisome issue. The versatility of employing techniques and algorithms of machine learning in solving real-world problems proves to bring efficient results. This paper details a comparative study using algorithms like – Logistic Regression, Decision Trees (DT), Random Forest (RF), XGBoost, Gradient Descent, Support Vector Machine (SVM), AdaBoost, and k-Nearest Neighbours. The used dataset is self-developed with reference to water potability parameters. Originally 5000 data entries were provided as input. XGBoost outperforms other models in terms of identifying consumable water. It is worthwhile to note that algorithm's performance is validated as best when it provides equal importance to both majority and minority classes. Thus, Synthetic Minority Oversampling technique (SMOTE) and Adaptive synthetic sampling approach (ADASYN) were employed to conclude and accurately identify for the best technique. XGBoost pertaining to SMOTE outperformed other techniques and was the best model to predict water potability.**

Keywords* – *Machine learning algorithms, ADASYN, SMOTE, XGBoost

I. INTRODUCTION

Water is indispensable for life to exist. One of the most jeopardizing issues that needs to address is identifying consumable water. According to UNICEF and WHO, 2.1 billion people worldwide lack access to safe drinking water. Adverse effects impacting every sector and aspect of life, including the vulnerability to water-borne diseases, are certain by consuming unclean or unsafe water.

Consumable water is expected to be free from pathogens that are harmful as well as from toxic chemicals. Contaminated water could be both natural and man-made. Naturally contaminated refers to those water bodies in which certain elements like fluoride, chloride, etc., have been found slightly more than the accepted level, whereas man-made contamination due primarily due to water pollution that is either by dumping waste into water bodies or by dumping chemicals from factories. Water quality is defined by various factors:

(1) Physical parameters: color, taste and odor, temperatures:
 1.1. Color of water results from form the dissolved organic substances
 1.2. Taste and odor are due to inorganic salts and dissolved organic components & gases
 1.3. Temperatures are usually typical for safe drinking water. Fluctuations in temperatures may be due to the presence of harmful chemicals and substances

(2) Turbidity:Suspended materials in water determine the turbidity levels of water. It is the amount of solid matter present in suspended form.

(3) Chemical parameters include BOD (biological oxygen demand), COD (chemical oxygen demand), etc. Amount of arsenic level (As), chloride (Cl^-), fluoride (F^-), zinc (Zn), iron (Fe), manganese (Mn), and other toxic substances also play a significant role in determining whether or not water is safe.

(4) Biological parameters like disease-causing organisms

(5) pH levels:The alkalinity of water is determined using pH levels. It is a logarithmic measure from 0 to 14 pH scale. The scale is divided into two sections – acidic and basic. Any value from 0 to 7 represents acidic nature, and any value above 7 represents basic nature. As per WHO standards, the permissible limit of pH for pure water is from 6.5 to 8.5. Any other value is considered impure in the case of water.

(6) Hardness:Calcium and magnesium salts cause water hardness.

(7) Total dissolved solids:Mineralized water consists of a high TDS value. However, the maximum limit for TDS ranges from 500 mg/l to 1000 mg/l for drinking purposes.

(8) Total Organic Carbon

(9) Conductivity:As per WHO standards, water conductivity must not exceed 400µS/cm.

(10) Other components like Trihalomethanes can be present only up to 80ppm.

The collected dataset considers pH, hardness, concentration of molecules, chloride level, sulphate levels, conductivity, TOC levels, amount of trihalomethanes, turbidity, and potability as its attributes. Machine learning serves to provide powerful tools and algorithms that can be used to bring efficient results to tackle real-world problems. For this problem statement, algorithms, namely - Logistic Regression, Decision Trees, Random Forest, XGBoost, Gradient Descent, Support Vector Machine

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(SVM), AdaBoost, and k- Nearest Neighbours, were used.I. LITERATURE SURVEY

In [1], the authors employed a SVM, Group Method of Data Handling (GMDH), and ANN in order to determine the quality of water of the river Tireh. It was found that the performance of GMDH was not satisfactory, and thus ANN and SVM were more suitable for predicting the quality. It was also noted that the Tansig transfer function and RBF kernel functions gave the best performance. Considering DDR index values, SVM was evaluated to have a lower value and, therefore, was found to be the most accurate of the three models [1]. Authors of [2] used ANN with a nonlinear autoregressive time series model to develop a complete framework for efficient prediction and analysis. Scaled conjugate gradient and log sigmoid was used for the training algorithm. Chlorophyll, specific conductance, dissolved oxygen, and turbidity were primarily considered as the determining factors by them. Results concluded that ANN- NAR proves to be a reliable method to identify the potability of water [2].

The primary aim was to employ Breiman's random forests and validate the results. It was also found that random forest techniques were also effective in solving this problem [3]. Random forest, deep neural network, gaussian naïve bayes, artificial neural network, and data distribution analysis were used to tackle the issue. The algorithms performed well wither maximum testing accuracy corresponding to ANN with 98.12%. The author of [4] was able to arrive at a conclusion that a total of 89.71% of water was found to be safe for drinking purposes [4]. In this paper [5], a decision tree and k- Nearest neighbour were used to estimate the water quality class. The models were optimized, and hyperparameter tuning was performed. The model's accuracy was once again validated. The k-nearest neighbour was identified to be better than the decision tree, with accuracy scores of 61.7% and 58.5%, respectively [5].

The author of paper [6], employed used (1) stratified sampling and wavelet de-noising ANFIS Model, (2) Fuzzy models and time series analysis, and (3) integrating ANFIS model with intelligence algorithms like – genetic algorithm and particle swarm algorithm. In the first algorithm, TDS, sulphate, chloride, and fluoride were the primary inputparameters since they have higher correlation values with electric conductivity. This algorithm was used to predict EC. WT-ANFIS model trained with a stratified sampling strategy was found to perform better than MLR, ANNs, ANFIS, and EANFIS. In the second algorithm - fuzzy and time series analysis also stratified sampling strategy was employed. With parameter EC in BB, FTS was able to predict well. For the third case, a comparison was made between ANFIS, ANFIS- GA, and ANFIS-PSO, that is, ANFIS integrated with intelligent algorithms. ANFIS-PSO was identified to outperform the other two cases [6].

Supervised machine learning approaches- support vector regression and extreme gradient boost (XGBoost). The algorithms were provided with big data. Both algorithms predicted well for temperature parameters. SVR was able to perform well even for dissolved oxygen. In the case of turbidity, the prediction by the two algorithms had more than 5% variation. However, cyanobacteria and fDOM had large variations. Other parameters didn't show much variation. Thus, considering these three factors to determine the better of the two, the authors identified SVR to be better than XGBoost for this model [7]. Authors of the paper [12] considered temperature, turbidity, pH, and TDS (total dissolved oxygen) as input, to apply to supervised ML approaches. It was found that gradient descent with a learning rate of 0.01 and polynomial regression with degree 2 performed better than other models [12]. Thus, it was also noted that PCA with SVR was performing better [15].

In this paper [8], the authors integrated IoT and performed real-time water quality checks using machine learning. The idea was to analyse the data using sensor inputs from lakes in rural locations and use k means for the process. Arduino UNO and Raspberry Pi embedded devices were used to validate the same. The sensor inputs were given to the pi4 edge-level processor, where k-means were used to predict the quality. The predicted values were then stored in a cloud server for future access. Thus, water could be monitored using IoT techniques without any human interference [8]. A similar approach was used by the authors of the paper [14], where Arduino was interfaced with the ZigBee handset, which detected low- quality water [14]. Synthetic minority oversampling technique and explainable AI were used in the paper [9] to predict the water potability prediction model. Oversampling was performed using Synthetic Minority Oversampling Technique (SMOTE). Therefore, replication of minority classes is performed in oversampling. As a result, the authors were able to replicate the data as 1998 for both not portable and portable after oversampling, from 1998 not portable and 1278 portable data, respectively. Later machine learning approach is applied to validate the results. Radom forest was found to outperform other models [9]. DT, RF, and MLP methods were employed for air quality with the same approach as that of the water quality case [13].

WQI was evaluated for Ebinur Lake Watershed using ML and remote spectral indices via fractional derivatives methods. The model pertaining to a spectral index of 1.60 was found to perform better than other models. The proposed models were GA-SVR and band difference algorithms [10]. In paper [11], the authors identified that the most commonly used machine learning approaches were ANN, RF, SVM, regression cubist, genetic programming, and DT. It was found that Chlorophyll- a, temperature, suspended solids, colored dissolved organic matter, salinity, and turbidity were the commonly used determining factors for the problem statement. 138 samples of water from Agastheeswaram, Tamil Nadu, were collected pre- and post-monsoon by the authors of the paper [17] to predict groundwater quality. Off DT, KNN, and SVM used, SVM was found to achieve better results [17]. Apart from these models, a fuzzy system was used to classify water into five different groups. Water from three lakes from Hosur, Tamil Nadu was collected, and the classification was computed [18].

III. PROPOSED SOLUTION WORKFLOW

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The primary objective was to perform a comparative study that validates the potability by analysing various algorithms.First, the dataset is thoroughly studied by performing data visualisation and exploratory data analysis (EDA). Then thefollowing three stages are computed to identify the best algorithm.

Stage 1: Analysing models without oversampling - At this stage, the original dataset is fed to the models, and the performance is analysed. Initially, a total of 5000 inputs were given to the model with the attribute values - pH, hardness, the concentration of molecules, chloride level, sulphate levels, conductivity, TOC levels, amount of trihalomethanes, turbidity, and potability. The values were randomly generated in Excel considering WHO standards. Logistic Regression, DT, RF, XGBoost, Gradient Descent, SVM, AdaBoost, and k- Nearest Neighbours were used, and the accurate algorithm was identified.

Further investigation was done by performing oversampling. Oversampling is done to reduce the possibility of ignoring minority classes by machine learning when unbalanced data is fed to the model requirement [9]. Thus, ML algorithms tend to be biased toward the majority class. Since potable data was found to be a minority class and is the criterion of interest. It was necessary to balance the data to get accurate and unbalanced results. Two techniques – the Synthetic Minority Oversampling technique (SMOTE) and the Adaptive synthetic sampling approach (ADASYN) were used with the same algorithms to conclude for the best technique.

Stage 2: ADASYN approach is used to balance datasets by adaptively generating minority data samples that are based on their distributions [16]. The advantage of using ADASYN is that it can shift the classifier's decision boundary to focus on- difficult to learn aspects, which allows the algorithm to improve its learning performance.

Stage 3: SMOTE works by analysing and identifying adjacent instances in feature space. A line is drawn to link them and to generate a new sample positioned at that line. By doing so, new data is replicated, and oversampling is successfully achieved.

Finally, a comparative study was computed to determine the best algorithm.

IV. Algorithms Used

A. *Logistic Regression*

Logistic Regression used in both classification and regression cases, is a statistical model that estimates the probability of the occurrence of an event. Logit transformation is applied on the odds whose function is given by:

$$log(\pi) = \frac{1}{1+e-\pi} \qquad (1)$$

It is a supervised learning technique for predicting categorically dependent variables using the provided set of independent variables.

B. *Decision Tree*

The decision tree - a supervised learning non-parametric algorithm used for both classification and regression problems is based on trees that consist of features like root node, leaf nodes, branches, and internal nodes. In order to identify optimal split points, decision tree employs a divide and conquers strategy by greedy search.

C. *Random Forest*

In this learning approach, ensemble learning is used that solves complicated problems by several classifiers. This technique is also employed for classification and regression purposes. Random forest is made up of many decision trees. The outcome is determined based on the prediction made by the decision trees. As the number of trees grows, the precision of the result also increases. It is primarily used to address the shortcomings of the decision tree method.

D. *XGBoost*

XGBoost is a machine-learning toolkit for distributed gradient boosting. It has been optimised for: (1) efficiency, (2) portability, and (3) flexibility. It is a parallel tree boosting algorithm that solves problems quickly and accurately. It is also a supervised learning technique to accurately predicttarget variables by combining weaker models. A depth of 8 was considered.

E. *K-Neighbors*

K-Neighbors or KNN is a supervised learning non-parametric algorithm that uses similarities between new and available cases and places a new case into a category that is closest to one of the available cases. KNN is also used to solve both classification and regression cases. It uses Euclidian distance (equation 2) as the determining distance metric criterion.

$$d(x, y) = \sqrt{\sum_{i=1}^{n} \ (yi - xi)^2} \qquad (2)$$

Nine nearest neighbors were considered, with leaf size as 20 for the comparative study.

F. *SVM*

SVM is a supervised learning algorithm that uses a decision plane and boundaries. A decision plane divides groups of data points into several classes. Therefore, in an n-dimensional space, the input data is viewed as two sets of vectors. SVM has several kernels like (1) Linear, (2) Polynomial, (3) Gaussian, (4) ANOVA, (5) RBF – Gaussian Radial Basis Function, and (6) Sigmoid. To compute the comparative study, RBF kernel was used since the results pertaining to RBF had better accuracy than other kernels.

G. *AdaBoost*

AdaBoost or adaptive boosting is a statistical meta-algorithm used for classification purposes. It is an ensemble technique used to solve complicated problems by combining weaker classifiers and building a stronger one. In AdaBoost, weaker ones are termed as decision stumps that denote decision trees with a single split. AdaBoost classifier with a learning rate of 0.002 was used.

H. *Gradient Descent*

Gradient boosting is an optimization technique. It is used to find the global minimum of a given function.

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However, it applies mainly in cases with few local minima. Gradient boosting with a learning rate of 0.05 and a maximum depth of 5 was used.

V. METHODOLOGY

Data visualization is presenting data in graphical or pictorial form. Heat maps are widely used in order to represent correlation matrix graphically. Correlation is a statistical metric to represent the relationship between two variables and ranges from -1 to +1. Figure 1 indicates a heat map of the given attributes. Considering values as $xi$and $yi$and mean values as X and Y, the correlation value is calculated as:

$$correlation = \frac{\sum(xi-X)(yi-Y)}{\sqrt{\sum(xi-X)2(yi-Y)2}} \qquad (3)$$

EDA is a sophisticated method for examining datasets to highlight key features often associated with visual methods. It provides valuable information that could be used in scientific research and visualizations. Box plots are plotted to identify outliers. Figure 2 represents a distplot that is used to plot univariate data distribution against density distribution.

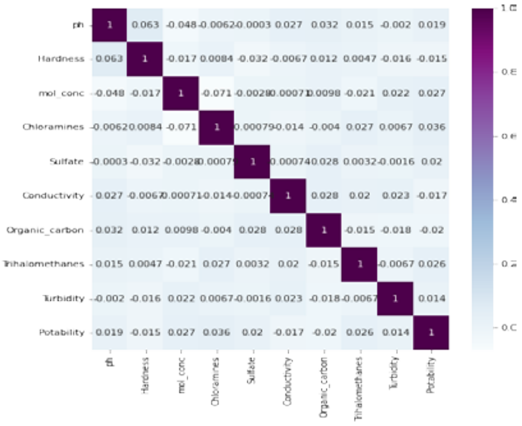

Fig.1. Heatmap representing correlation between attributes

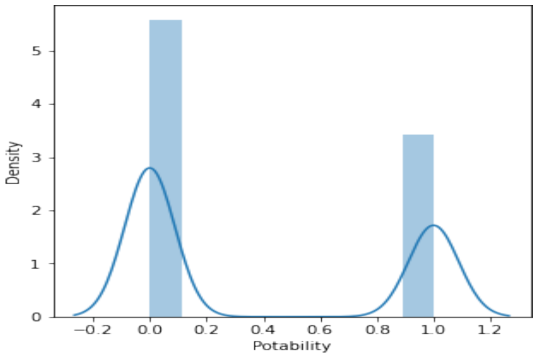

Fig.2. Distplot of potabilityvs density distribution

Observations from the dataset fed to the system is analysed as follows: in Figure 3, the blue box plot corresponds to non-potable. The minimum and maximum values found in the dataset were 1.2 and 14. However, the lower and upper fences were considered as 2.175578 and 13.10774. Thus, any value below and above the lower and upper ranges were treated as outliers. The median for the non-potable case was 7.848005, whereas q1 and q3 were 6.317914 and 9.093132, respectively. Similarly, the red box plot corresponds to potable. Here, the lower and upper ranges were 3.738116 and 12.10508. The median for the potable case was 8.004796, whereas q1 and q3 values were 6.677912 and 8.944125, respectively. Figure 4 is a box plot with respect to the hardness of water and potability. The blue plot box in figure 6 corresponds to the non-potable. The minimum and maximum entries received were 50.0006 and 354.2365, respectively. Any value other than this range was treated as an outlier. The lower and upper fence values were 168.9892 and 325.8871. The median for this case was 247.5177, whereas q1 and q3 values were 227.5106 and 267.0189. The red box plot corresponds to potable. Here, the values of the lower and upper fence are 161.4792 and 328.62, respectively. The median for the potable case was 247.3163, whereas q1 and q3 values were 224.6147 and 266.7835. It is worthwhile to note that as per WHO standards, the permissible pH value for pure water was between 6.5 and 9, while hardness limitations are in the range of 200-300mg/L.

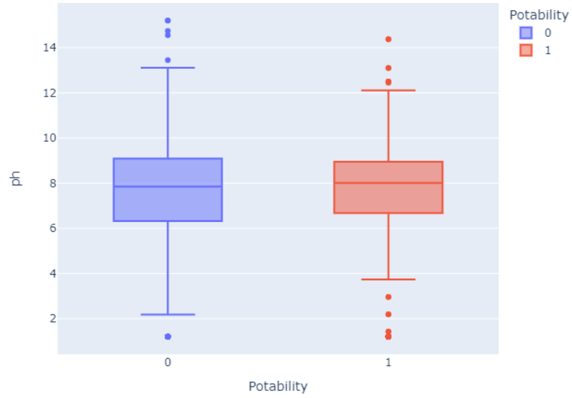

Fig. 3. pH box plot (Blue Box plot – non potable, Red Box plot – potable)

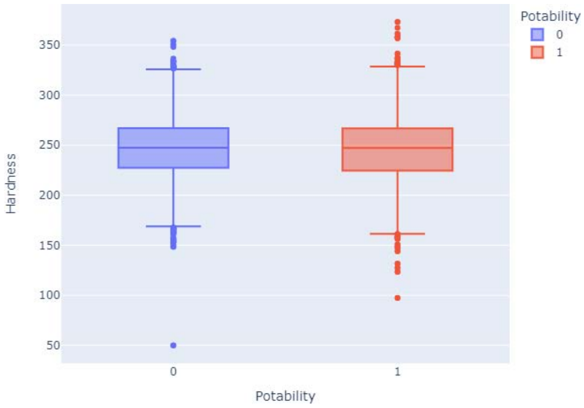

Fig.4. Hardness box plot (Blue Box plot – non potable, Red Box plot – potable)

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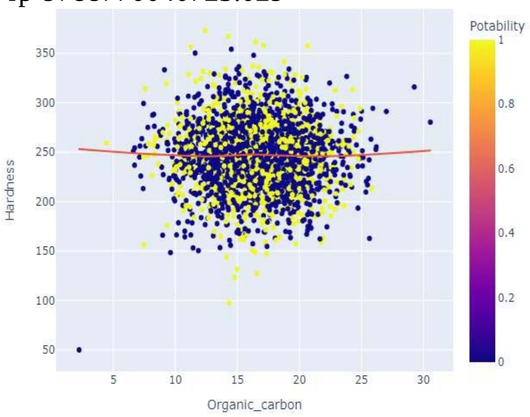

Fig.5. Hardness and Organic Carbon as determining factors to identify potability

Water contamination or determining factors could be due to two attributes, for such cases, a scatter plot corresponding to two determining factors (Figure 5) was implemented.

Considering input parameters such as pH, hardness, the concentration of molecules, chloride level, sulphate levels, conductivity, TOC levels, amount of trihalomethanes, and turbidity. Then, a feature scaling technique called Standard Scaler is applied to x. This standardizes data into a standard format that is that mean of the data to zero and standard deviation to one. Standard scaler performs an operation on the dataset as mentioned in equation 4 where xi represents values and X is mean. Later, a train test split is performed, and the models are trained and validated.

$$standardscaler = \frac{(xi - X)}{standarddeviation} \quad (4)$$

Potability represents whether or not water is drinkable. The value of potability is binary – 0 and 1. For the given conditions, if the value corresponds to 0, that indicates that water does not fall under the drinkable category. A value of 1 indicates that the water is consumable and safe. Initially, out of the 5000 entries, 62%-38% was the distribution of potability in the dataset. After ADASYN and SMOTE, a total of 6196 and 6206 entries, respectively, were used for model training. Table 1 summarises the distribution.

TABLE 1: SUMMARY OF DATA ENTRIES

Name	Total	X_train	X_test	Y_train	Y_test
Before Oversampling	5000	3350	1650	3350	1650
ADASYN	6196	4192	2004	4192	2004
SMOTE	6206	4156	2050	4156	2050

VI. RESULTS AND DISCUSSION

To validate accuracy precision, recall, and f1-scores are analysed. The accuracy of an algorithm is the score that corresponds to the number of correct predictions to all predictions. It is given by:

$$accuracyscore = \frac{TP+TN}{TP+TN+FP+FN} \quad (5)$$

The precision determines how many predictions (positive) are correctly made. This is a measure of true positive given by:

$$precision = \frac{TP}{TP+FP} \quad (6)$$

The recall is also referred to as sensitivity checks for correctly predicted cases over the entire positive cases in the data. It is given by:

$$\text{recall} = \frac{TP}{TP+FN} \quad (7)$$

F1-score is given by: $f1 - score = 2 * \frac{precision*recall}{precision+recall}$ (8)

TABLE 2: COMPARISON OF PRECISION RECALL F1-SCORE AND ACCURACY VALUES BEFORE OVERSAMPLING

ALGORITHM	**BEFORE OVERSAMPLING 0- non-potable, 1 - potable**						
	Precision		**Recall**		**F1-Score**		**Accuracy**
	0	**1**	**0**	**1**	**0**	**1**	
Logistic Regression	0.62	1.00	1.00	0.00	0.76	0.00	61.69%
Decision Tree	0.67	0.53	0.79	0.39	0.73	0.45	63.33%
Random Forest	0.62	0.00	1.00	0.00	0.76	0.00	61.63%
XGBoost	**0.76**	**0.84**	**0.94**	**0.51**	**0.84**	**0.64**	**77.51%**
k-Neighbors	0.69	0.58	0.81	0.42	0.74	0.48	65.87%
SVM	0.66	0.75	0.96	0.21	0.78	0.33	67.03%
AdaBoost	0.62	0.00	1.00	0.00	0.76	0.00	61.63%
Gradient Descent	0.66	0.84	0.98	0.20	0.79	0.33	67.93%

TABLE 3: COMPARISON OF PRECISION RECALL F1-SCORE AND ACCURACY VALUES AFTER OVERSAMPLING

ALGORITHM	**AFTER OVERSAMPLING 0- non-potable, 1 - potable**													
	ADASYN							**SMOTE**						
	Precision		**Recall**		**F1-Score**		**Accuracy**	**Precision**		**Recall**		**F1-Score**		**Accuracy**
	0	**1**	**0**	**1**	**0**	**1**		**0**	**1**	**0**	**1**	**0**	**1**	
Logistic Regression	0.52	0.52	0.51	0.52	0.51	0.52	51.59%	0.52	0.52	0.50	0.53	0.51	0.52	51.60%
Decision Tree	0.66	0.54	0.27	0.86	0.38	0.66	56.53%	0.55	0.65	0.84	0.31	0.66	0.42	57.31%
Random Forest	0.54	0.55	0.58	0.51	0.56	0.53	54.74%	0.50	0.00	1.00	0.00	0.67	0.00	50.00%
XGBoost	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**77.29%**	**0.80**	**0.81**	**0.81**	**0.80**	**0.80**	**0.80**	**80.34%**
k-Neighbors	0.00	0.50	0.00	1.00	0.00	0.67	50.00%	0.63	0.62	0.61	0.64	0.62	0.63	62.14%
SVM	0.50	0.50	0.65	0.36	0.57	0.42	50.29%	0.50	0.51	0.77	0.25	0.61	0.33	50.58%
AdaBoost	0.60	0.53	0.32	0.79	0.41	0.64	55.08%	0.58	0.53	0.31	0.77	0.40	0.63	54.09%
Gradient Descent	0.66	0.65	0.64	0.67	0.65	0.66	65.61%	0.66	0.66	0.65	0.67	0.66	0.66	65.90%

Table 2 details the performances of models without oversampling. It is noted that XGBoost is able to provide an accuracy of 77.51%. The idea behind oversampling is to avoid algorithms tending to be biased towards one category while predicting the output. It can also be noted that other models were able to perform well, giving approximately 70% results. Thus, it was not sufficient to conclude that XGBoost was the best method among all the other algorithms. To rectify this issue and to conclude on the best algorithm, ADASYN and SMOTE results are compared with the before oversampling case. Table 3 details the performance of models after oversampling. It is worthwhile

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to note that Logistic regression, decision tree, random forest, k-nearest neighbors, SVM, AdaBoost, and gradient descent have a significant decrease in the performance. This concludes that these models did not give equal importance to the minority class, which was to be required in this problem statement. However, XGBoost's performance is seen to improve from before sampling case of 77.51% to 77.29% in ADASYN (approximately same but better than other models) and to 80.34% in SMOTE with improvements in precision, recall and f1-scores, indicating that it is the best accurate model to determine consumable water. Confusion matrix are plotted to validate the results. Figures 6, 7, 8 correspond to XGBoost algorithm. Bar plot in figures 9, 10 and 11 represent accuracy scores. These are the accuracy plots for individual cases. It can be observed that accuracies of other models are gradually decreasing when unbiased data is fed. Finally, a combined performance analysis plot is plotted (Figure 12). Green line corresponds to SMOTE, blue for unbalanced dataset and yellow for ADASYN. Overall performance of XGBoost outperforms other models.

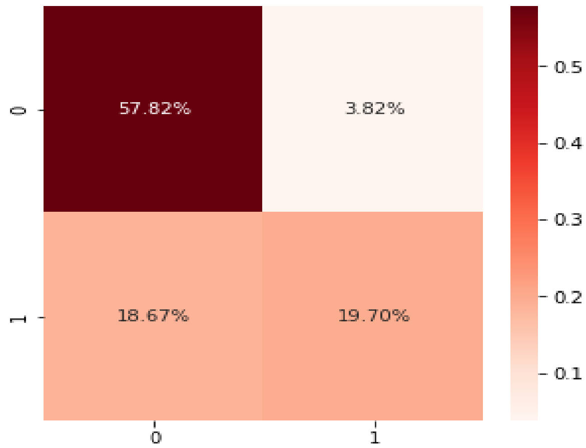

Fig.6. XGBoost Confusion Matrix – Before oversampling

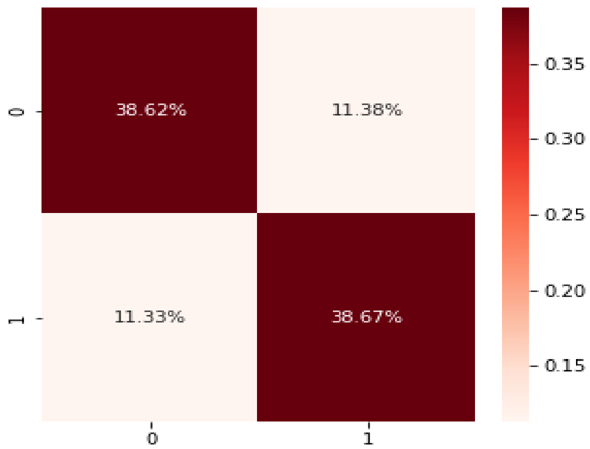

Fig.7. XGBoost Confusion Matrix – ADASYN

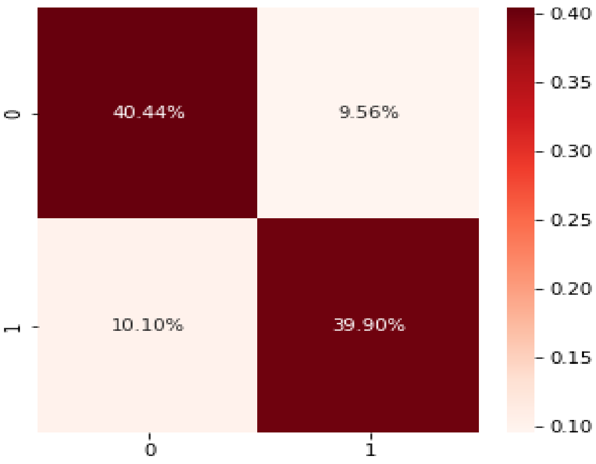

Fig.8. XGBoost Confusion Matrix – SMOTE

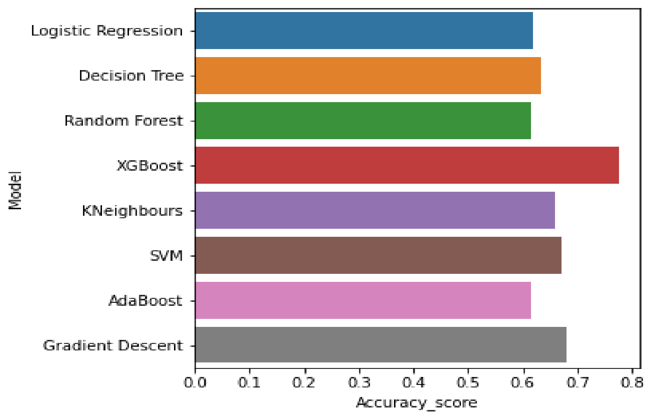

Fig.9. Accuracy scores before oversampling

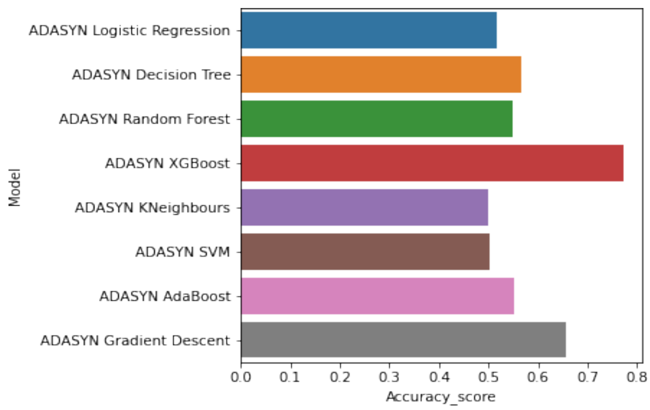

Fig.10. Accuracy scores ADASYN

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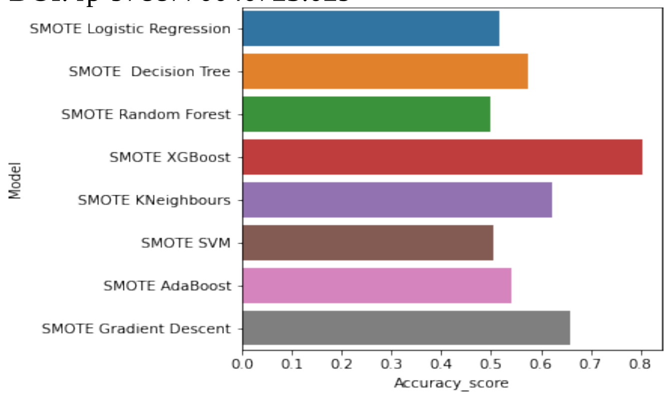

Fig.11. Accuracy scores SMOTE

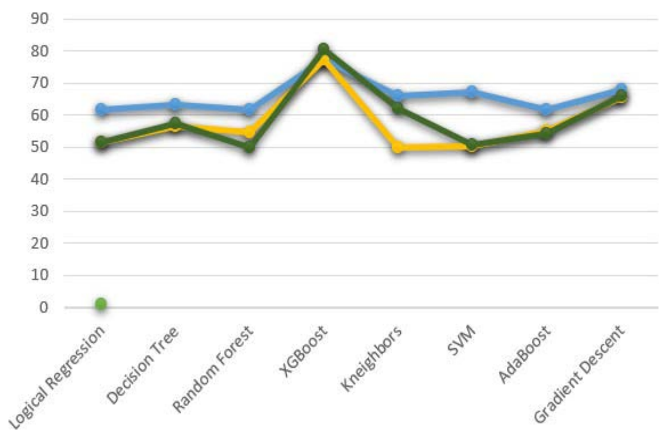

Fig.12. Performance Analysis

VII. Conclusion

Water is one of the most important and essential resources that determines life on Earth. The availability of safe consumable water is a jeopardizing situation that is being faced in many countries around the world. Apart from natural contaminants, water pollution has become a major concern for many environmentalists. Water potability is affected by a number of factors. In this paper, factors such as pH, hardness, the concentration of molecules, chloride level, sulphate levels, conductivity, TOC levels, amount of trihalomethanes, and turbidity were considered. The used dataset is self-developed. However, the models will work with the same efficiency as other river or lake datasets with the same attributes. Exploratory data analysis is widely used by researchers to study and investigate various data. The same concept is applied here to understand and analysis the distribution of data when considering different attributes. WHO standards were considered, and analysis was performed on the dataset.

Machine learning algorithms are powerful and sophisticated tools that can tackle problems such as water quality index determination or water potability. From the previous research, it was identified that various algorithms were used to analyse the same. But it was noted that the algorithms were performing differently depending on the dataset. On further investigation, it was found that the models tended to be biased toward the majority class.

Therefore, an imbalanced dataset was used to have a comparative analysis of various models. The imbalanced dataset consisted of more data entries with non-potable conditions. The goal was to predict potability, thus maintaining potable cases as a minority class. To balance the dataset, ADASYN and SMOTE were used. In both ADASYN and SMOTE cases, models like logistic regression, decision tree, Support vector machine, AdaBoost, and Gradient descent had the same performance/accuracy level with negligible percentage difference. However, it was also observed that these models had a drastic decrease in their performance from their original performance, as in the case of the unbalanced dataset.

XgBoost, on the other hand, performed well and had a slight improvement in its accuracy too. The precision, recall, and f1-scores of XgBoost were significantly higher with values - 0.80, 0.81, 0.80 for non-potable and 0.81, 0.80, 0.80 for potable cases. This model can effectively produce results when interfaced with IoT or TinyML real- time projects. Therefore, the comparative analysis concluded that XGBoost was the best technique since it outperformed other models in all three stages of the proposed workflow.

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Cardio Vascular Disease Prediction Using Multiple Machine Learning Algorithms

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***Abstract*— This Cardiovascular disease is one of the serious issue that we are facing in current day it has become a massive challenge to try and analyse the cardiovascular disease survivors. Artificial intelligence is a component of machine learning, which is used to address several issues in data science. We can predict results based on past data which is a very frequently used application of machine learning for the machine to forecast predictions it has to identify patterns from the previous data and these patterns can be used on latest or new data to predict the outcome. The health business generates enormous amounts of raw data, which data mining transforms into meaningful information that might aid in making decisions. Decision Tree (DT), Adaptive boosting classifier (AdaBoost), Logistic Regression (LR), Random Forest (RF), Gradient Boosting classifier (GBM), and K-Nearest Neighbor (KNN) are the classification methods used in this study.**

Keywords*— *Cardiovascular disease, Machine learning, Random Forest, Decision Tree, Adaptive boosting classifier, Gradient Boosting classifier, KNN

I. Introduction

The biggest cause of death worldwide, as reported by the WHO, is heart disease. According to estimates, cardiac conditions account for 24% of deaths in India from non-communicable diseases. The cause of one-third of all fatalities worldwide is heart disease. Heart diseases are to blame for 50 percent of mortality in the United States and other industrialised nations. Every year, around 1crore 70 lakh people worldwide die from cardiovascular disease (CVD). It might be difficult to identify (CVD) due to several contributing variables, including high BP, high cholesterol, diabetes, irregular pulse rate, and several other illnesses. The symptoms of CVD might occasionally vary based on a person's gender. For instance, a female patient may also suffer nausea, severe tiredness, and shortness of breath in addition to chest pain, but male patients are most likely to have chest pain. Researchers have investigated a variety of ways to predict cardiac diseases, but predicting so at a beginning stage is not particularly successful for a variety of reasons, including complexity, execution time, and method accuracy. Consequently, efficacious diagnosis and treatment can save a lot of lives. Between healthcareservice guidelines, medications, and lost productiveness as a result of death, in 2014 and 2015 it cost roughly $219 billion annually. Heart failure, which can result in death, can also be avoided with early detection. Although angiography is thought to be the most exact and accurate procedure for predicting cardiac artery disease (CAD), it is quite expensive, making it less accessible to families with limited financial resources. Physical examination can cause few errors which might even lead to death of few patients as heart disease is a very complicated disease and we have to take at most care and here using machine learning based expert systems will help us to effectively diagnose Cardio Vascular Disease (CVD). Data Mining plays a major role in many fields like engineering, business, and education to extract data and find interesting patterns out of those. Examining data to find hidden information that will be useful to take important decisions in the future is a process called as "data mining". By decreasing the error in factual results and forecast, Understanding the complexity and non- linear interplay between several components, a wide range of machine learning techniques have been used. Medical experts must employ ML and AI algorithms to analyse data and draw exact and detailed diagnostic judgments because the amount of medical data is always growing. Different categorization algorithms are used in data mining of medical data to predict patients' CVD and deaths from heart attack.

II. Literature Survey

[1] Melillo et al. proposed a system that automatically distinguishes high-risk patients from low-risk individuals. Classification and regression tree (CART) (93.3% sensitivity, 63.5% specificity) performed better in their investigation. Only 12 little-risk and 34 huge-risk patients were examined. To determine whether their suggested method is beneficial, a larger dataset must be examined.

[2] Guidi et al examined the clinical support system (CDSS) for heart failure analysis. This model provided outputs such as HF(Heart Failure) sensitivity . They conducted study using various machine learning classifiers and compared the results. Random forest and CART performed best with 87.6% accuracy out of all classifiers.

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[3] Parthiban and Srivatsa have done a extensive study and have conducted research to find out heart disease in those patients who have diabetes.They used many predictive features like blood pressure, blood sugar, and age there is a imbalance in data set and the writers of have not employed any strategy to address this issue. they were able to achieve an accuracy of 94.60% by using support vector machine (SVM) classifier. Al Rahhal*et al* have used a novel approach using deep neural network (DNN) they used raw ECG data to predict using an unsupervised learning technique stacked denoisingautoencoders (SDAEs) to examine the highest level of features. They allowed expert engagement, which can induce biases, throughout each training cycle. It may bring about prejudice.

[4] Muthukaruppan and Er proposed a fuzzy expert system for the identification of CVD that is based on Particle Swarm Optimization (PSO). Fuzzy rules were created when rules from the decision tree were retrieved. Their accuracy using the fuzzy expert system was 93.27%. On the short dataset used in their investigation, a few rules were extracted. Alizadehsani and others

[6,7] Alizadehsani*et al.* utilised a group-based learning strategy. They utilised a dataset with 303 cases that they aquired from the "Rajaie Cardiovascular Medical and Research Centre" for their study. For CVD prediction, authors employed the introductory C45 ensemble learning approach. Left circumflex stenosis, left anterior descending stenosis, and right coronary artery (RCA) stenosis were accurately identified with 68.96%, 61.46%, and 79.54%, respectively (LAD). By using the SVM model, the results were improved and "80.50% accuracy for RCA, 86.14% accuracy for LAD, and 83.17% accuracy for LCX" were reached by a new team of researchers.

[8] Tama *et al.* presented the idea of a two-tier ensemble paradigm, where certain classifiers serve as the basis for another ensemble. Using class labels from Extreme Gradient Boosting (EGB), Random Forest (RF), and Gradient Boosting Machine (GBM), the suggested stacking architecture is constructed (XGBoost). Four different types of datasets are used to evaluate their suggested detection model. Moreover, they employed feature selection methods based on particle swarm optimization. With a k value of 10, their suggested model fared better in the k-fold cross- validation. Only the stacking of tree-based models was considered by the authors. Additional statistical and regression-based techniques might be used to improve model results.

[9] Abdar et al. established the N2Genetic optimizer, a novel optimization approach. The patients were then identified as having CHD or not using the nuSVM. On the Z- AlizadehSani dataset, the proposed detection approach had an accuracy of 93.08% when compared to earlier works. Raza proposed an ensemble architecture with majority vote. To forecast heart illness in a patient, it incorporated logistic regression, multilayer perceptron, and naive Bayes. A classification accuracy of 88.88% was attained, surpassing all base classifiers combined.

[10] Mohan et al developed a hybrid approach based on combining a linear model with a random forest to predict cardiac disease (HRFLM). On the Cleveland dataset, the suggested technique raised performance levels and had an accuracy rate of 88.7%.

[11] Soni and Vyas they used WARM, and their degree of confidence was 79.5%. dependent on age, smoking behaviours, BMI range and Hypertension their research assigned weights. Soni et al. on the other hand, gave each quality a weight depending on the advice they obtained from the medical experts. By attaining a maximum score of 80% confidence, Using a weighted associative classifier, they demonstrated a bright and effective cardiovascular attack prediction system.

[12] Ganna A, Magnusson P K and team. Effort on using machine learning algorithms to identify cardiovascular heart disease has had a substantial effect on this work. In this paper, a summary of the literature is presented. Using a variety of methods, an effective prediction of cardiovascular disease has been achieved. Logistic Regression, KNN, Random Forest Classifier, etc. are a few of them. The outcomes demonstrate the capability of each algorithm to register the given objectives. The findings indicate that every algorithm is capable of registering the given objectives, with KNN displaying the greatest performance (88.52%).

III. Proposed System

In this literature we have proposed multiple machine learning algorithms to detect if a person has Cardio vascular disease or not. Building, training, testing and validating the architecture for a specified challenge is a complex process. Decision Tree, Adaptive boosting classifier, Logistic Regression, Gradient Boosting classifier and K-Nearest Neighbor are the classification methods used in this study. Google colab was used to run the experiment. In this study the data is collected from 1025 patients which consists of both healthy and patients suffering from cardio vascular disease and we use attributes like age, sex, chol, cp(chest pain) etc to predict if a person is healthy or suffering from cardio vascular disease and this data set contains a total of 14 attributes the above mentioned algorithms are considered to be best for predicting the cardio vascular disease as they are all supervised learning algorithms.

A. Overview of architecture

Fig 1 consists of the overall architecture of the cardio vascular disease prediction using multiple ml models and the main parts of this architecture is data collection, data preprocessing and predicting the data using the given algorithms. Our technique uses the data of patient to predict the patient's heart condition weather the person has the heart disease or not. And these predictions are made by the best algorithm of all the ml algorithms used and the model is trained before hand with a genuine data set to make accurate predictions.

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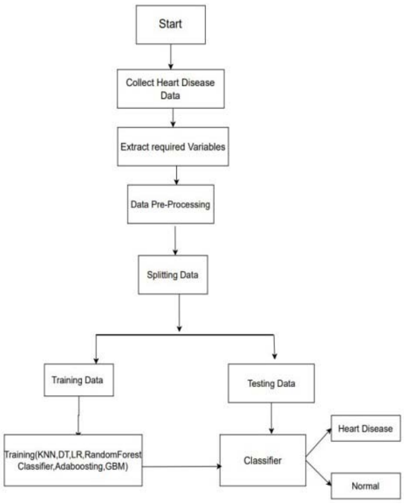

Fig..1. Flowchart for Heart disease prediction

B. *Related Work*

ApurvGarg et al have proposed a model that predicts the chances of getting heart disease using two machine learning algorithms that are KNN and Random forest they have compared these two models in order to get the best accuracy possible out of which KNN yielded a prediction accuracy of 86.88% where as the RF yielded an accuracy of 81.96% [15]

Archanasingh and Ramesh kumar have proposed a prediction based model with multiple machine learning algorithms like SVM, DT, LR, KNN out of which KNN yielded highest accuracy of 87% they have first collected data then selected the required attributes then the data is preprocessed and then balanced the data they have used UCI repository dataset [16]

In this study we have used similar approaches and we were able to get better accuracies for the models by using different dataset with more number of data points. We were able to achieve better accuracy for our proposed model KNN

C. *Data Collection*

We took our data from kaggle website for free and our data is called heart.csv this data set contains of 1025 patients records. Out of this 1025 people 499 people are normal and526 people have heart disease and this data set has 14 attributes and out of these people there are 713 male and 312 female. And out of people that have heart disease 300 are male and 226 female

```
.: Dataset Info :.
******************************
Total Rows: 1025
Total Columns: 14
******************************


.: Dataset Details :.
******************************
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       1025 non-null   int64
 1   sex       1025 non-null   int64
 2   cp        1025 non-null   int64
 3   trestbps  1025 non-null   int64
 4   chol      1025 non-null   int64
 5   fbs       1025 non-null   int64
 6   restecg   1025 non-null   int64
 7   thalach   1025 non-null   int64
 8   exang     1025 non-null   int64
 9   oldpeak   1025 non-null   float64
 10  slope     1025 non-null   int64
 11  ca        1025 non-null   int64
 12  thal      1025 non-null   int64
 13  target    1025 non-null   int64
dtypes: float64(1), int64(13)
```

Fig. 2. Data values and the attributes

D. *Data Pre processing*

In this step we use one-hot encoding technique to transform categorical values to numerical values then we drop of unnecessary variables then we separate features, now we normalize the data using min-max method now we split the data into two parts training and testing out of which the ratio of training is 80 and testing is 20 and now the data is ready and can be used in any model.

IV. Machine Leaning Algorithms

A. *Logistic Regression (LR)*

Logistic Regression is one of the best available tough classifier among the supervised ml algorithms. It is an elongation of general regression model it reflects the likelihood of the occurrence or nonoccurrence of a certain instance. Logistic regression is used to describe data and the connection between a dependent variable and one or more independent variables. Nominal, ordinal, or period types are all acceptable for the independent variables. The likelihood that a new observation will fall into a particular class is determined by LR, with the result falling between 0 and 1 because it is a probability

B. *Decision Tree (DT)*

Decision tree is one of the oldest ml algorithms. For issues related to classification and regression we have a best supervised algorithm that can deal with them and that algorithm is Decision tree and most of the times it is used for classification problems. It is basically a Tree shaped classifier root node is the top node while others are child nodes. Internal nodes represent the features of datasets while leaf node consist result Decision node and the leaf node are the nodes that make up decision tree. Decision node generally makes up decisions as it has many branches whereas leaf node can’t make any decisions.

C. *K-Nearest Neighbor (KNN)*

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KNN is among the very few oldest algorithms or statistical learning technique. In KNN K is basically to represent the total number of nearest neighbors used which is directly mentioned in the object builder. As a result, related situations are classified similarly, and a new instance is classified by comparing it to each of the existing examples. KNN method will search the pattern space for k training samples adjacent to the supplied unique sample when one is provided. Two distinct methods are offered to translate the distance into a weight so that predictions from many neighbors of the test instance may be calculated based on their distance.

D. Adaboost

An ensemble method in machine learning is called AdaBoost, also known as Adaptive Boosting. The most popular AdaBoost algorithm is a decision tree with one level, or a decision tree with only one split. A model is created via AdaBoost, and all the data points are given the same weight. After that, it gives points with incorrect classifications more weight. The following model now accords greater relevance to all of the points with higher weights. As long as no low errors are received, it will continue training models.

E. Random Forest

A ML technique that uses many numerous decision trees to make a decision is known as Random forest. It is a ensemble learning based technique. While it is in the training stage, itProduces many trees and a forest of decision trees. Each and every tree, a component of the forest, predicts a class label for each and every occurrence during the testing period. The model will take the class with the highest votes and makes it as prediction. The individual tree makes a class prediction from a very large independent tree models working together will give out the best result.

F. Gradient Boosting

Using boosting, weak learners may become strong learners. Each new tree created by boosting is fitted to a modified version of the initial data set. It is anticipated that when merged with older models, the new model will produce forecasts with lower error rates. The major goal is to set objectives for this next model to reduce mistakes. Gradient Boosting in a gradual, additive, and linear fashion trains many models. Because each case's goal results are decided by the gradient's deviation relative to the predictions, the phrase "gradient boosting" came into popularity. Every model picks up speed in the correct way by reducing the prediction errors.

E. Proposed Algorithm

In this study the best out of all the algorithms is KNN which has achieved an accuracy of 97% which is considered as one of the best algorithm in supervised classification algorithm and other than that it is simple KNN is non-parametric and lazy, which means it does not assume anything about the distribution of the underlying data anddoes not create a model from the training set. As an alternative, it memorises the full training dataset and utilises it to make predictions when presented with fresh test cases. For many applications, KNN is a straightforward and efficient method, although it can have large computing costs and be sensitive to the choice of K and the distance metric used to compare instances. KNN is a flexible technique that may be used to solve a variety of issues since it can be applied to both classification and regression jobs.

V. Evaluation

For the machine learning models, there are some approaches for performance evaluation. It is anticipated that the blending of several assessment tools will support the advancement of analytical research. Four fundamental measures (accuracy, precision, recall, and F-Score) will be looked at in this study to see how machine learning-based algorithms differ from one another.

Using the confusion matrix, we may assess the four measures. The Confusion Matrix's constituents are True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN).In the medical data the most important thing is to find out (FN). The performance metrics are provided below

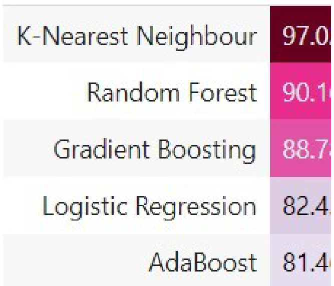
Accuracy = Number of correctly classified predictions / Total predictions (1)

Precision = TP / TP + FP (2)

Recall = TP / TP + FN (3)

F–Score = 2*precision*recall / precision + recall (4)

The total collection of features in the heart disease dataset have been exposed to comparison analysis of supervised machine learning classifiers. Some classifiers performed well on evaluation measures, whereas others did not. In order to predict heart failure survival, this work employed tree-based, statistical-based and regression-based models. The DT, RF ensemble models are tree-based. AdaBoost and GBM are two tree-based boosting methods. Statistically-based models whereas regression-based models include LR and KNN



K-Nearest Neighbour	97.0
Random Forest	90.1
Gradient Boosting	88.7
Logistic Regression	82.4
AdaBoost	81.4

Fig. 3. Different accuracy comparison

As per the table we have KNN with the best accuracy of 97.02%, Random forest with an accuracy of 90.16%, Gradint boosting with a accuracy of 88.7%, LR with a accuracy of 82.43%,Adaboost with a accuracy of 81.46%and with the least accuracy is the decision tree algorithm with an accuracy of 79%

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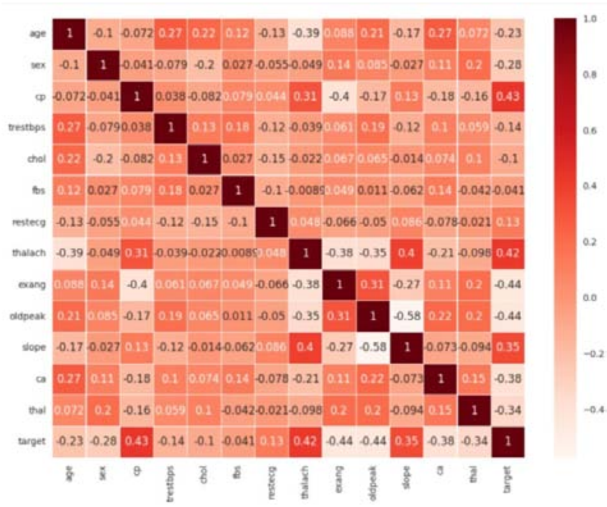

Fig. 4. Correlation matrix of variables

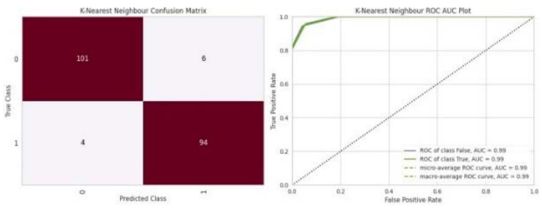

Fig. 5. Roc and confusion matrix of KNN the best algorithm

TABLE.1. PRECISION, RECALL AND F-MEASURES

Algorithm	Precision	Recall	F-1
K Nearest Neighbor	0.97	0.97	0.97
Random forest	0.91	0.90	0.90
Gradient Boosting	0.89	0.89	0.89
Logistic Regression	0.84	0.82	0.82
Ada boost	0.82	0.81	0.81
Decision Tree	0.80	0.79	0.79

TABLE.2. VALUE OF AREA UNDER ROC

Algorithm	AUROC
K Nearest Neighbor	0.99
Random forest	0.96
Gradient Boosting	0.95
Logistic Regression	0.91
Ada boost	0.87
Decision Tree	0.86

In conclusion, a dataset on heart illness was gathered, preprocessed as needed, and then analysis was done to better understand the dataset. Following the application of six machine learning algorithms Ada boost, LR, Gradient boost, KNN, DT, and RF we assessed the predictions using the F-1 Measure, ROC curve, recall, accuracy, and precision. We discovered that all of the used algorithms performed well, with KNN demonstrating the greatest performance with 97% accuracy, showing that these algorithms are the most effective at predicting cardiac disease.

VI. CONCLUSION

Heart patients' lives will be saved through the processing of raw health data of heart information using machine learning algorithms. By identifying risk factors for heart failure, preventive steps can be taken to lower mortality rates. In this study, a machine learning-based technique for predicting the survival of heart patients is suggested. The following machine learning methods are used: LR, AdaBoost, RF, GBM, DT and KNN. KNN with a accuracy of 97% the highest of all algorithms with precision score0.97 recall 0.97 F-1 0.97 and AUROC 0.99 the work done here has the potential to advance the medical field and help doctors forecast how long a patient with heart failure will live. Additionally, it will aid doctors in realizing that if a heart failure patient survives, they can concentrate on key risk factors. To gain from their combined advantages, the research can employ a range of machine learning model combinations in the future. To better the efficiency of ML models, better feature selection methods may be created. Due to the fact that these feature selection issues are NP-hard, meta-heuristics can be used.

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Enhancing Commuting Experience for Students and Faculty: A Transportation Kit

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***Abstract*—Students and faculty members of any college on a day-to-day basis use the buses provided by the college to commute. There is a lot of meticulous planning that goes into this. The data required for planning will surmount to decisions made such as how many buses should run today, the routes they need to take and have the buses reached the college premises. A kit has been developed in order to ease the work of the transportation department. Using this data collection will help in enhancing the experience of the passengers and also make the work of the transportation department easier. The two features that come in the transportation kit are: a license plate detection model to detect the number plate of buses and cars entering the college, which is developed using OCR and YOLOV7 model in machine learning and a bus tracking mobile application to track buses for students and faculty members, which is developed using Flutter and Firebase.**

Keywords— Students, Faculty, Transportation Kit, License Plate Detection, Bus-Tracking Application

I. Introduction

Rajalakshmi Engineering College has many great facilities especially like the transportation department. It provides transportation from home to college and vice versa every morning and evening. Two solutions were required namely number plate detection and real time tracking for students and user side (students and faculty). This is a tool kit consisting of two features developed and given as a package to the college. The first project consists of a license plate detection system where machine learning is used to develop a model and detect the license plate with accuracy and automate the system of registering buses which enter the premises of the college.

The second part of this project is the live tracking application. Students and faculties some days tend to miss their buses or in general want to plan when they can leave their houses depending on where the bus currently is. This is also useful for parents to track the buses to see if the student has reached college or vice versa. In conclusion, these two features together will definitely play a vital role in helping the transportation department and the many students and faculties who are using it.

II. Literature Survey

A. Object Detection Models

A paper was by Rantelobo, K., Indraswara, M. A., Sastra,N. P., Wiharta, D. M., Lami, H. F. J., &Kotta, H. Z. had the title “Monitoring Systems for Counting People using Raspberry Pi 3”. The objective of this study is to develop a monitoring system for population counting in a room using a visual sensor in a Wireless Sensor Network (WSN) environment. The system can determine the number ofpeople in the room from the image processing results and then send that information to the web [9].

A paper by T. A. A. H. Kusuma, K. Usman, and S. Saidah had the title “People counting for public transportations using you look once method”. This research is suggested so that the service operator can use image processing with the You Only Look Once (YOLO) method [15].

A paper by ZahraasalahDhaief Al-Mustansiriya had the title “People Counting Technology”. The proposed approach turns a color image into binary. The suggested method employs erosion and dilation methods to remove noise from the image, which may also contain noise. The technique relies on pre-existing packages to speed up development. Java is used to implement the suggested methodology [14].

A paper by Kasper-Eulaers, M., Hahn, N., Berger, S., Sebulonsen, T., Myrland, Ø.,&Kummervold, P. E. had the title “Detecting Heavy Goods Vehicles in Rest Areas in Winter Conditions Using YOLOv5”. You Only Look Once (YOLO)v5 can be used to detect heavy goods vehicles at rest areas during the winter. In order to determine whether the front cabin and the back are sufficient characteristics for heavy goods vehicle recognition, transfer learning was applied to YOLOv5 because these photos often contain a high number of overlaps and cut-offs of vehicles. The front cabin of heavy goods vehicles can be detected by the trained algorithm with a high degree of confidence [16].

A paper by Yonten, Jamtsho, PanomkhawnRiyamongkol, RattapoomWaranusast had the title “Real- time license plate detection for non-helmeted motorcyclists using YOLO”. The real-time LP detection for non-helmeted motorcyclists utilizing the real-time object detector YOLO (You Only Look Once) is presented in this work. A single convolutional neural network was used in the suggested method to automatically identify a non-helmeted motorcyclist's LP from the video stream. The false positive caused by the helmeted rider leaving the video frames was removed using the centroid tracking approach

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and a horizontal reference line. 98.52% of all LPs were detected overall [17].

B. Object Detection Model with License Plate Reading

A paper by R.A. Lotufo, A.D. Morgan, A.S. Johnson had the title “Automatic number-plate recognition”. The study's goal is to create a computer vision-based automatic vehicle identification system that uses optical character recognition (OCR) methods to identify vehicles. Investigations on real- time automatic number-plate recognition and its application to other aspects of monitoring and controlling road traffic are part of the effort [1].

A paper by Arth, C., Limberger, F., &Bischof, H. had the title “Real-Time License Plate Recognition on an Embedded DSP-Platform”. The proposed system operates in real-time while processing a video stream on an embedded DSP platform. A region-based method is used to partition detected license plates into separate characters. Support vector classification is used to classify characters. A Kalman tracker is incorporated into the system to quicken the embedded device's detection process. Additionally, the classification accuracy is increased by combining the findings of successive frames' classification [3].

A paper by Silva, S. M., & Jung, C. R. had the title “Real-Time Brazilian License Plate Detection and Recognition Using Deep Convolutional Neural Networks”. 2017 30th SIBGRAPI Conference on Graphics, Patterns and Images. Deep Learning (DL) techniques have lately been used in the context of ALPR, as they have in other computer vision tasks, with a focus on country-specific license plates. In this study, a state-of-the-art Convolutional Neural Network architecture-based end-to-end DLALPR system for Brazilian license plates was suggested [7].

A paper by Qadri, M. T., & Asif, M. had the title “Automatic Number Plate Recognition System for Vehicle Identification Using Optical Character Recognition”. The goal is to create a successful automatic approved vehicle identification system that makes use of the license plate. The created system first recognises the car before taking a picture of it. Using image segmentation in an image, the region containing the vehicle number plate is extracted. Character recognition is done using an optical character recognition technique. The obtained data is then used to compare with the records in a database [13].

A paper by Laroca, R., Severo, E., Zanlorensi, L. A., Oliveira, L. S., Goncalves, G. R., Schwartz, W. R., & Menotti, D had the title “A Robust Real-Time Automatic License Plate Recognition Based on the YOLO Detector”. A two-stage method specifically for character segmentation and recognition using low-tech data augmentation techniques like reversed license plates (LPs) and flipped characters was created. The resulting ALPR method produced remarkable outcomes in two datasets. The trial versions of commercial solutions had recognition rates under 70% for the suggested dataset [10].

1) Drawbacks:

From all the Literature Surveys the following problems/gaps have been identified: -

The models which were used where of lower versions better versions have come up for example the version used is YOLOv7.Inference speed for the version YOLOv7 is 114 FPS as opposed to the comparable YOLOv5's 99 FPS, and YOLOv7 also achieves greater accuracy (higher AP by 3.9%). The YOLOv7 gets a 21 FPS faster inference speed than the YOLOv5 when compared to models of a comparable size. Accuracy can be improved with the collection of dataset being manipulated to suit our needs.

C. Bus-Tracking Application

A paper by Rahman, Mir SazzadurHaque, SM. HasanHafizul had the title “Location Based Service for the Mobile users using the GPS Technology”. Some of their mobile application developers created some LBS services using the LBS API offered by the cell operator. However, this is notavailable at the moment due to the platform's development of security. Consequently, the GSM network can provide a mobile user's location information [2].

A paper by Battin, P., &Markande, S. D. had the title “Location Based Reminder system using Google Maps”. Here it added a few permissions to allow the Android SDK to retrieve the user's location. This software runs flawlessly on Android Oreo, but other comparable apps won't. Google Maps directions: Get driving instructions from the app to the task location. Address Search: Use the place picker to look up addresses to add location reminders. Setting location reminders is now simple. Reusable reminders allow you to easily reset them without having to add them again and saves great effort [4].

A paper by Muhammad NurZakiJuhari and HasmahMansor had the title “IIUM Bus on Campus Monitoring System”. The goal of this project is to provide a low-cost, real-time campus monitoring system for IIUM buses. Students at IIUM must wait for the bus without knowing when it will arrive, which is a huge waste of time [5].

A paper by WillianMuliaMirandaa, Ricardo Tavares RibeirodeMendonçaa, AllefAndersondaSilvaa, André Márciode Lima Curvellob, FlávioLuís dos SantosdeSouzaa and Henrique JosédaSilvaa had the title “BusMe: Automatic Bus Localization System and Route Registration”. The solution unifies GPS transmitted data from buses to Android applications using Amazon AWS as the cloud backend. The terminal is a Raspberry PiTM that transmits data using an HSDPA module and a GPS receiver. It is put in the bus. The received data is plotted in real time using Google MapsTM in the Android application, enabling the user to see where his preferred bus is and even where it is on its journey [6].

A paper by Jisha, RC., Mathews M. P, Kini, S.P., Kumar, V, Harisankar, U V., &Shilpa, M. had the title “An Android Application for School Bus Tracking and Student Monitoring System”. The suggested technique offers a technical solution for the above issue, which occurs occasionally and necessitates pupils waiting a significantly longer period of time for their school bus to arrive. The

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system comprises an Android application with Internet access that communicates with a server. The system also offers authentication, attendance monitoring, and vehicle tracking. Using this Android app, parents may monitor the bus's movements at all times [8].

A paper by S.Sabareesh, S.Sibicharavarthi, K.Vishnu, N. Mohammed Illiyas and K. Naveen Durai had the title “Location-Based Bus Tracking Application Using Android”. The main goal of this article is to gather GPS data and transfer it to a Firebase server, from which an Android application will retrieve it and display the bus' real-time location on a Google Map that is included into the Android application [11].

A paper by S., Islam, T., Olanrewaju, R. F., & Binyamin,A. A. had the title “A Cloud-Based Bus Tracking System Based on Internet-of-Things Technology”. In order to save time, energy, and human involvement, a cloud-based bus tracking system based on IoT is proposed in this study. The precise location and arrival time of the bus can be recorded dynamically using a mobile application. Additionally, by paying online, customers can purchase tickets without standing in line and reserve the available seats [12].

A paper by BadghainyaAnchal, MaripallyLokesh, MohdSaleem, UmamaMahreen, Ramesh Alladi, had the title “Smart Bus Tracking Application using IOT”. Building a mobile application for real-time bus tracking is the paper's main goal. The system offers the necessary data, including the driver's contact information, the route specifics, the average waiting time, and the anticipated arrival time. The flutter framework is used to create the mobile application, and a real-time firebase database integrated with a Node MCU is also used [18].

A paper by N AyushUbale and DrMohdTajammul had the title “efficient model for automated school bus safety and security using iot and cloud”. This study proposes an SMS- based method for parents to monitor their children's school bus location. An RFID and GSM-based system is used to authenticate the student's identity and count the number of students in the bus. Parents receive SMS notifications about their children's location, and a visual studio application installed in the AWS cloud controls the system. [19].

A paper by Sourav Kumar, ShreyashMoundekar, MansingRathod and RupeshParmar and the title “Location-Based Bus Tracking Application Using Android”. An application that overcomes the shortcomings of the public transportation system was proposed. It gathers the necessary information, and using it, the bus is traced. Passengers can access these details at any time in real time [20].

1) Drawbacks:

From all the Literature Surveys the following problems/gaps have been identified: -

This system developed using Flutter instead of native Java as Flutter supports Cross-platform development (Android and IOS), It has higher development speed it supports multiple platform which require only a single code base, the cost of development is reduced and the amount of resources and libraries are much higher compared to Java [21-23]. The database used for this system is google firebase. This database service is much preferred compared to other database providers because the learning curve for other database services such as AWS Amplify and Microsoft Azure SQL as a whole are actually steeper, since there are a number of things that are quite difficult to implement [24- 26]. Old version of Google Maps API causes the accuracy of location to be low and the app does not work when the phone enters sleep mode, the distance between two geo locations have been calculated manually, only one bus is able to be tracked and the cost of Amazon AWS and usage of IoT are expensive.

2) Common Deficiencies:

From all the Literature Surveys the following problems/gaps have been identified: -

A better model can be used for object detection. Accuracy can be improved with more dataset which is manipulated to our needs and for the bus-tracking application, mostly IOT is used along with old location frameworks. Hence they tend to not be user-friendly. IoT is comparatively expensive and data handling via IoT is difficult.

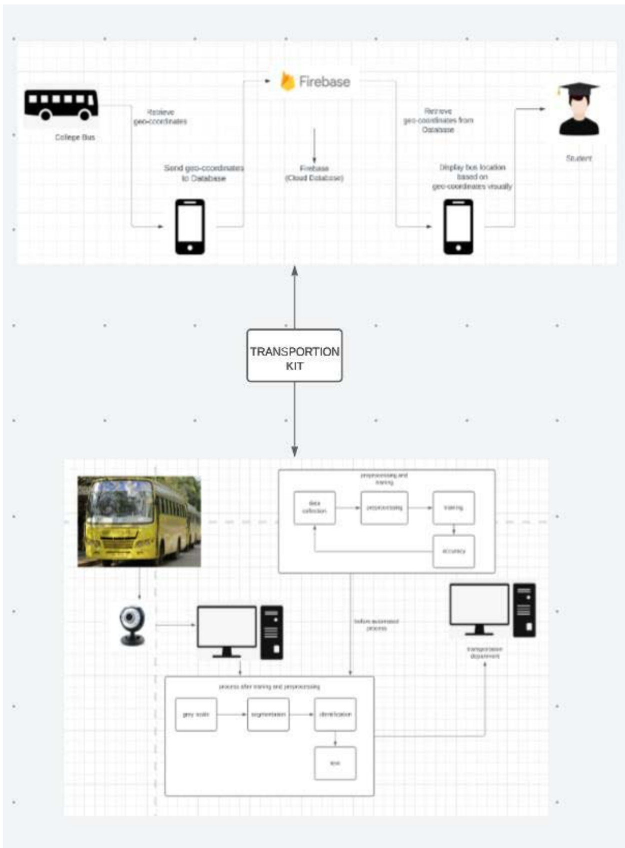

Fig. 1. Transportation Kit System Architecture

A. *License Plate Detection and Recognition*

The system that is proposed is to make the detection model using the yolo (you only look once algorithm). Many projects use the 5th version to make their projects but now there is version 7 which is superior to its predecessor, hence

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for the detection model the yolov6 or yolov7 algorithm will be used. For the Optical Character Recognition algorithm, a simple algorithm can be written which will pair properly with the object detection model being used. For better efficiency Theos AI tool is used to train test and split. Using the same tool, we can label our dataset. Once the dataset is labeled it is trained using YOLOv7 algorithm. It is then paired with OCR code to read the letters that is present inside the detected license plate.

III. Proposed Work

This section provides the proposed methods for the three projects in the kit respectively.

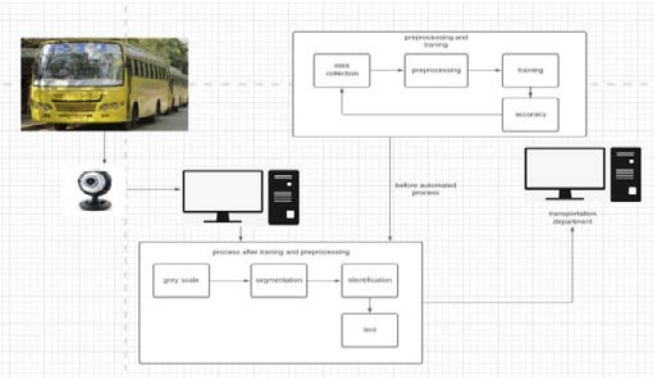

Fig. 2. License Plate Detection and Recognition System Architecture

The dataset will consist of multiple images and videos since it is only the license plate of the buses which needs to be extracted. The dataset can be manipulated to suit our needs and ultimately improve accuracy.

B. Bus Tracking Application

The proposed system for the bus-tracking system is a mobile application. With this application students and faculties will be able to find the location of their respective buses with ease in a short period of time. The only requirement needed to use the application is a mobile device with active internet connection and feature to access the location.

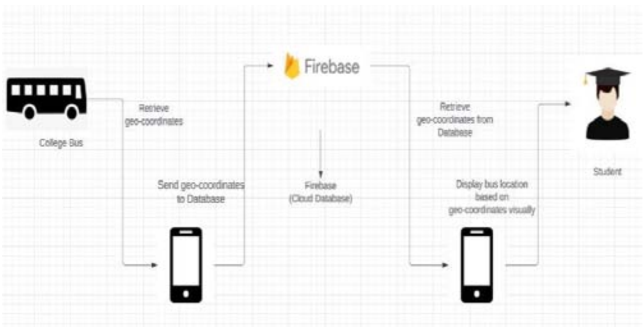

Fig. 3. System architecture for bus-tracking application

As mentioned above, the technologies used here are Flutter to build the mobile application and Google Firebase to play the role of the database. Two applications are developed using Flutter (Driver App and Student App). Once the driver logs into the application using the credentials provided by the Transportation Department, the bus number mapped to that particular account gets retrieved into the application. The driver will then be able to start streaming his location by clicking the 'Start' button. That location stream is sent to the Firebase database along with the bus number. In the student application, the student can log into the application using their college mail and start tracking their bus live by selecting the bus number.

Firebase makes this job easy as it is accurate with data and has an immutable class called 'GeoPoint' in-built which allows to easily work with location coordinates. On the other hand, Flutter provides smooth functioning of the mobile application with a clean user interface [27-30]. The proposed system helps combat the problems/gaps in the existing system using the following methods - New version of Google Maps along with geolocation package is used in Flutter which has a lot of in-built algorithms which enhances the time complexity and user efficiency, there is no limit to the number of buses to be tracked and only Firebase is used as the database and two apps (Driver App and End-User App) are being used, thus eliminating the need of IOT devices and thereby reducing costs.

IV. Results and Discussion

Based on the comparison and differentiation performed with the existing systems mentioned above, some of the advantages of the proposed system are:

a) *Recognition of model :*Our model is able to regognize the licence plate and is able to read the plate with a confidence of 60-70%.

Fig. 4. Object detection and recognition result

b) *Bus tracking driver app:* In this application the driver can start/stop streaming his live location.

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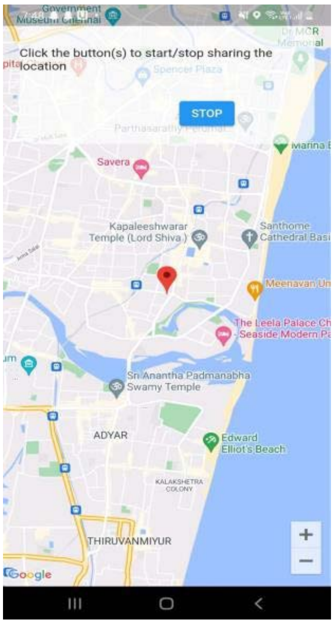

Fig. 5. Bus tracking driver app

c) Bus tracking student app: In this application the students can select their respective bus number and start tracking their bus live location.

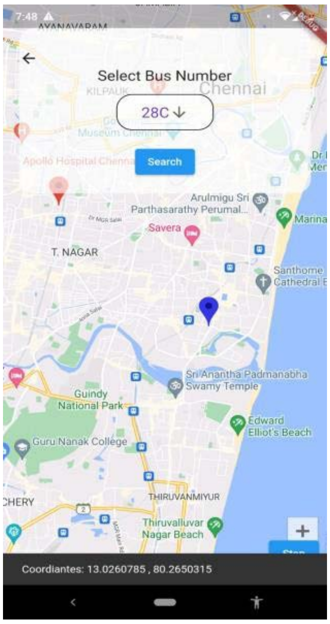

Fig. 6. Bus tracking student app

d) *Firebase database:* Due to its accuracy with data and built-in immutable class named "GeoPoint," Firebase makes this task simple by enabling simple working with geographic locations.

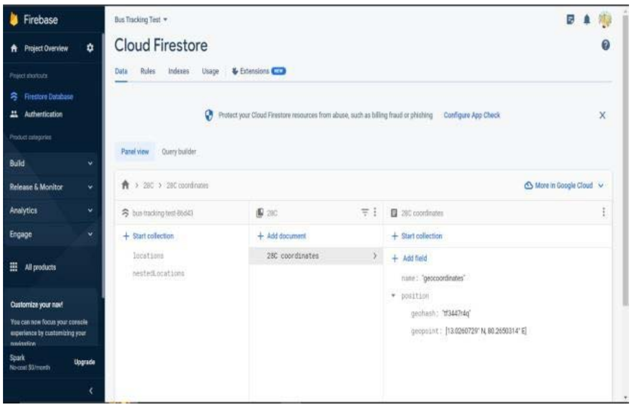

Fig. 7. Bus tracking firebase database

V. Future Endeavor, Scope And Conclusion

In this paper, the main objective is to ease the work of the transportation department by providing them with easy-to- access products which helps them in managing their resources efficiently. In conclusion, these three kits together will definitely play a vital role in helping the transportation department and the many students and faculties who are using it.

Future modification can only be made with feedback from the user side for example the plate detection system can only be tuned better after seeing the accuracy it has generated after detecting the bus's number plate. Similarly for other models future works and enhancements can be made purely based on user feedback.

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Talking Glove Using DF Mini Player and Speaker

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***Abstract* — This paper presents the design of Talking Gloves which converts Sign Language to Speech. The project's main aim is to develop an affordable communication aid which can help the speech and hearing impaired people to express their thoughts and opinions without any difficulties, thus bridges the gap between two different groups. Specially challenged person can also uplift their career with the help of Talking Gloves. When speech and hearing impaired people wear that glove, they can communicate through sign language easily just by bending their fingers. The respective output is heard from the speakers using the DF mini player which reads the SD card and selects the sample voices stored in it and the corresponding text is also displayed using the LCD with I2C module.**

Keywords —Arduino UNO, LCD with I2C module, DF-mini player, speaker, Resistors.

I. Introduction

People with hearing and speech impairment had difficulties in communicating in the society till now while others do not understand this sign language as it involves the orientation and movement of hands, arms/body, combining of various hand shapes and various facial expressions to express the thoughts. A new communicational aid is developed which converts the hand gestures into speech output which enables deaf and dumb individuals to interact verbally with the other people and share their thoughts and opinions.

The device of communication is a "The Talking Glove". The glove is fitted with the flex sensor whichmeasures the change in resistance based on the degree of bend it is subjected to. The values of the flex sensors is compared with the data alreadystored and the respective speech is heard using Speakers as played by the DF mini Player.

II. Literature Survey

The work related to Sign language conversion using Arduino Mega, Bluetooth, flex sensor, ARM controller is described in this section.

SanishManandhara et al [1] The Hand Gesture Vocalization was proposed by him for Speech and Hearing impaired people. This system includes Arduino Mega, Accelerometer and Flex sensors, which is used to translate the given hand gesture into its proper form of text, audio, and graphical representation, which is easily understood by any other common person. In the current system, the training model predicts the accurate output with a percentile of 85 which makes of the Random forest algorithm.

Mangesh T Nikam et al [2] put forward a system consisting of 3 axes accelerometer sensor being mounted on hands. The system for Deaf and Dumb People is named as Talking Hands. The micro- controller senses the movements using the accelerometer with the help of ADC. Each movement is set with a specific word and this movement is read by the micro-controller and makes the Voice IC to play that particular pre-recorded message.

KshirasagarSnehal P et al [3] proposed gesture vocalizer for deaf and dumb. The proposed systemuses AVR microcontroller (ATmega16), flex sensor, accelerometer, speech synthesizer, speaker, and LCD.Flex sensor detects the degree of bend and its output along with the output of the accelerometer are converted to the digital values where they are compared with the prerecorded values and the corresponding audio is played via speaker and the text message is displayed using LCD.

SupriyaShevate et al [4] proposed a Vocalizer based on Gestures for Hearing and speech impaired people. This vocalizer detects all the hand movements and converts it into an audio and displayed on the LCD screen. For all speech synthesizer and sensors ARM 7 controller is used. Two types of accelerometer and flexible sensors as a titled sensor are present in data glove.

Mali PoojaDadaram et al [5] proposed a system using gloves with Flex Sensors and Arduino to convert Sign Language to Speech. This method uses a flex sensor and microcontroller such as Arduino UNO attached to glove, while the data is transferred, the LED will light up. With respect to each touch a change in resistance which is uniform is made by the rotation detector and the hand gestures are analysed. This process is completed in controller. The values are compared according to the touch in the website, and audio and text are generated as output.

Khan, Mubashir et al [6] proposed "SignTalk and animator for speech and hearing impaired." This system uses flex sensor, Arduino Nano, accelerometer, gyroscope and bluetooth where the hand gestures are converted to digital values using ADC.These values are sent to mobile phones through Bluetooth and the respective audio is played.

Boppana, Lakshmi et al [7] has put forward a system for Deaf and Dumb, an Assistive Sign Language Converter. This device enables a person to interact with other people where controller processes images, compared with samples using processing techniques and identifies signals with in-

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depth reading models. The text-to-speech module converts these features to real-time speech.

Rajaganapathy S, Aravind B, Keerthana B, Sivagami M [8] "Conversion of Sign Language to Speech with Human Gestures". This system uses Microsoft Kinect to track the human joints and gestures. The stream of input data is the live actions of human skeleton. The System keeps tracking with the user defined gestures if both the gestures are matched the corresponding word is played.

Aishwarya V, NarenRaju N, Singh S Johanan Joy, T NagarajanVijayalakshmi P [9] "Hidden MarkovModel-Based Sign Language to Speech Conversion System in Tamil." This work constitutes the use of accelerometer, gyroscope sensor-based hand gesture that recognises various signs and converts into corresponding Tamil phrases.

Harini R, Janani R, Keerthana S, MadhubalaS,Venkatasubramanian S [10] "Sign Language Translation". This system consists of image capturing cum processing, feature extraction and conversion by using OpenCV python library. The prediction can be done with atmost accuracy and it also uses convolution neural network.

ParamaSridevi, Tahmida Islam, UrmiDebnath, Noor A Nazia, RajatChakraborty, Celia Shahnaz. [11] "Sign Language Recognition for Speech and Hearing Impaired by Image Processing in MATLAB".The proposed system converts the sign language to speech using MATLAB where it extracts the features of the hand gestures and it is compared with the already stored features in the database and produces the output depending on the highest resemblance.

YashJhunjhunwala, Pooja Shah, PradnyaPatil [12] has put forward a direct algorithm which converts the basic Alphabets and numeric which will be further extended for recognition of words.The glove uses flex sensor which monitors the amount of bend which in turn relates the change in resistance.

III. Existing System

In the existing system, the glove translates the American Sign Language alphabets to speech using Arduino Nano. The glove uses flex sensors, accelerometer and HC-05 bluetooth module to connect the glove to the mobile phone. This system is not efficient enough to help the speech and hearing impaired people to communicate with others.

IV. Proposed System

The proposed method involves the use of flex sensor in the place of image processing technique. Initially, the hand gestures are converted to analog signal, then it is converted to digital signal with the help of ADC from the Microcontroller. The digital signal is processed in the Arduino and the corresponding is heard output.

The Figure 4.1 and 4.2 decribes the block diagram and work flow of the proposed system.

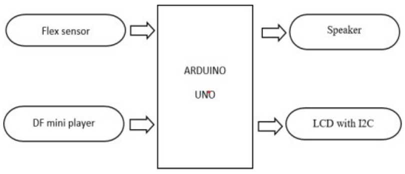

Fig. 4.1. Block diagram

Fig. 4.2. Work flow

V. Working Principle

Initially a power supply of +5V is given to the circuit as an input. Arduino Uno acts as a microcontroller and the code is executed using the software Arduino IDE. The Flex Sensors detects the change in the resistance based on the degree of bend it is subjected to. The output of these flex sensors are analog in nature which are sent to the Arduino where analog signals are converted to digital and this digital information is compared with the already stored data in Arduino. If the output from the flex sensors are matched with the stored data i.e., the string or alphabets, then the respective output is heard from the speakers using the DF mini player which reads the SD card and selects the sample voices stored in it.It also displays the output speech to text using the LCD16X2 with I2C module.

VI. Results and Discussions

The proposed scheme provides a interpersonal communication between the two groups easily by converting the hand gestures into speech. The additional feature of this system is to display the output speech into text using the LCD with I2C module. So, this project is quite feasible and easy to operate which breaks the gap

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between both the communities. For convenience few actions are translated and the output is shown.

The Figure 6.1. Signifies the hardware connection that is required for converting sign language to speech.

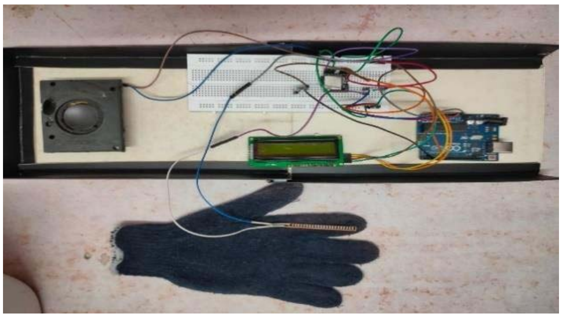

Fig. 6.1. Hardware setup for implementing Talking Glove

The Figures from 6.2. to 6.7. shows the working of the proposed system which consist of**:** Arduino UNO, LCD with I2C module, DF-mini Player, Speaker, Resistors.

Fig. 6.2. Initializing of Sign Language to Speech conversion.

Fig. 6.3. Initializing of DF-mini Player

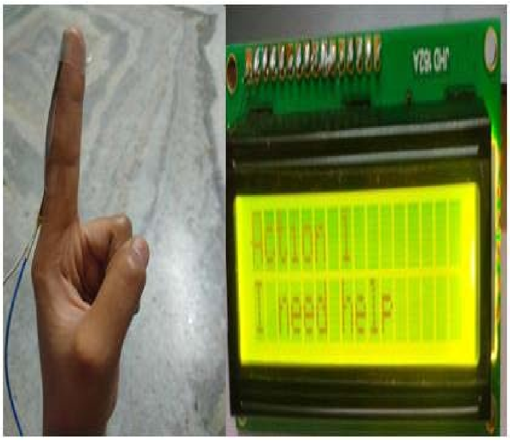

Fig. 6.4. The display of action 1 representing the statement "I need help".

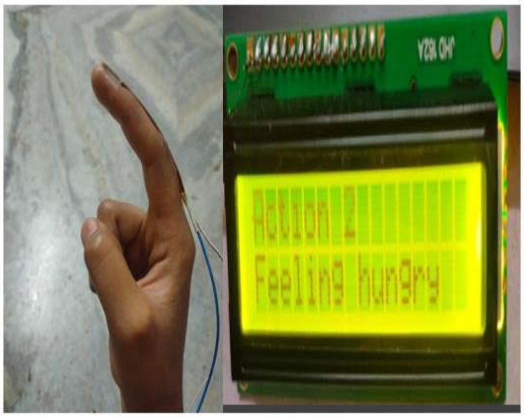

Fig. 6.5. The displaying of action 2 represents the statement "Feeling Hungry".

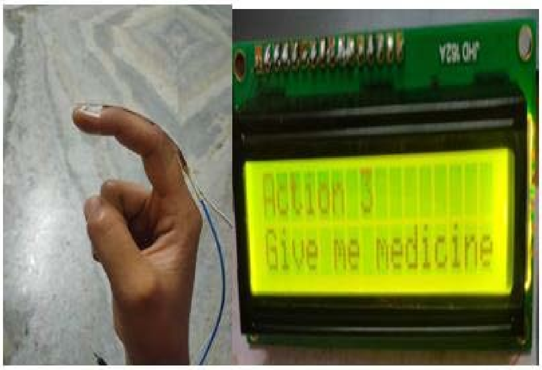

Fig.6.6.Thedisplayingoftheaction3representsthestatement"Givememedicine".

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Fig. 6.7. The display of action 4 representing the statement "I want to sleep".

The Figure 6.8 and 6.9 depicts the graphical representation between the change in the resistance versus the degree of bend of the flex sensor and the time response of the flex sensor to change the sign language to speech with respect to voltage.

Fig.6.8. Relationship between the variation of resistance and degree of bend.

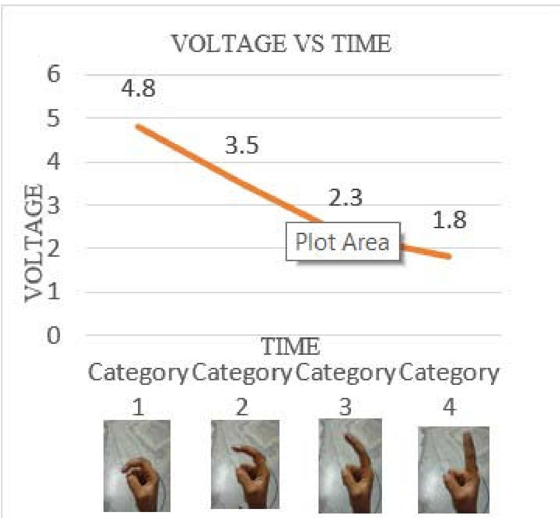

Fig.6.9. The time response of the flex sensor to change the sign language to speech.

VII CONCLUSION

In this project, we developed a system using a glove which provides an opportunity for the speech and hearing impaired people to communicate with others easily. The use of flex sensors, DF mini Player, Speaker, Resistors onto a glove helps to reduce the gap between the two different groups of people. This device will suit better for all the people with various oral disabilities. This project can be further enhanced by integrating with various services which helps to increase the employment for the deaf and dumb people .This can be paired up with fitness sensor to monitor health of the individual. Further, they can be geared up with the controller to provide home automation on finger tips.

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Algorithm of Biometrics – The Relative Study

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Abstract*— The identification of individuals based on their distinguishing biological and behavioral attributes is the focus of the newly growing field of biometrics. Biometric algorithms play a significant role in the efficient operation of identification technologies, which are used for a variety of tasks such as identification, access control, and surveillance. The purpose of the study is to examine the various biometric approaches and performance levels employed in the development of biometric technology. The survey's results are listed below. The many phases involved in developing a biometric system, such as data collection, feature extraction, pairing, and choice, will be described in the next section. The study's primary focus will therefore be on evaluating biometric algorithms, coupled with performance metrics including accuracy, untrue admission rate, and non-match rate. To examine the efficiency of several biometric algorithms, benchmark datasets including the Biometric Vendor Test and the Fingerprint Identification Competitor will be used. Future breakthroughs in biometric algorithms are also covered, including the development of hybrid techniques that integrate several biometric modalities for improved performance and the use of deep learning techniques for feature extraction and matching. Identifying key properties inside a biometric, such as a face's specific form or the grooves of a biometric, is referred to as feature extraction. All of these traits are being used to create a unique foundation for each person. The pattern generated from the biometric data is compared to a dataset of previously stored data in the comparison process. Overall, the biometrics approach is a complex and advanced procedure that needs specialized expertise and tools to be successful. With the popularity of biometric systems growing, more scientific study will be needed to improve the accuracy and dependability of the systems. Suggestions to improve the accuracy of the system, the biometric would be best option.

***Keywords*— Security environment, biometric authentication, and biometric technology authentication, verification, performance metrics.**

I. INTRODUCTION

The word "bio" as life, "metria" as measuring are source of the word "biometry." The method of assessing specific body characteristics of individual using automated systems is our goal in the area of security sciences, and it is referred as biometric identification. To use a specific technique to identify or validate a person is one way to increase security for the purpose of person verifying and identifying attributes utilizingbiological and behavioral types, biometric systems are used. The two primary types of biometrics are: biological or behavioral traits. The most trustworthy and secure solutions to traditional means, such as knowledge-based and token-based systems, are faces, fingerprints, veins, and speech. Uni biometric systems have a number of issues, including inconsistent biometric data, a poor recognition rate, the ability to be easily fooled, and others. The multimodal biometric system's sensor measuring unit receives information from several attributes. A biometric pattern identification system compares biological or behavioral characteristics of a person's biometric attributes to determine their identity. A biometric system is an automated identification method that uses a person's distinctive traits to identify individuals.

Identification: By comparing the biometric test sample to the trained structure recorded in the database, the authentication of a person is carried out.

Verification: By comparing the test image to the alleged biometric characteristics in the database, the authentication of a person is carried out.

Verification and identification are the two crucial building blocks of human identification in the biometric system. As was said above, each block is used in a variety of applications and under various circumstances. The selection is made after comparing the image to the databases' recorded photos, which makes the identification procedure more difficult and expensive. In contrast, one-to- one matching is carried out in the verification system.

II. LITERATURE REVIEW

A. *Access control-based remote authentication method for multi-server environments.*

Min Zhang, Wen-Rong Tan proposed the importance of the user's access log on the website has significantly increased. Additionally, the site analytics service is extensively utilized and is now frequently effective. This study's goal is to provide behavioral biometrics that may be used to forecast a user's level of interest in a particular product by looking at website access data. We carried up an experiment in which the participants were instructed to purchase online. Comparative analysis is done between the amount of interest in a certain category of goods that is expressed in an interview and the website access logs recorded throughout the purchase process. The findings reveal that there were considerable differences between the web-searching activity patterns and several factors based on the access log.

The multi-server authentication technique provides a

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number of advantages over the single-server scheme, including a lot of benefits. Users don't have to remember several passwords or sign up for each application server for instance.

B. Fusion of Hand-Based Feature Levels for Biometric Recognition of Single Sample.

Yanqiang Zhang; Dongmei Sun; ZhengdingQiu proposed the real-world applications, one sample biometric recognition may produce subpar recognition results. We describe a unique feature level biometrics fusion method to address this issue by fusing the palmprint and middle finger picture, both of which may be obtained from a single hand image. The pictures of the palmprint and middle finger are first used to determine the local embedding subspaces using a manifold learning technique, and the concatenated feature is then extracted using principal component analysis (PCA). This would result in good performance since the local structures of individual biometric models would be kept while the redundancies between them would be minimized. The testing findings showed the average recognition rate of score level fusion and single modal biometrics, in comparison to recommended strategy received a considerable boost, reaching 98.71%. To show the effectiveness of the suggested fusion strategy, performance comparisons of the cumulative matchcharacteristic (CMC) curves for various recognition algorithms were also made.

C. The Federal Bureau of Investigation uses forensic biometrics from images and video.

Nicole A. Spaun proposed According to the forensic Sound, Live feed, and Photogrammetric Unit employs forensic examiners who carry out tasks including human identification (from images and videos), which includes height estimation and comparisons of the face, ears, hands, and feet. Exams are carried out without the use of automated biometric software. The amount of case, it is predicted that automated biometrics would improve examination process efficiency and give statistics and likelihood rates that may be used as evidence in court. It provided funding for research initiatives on ear and facial individualization in order to create such biometric systems. The planning more study on hand, ear, and face biometrics.

III. Biometrics Implementation

Unique identifying systems with high operational accuracy are definitely needed. Biometric authentication is one approach for this, where the distinct traits that are mostly unchanging and unforgeable are all being investigated. There are several such characteristics, like the well-known eye, palm, or optic. All while these technologies do have weaknesses, they nonetheless provide significantly better safety than knowledge- or ownership ones. Various categories may be used to classify biometric security methods, but from the viewpoint of the reader, three things stand out: the amount of the gadget requires physical touch to work, and the recognition period (which includes the level of user cooperation/effort, any additional time required for location or other recognition operations. Regarding the consumer, the accuracy and security are the key factors, which ensure a negligible amount of erroneous acceptance. Since many users have hygiene issues about devices that many other users also contact, contactless technologies are frequently selected. Although this concern unfairly disadvantages biometric identification methods, user acceptability is nevertheless a crucial element in the effective implementation of such system. Dentification time is often minor compared to the entire access cycle,but it depends on the user's amount of cooperation, which implies that it might vary widely. The performance of the algorithms in the systems now in use is often under a second, but no longer than a few seconds. Improper system utilization is the source of the problems. A person finds an only one refusal irritating, and numerous failures may require the action of the guard force based on the safety rules in place, having caused backups in the entrance waiting list and significant disadvantage for the telecommunication services. But even so, consumers must acknowledge that these instances will everyone in a while give rise and may not be totally eradicated. Various surfaces and indications may assist the user in this. By eliminating some degrees of freedom, we can lower the likelihood of inaccuracy. Indications with restrictive materials to restrict freedom levels to one help the operator, making failed identification with that technology very uncommon. Hand geometry identification is an excellent illustration of this. On the other hand, this implies an increase in the need for physical interaction, which might result in user unhappiness given the previously mentioned concerns.

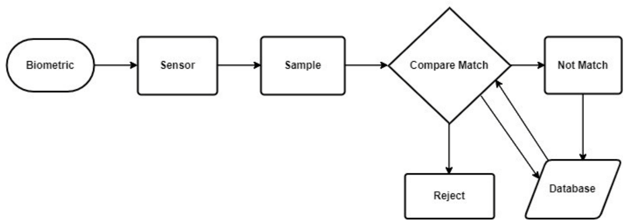

Fig: 1. Biometric system

IV. Biometric Technologies Comparison

The preceding point's biometrics remedies may be categorized and compared using a variety of criteria and measures. Such an analogy will give guidance when coordinating the installation of a new technology and aid in outcome prediction.

- FAR: This demonstrates how frequently a system will identify an unauthorized user as authorized, weighed in percentage.
- FRR: This demonstrates how frequently the system will treat a legitimate user as anunauthorized one and deny access calculated as a percentage.
- GFRR: This illustrates the FRR of a device in real-world conditions, including user mistakes, with the assistance and expansions of [1] ABI's research %-based measurement.
- FTE: This demonstrates the number of persons that might not be registered in the system and are thus unable to utilise it. calculated as a percentage.

- SPOOF OF RISK: It demonstrates how easy the system may be thwarted by various means (for example, displaying simply a picture of the fingerprint to an optical fingerprint scanner instead of a real one).
- SAMPLE LIVE DETECTION: This demonstrates if the system can tell the difference between a real user and a spoofing attempt.
- ACCEPT USER: This demonstrates a user's overall acceptance of the technology, together with their readiness to cooperate and any misunderstandings or anxieties that may have affected their acceptance.
- REQUIREMENT CONTACT: This demonstrates if the user must remain in close proximity to the gadget in order to carry out the identification.
- BIOMETRICS STABILITY: This demonstrates if the sample evolves ovetime and whether any outside influences may be present.

V. Problem Statement

These issues inevitably lead to another one, which is that choosing a biometric solution for a security project is totally based on opinion. For instance, a well-known partner may advise something, or a consumer may choose for a well- known company's well-publicized system. The whole distribution chain is characterized by this ignorance. Manufacturers make claims about their goods, distributors buy them based on arbitrary pricing and value standards, and designersandpotential customers utilize this information to choose the system. No independent, trustworthy sources exist that could offer information on whether the system is capable of carrying out a specific job or not. Even safety firms and specialists are bumbling throughout the dark and frequently carry out the necessary checks itself. However, the majority of these businesses short in time, finances, and expertise needed to conductsuch tests in a logically sound and repeatable manner.

TABLE 1:Analysis Of Biometrics System

REFERENCES	TRAITS	RATE OF RECOGNITION
Turk et al. (1991)	Face	71
Wang et al.(2006)	Face	77.50
Eskandari et al.(2013)	Face and Iris	97.25
GottumukkalandVijayan (2004)	Face	72.50
Ahonen et al.(2006)	Face	78.75
Patel et al. (2019)	Fingerprint	97.7

TABLE 2:Comparatives Biometric Identification

Biometric identification methods	Biometric Stability	Application	Threat
Retina Biometrics	will not alter	To unlock various devices like smart phone etc.	cannot be used by everyone
face identification	Alter regular	Measuring features in an image.	Many people might not utilize commonplace technologies. extremely unreliable innovation
Visual sensor	Alter rare	Range of application for object recognition.	Many may not use it in everydayapplications extremely unreliable technology
Capacitive sensor	Unique alterations	Brake disc measurement	Many may not use it in everyday applications extremely unreliable technology
Tap the sensor	Unique alterations	Industrial usages	Many people might not use it in daily situations. extremely unreliable innovation
Multiple-spectral imaging	Will not alter	Water leak detections	insufficient skills
Recognition of voice	often alters	peech recognition	Many people might not use it in daily situations. extremely unreliable technology
The eye scanner	Alter extreme rare	Eye accuracy	Discarded invention
Palm vein recognition	Will not alter	Computer login and room entrance	NA
Identification of fingers veins	Will not alter	Credit card login, Atm etc.	may not be utilized by everyone
Geometry recognition in hands	Unique alterations	Personal verification, tracking attendance	sensitive innovation

VI. Conclusion

Human identification by biometrics is based on physiological and behavioral traits. Condensed biometric scanners come in many different varieties, computers can analyze enormous volumes of data, and developing biometric authentication systems is readily affordable in today's technologically advanced world. In addition, the threat of terrorism still exists in the modern world, and rigorous security and monitoring measures have emerged as a major worry. Because biometric technologies outperform traditional security measures, they are now a wise alternative for authorization, employee identification, and access control. This article provides key facts about biometric technology to assist novice researchers in selecting a subject in this area based on their preferences. Information has been provided on everything from the fundamental design of the biometric system to recently developed biometric technologies. Researchers have proposed two distinct state-of-the-art designs for access control biometric systems (uni-modal and multi- modal). One must have finally come to the conclusion that a multi-modal biometric system offers greater accuracy than a uni-modal one.

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Hypertension Tracking System Powered by the Internet of Things

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***Abstract*—Annually, more people are admitted to hospitals, and some of them require routine blood pressure checks from health professionals. In order to ensure that the results are correct, the medical team must usually visit to the person and take many readings during each session. As a result, Malaysian hospitals, tracking procedures need to be made simpler. The Hypertension tracking system powered by the internet of things used in this study is created to directly monitor patient hypertension. In this project, the Raspberry Pi serves as a portal for viewing the hypertension number online. The system can transmit data from a blood pressure monitor across a network using a USB TTL serial connection that is connected directly to a Raspberry Pi, according to test results. The WhatsApp app and email platform both allow users to continuously monitor their hypertension. Additionally, the technology can precisely measure hypertension while the person is seated.**

Keywords*— *Hypertension, Email, Internet of Things, Raspberry Pi, WhatsApp.

I. Introduction

In its most latest report, the National Compliance Department noted that several Malaysian hospitals, ETD were overloaded, overworked, underpaid, and inadequately provided. The Department of Health is under enormous pressure to provide health care to all Malaysians towards the best of its abilities as the amount of patients keeps rising. Therefore, it is necessary to streamline the monitoring procedure within the Malaysian hospital. Having an online tracking system that displays every situation in engineering is simpler. One approach is to keep an eye on the patient's condition via the Internet of Things. Many technologies are being created and used today to improve the effectiveness of hospital administrators. An Internet of things hypertension tracker was created to assist hospital workers in tracking individual a patient's blood pressure reading. This will improve how doctors take decisions based on medical status in real time and decrease the reliance of patients on medical staff. For disabled people who may find it difficult to travel to the hospital to examine on their status, an Internet of things hypertension tracker is also helpful. The system has the capacity to move the location of medical services from the patient's house to the clinic. The hypertension trackingtechnique has recently experienced extensive research and developed from several types, including digital, aneroid, and conventional healthcare devices. It was suggested to use an Arduino-based health tracking system, where data is transferred to a computer for analysis using Software simulation. The Raspberry Pi module served as the processor in this system that sent the server the status of a patient's health tracking. The data was provided to a website that updates every 60 seconds, suggesting a healthcare tracking system. In contrast to many other works that employed databases to track the performance of the built system, this approach sends output to mobile applications and Email rather than a personal computer. The proposed method in this research is more mobile, allowing the doctor or hospital personnel to check on the patient whenever necessary. The remainder of the essay is structured as follows. The summary of the research methodology employed in this work is described in Section 2. Section 3 elaborates on the conclusions and analysis, and Section 4 is where the author draws a conclusion about the article's results.

II. Study Methods

Both computer and network execution are part of this project. Figure 2a flow chart shows the structure of the system that was created. The Raspberry Pi, which controls the entire system, is capable of detecting data from the hypertension gadget and transmitting it over the internet so that users may examine it in the WhatsApp and email applications. Anyone with the authority to examine the relevant data on the server can view this application.

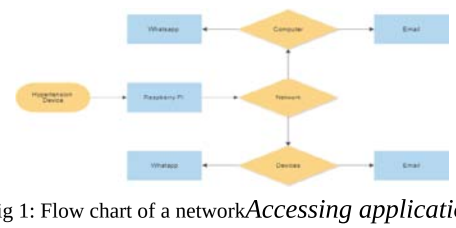

Fig 1: Flow chart of a network*Accessing applications*

A few software programs have been employed to ensure the project's effective completion and execution. A tracking tool called H-term is applied to read and view the analog data sent from a hypertension tracker to a personal laptop. The display of the H-term software can consistently

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show three different sorts of data on the hypertension tracker. Another piece of software used in this project was Putty, which was employed as a system file sharing tool. The software used to run the programme on the Raspberry Pi is called PuTTy. To utilisePuTTy, one must confirm that the Raspberry Pi's IP address has really been verified and entered properly. To ensure that the PuTTy and the Raspberry Pi device can connect, this is done. It demonstrates that the Python scripting language is run using the PuTTy technology. If a user turns on the hypertension monitor, the system activates. The user must then wait for the device to detect their hypertension. Before being sent to email and WhatsApp, the results will first be presented in the Juice SSH program. A helpful Android software that makes it simple to operate Linux servers is called JuiceSSH.

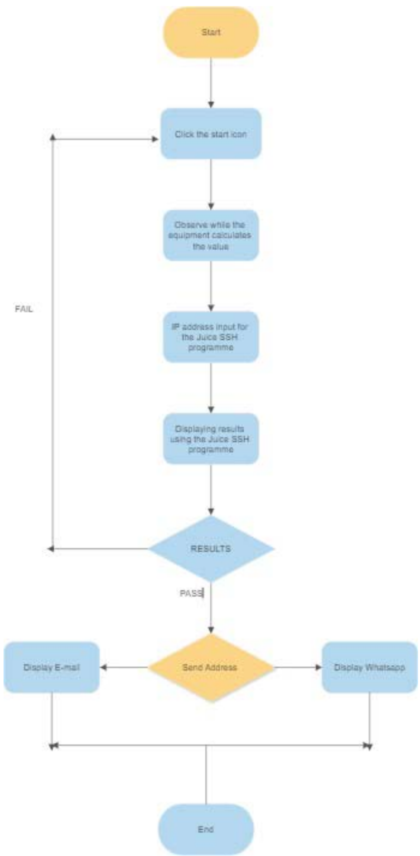

Fig 2: Flow Chart

A. *Structure of the devices*

The information from the hypertension sensor is sent to a personal laptop using a Universal Serial Cable to TTL Wired connection. In this project, there are two ways to access the internet: using an Ethernet connection and a wireless adaptor. In this design, a Raspberry Pi model B+V1.2 with 40 General-Purpose Information pins is used. Linking the USB cord to the PC will provide the Raspberry Pi with the 5 volts it needs to turn on. The wrist-mounted hypertension tracker utilised in the experiment has the product code CK101. Using a USB to the Universal Asynchronous Receiver Transmitter cable, the hypertension information from Electrically Programmable ROM will be sent to the PC. Figure 3 shows the hypertension device used in this experiment.

Fig 3: Hypertension Device

III. Result and Discussion

The wrist-mounted hypertension tracker is linked to the Raspberry Pi with a USB wire. The WiFi dongle is then attached to the Raspberry Pi to provide internet access. The data must be transferred via a Bluetooth link in order to use the Networks.

A. *Results on WhatsApp and email*

It depicts the Whatsapp application displays, while it shows a screen grab of an Email. Basically, the hypertension values, a description of the findings, and a date regarding when the information came were all presented on both devices. According to the American Heart Association (AHA), hypertension is deemed to be normal if it is less than 120 mmHg and high if it is around 120 and 129 mmHg. The remainder is classified as systolic, stage 1, or stage 2. Based on the data, a summary is generated by the software according to each person's systolic readings, regardless of whether they indicate a healthy, lower, or high hypertension measurement

B. *Hypertension accuracy depends on user location*

When the data was collected, the user's hypertension was healthy. In the sitting posture, hypertension appears normal. In the standing position, hypertension appears more, and in the laying position, hypertension appears down. When the user is seated and holding the device properly, the readings are most accurate.

IV. Conclusion

The establishment of an Internet of Things Hypertension tracking system utilizing a Raspberry Pi is discussed in this study. The system can read and transfer data to both the WhatsApp and Email applications, according to the results. The system has successfully undergone design and analysis. Future wireless connections between the Raspberry Pi andhypertensiontracker will allow for a more compact design. Additionally, the concept might be expanded to read additional medical devices like ECGs. Additionally, the system can combine many wireless technologies, including Wi-Fi, Multi-hop Wireless Systems, and Device-to-Device Connections.

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Improving Seedling Quality and Predict Plant Growth Using Convolutional Neural Networks

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***Abstract*—Plant seedling classification is a crucial task in the field of agriculture as it plays a significant role in the evaluation of the seedling quality and the prediction of plant growth and yield. With the advancements in computer vision and machine learning techniques, various methods have been proposed for automating this task, ranging from traditional machine learning algorithms such as decision trees and k-nearest neighbors to deep learning techniques such as Convolutional Neural Networks (CNNs). The choice of method depends on various factors, including the quality and size of the data, the computational resources available, and the desired level of accuracy. In recent years, deep learning methods have shown promising results in plant seedling classification due to their ability to automatically learn stratified representations of the data. Despite these advances, there are still significant challenges in this field, including the variability of seedling shapes, the limited availability of annotated data, and the difficulty of generalizing models to new species. To address these challenges, ongoing research focuses on improving the performance of existing methods and developing new methods that are more robust and generalizable. This proposed work deals with applying CNNs to the plant seedling dataset. The dataset contains 5545 train images and 794 test images, based on images of approximately 960 unique plants belonging to 12 species at several growth stages, when the models' convolution blocks were decreased, the reduced layers gave a validation accuracy of 93 percent, while the model without reduced layers provided a validation accuracy of 95 percent.**

Keywords—Convolutional Neural Networks (CNN), Deep Learning, Plant Seedling, Machine Learning

I. INTRODUCTION

CNNs are well-suited for plant seedling classification due to their ability to learn features from images and their effectiveness in image classification tasks. However, it's important to consider the specific problem and available data when choosing a machine-learning technique. The task of classifying diverse varieties of plant seedlings based on different characteristics is known as "plant seedling classification." Due to their capacity to automatically learn and extract information from pictures, convolutional neural networks (CNNs) are the popular choice for this purpose. However, depending on the issue and the data at hand, different machine learning models like K-Nearest Neighbors (KNN), Support Vector Machines (SVMs), and Decision Trees can also be used to classify plant seedlings.

Using decision trees, it is possible to categorize subtrees according to their size, form, and color. Decision trees may efficiently understand the relationship between the features and the target class by segmenting the data into smaller subsets based on the most crucial feature.

K-Nearest Neighbor (KNN) is a non-parametric classification method that can be used to categorize subtreesaccording to how closely they resemble known examples. The KNN algorithm can categorize a new subtree given a set of previously labeled subtrees by locating the k nearest neighbors in the training data and applying the majority class label.

By utilizing the spatial hierarchical learning of characteristics from photos, CNNs can be utilized to classify seedlings. To forecast the properties of a novel type of seedling, the network can be trained to recognize traits of the seedling, such as the form and texture of the leaves.

Support Vector Machines (SVMs), Random Forests, Naive Bays, and Artificial Neural Networks are additional methods that can be utilized for subtree categorization (ANNs). These methods can help in capturing intricate connections between things and target classes and in producing precise predictions based on learned models.

It is significant to remember that the technique used will rely on the particular situation, the data at hand, and the desired result. Synchronous learning is the process of using many methodologies and combining their predictions to produce more accurate predictions.

As can be seen from the above plot, The bar chart with the maximum number of images belongs to the class Loose Silky-bent. There is class imbalance with 5 classes having a really low number of images while 2 classes have a high number of images with the rest around the median.

Fig. 2 shows the class imbalance and can also be inferred from the pie chart, but this shows that it is not as steep as compared to the bar chart. It is advisable to normalize the count to give a better representation of the data present.

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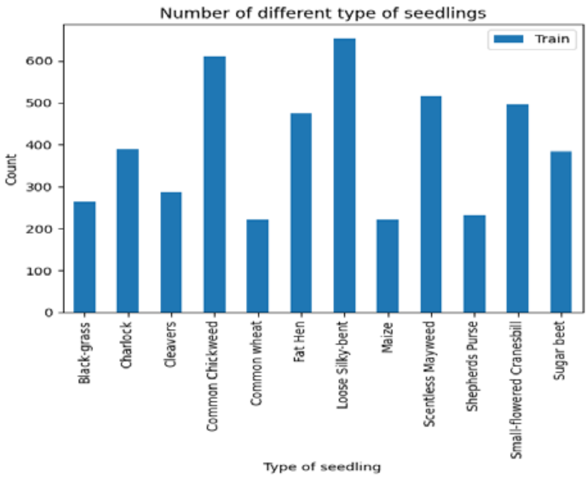

Fig. 1. A bar graph displaying the prevalence of various seedling kinds

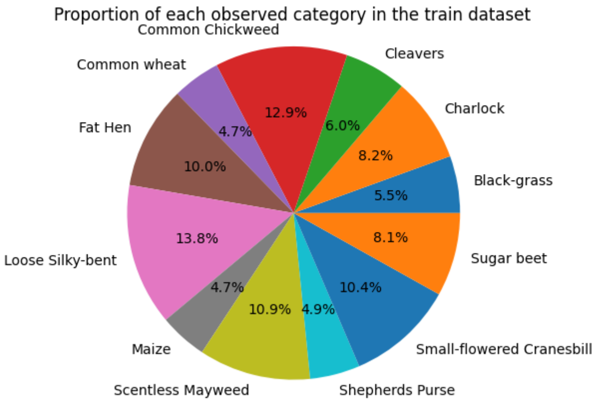

Fig. 2. Pie Chart representing proportions of each observed category in the training dataset.

II. Literature Survey

After surveying the available literature, we understand the architecture of learning methods, deep learning image models, transfer learning approaches using deep convolutional neural networks, and the methodology used to determine the classes of the plant seedlings.

A. *Convolutional Neural Networks have the following advantages:*

- Image Recognition: CNNs are particularly adept at classifying images because they can learn spatial feature hierarchies.
- Automated Feature Extraction: CNNs can recognize and learn about features automatically from input images, doing away with the requirement for manual feature engineering.
- Translation Invariant: CNNs can recognize entities in any location within a picture because they are translation invariant.
- Sparsity of Connections: CNNs are computationally effective due to their sparse connections, which enables them to process high-dimensional data such as images.
- Shared Parameters: By minimizing the number of parameters that must be learned, shared parameters in a CNN's convolutional layers enable the network to learn many features from various regions of the image.
- End-to-End Training: CNNs can be trained from beginning to end, increasing the automation and effectiveness of the learning process.

B. *Limitations are also there while using Convolutional Neural Networks, those are listed below*

- Data Diversity: One of the major limitations of current CNN-based methods is the limited diversity of the training data. Most existing methods use small and homogeneous datasets, which may not accurately represent the diversity of plant species and growth stages. To overcome this limitation, larger and more diverse datasets need to be collected and used for training the models.
- Transfer Learning: Another challenge is the limited availability of annotated data for training the models from scratch. To get around this problem, transfer learning—which involves fine-tuning previously trained models for the task—can be an effective strategy. However, the performance of transfer learning can be affected by the differences between the pre-trained model and the target task, and appropriate methods need to be developed to address these differences.
- Model Robustness: CNN-based methods can be sensitive to variations in the images, such as changes in lighting conditions and image resolution. To make the models more robust and effective in real-world scenarios, methods need to be developed to address these variations and improve the robustness of the models.
- Explanation and Interpretability: While CNNs have shown to be effective in plant seedling classification, they are often considered black box models, making it difficult to understand the reasons behind the predictions. To improve the transparency and interpretability of the models, methods need to be developed to provide explanations and interpret the decisions made by the models.

As a whole, while CNNs have shown to be effective in plant seedling classification, there is still much work to be done to overcome the limitations and gaps in the current methods and improve the performance of the models for real-world applications.

III. About the Dataset

The Aarhus University Signal Processing group, in collaboration with the University of Southern Denmark, has recently released a dataset containing images of approximately 960 unique plants belonging to 12 species at several growth stages.

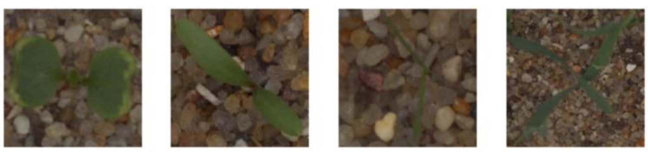

Fig. 3. Arbitrary selection from the data

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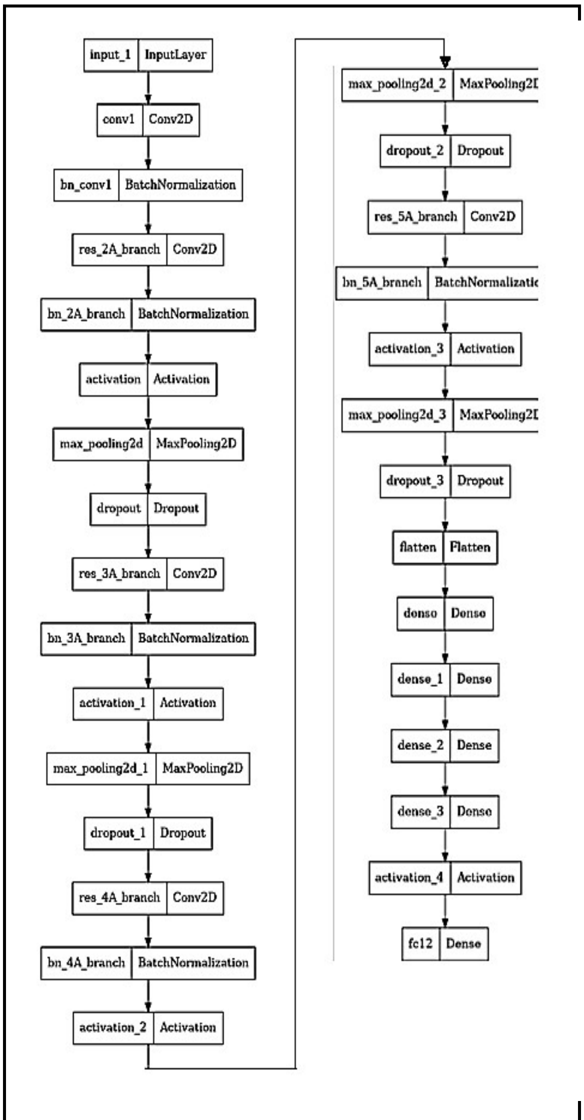
IV. PROPOSED WORK

The proposed work for plant seedling classification using Convolutional Neural Networks (CNNs) involves the development of a deep learning model to classify images of plant seedlings. The process will start with the collection of 5545 images representing different species and stages of growth, which will then be preprocessed and divided into training, validation, and testing sets. The CNN architecture will be designed to extract hierarchical features from the images using multiple convolutional, max pooling, and fully connected layers. The model will then be trained using the training set, validated using the validation set, and finally tested using the test set. The results will be evaluated using various performance metrics, such as accuracy and F1 score, and compared with other methods. The trained model will be capable of automatically classifying images of plant seedlings and providing valuable insights into the quality and growth potential of the seedlings, making it a useful tool for farmers and researchers in agriculture.

V. MODEL ARCHITECTURE

C. General Structure



Proposed General Model Architecture

Model: "CNN"

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 150, 150, 3)]	0
conv1 (Conv2D)	(None, 73, 73, 64)	4864
bn_conv1 (BatchNormalization)	(None, 73, 73, 64)	256
res_2A_branch (Conv2D)	(None, 73, 73, 64)	102464
bn_2A_branch (BatchNormalization)	(None, 73, 73, 64)	256
activation (Activation)	(None, 73, 73, 64)	0
max_pooling2d (MaxPooling2D)	(None, 36, 36, 64)	0
dropout (Dropout)	(None, 36, 36, 64)	0
res_3A_branch (Conv2D)	(None, 36, 36, 128)	73856
bn_3A_branch (BatchNormalization)	(None, 36, 36, 128)	512
activation_1 (Activation)	(None, 36, 36, 128)	0
max_pooling2d_1 (MaxPooling2D)	(None, 12, 12, 128)	0
dropout_1 (Dropout)	(None, 12, 12, 128)	0
res_4A_branch (Conv2D)	(None, 12, 12, 256)	819456
bn_4A_branch (BatchNormalization)	(None, 12, 12, 256)	1024
activation_2 (Activation)	(None, 12, 12, 256)	0
max_pooling2d_2 (MaxPooling2D)	(None, 4, 4, 256)	0
dropout_2 (Dropout)	(None, 4, 4, 256)	0
res_5A_branch (Conv2D)	(None, 4, 4, 512)	6423040
bn_5A_branch (BatchNormalization)	(None, 4, 4, 512)	2048
activation_3 (Activation)	(None, 4, 4, 512)	0
max_pooling2d_3 (MaxPooling2D)	(None, 1, 1, 512)	0
dropout_3 (Dropout)	(None, 1, 1, 512)	0
flatten (Flatten)	(None, 512)	0
dense (Dense)	(None, 256)	131328
dense_1 (Dense)	(None, 256)	65792
dense_2 (Dense)	(None, 256)	65792
dense_3 (Dense)	(None, 256)	65792
activation_4 (Activation)	(None, 256)	0
fc12 (Dense)	(None, 12)	3084

Total params: 7,759,564
Trainable params: 7,757,516
Non-trainable params: 2,048

Proposed Work Architecture

VI. RESULTS

From Figure 4 and Figure 5 below we can observe that the model has arrived at the global minimum. It's excellent

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that the model isn't overfitting. However, the terrain is too uneven; the optimizer's momentum and learning rate may need to be changed.

Figure 6 Confusion Matrix, shows that our model is biased toward the loose silky bent plant seedling class.

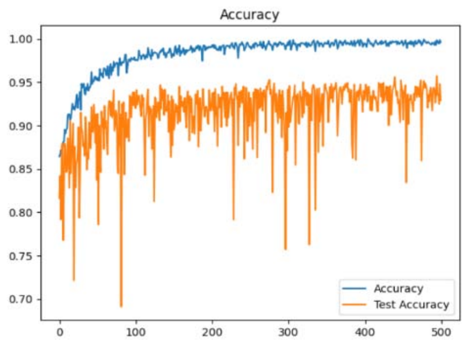


Fig. 4: Train Accuracy compared with Test Accuracy

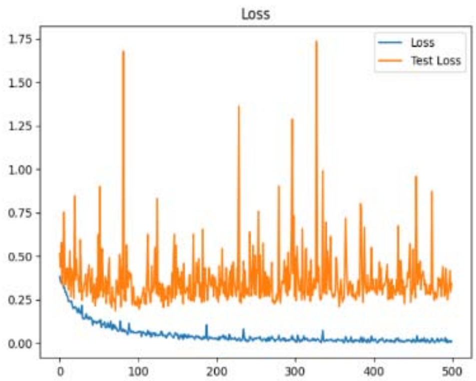
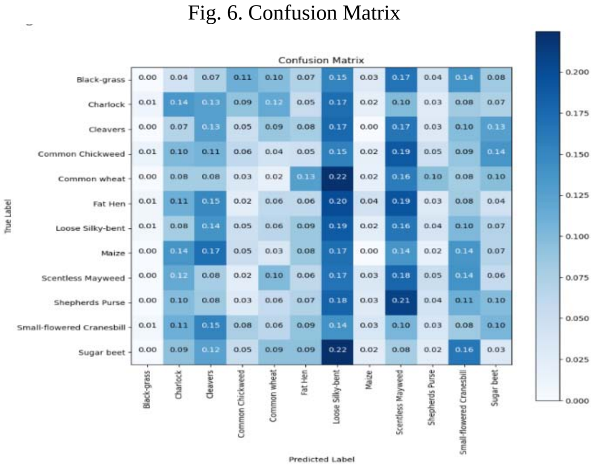


Fig. 5: Train Loss compared with Test Loss

Fig. 6. Confusion Matrix



VII. CONCLUSION

The results from the plant seedling classification using Convolutional Neural Networks (CNNs) show promising performance, with a validation loss of 0.25 and validation accuracy of 95.80%. This indicates that the model was able to learn the representations of the images and make accurate predictions for the validation set. The loss of 0.01 indicates that the model was able to generalize well to unseen data and avoid overfitting, which is a common challenge in deep learning. The high accuracy of 95.80% indicates that the model was able to correctly classify a large percentage of the images in the validation set. These results suggest that the proposed CNN-based method is a promising approach for plant seedling classification and can provide valuable insights into the quality and growth potential of the seedlings. But more research is required to verify the findings and assess how well it performs in comparison to alternative approaches. The resulting test score was 85%.

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A Peak Load Scheduling for Qos Promotion in Energy-Efficient Datacenters.

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***Abstract*— In Cloud frameworks, Virtual Machines (VMs) are booked to has as per their moment asset use disregarding their generally and long haul usage. Likewise, as a rule, the booking and arrangement processes are computational costly and influence execution of sent VMs. In this work, a Cloud VM booking calculation that considers previously running VM asset use over the long haul by examining past VM usage levels to plan VMs by improving execution The Cloud the executive's processes, as VM situation, influence previously sent frameworks so the point is to limit such execution corruption. Also, over-burden VMs will quite often take assets from adjoining VMs, so the work augments VMs genuine CPU usage. The outcomes show that our answer refines customary Instant-based actual machine determination as it learns the frameworkconduct just as it adjusts over the long haul. The concept of VM planning as suggested by asset checking data extrapolated from previous asset usages (counting PMs and VMs). The count of the actual machine gets decreased by four boundaries utilizing the TYPE, CPU, MEMORY, COST.**

Keywords—Long usage,Calculation, Utilization, Cost, CPU usage.

I. INTRODUCTION(*CLOUD COMPUTING*)

Distributed computing is the cutting edge computational worldview. It is quickly merging itself as the eventual fate of conveyed on-request processing. By utilizing the idea of virtualization; Cloud computing is becoming the backbone of choice for a wide range of digital businesses. However, Internet-enabled business (also known as "e- Business") is now one of the finest strategies. Processing is being altered to a model that consists of administrations that are commoditized and delivered in a fashion similar to traditional utilities like water in order to fulfil the needs of web-enabled company. Regardless matter where the services are offered or how they are delivered, clients can access them based on their needs. The promise to convey this usefulness figuring has been made by a few processing ideal models.Distributed computing isonesuch dependable processing worldview.Distributed computing engineering comprises of a front end and a back end. These two closures are associated byInternet or Intranet. The front end involves customer gadgets like slight customer, fat customer or cell phones and so forth The customers need some interface and applications for getting to the distributed computing framework. The back end comprises of the different servers and information stockpiling frameworks. There is likewise a server called "Focal Server". A focal server is utilized for controlling the cloud framework. It additionally screens the general traffic and satisfying the customer requests continuously.

II. CHARACTERISTICS OF CLOUD COMPUTING

A. *Shared Facilities*

Uses a virtualized software approach to share physicalresources including networking, storage, and services. Regardless of the deployment option, the cloud infrastructure aims to maximise the use of the available infrastructure among a number of users.

B. *Flexible Provisioning*

Enables the provision of services in accordance with the needs of the current market. Software automation is used to carry out this task automatically, allowing for service growth and contraction. capacities along with appropriate. While performing this dynamic scaling, high standards of reliability and security mustbe up held.

III. RELATED WORK

- **Yong Yuet**has suggested this paper. A server that keeps information, a cloud provider, for example, can show a validator that such data is, in fact, being stored by the information owner thanks to a technology called remote information trustworthiness checking (RDIC). As most of these advances depend on the expensive open key foundation(PKI), that would potentially restrict the deployment of RDIC, they have an issue with advanced key management. A number of RDIC conventions have been published in writing up to this point. In this article, we propose another enhancement of the character-based (ID-based) RDIC convention in order to decrease the public key validation structure's complexity as well as the cost of establishing and maintaining it in RDIC systems that use PKI. We formalise RDIC based on ID, which has no information security against an outside verifier and no defence against a rogue cloud server, and its security model. The suggested ID-based RDIC protocol states that the validator is not provided with any RDIC protocol data.It is demonstrated that, in contrast to the conventional collection paradigm, the unique technique achieves zero information protection

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from a verifier and is secure against the malicious server.Consequently results of a thorough security research and implementation show that the recommended convention is clearly secure and useful for usage in actual applications. In this work, we investigated character-based distant information trustworthiness verification, a distinct method for secure distributed storage.

- **UsmanWaziret**has proposed this paper Global clients can access dispersed assets thanks to distributed computing. The flexible engineering used in distributed computing provides organisations in many locations with services as needed. However, there are a lot of challenges with cloud administrations.

Different approaches have been suggested for distinct types of cloud administrative challenges. In order to overcome the challenges with SLA, this study evaluates the many models for SLA in distributed computing that have been developed. Performance issues, customer satisfaction issues, security issues, profitability issues, and SLA breaches. We go through SLA design in distributed computing. The SLA models that have been suggested for usage in several cloud management models, including SaaS, PaaS, and IaaS, are then covered. Tables are used to explain the benefits and limitations of existing models in addition to this section. In the final section, we conclude and signal the conclusion. In this post, we reviewed various SLA models used in a setting of cloud applications. Some of the devices can provide excellent customer data protection, while another portion of the models can charge SLA infractions. Some of these boost customer confidence, while others enhance displays.

- **PritiNarwalet**has published this particle on Distributed computing is another transformative along with dynamic stage that utilizes virtualization innovation. In Cloud figuring climate, Every application may function in a separate environment called a virtual machine thanks to virtualization, which isolates the equipment framework components in programming. The hypervisor distributes numerous clients hosted on the same server in virtualization. Despite the fact that it gives many advantages like asset sharing, cost-proficiency, superior executioncalculability and diminishing in equipment cost however it additionally forces various security dangers. Risks can have an impact on a virtual machines (VMs) either directly or indirectly through the virtual machines in which the Hyper-visor supports. This study uses a game theoretic method to give an audit of all potential security risks and associated mitigation strategies. Due to the free and important dynamic character of cloud clients, where each player would seek out the optimal arrangement in a secure manner is handled, game theory may be used as a safeguarding endeavour.
- **Nitin Kumar** Sharmaet.al has proposed this paper Quality Based Access Control (ABAC)is a kind of models that are planned with the intention of overcoming the drawbacks of outdated accessible methods of control (DAC in addition to this MAC and finally RBAC) and combining their advantages. Attribute - based access bases admittance limitations on the non-exclusive qualities of drugs. Many reputable security strategies tie access decisions to credits. ABAC models may be used to find security measures, which can then be properly classified and handled using OWL. In OWL, we have described models, places, information, and security measures, and a justification was used to decide what is allowed. This research, we describe a technique using Web Ontology Language to handle the Aback model (OWL). Utilizing the EYE reasoned, which derives the intelligent relationship and concludes the entrance reward for each described action,the need of strategies is completed. In this work, we have demonstrated how the Web Ontology Language may be used to handle the Attribute Based Access Control paradigm (OWL).
- **ZiadIsmailet**has suggested this paper. Critical security issues have been introduced by recent advancements in distributed computing to assure the categorization, dependability, and accessibility of information that has been appropriated. Usually, the client and the cloud provider agree to a Service Level Agreement (SLA). Check the cloud provider's adherence to the SLA's information reinforcement criteria for still another benefit. The accuracy and accessibility of updated information may be thoroughly examined using a variety of security mechanisms. A client or a self-sufficient component, which we'll call the verifier, may be given this responsibility. However, confirming the availability of information incurs additional costs, which may prevent the customer from completing information confirmation on a regular basis. To choose the best information check technique, It may be possible to determine the connection between the verifier and the cloud provider. Finally, we show how we assess the model's boundaries and mathematically validate our model using a contextual analysis.

IV. EXISTING SYSTEM

The notion of VM scheduling based on resource monitoring data derived from previous resource utilizations (including PMs and VMs), and the resource data are categorised using the optimizationmethods K-NN and NB, thus scheduling is performed. A classification model makes an effort to infer a conclusion from observable facts. A classification algorithm would make an effort to predict the value of one or more outcomes provided two or many sources. Results that potential labels that might be used on a dataset. The two methods of machine learning are supervised and unsupervised. In a supervised model, the classification algorithm is fed a training dataset. The k-nearest neighbour approach is a non-parametric tool for algorithm likes regression and classification (k-NN). In both scenarios, the input consists of the nearest neighbor training instances in the feature space. Whether k-NN is used for classification or regression, the outcomes will change.

V. PROPOSED METHODOLOGY

A idea seems to be present the concept of VM scheduling based on resource monitoring data taken from previous resource utilizations and to assess previous VM

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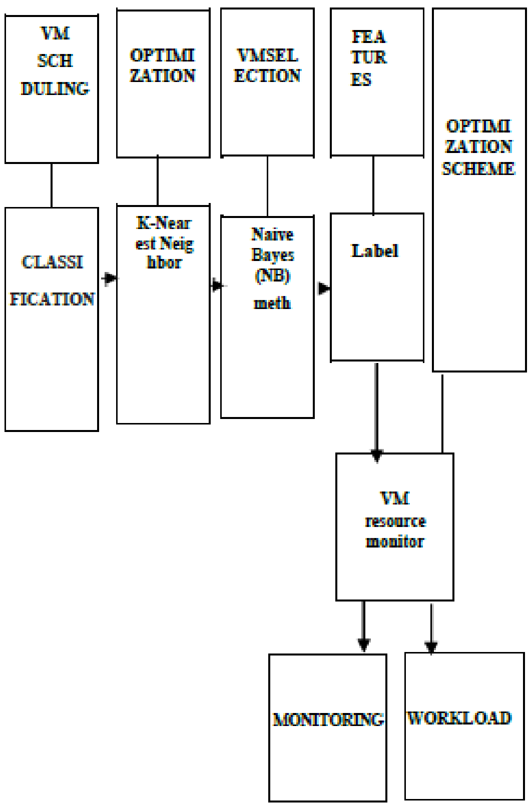
usage levels using two classification techniques such as PSO in order to schedule VMs while maximising performance. The suggested VM scheduling technique improves the VM selection by gathering real-time monitoring information and examining physical and virtual resources during the period. The goal is to improve VM scheduling by including factors relating to real VM use levels, so that VMs may be deployed while reducing the penalization of overall performance levels.

A. VM Scheduling

By relying on continuous dataset observation information collects and study of actual and virtual assets, the recommended calculation improves the VM determination phase. We want to improve VM planning. VMs may be put by limiting the punishment of generally speaking execution levels by combiningcriteriarecognised with real VM use levels. The upgrading plans include study on the widely disseminated virtual machines (VMs) to incorporate (a) higher utilisation levels and (b) lower presentation drops. A checking engine that accepts the usage of assets online while gathering information from virtual machines The motor is made to gather stretch-based framework information and save it in an internet-based cloud administration so that it is accessible for information management. Information from each brief moment (for instance, 1 second) is recorded.



VI. Classification Algorithm

A. The K-Nearest Neighbour Method

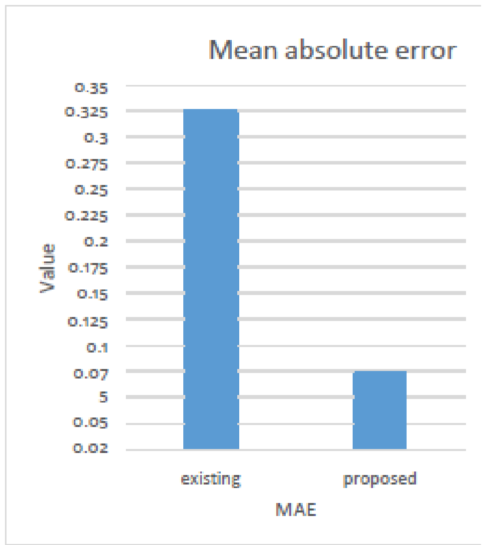
A fundamental calculation called K-closest neighbour preserves all examples that are already known and creates new cases based on a similitude measure supervision. K-NN has been used for quantitative evaluation and examples. A non- parametric technique for characterising and relapsing is the computation of K-Nearest Neighbours (KNN).

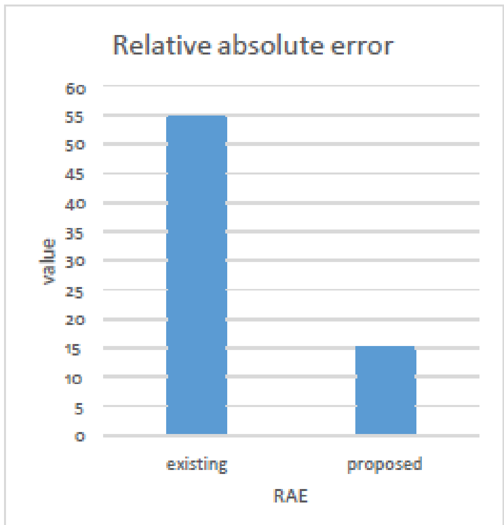
B. Optimization Scheme

These development plans seek to identify the PM's asset heaviness as indicated by the VMs' asset usage. This will show details on the general condition of transmitted VMs, such as whether a responsibility is running or not. To do this, we provide two upgrading strategies. The KNN is used to characterise the order in which the VM state for its current asset consumption. Before aggregating the data using AI techniques like K-NN, the virtual machine asset utilisation dataset are first acquired and confirmed.

VII. Experimental Setup

The outright mistake is characterized as the outright worth of the contrast between the deliberate worth and the genuine worth. In this way, let:





ea = the outright mistake ,

xm = the deliberate worth ,

xt = the genuine worth .

Finally,formula to recording a clear error is:

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$$ea = | xm - xt |$$

CONCLUSION

Various virtual machine location computations were used for planning by selecting actual machines based on framework information (such as CPU, memory, and transfer speed) in the cloud framework. Real-time VM asset utilisation levels are not taken into consideration in the current VM scenario. Furthermore, a prediction is given for a particular VM scenario based on the previous VM usage experiences. After that, the VM use is described, information is generated to calculate the anticipated VM asset consumption and place VMs as needed. A calculation that allows VM scenario as per PM and VM usage levels was offered, as well as a computational learning approach based on the notion of analysing historical VM asset use as per authentic data to speed the PM determination stage. In addition, a VM arrangement calculation based on continuous virtual asset checking was provided, in which AI models are used to prepare for and profit from previous virtual machine asset use. An observing motor is therefore accepted with asset utilisation information. By using KNN, the real machine's count is reduced by four. The task completed by 28 real computers when using pre- selected VM for work is reduced by 24 actual machines when using KNN.

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Design and Implementation of Motion Detector-Based Anti-Theft Bag System

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***Abstract*— Thievery and misplacement of luggage are two of the major exasperating and inconclusive troubles faced around the globe by the people who travel a lot. Many innovations were put in place to solve this problem, but they were unsuccessful and lacked in implementing progressive technologies. This work is an advanced approach to prevail over such concerns. Unlike the existing systems, this system equips an idiosyncratic and coherent property of the SMS (Short Message Service) controllable location tracer and motion detection of the luggage or the bag. Which can be turned on as per the need of the user. The system further integrates a GPS (Global Positioning System) which sends the coordinates as SMS. This proposed system is incorporated with existing technologies to get to the button of the above discussed obstacles faced by the user in the most efficient and peculiar way.**

***Keywords*—Arduino UNO, SMS, GSM module, GPS module, Orientation, anti-theft.**

I.INTRODUCTION

Data released by the Delhi Police show that over 70% of cases of baggage theft at Indira Gandhi International Airport involve items accidentally left behind in the trolleys or in the taxis by passengers involuntarily. According to a senior GRP Official, approximately 84% crimes on Mumbai railways reported in the year 2021 were of theft. Tourists have always been obvious targets for thieves. In 1950, at the commencement of the jet age, just 25 million people took foreign trips. By 2019, that number had reached 1.5 billion, and the travel and tourism sector had grown almost too big. These statistics give us a sign that frequently tourists are at risk of theft, exclusively bag theft, which is one of the foremost misdemeanours against tourists.

This work has been proposed after numerous analysis on the disputes encountered by the user with their luggage while traveling around like their bags has been missing or stolen because of the misplacement or because of some carelessness while transporting it, [1] and one of the major issues we received from the user is that they demand to depend on others to take care of their bags when they are not available at that particular places, so they are depended on some intruders to take care of their bag, which is a perilous process. People who lead their life in metropolitan cities are frequently prone to thievery and misplacement of their bags because of their frenetic schedule. The presently usable smart bag system particularly allows the user to access its location whenever it is missing through a real time location detector, but does not contribute any kind of comprehensible anti-theft features [2,3,4]. The put forward system serves a solution for concluding the cited issues adequately.

The proposed work yields an effective solution for luggage security. The system is more favourable to people in metropolitan cities who carry expensive things. Gadgets for their day-to-day activities and some for special things such as an application of the internet of things. The user entirely controls this system with the help of SMS [16,17]. In this system, a signal is sent through an SMS since the primary target of the system is to make it convenient for the users to ensure maximum safety, such that no extra applications are required to control the system which may lead to unwanted malware entering the phone. This system is also incorporated with the motion detection which provides extra protection [13,14]. The user will be able to control all the above things with a very basic phone. This ensures that the user does not need to buy any special device.

II.LITERATURE SURVEY

Nagar M et al. have done research on implementation of GSM and GPS modulebased tracking systems with an emphasis on easiness in installation in [2]. The authors claim it to be a "plug-and-play device" owing to the simplicity it provides for the user. MNH Raimi et al.have implemented a smart bag which has a solar panel with it for both powering the system and charging devices in [3]. Object tracking feature, implemented using GPS, is present in this project. The author abbreviates it as 'SVB'. E Terence et al.have made a project which solves the strain of carrying heavy bags in [4]. This system also incorporates a GPS tracking system with GSM acknowledgement to the user. A. Ifeoluwa and I Francis have implemented a GPS tracking technology with the main intention of providing security to Nigerian school students in [5].It is told that this project could be considered as a business-to-government (B2G) model. NavyaAnanthula et al. have proposed a system base of which is a GPS based women's safety system that consists of dual-alerts that is voice module and message which is sent through GSM to the predefined mobile number in [6]. The entire system is

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activated with the help of a dedicated button. SuvarnaLakshmi et al. have made a research on a device mainly intended in providing safety to women in [7]. This is implemented using a GPS-GSM tracking system with audio and image capturing of the culprit. M. V. Singh et al. have implemented a GPS tracking device with target users as students in [8]. This device has an alerting system which reminds the users about the books to be arranged into their bags. Sunil K Punjabi et al. in [9] have proposed a system for women and children which allows immediate responses to any harassment in public places, societies, etc. It has a pressure switch which sends an SMS when pressure is applied at critical instances.

III. FUNCTIONING OF PROPOSED WORK

The whole system is controlled using the SMS system through the GSM module. As a result, the system must only execute commands issued by the owner of the bag. To do this, each unit of the system is given a unique password during the initial step of system setup. An Arduino UNO, being one of the most conveniently programmable and effective development board, is programmed with Embedded C to control all the modules connected to it. A GSM module is connected to the Arduino UNO, and it receives commands from the user through SMS and transfers them to the Arduino UNO's digital pins. To increase the system's applicability, it also sends an SMS to the user with information on possible threats as well as real-time geographic coordinates. There are several ways to implement position tracking using a GPS module, and it has numerous uses [5-8]. A GPS module is connected to the Arduino in order to collect real-time position coordinates. The precision and reliability of GPS systems are enhanced in numerous ways [9,10]. Gyroscopes are employed in a variety of applications [11,12,13]. They are getting better as technology develops [14]. This module is additionally linked to the system and provides real-time changes in the orientation or location of the bag when it is secured by the user, detecting changes in all six axes in three dimensions. A burglar alarm is linked to the system, and if there is any change in position, the alarm is activated, alerting the surroundings and sending an alert to the user through SMS. The preceding is depicted as a block diagram (Figure.1)

Whenever anyone tries to move the bag when it is locked by the user, the user receives an SMS warning. The burglar alarm in the system is also activated, and the people in the vicinity get notified of the theft. The system was designed such that motion detection begins only when the user sends a command to the system of their choosing. This is done to ensure that the user does not receive a warning for moving their luggage by themselves. A buzzer is rung for 2 seconds to notify the user that the system has been enabled. There are many additional equivalent features that may be enabled from anywhere in the globe using the network through SMS [15,16]. Users can replace the initially provided passwords with relevant terms which are easy for their remembrance. When the activation instruction is received from the user, the gyroscope is activated to alert the user of the bag's orientational changes. The GPS coordinates are delivered through SMS when the instruction to get location is sent. This is useful for guaranteeing the bag's security even when the user is not there. Additionally, specific commands are given for this system to assist the user with the system. The alarm will be activated when the command to instantly find the bag is sent, making it easier for the user to locate the bag in the nearby local places. It also keeps the user informed of any changes in the bag's orientation. Similarly, all of the system's digital outputs will be conveyed to the user via SMS in linguistic structure. The messages contain the necessary data, so that the user is kept up to date on all relevant information. This assures the bag's safety. When the user needs to grab the bag, the lock may be temporarily deactivated by disabling the gyroscope using a simple command, allowing the user to access the bag. When the system is deactivated and free to move, the user will be notified with a beep sound via the system's alarm, ensuring that the user does not get into any trouble.

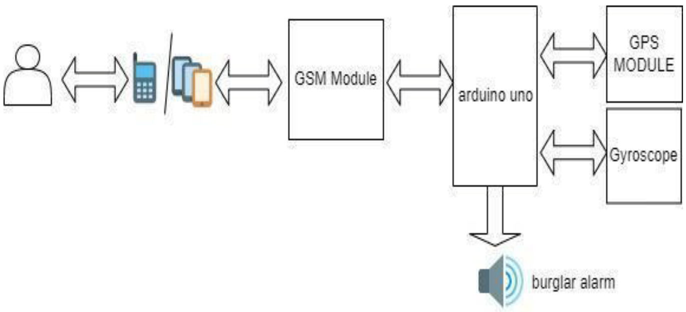

Fig. 1. The figure portraying the process flow of the system

IV. FLOW CHART

The flowchart broadly comprises two parts, namely the initialisation part and the loop part. In each process described below, these two parts are described.

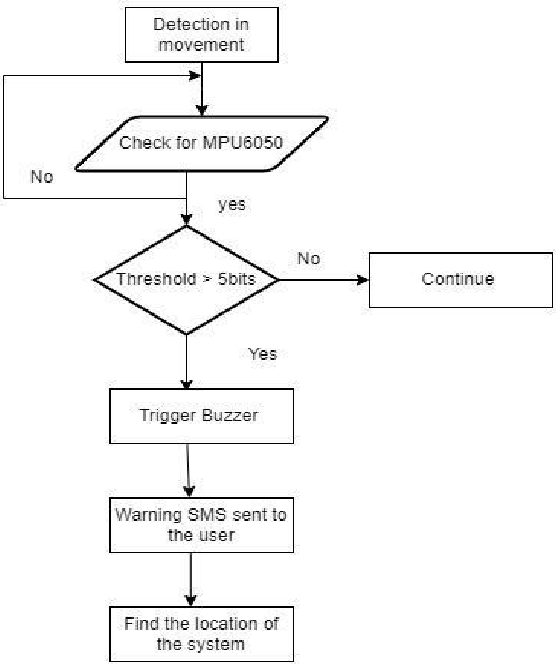

Fig. 2. Complete flowchart of the anti-theft bag system

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In Figure. 2, the GSM module is initialised by connecting its transmitter and receiver pins to the microcontroller's digital input pins. During initialization, the module attempts to connect to the GSM frequency band. The system is set up to run in SMS mode. The methodology for dealing with received messages has been established.

These parameters in the startup section are accomplished through the utilization of AT commands. A variable is declared in the loop and is used to record the received messages. All the characters within the string of received messages are capitalised. The pre-defined instructions are compared to the recorded messages. When the SMS received contains the word "LOC," the geographical coordinates are sent to the user via SMS. When the received SMS contains the word "FIND," the buzzer is activated for a limited period of time. The motion detection begins, Whenever the SMS received by the system is "ON ". The system then enters a loop in which variations in orientation are continually monitored.

The messages received are also updated on a regular basis in this loop. When an SMS is received by the system is "OFF" the system disables the motion sensing by interrupting the loop. This module serves as a conduit between the user and the protection system.

In Figure 3, the gyroscope is initialised by connecting its serial clock and serial data pins to the microcontroller's analogue inputs. The serial connection between the microcontroller and MPU6050 is established during the initialization process. The MPU6050 has a 0 to 63 Hz high-pass filter and a motion detection duration of 20ms. When the system is turned on through the command received from the user, motion detection begins inside the loop. When the change in orientation detected exceeds a threshold of 5 bits, it is considered as a change in motion of the bag, the user will be notified about movement in the bag through SMS. Following the previous step, this will activate the buzzer by digitally programming the buzzer's pin as high, enabling the user to catch the burglar red-handed. The flowchart in Figure 4 shows how the location retrieved from the GPS module and the data is transmitted to the user. When the user sends an SMS with the keyword "LOC," the position of the bag is communicated to the user in the form of coordinates for latitude and longitude. When the GPS does not acquire a proper signal, it takes some time to locate the correct coordinates which must be communicated to the user, and data from the GPS is also necessary when there is movement detection in the system to alert the user about the theft and the location of the crime. The system has some pre-defined text that must be delivered to the user through SMS based on the function invoked by the user. The above-mentioned combination of GPS and GSM has yielded numerous favourable performance [17,18]

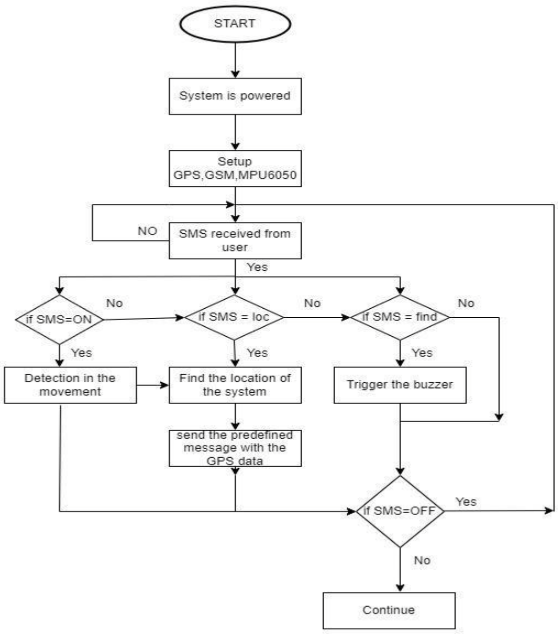

Fig. 3. Movement detection flow chart

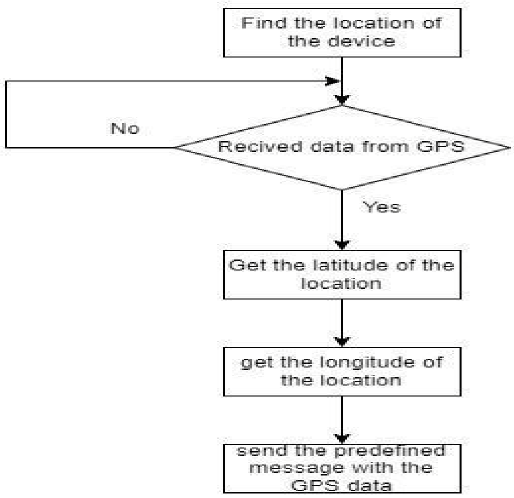

Figure. 4 Finding the location of the system flow chart

IV. RESULT

The presented results were taken out from the real time hardware testing in the period of the testing the final proto type of the proposed system and the the output results were further mainly classified into the different working states of the system which gives out the correct signals on the period of the large movement applied to the system while placed inside a bag and the classification of results are.

A. Initialization of hardware

In Figure5, all modules have been initialized. First, GPS is configured. The GSM is then connected to the global system network, as shown by the phrases "Connecting" and "Connected." The four "OK" phrases indicate that GSM is connected to the network, the module is set to SMS mode, received SMS is defined, and all unread received messages are recovered in that order. The phrase "MPU6050 detected"

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indicates that communication between the controller and the gyroscope has commenced.

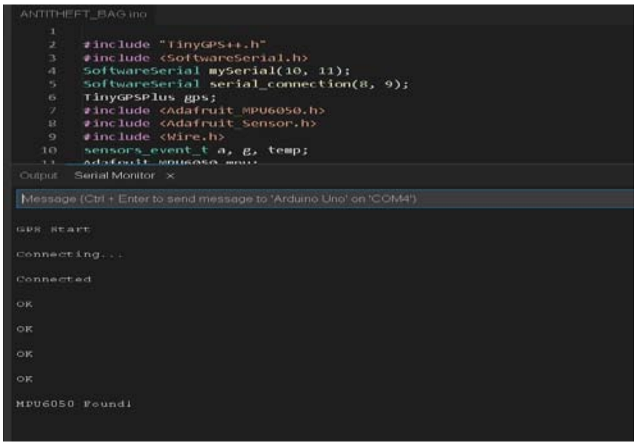

Figure.5 The initialization of the system

B. The ON function (activating the motion detection)

Figure 6(a) Figure 6 (b)

Fig. 6 User pressing the trigger button on phone

Figure.6labelled with (a) and (b) where (a) represents SMS app indicating theON function and (b) representing Serial monitor indicating the ON function .In Figure.6(b), the keyword beginning with "+CMT" specifies the phone number (which has been anonymized), as well as the date and time the message was received. Similarly, incoming messages are received. All phrases with "Ok" indicate that the message has been sent to the user. This is supported by the words in Figure.6(a). Similarly, remaining messages that are transmitted are marked. The line "Motion detected" indicates that somebody attempted to move the bag.

C. Detecting the location of the bag

Figure 7(a) Figure 7 (b)

Fig. 7 User knowing the location using simple command

Figure 7.labelled with (a) and (b) where (a) indicating SMS app indicating the LOC function and (b) indicating Serial monitor indicating the location of the system.

The keyword "LOC" in Figure 7(a) indicates that the user has sent the command to determine the position of the bag. The following phrase demonstrates how the bag's latitude and longitude are determined. The determined value is delivered to the user, as seen in Figure 7(b). There are several applications for tracking systems in this manner [19,20].

VI.HARDWARE IMPLEMENTATION

To implement the proposed idea, an Arduino UNO microcontroller, GSM module, GPS module, Gyroscope, phone, burglar alarm, and a 12 V, 1.3 Ah battery are used. These modules are controlled by Arduino UNO (microcontroller), and it is programmed using Embedded C in the Arduino IDE platform. The connections of the hardware modules are previewed in EasyEDA. The Gyroscope module makes use of the former, while the GPS and GSM modules make use of the latter. Figure 8 depicts the suggested system's architecture. The system is constructed in such a manner that all of the modules are powered by the Arduino UNO, which is supplied by an external power supply. The motion detecting capacity of the gyroscope is used here, as in prior publications [21,22]. The threshold is set low to avoid the detection of very small changes in orientation by accident or by Naturally induced acceleration.The GSM module's Rx and TX pins are linked to the Arduino board's digital pins, accordingly, so that signals are delivered and received through the allocated lines. And it is employed in SMS mode. Similar applications exist for GSM modules in SMS mode [22, 23].

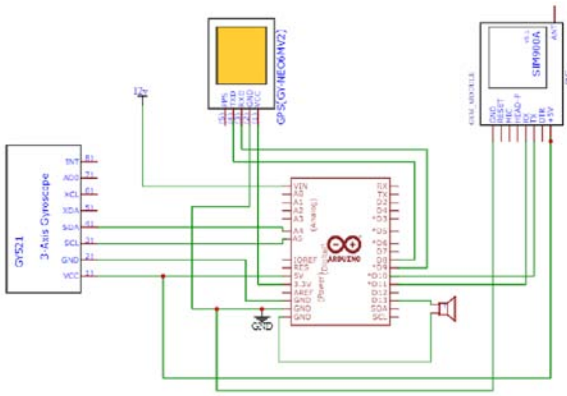

Figure 8 circuit diagram replicating the hardware which is used for simulation purpose

VII.CONCLUSION AND FUTURE WORKS

Anti-theft bags are currently available in the market, but they do not address some major and crucial issues. To address these shortcomings, a security system against bag theft using SMS controllability and a GPS location is designed. With this proposed paper, the rate of luggage theft or misplacement can be reduced in contrast to the existing scenario and systems. This also aids in finding people in critical instances such as getting lost. A basic cell phone that is a part of everyone’s life today is all that is required to manage the system and obtain information on lost or misplaced luggage. It additionally operates in locations with low network coverage. In addition to this, it benefits those who travel alone. This makes them more independent. Unlike other smart and handy bags, this method ensures additional security along with smart features. Instead of providing an image of the suspect, the proposed system provides the exact coordinates of the bag, which is more simplified but much more effective. This system may be incorporated with containers while shipping expensive items. To a much wider reaching extent, this offers security for all types and sizes of commodities. Unlike the existing security system, which catches the suspect when the bag is opened and sends a mail to the owner, instead of providing an image of the suspect, the proposed paper provides the position of the bag, which is simpler but much more effective. In industries, we may integrate this system with containers while shipping expensive goods. To a great extent, this system provides security for the commodities.

In the future, in addition to all of these functions, item detection within the bags may be added; they can also identify such that individual protection is provided to each thing present in the bag through SMS. In addition, instead of utilising the GPS module, alternative technologies can be used in the system to determine the position of the bag, as the GPS may lose signal and be unable to relay the location of the bag to the user in certain conditions.

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A Robust Texture Descriptor for IdentifyingLicense Plates in Challenging Vehicle ImageConditions using SVM Algorithm

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***Abstract*—The implementation of licenceplate detection in smart transportation systems is discussed in this study paper. The suggested system makes use of character detection techniques as well as an unique method for eliminating shadows. The invention of an enhancedbinary approach for shade elimination that blends the Bernsen approach withGaussian filter and the incorporation of a character detection method utilising the Support Vector Machine (SVM) technique are the paper's two significant contributions to the area. The SVM approach concentrates on the whole licence plate rather than individualcharacters and obtains characterattributes from a stretchy mesh. The research also presents new methods forimprovinggrayscale photos and correcting image tilt. The proposedalgorithm is resilient to variations inlighting, viewing angles, position, size, and colour of license plates, making it suitable for use in complex environments.**

I. Introduction

An image is a column- and row-organized array, or matrix, of square pixels (picture elements). The most popular and practical method of sharing or distributing information is through images. There are a thousand words in a picture. Images clearly communicate information about the positions, dimensions, and connections between items. They depict geographical data that humans may identify as objects. Because of our natural visual and cerebral capacities, humans are good at extracting information from such images. Humans get about 75% of their information in visual form. Picture compression, image amplification and revival, and dimensionretrieval are the three main types of image processing operations. Many individuals are familiar with the idea of picture compression, which seeks to utilise less memory.

II. Literature Survey

[1] An intelligent strategy for checking the annualinspection status of motorcyclesbased on: license plate recognition

Techniques for recognisinglicence plates have beeneffectively used to manageparking lots, track down stolen vehicles, andregulate traffic. This study suggests alicence plate-based method for determininga motorcycle's annual inspection status usingphotos taken at authorized inspection locations and along the roadside. Ashardware platforms, a desktop PC and an UMPC (Ultra Mobile Personal Computer)with a web camera are both employed. A search window is used to scan integratedhorizontal and vertical projections, which are used to locate licence plate locations in photos. Additionally, a character recoverytechnique is used to increase the success rate. Both a back propagation artificialneural network and feature matching are used to recognise characters. Then, using the specified licence plate.

[2] An Efficient Method of License Plate Location in Natural_scene Image

This work proposes a novel and effectivealgorithm for the placement of automobile license plates. This method's goal is to efficiently locate license plates in spite of restrictions on LP distance, angle of view, lighting, and background complexity. This approach's contribution is that it combines the mathematical morphology method with the sliding concentric windows (SCWs) method to create a faster, more reliable method. Our method utilizes the colorinformation of LP toaccurately locate it. It iscapable of identifying multiple LP inanimage,and is less restrictive than other LP locationtechniques. Furthermore, it has a quickerprocessingtime,taking only 0.1 second, makingit suitable for real-timeapplications. 200 natural-scene car photos with various backdrops and ambient lighting were used totest the system.

[3] License Plate detection of movingvehicle

This study proposes an Egyptian license plate recognition system for moving automobiles. The suggested method takes an image from a digital video camera and extracts the distinctive elements of a plate from it. The suggested method detects the numbers and letters on a license plate usingamultilayer neural network. The system is split into two primary phases: the first is the training stage, during which a dataset is produced and the neural networks are taught for recognition. The second is the recognition procedure, which includes segments for words and numbers, detecting vehicles from a stream of frames, estimating plate positions, and plate recognition.

[4] Enhancement of license plate recognition performance using Xception with Mish activation function

The research's goal is to offer a reliable and efficient method for reading characters on license plates under challenging environmental situations. The proposed method was tested using four benchmark datasets, which are, FZU Cars, Stanford Cars, Application-Oriented License Plate(AOLP) and HumAIn 2019 Challenge.

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[5] A Method for Identifying Specific Vehicle Using Template Matching

A novel recognition method is proposed in this work to overcome the concerns brought up by the identification strategy that makes use of the previously discussed template- matching process. In order to further verify the algorithm's accuracy in object recognition, we applied it to a real road. Thefindings revealed a 99.6% accuracy rate, which is sufficient for practical application.

[6] Automated new license plate recognition in Egypt

The functional use of license plate recognition (LPR) is utilized by Automatic Vehicle Identification (AVI) systems. This research offered an original and simple technique for the LPR system of Egyptian automobiles. Database communication, plate region extraction, and plate characteridentification are the three key parts of the proposed method. A video stream was one of this system's most important advantages. Real-time functionality could be used without the need of extra sensors, such as infrared ones. Automated New License Plate

[7] A Survey on License Plate Recognition Systems

This study proposes an Egyptian licenseplate recognition system for moving automobiles. The suggested method takes animage from a digital video camera and extracts the distinctive elements of a plate from it. The suggested method detects the numbers and letters on a license plate using a multilayer neural network. The system is split into two primary phases: the first is the training stage, during which a dataset is produced and the neural networks are taught for recognition. The second is the recognition procedure, which includes segments for words and numbers, detecting vehicles from a stream of frames, estimating plate positions, and plate recognition.

[8] An edge:basedcolor:aided method forlicense plate detection

Detecting licence plates is a challenge that isexamined in this research. Some commonissues include poor imagequality brought onby poor lighting, moving vehicles, shifting viewpoints and distances, complex backgrounds, etc. It is suggested to use edge density and intensity variance to improveimages in two separate ways.

[9] CarLicensePlateDetection

This study examines automobile licence plate detection (CLPD) technology, whichuses car license plates to identify vehicles (CLP). Due to several applications, including crime prevention, electronic toll collection, intelligent traffic management, etc., car license plate detection (CLPDS) is a growing field of study. The suggested system employs adaptive thresholding to produce the binary picture after converting the colour input image to grayscale. The undesirable lines are then eliminated using an algorithm for unwanted lines (ULEA).Finally, the Sobel operator detects vertical edges to identify the license plate. For the purpose of detecting license plates in both the front and back views, experiments were performed. The experimental evaluation is done on 60 photos that were obtained from parking lots and the sides of roads.

[10]Autonomous Vehicular Surveillance using License Plate Recognition over Cloud Computing Architecture

For the purposes of vehicular surveillance, these cameras are inefficient, as a lot of them will be required to monitor vehicles effectively. These cameras capture meaningful images of license plates from their video feed, and upload these images to the cloud using a Vehicular Cloud Computing architecture. The cloud compares them to a database of license plates that are flagged by law enforcement. If the license plate is found to be flagged, then the respective law enforcement authorities are notified of the location of the car.

[11]Vehicle plate number localization using a modified GrabCut algorithm

A key stage in any vehicle plate number recognition system is to first locate the vehicle plate number. In this paper, they presented a modified GrabCut algorithm for localizing vehicle plate numbers. In contrast with the traditional interactive GrabCut technique, a modified GrabCut algorithm was designed to identify and extract vehicle plate numbers in a completely automatic manner. Finally, to evaluate the performance of the proposed technique, the localization accuracy is tested with a dataset of 500 vehicleimages with vehicle plates from different countries.

[12]Region-based license plate detection

In order to recognize a license plate efficiently, however, the location of the license plate, in most cases, must be detected in the first place. Due to this reason, detecting the accurate location of a license plate from a vehicle image is considered to be the most crucial step of an ALPR system, which greatly affects the recognition rate and speed of the whole system. In this paper, a region-based license plate detection method is proposed. These candidate regions are then analyzed and classified in order to decide whether a candidate region contains a license plate.

[13]Towards aMultinationalCarLicensePlateRecognitionSystem

A full-fledged image-based car license plate recognition system is described in the paper. The localization stage of the CLPR yields a plate clip followed by character segmentation and recognition. The recognition scheme combines adaptive iterative thresholding with a template-matching algorithm. Promising results have been obtained in the experiments with Israeli and Bulgarian license plates including images of poor quality.

[14]Vehicle license plate character segmentation

Auxiliary lines are added into the image to make the separated parts of each Chinese character to be an interconnected region. The noise regions will be eliminated after two fusing images are merged according to the minimum principle of gray values. Then, the characters are segmented by projection method and the final character images are obtained. The experimental results show that this method features fast processing and good performance in segmentation.

III. PROPOSED METHOD

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Our proposed method focuses on a solution for image disturbance brought on by varying outdoor conditions including shadow and exposure, as well as uneven illumination,which are typically difficult to successfully handle using conventional binary methods. We discussed the method of extracting features from alphanumeric characters, and applied a Support Vector Machine (SVM) to classify those features. The system's overall performance along with the effectiveness of every single element were also evaluated.

This paper presents several newcontributions to the field of image processing. Firstly, a novel technique for eliminating shadows from images is proposed, which combines an advancedversion of the Bernsen algorithm with theuse of Gaussian filter. Secondly, an algorithm for character recognition is presented, which uses Support Vector Machines (SVMs) to recognize characters in an address string, rather than just a single character.

Additionally, the most effective character feature extraction are evaluated in order to determine which ones are most useful in practical contexts. The paper also includes techniques for correcting image slant and enhancing image quality. Furthermore, the paper proposes an image tilt correction method for license plate pre-processing. Finally, the paper presents the results of experiments evaluating the performance of the proposed techniques.

IV. Implementation Modules

1. *License plate preprocessing*

In license plate recognition (LPR),preprocessing the image of the license plate is a crucial step. This process includes identifying the location of the license plate, correcting any distortions in the image, and segmenting the elements on the plate. The objective of recognition is to find regions of the image that resemble a number plate. However, variations in the image's orientation can result in skewed or distorted images. Therefore, adjusting the image tocorrect these issues before attempting to segment the characters is an essential step inthe process.

2. *License plate detection*

The connected component analysis (CCA)technique is used in the search for binary images that are connected in an eight- neighborhood relationship. Using theConnected Component Analysis (CCA) method, the picture is examined and its pixels are arranged into distinct clusters based on their connectedness.

3. *Character segmentation*

Character segmentation is a multi-step process that includes the following steps: 1) creating a white backdrop with black text on the licence plate picture, 2) resizing the plate to 100x200, 3) applying tilt correction and image enhancement techniques, 4) dividing the numberplate into two portions using a projective approach, then separating theelements from each area and, 5)standardizing the size of the characters.

4. *Character Recognition Algorithm*

The peripheral direction contributive density(PDC), the local direction contributive density (L-DCD), and the global direction contributive density (G-DCD) are examples of characteristics of the stroke direction that are used in a statistical procedure. The steps taken to achieve the G-DCD and L-DCDcharacteristics are described in thistechnique.

IV. Proposed Method Diagram

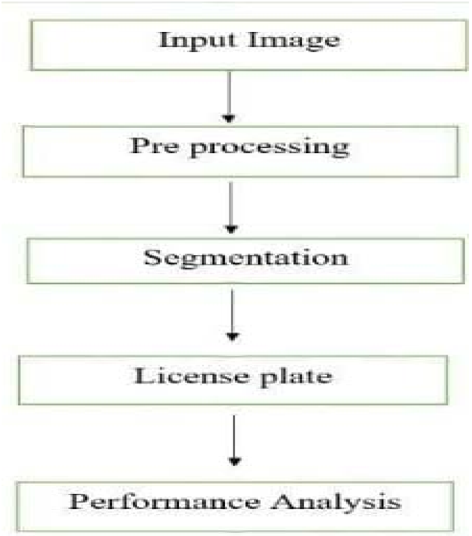

Fig.1 Proposed Method

5. *Experimental analysis*

The process of extracting features from binary characters is found to be simple and efficient, in comparison to grey-value characters. Oursystem, which can acquire images under various lighting conditions and environments, achieved an accuracy of 90.98%.

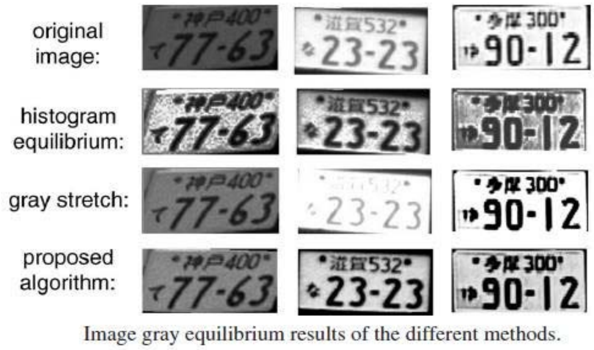

Fig.2 Image gray scale results

The performance of the system in terms of location, segmentation,recognition and overall performance was 96.96%, 98.23%, 98.01% and 93.45% respectively. To ensure optimal image quality, a step of grey equilibrium is included in the segmentation stage. In this study, we utilized a gray statistical method (GSA) to improve image quality.

V. Advantages

The License Plate Recognition (LPR) system operates as follows: When the system receives an input image, the initial step is pre-processing which includesactions such as making the image binary andeliminating noise. Then, using either frame location or character location methods, potential number plates are obtained fromthe picture. If the system is unable to locate any license plates, it will generate a "refusedrecognition" outcome. However, it ispossible for

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multiple license plates to be detected. After that, the system advances to the detection and segmentation phases. The segmentation step of the licence plate willbe completed if it can be recognised. If not, the system will consider a different possible licence plate.

Two assessments areperformed during the segmentation phase:one for a plate with a single huge number ona bright-white background and another for a binary alteration procedure. The first assessment concerns plates with a single big number on a white background. When the present approach fails to appropriately segment the plate, a different binary method is used in the second evaluation. While, text detection includes classifying characters into4 distinct categories.

The end result of the detection process is determined by selecting the best recognition method among the different methods used. To generate a legitimate licence number, all characterrecognition results are taken intoconsideration, as long as they conform to thestructural rules of license numbers outlined previously.

VI. Discussions

For a variety of reasons, including car park operations, surveillance systems in secured areas, and road system, its capacity to recogniselicence plates (LPR) is crucial. The many plate formats and the variable illumination.Outsideduring photogrammetry, including backdrop, lighting, speed limit, and camera-vehicle distance, might make this work challenging. Consequently, many techniques are confinedto specific situations such as constant lighting, predefined paths, and unchanging backdrops.

The identification and division ofthelicence plate, segmenting and normalising the characters, and character recognition make up the four key elements of an LPR system. For the whole system, thesuccess of the locating operation is essential since it directly affects the precision and effectiveness of the succeeding processes, however, this step is challenging to accomplish due to different lighting conditions and complex backgrounds.

VII. Conclusion

The three primary aspects of the license plate recognition (LPR) method presented in this work are: identifying the registration plates, dividing the tokens, and recognizing the licence tokens. The overall performance of the algorithm is 95.8%. The performance of identifying the plate, segmenting the characters and recognizing the characters individually are 96.96%, 98.23%, and 98.01%, respectively. Our system achieved satisfactory results for individual rates and overall performance. Even though the suggested method isdesigned to work with number plates from a certain nation, many of its components may be readily changed to work with licence plates from other nations. The improved binary algorithm is particularly useful in dealing with uneven illumination, a commonissue in plate detection, and can be adapted to various surrounding conditions. As license numbers are commonly composed of numerals and Roman letters, the suggested algorithm is suitable for any number plates that follow a similar composition.

VIII. Result

Fig.3. Output

As observed in the above diagram as shown the image of the vehicle is the input that was provided to the model andwegotthe number plate of the vehicle asthe output and the accuracy received was 95.8. The heat map represents confusion matrix.

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Unlocking the Potential of Machine Learning in Osteoporosis Detection: A Comparative Study of Multilayer Perceptron, Convolutional Neural Network and Dropout Models

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***Abstract* — Osteoporosis is a chronic condition characterized by low bone density and an increased risk of fractures. It is a common problem among older adults and can significantly impact the quality of life and healthcare costs. Early diagnosis of osteoporosis is crucial for the implementation of effective treatment and prevention strategies. However, current methods for detecting osteoporosis, such as Dual-energy X-ray Absorptiometry (DXA), are not always reliable and can be inconvenient for patients. In this article, we explore the application of machine learning methods for osteoporosis detection and have evaluated it using a few models, like the Multilayer Perceptron, Convolutional Neural Network A - 3 Conv. layers, (16 32 64), Convolutional Neural Network B – 4Conv. layers, (32 64 128 128) and Convolutional Neural Network+ Dropout (over Dense Layer only) to see which one might give us the best result. We used a dataset of bone scans compiled and categorized by Mendeley data and used this data to train the models. Our results demonstrate that these models can effectively identify individuals with osteoporosis with some accuracy and sensitivity, some more than others. Overall, our study shows that the best-trained model found during cross- validation has an accuracy of 89.34%.**

Keywords—- Osteoporosis, Machine Learning, Deep Learning, Detection, DXA Scans, Bone Density, CNN, Multilayer Perceptron, classifiers

I. INTRODUCTION

Bones support our bodies and give us mobility. They preserve the health of our heart, brain, and other internal organs. Bone is a growing, living tissue. It is mostly composed of collagen, a protein that imparts strength and hardness and calcium, a mineral that offers a soft structure. A calcium deficiency can lead to the bones becoming weak and losing most of their power and rigidity. This leads to them breaking up most of the time, even in minor disturbances. This condition is called osteoporosis. Osteoporosis can cause spinal or hip breaks that may provoke budgetary weight and high depressing ness. As needs are, there is a prerequisite for the early examination of osteoporosis and expecting the proximity of the break. According to the World Health Organization, musculoskeletal problems account for up to one in three cases of disability globally and impact people of all ages. These ailments include more than 150 diagnoses, ranging from straightforward fractures that recover quite fast to chronic illnesses like osteoarthritis. Such musculoskeletal problemswill become more prevalent and their accompanying socioeconomic consequences will rise as the world's population ages. Over the next few decades, the significance of accurately detecting these conditions, frequently done by Bone X-Ray scans evaluated by skilled radiologists, will only increase. An automated method for swiftly and affordably identifying bone abnormalities from X-Rays would be extremely helpful given that there are so few qualified radiologists in the world, with only a handful an automated method for efficiently and affordably identifying bone abnormalities from X-Rays would be extremely helpful given that there are so few qualified radiologists in the world, with only a handful of them being found in underdeveloped nations.

Our main objective is to build a system that can predict from the input if said person has osteoporosis, i.e., his bones are normal or not, and for that, we will train our model using a dataset and effectively train the model to get better at predicting.

This machine learning project aims to experiment and provide different solutions employing various neural network architectures in a binary classification task. In particular, the dataset at hand is composed of 614 images representing normal (359) and osteoporosis (255), a standard image classification dataset for composing and improving neural network models. All the different phases of the work are developed in python with the TensorFlow machine learning library via Colab Notebook.

II. LITERATURE REVIEW.

A recent study conducted on detecting liver disease lesions used a very highly sought-after and upcoming CNN architecture, DenseNet which was trained with around 10000 real-time samples of liver Xrays. The resulting model had an accuracy of 98.34, higher than previous works due to DenseNet‘s unique dropout layer [1].

A couple of researchers from McMaster University in Canada along with a few researchers from other universities conducted a study by training a CNN to identify vertebral compression fractures but with a twist. Instead of using a pre-labelled dataset, they used active learning to decrease

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class imbalance and produce an effective image classifier. This reduced the cost and time required to train an ML model [2]. CNN was also used todetect lung nodule candidates by training the model with the LUNA16 dataset. This turned out to be a huge success and the results surpassed the previous SOTA approach. The model also was insensitive to the input sizes of the image making it highly useable across a wide range [3]. To make skin cancer detection easier and more accurate, work was done on combining well-known deep-learning models to extract features and then use those to train support vector classifiers. The resulting model was able to give an accurate prediction of 83.83% for melanoma classification and 97.55% for another classification [4]. Another Skin cancer detection proposal used a CNN on a dataset consisting of a whopping 129,450 images to effectively compete against 21 board-certified dermatologists to classify the images into two critical binary classes. The CNN performed as good as the doctors [5]. Researchers in china concluded that the deep learning model, DCNN, could not replace DEXA for BMD (Bone Mass Density) screening, however, it might be employed if a DEXA has not been performed but a lumbar spine X-ray is easily accessible [6]. Another proposal we came across tested a Multilayer Perceptron and Naive Bayes on 33 scans. The results showed that the Multilayer Perceptron outperforms the Naive Bayer classifier in every way [7]. A test was conducted between SVG and an EBP-NN (Error Back Propagation Neural Network) to see which was able to classify fractured and non-fractured bones accurately using a dataset which was preprocessed with wavelet transform to remove noise. The SVG outperformed the EBP-NN by 2% [8]. There was a test between an FEA model and a CNN model to test bone anonymities. Both were put to the test using a large database of artificially produced cancellous bone anatomy. The execution time difference between the FEA model and CNN was around 1000 times, from 32.1 seconds to 0.03 seconds [9]. This is one of the studies that helped us go with CNN architecture. Twenty machine learning techniques were evaluated based on their popularity and frequency in biomedical engineering challenges to divide subjects into two classes (osteoporosis and non-osteoporosis). The well-known 10-fold cross-validation method has been used to evaluate all classifiers, and the results were presented analytically. Their research showed that "age" and "weight" were rated as the most significant diagnostic criteria initially generating the feature set by a feature selection approach. It was evident that eliminating the "sex" diagnostic component did not affect the majority of techniques' efficacy [10]. Cruz et al. methodically gathered and condensed the main approaches used to categorise risk categories for osteoporosis, highlighting their issues and patterns. In conjunction with earlier studies like QUS and DEXA, methods that used AI principles for categorising risk groups were emphasised, concluding that developing a model utilising AI to forecast risk groups has frequently proven to be very beneficial for the patients in their treatment. A relatively new and non-invasive technique for determining bone mineral state at the peripheral skeleton is quantitative ultrasonography (QUS). In addition to bone density, QUS methods offer some structural data that may be crucial in assessing the risk of fracture [11]. The use of fuzzy neural networks (FNN) to identify postmenopausal women with osteoporosis was suggested in another proposal that we came across. This study used 100 postmenopausal women's dental panoramic radiographs from visits to their clinic for BMD evaluations at the lumbar spine and femoral neck. The results indicate that postmenopausal women with osteoporosis can be identified in the dental clinic using a combination of cortical width and shape by employing FNN. Fuzzy neuralnetworks combine the advantages of fuzzy systems and neural networks, enabling them to consider various characteristics and variables related to a condition and produce more accurate and dependable forecasts. Using the new FNN-based system, dentists can effectively identify postmenopausal women and then refer them for BMD testing to obtain an accurate t score and continue with their testing. [12]. A system to automatically detect and localisetumours as small as 100 x 100 pixels in gigapixel microscopy images with a resolution of 100,000 x 100,000 pixels has been developed in studies on employing CNNs for disease diagnosis, such as this one. On the tough lesion-level cancer identification challenge, their approach, which makes use of a convolutional neural network (CNN) architecture, achieves state-of-the-art results when trained with the Camelyon16 dataset. According to their reported results, CNN detects 92.4% of tumours compared to 82.7% for the previous best-automated method. [13]. A proposal conducted by researchers in Saudi Arabia led them to produce a model using Mask-RCNN that is trained to perform bone age assessment and classify them. Without changing the program's structure, they applied innovative methods like the whale optimization algorithm to handle various optimization challenges for real-world applications. The resulting model had a maximum accuracy of 99.2% [14]. A study was done on assessing how well neural networks have helped various healthcare operatives were documented in a survey, where it is noted that CNN, especially in the field of ML has had the most success in medical image classification among other ML-based solutions [15].

III. Data Pre-Processing

The first step is to load the dataset into the Jupiter notebook to start working on it. Assuming the images are stored locally, this is achieved via the os python library. A crucial first step for all types of machine learning applications is to check the dataset thoroughly and apply some kind of pre-processing even the best model cannot learn much from a poor, noisy and inconsistent dataset. Given the project's experimental nature, all images present in the original dataset are being considered, without any kind of manual removal of noisy samples. Anyhow, the images have different sizes and are stored in jpg format.

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Hence, in this case, pre-processing consisted of a resize of all images and a colour conversion, resulting in 250x250 grayscale images. These procedures aim to align the dataset, speed up the training and reduce the memory requirements without affecting the final results too much. This is achieved via a single custom function adopting the computer vision library Open-CV. Not much else applies to images in terms of data pre-processing, however, data normalisation can be employed. It consists of adjusting feature values to have them on a similar scale, this is proven to increase the performance and the training stability of the model, in particular of neural networks. In this case, grey scale pixel values ranging from 0 to 255 are normalized in the 0-1 range.

After this phase, images are stored in an array with shapes (614, 250, 250) and labels are represented in a separate array with shapes (614, 2). Labels are represented via one-hot encoding since classes are not related in any way and distance has no meaning.

Using 5-fold cross-validation, the risk estimate for each model is calculated. This enables us to train the model on several dataset subsets, produce five distinct predictors using a particular network architecture, and assess the overall model performance by taking into account the average loss and accuracy across all predictors. This is accomplished using a custom function that folds the images and their labels simultaneously shuffles the images and their labels, trains the model over four folds, and then tests it over the final fold five times. Naturally, the model weights are reset at the beginning of each training phase, thus five distinct predictors are generated. The function then returns the average loss and accuracy of the predictors as an overall evaluation of the learning algorithm with that fixed structure and hyper parameters.

IV. Model Set-Up

Each model is built in Tensorflow. Keras uses the same training loss function and optimizer. Since the approach only attempts to optimise the loss function, it is essential for the model's overall performance. A standard loss function for the binary classification task is employed in this instance, which is binary cross-entropy. The optimizer, which affects the network's updated weights, is also crucial. Adam, an expanded variation of stochastic gradient descent that has become the industry standard for deep learning and computer vision tasks, is employed in this situation.

The batch size and epoch count are additional important training factors. The batch size determines the number of samples the model runs through before updating its internal parameters. An epoch is a full pass over the entire training set, and the number of epochs defines the number of times the algorithm goes through it during the training procedure and so we set the batch size to 64 and the no of epochs to 15.

The accuracy and the zero-one loss are additional parameters that are offered when evaluating each model. The accuracy gives back the total number of accurate predictions across all samples taken into account, typically given as a percentage. The custom metric known as the zero-one loss merely counts the number of errors over the overall sample count taken into account.

The architectures we chose are as follows:

*Multilayer perceptron:*The multilayer perceptron is the first neural network architecture to be tested. It has six layers and is a feed-forward neural network. The first layer is a flattening layer, which converts the 100x100 2D input array into a 10000 by 10000 1D array to enable computations for the subsequent levels. Basic layers with dense connections make up the following four layers; the first has 100 neurons and the second, has 64. The Relu function, which is the most frequently utilised for hidden layers since it prevents the vanishing gradient problem during training, serves as the activation function for these layers. Only two neurons make up the output layer, representing the two distinct predictions' outcomes. The sigmoid activation function is utilised here, which outputs two values between zero and one summing upto one, representing the likelihood of either normal or osteoporosis.

The results were as follows:

MLP Metrics - 5-fold cross-validation estimate:

0-1 LOSS: 16.6 (over batch size = 64).

BCE LOSS: 0.5510249614715577

ACCURACY: 0.7221181392669678

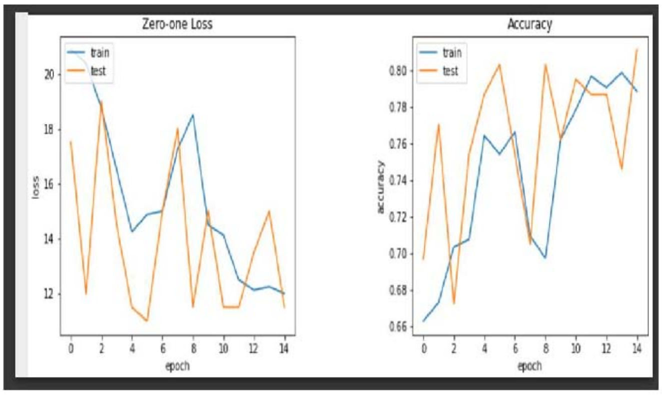

Fig 1. MLP Results

*Convolutional neural network A - 3 Conv. layers (16 32 64):*A convolutional layer followed by a max-pooling layer makes up the building block of a convolutional neural network; the whole network is made up of many blocks of this type. The number of applied filters, size of the kernel, and padding especially to prevent the shape of the picture from being altered during convolution must all be specified when building a convolutional layer. Three blocks with increasing numbers of 3x3 filters (16, 32, 64) were utilised for this model. The output must next pass through a flattening layer to become less dimensional before being fed to a dense layer made up of 512 neurons. Again, there are only two neurons with a sigmoid activation function in the output layer.

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The results were as follows:

CNN_A Metrics - 5-fold cross-validation estimate:

0-1 LOSS: 13.2 (over batch size = 64).

BCE LOSS: 0.5615522921085357

ACCURACY: 0.7696174907684326

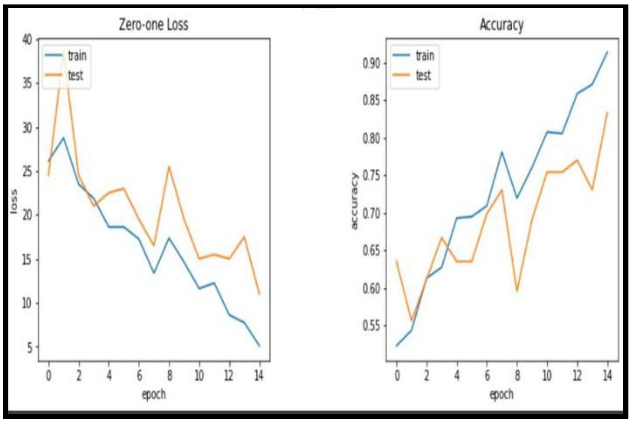

Fig 2. CNN (A) Results

Convolutional Neural Network B - 4 Conv. layers, (32 64 128 128): A second CNN can be defined to do additional research on this powerful architecture. This CNN is made up of four blocks that generate 32, 64, 128, and 128 filters, while the rest of the network is left unaltered. This ought to give the network additional strength and enable it to gather more information.

The results were as follows:

CNN_B Metrics - 5-fold cross-validation estimate:

0-1 LOSS: 13.1 (over batch size = 64).

BCE LOSS: 0.5430635213851929

ACCURACY: 0.7896695256233215

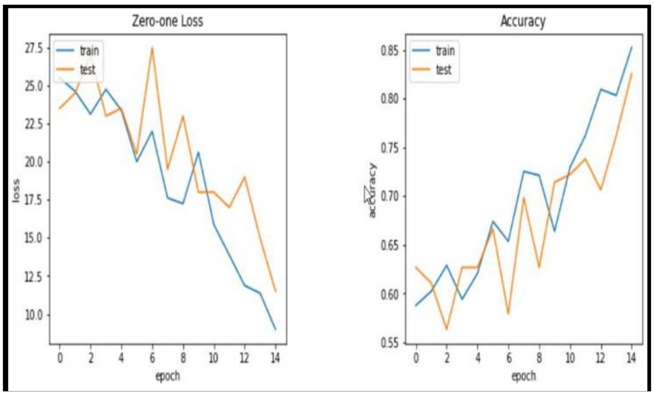

Fig 3. CNN (B) Results

Convolutional neural network + Dense dropout: Here we took the previous B model and added a dropout layer right before the dense layer and the dropout rate was set to 0.2.

The results were as follows:

CNN_dropout_dense Metrics - 5-fold cross-validation estimate:

0-1 LOSS: 11.0 (over batch size = 64).

BCE LOSS: 0.514670866727829

ACCURACY: 0.7984426307678223

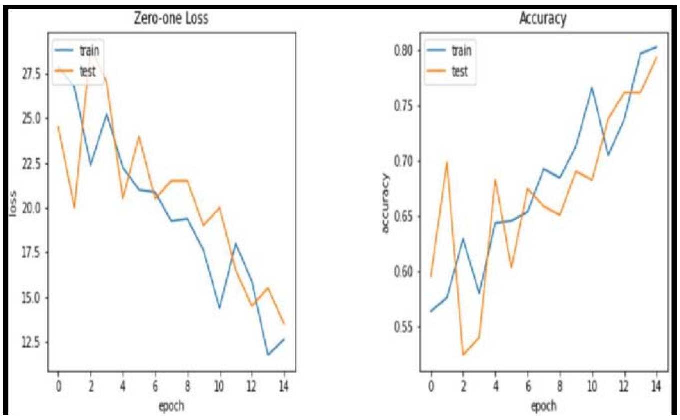

Fig 4. CNN Dropout over Dense layer, rate = 0.2 - Results

All the above graphs refer to a single step of the k-fold CV, graphs from other steps show a similar trend.

These results show that overfitting has been lessened but not completely avoided when compared to those CNN B. With dropout, this occurs around the 9th epoch as opposed to CNN B, when test loss started improving around the 7th epoch.

V. CONCLUSION

In the end, we performed a K-fold Cross Validation to pick the best-trained model and give out the best accuracy encountered. The result was as follows:

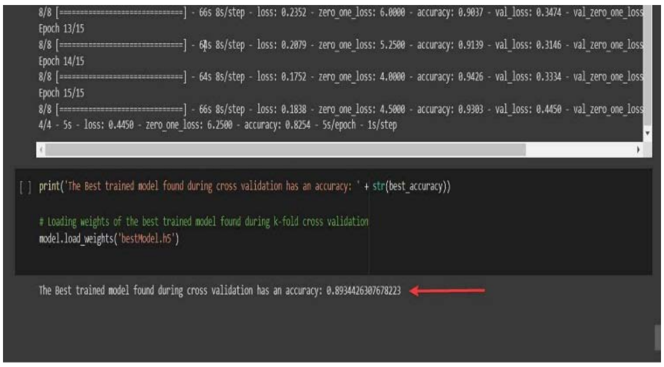

Fig 5. Accuracy of the model

The purpose of this research was to explore various neural network topologies and learn how to conduct tests and assessments using k-fold cross-validation that was statistically sound. Having stated that, the most recent models nearly attained a 90% accuracy. There is still room for improvement but our main goal for the next step of this research is to look at CNN models with a dropout layer

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and some particular architecture like DenseNet to take this to the next level.

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A Social Distancing Violation Monitoring and Alert System

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***Abstract*–The increase in the Virus outbreak has caused a great deal of damage not only to the people around the world but also to the economy and the way we look at small things around us. From the year 2019, the world has seen different types of viruses. COVID 19, a horrific virus that put the entire world to an absolute stop. It caused widespread damage to the businesses, people, education, technology, medical and various other sectors. The Omicron which was a version of the SARS-COV-19 destroyed the immunity in most of the people. Recently the newer virus the H3N2 has also started its spread across India. When the cases were going sky-rocketing, the WHO came up with the idea that, when people stood at about 1-1.5meters it turned out to be safer for people. This process was coined as social distancing. Even though it is a very simple rule, a lot of people are not able to follow it because of the increased crowd around them. It has become very difficult to maintain it in places such as malls, markets, transportation stations etc. Using machine learning techniques, we have been able to monitor whether a proper distance is maintained between people.**

Keywords - SARS-CoV-2, Omicron, H3N2, Social Distancing, YOLOv3, Violation, Monitoring.

I. Introduction

The SARS-COV-2 surge started in December 2019. By March 2023 there had been 681,827,072cases in total and 6,813,670 deaths. The most effective method suggested by WHO (World Health Organization) is socialdistancing, which has become very difficult for people to follow. Manually people used to draw lines and circles on the roads, malls, worship places, which marked the territory for the people to stand and not cross it and as would violate the social distancing norm. We can never always blame the people for not following it as most of us were not prepared to face a situation beforehand. Human beings due to their mob-mentality often tend to roam to places with a large crowd.Placessuch as very narrow streets, malls, markets, eateries where the daily crowd is enormous,alwaysmaintaining social distancing is difficult. And especially during times such as the festivals like Christmas, Diwali, New year, the number of people who throng on the roads is humungous. Due to this there will be lot of people who might get infected, and here by, to maintain hygiene in such places by the health care workers would be difficult. The other viruses also demands such a selective isolation of the people in crowd to prevent the spread of the deadly virus, but physically monitoring all the time is a tiring process.

We considered the health care workers who would be on the field monitoring social distancing the whole time. Asthey are very near to the public the chances of their health getting deteriorated is very high. Our main goal was to terminate this problem. Thus, a technology that would monitor this at a remote location could be helpful to them.

Keeping all this in mind we have come up with a very simple system where the proximity of the people is determined using the deep learning mechanisms. We monitor the live video streaming camera, or even a recorded video or photo and detect the proximity of people and alert immediately if there was a breach.The system that we have made not only displays efficiently the number of people who are not following the social distancing but also helps to safely control the spread of the SARS-COV-2 virus.

II. Literature Survey

With the Indian population over 1.3 billion, it is becoming very difficult to monitor social distancing with minimal technologies. The works done by those researchers has helped the government to maintain social distancing to a bit. Technologies such as machine learning, deep learning and artificial intelligence are used by many tech-enthusiasts and they have easedout the process. In this section we will analyze different projects undertaken by different researchers.

Initially we had investigated [1] which was monitoring the social distancing using artificial intelligence. The camera would capture the images or the live stream. Then using R-CNN methodologies, it would detect the images present in the image or the video after which the distance is calculated using the distance matrix. Then the people are highlighted and shown is the distance is violated or not.

[2] [3] used image processing methods. Edge detection where, the edge of each object on the image is considered and if the edge of the two people cross the threshold level, we say that it was a breach of social distancing. Even though edge detection is a very efficient methodology, it is not very accurate while giving out the results. Another approach that we saw was [4] training the datasets using the Microsoft Common Object in Context (MS-COCO) for the image segmentation. This proposal also gave a proper measurement of the distance between them. [5] also followed a similar method. But instead, it identified the triggered areas where the spread of virus could be higher and instantly gave a warning that the following place was at risk. By this people could restrain themselves from going there.[6]used the centroid to find out the distance between the people and detect the social distancing.

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[7] uses UAV(unmanned Ariel Vehicle) which is similar to a drone which captures the real time images and searches for the pedestrians. They are marked on a map and the distance is checked. [8] similarlyused Artificial Intelligence for the monitoring Social Distance where, CNN and Convolution Long Short-term memory ConvLSTM was used. [9] used CNN methodologies which proved to have 98.5% accuracy. [10] took a different approach for this and used the IoT (Internet of Things) for detection. VidMask was used by few projects like [11] for training and detecting people with masked faces and then detect social distance. [12][13] used the deep learning concept. [14] had a special feature of identifying the people in the low light as well. [15] gave us the inspiration to work on this project. It explained the importance of social distancing and the various effects it has if not followed properly.

The major implication that we noticed from all the above projects was that none of them had a proper alert system. The above proposed methodologies just display on the screen of a recorded video the number of violations that have occurred. Due to this the security officer or the person who is governing the system might know that the social distance is violated, but the people who are standing there will not be knowing. Thus, we have inculcated the knowledge from the previous projects and the idea that we had come up with. They are

- Instant sound alert
- Instant WhatsApp message alert

Instant Sound alert is a feature that gives out a beep sound for about 2 seconds whenever there is a security breach in real time. As soon as the people in the given locality cross the threshold distance, a wide awakening sound is heard that could help people adjust themselves from where they are standing immediately.

Sometimes when the security officers are not viewing the camera from the security room, it would be difficult to keep a track if there has been a breach or not. Hence, sending a WhatsApp message to the group in which the security officers or the health care workers are present would make them attentive and help them clear out the crowd that is present. It can also be combined with the help of camera to see the exact person who violated the social distancing norms and take necessary actions on them.

III. Proposed Methodology

The proposed method makes use of image-processing techniques to track social distance in public spaces and workplaces. Cameras are placed in strategic locations, and video streaming is used to monitor the social distance. We can combine this solution with the security camera systems at workplaces, factories, and retail locations so that we can monitor whether individuals are maintaining a safe distance from one another. Utilizing the YOLO (You Only Look Once) Object detection technique that accurately identifies a person's class as input. Here is a stream of video. We track the objects in accordance with their movement by utilizing Object Tracking. The individual who disobeys the social distance rule is depicted by the RED bounding box elsewhere with a GREEN box's perimeter.

Majorly there are 3 main steps in doing this:

Person Identification: The initial step of identifying a person in the given camera or a video stream was done with the help of the YOLOv3. It is an object detection algorithm, whose purpose is to identify unique objects with help of training. The weights that were used had distinctive ability to filter out rest of the parts in the image and correctly mark the human beings in the video. The imutils library does the basic image processing. Using CNN or R-CNN could have slowed down the process of training as it would have very less frame rate for comparison as contradictory to the YOLOv3 that has been used. In order to make sure that same person is not detected twice and the exact person is detected throughout the video, we give out a class id to each of the person in the video individually. Thus, it will be their identification and even if the person moves out of the frame and comes again, it will again track him as the same person and not a different person. The box that is drawn around the person using the coordinates X, Y. As the person moves inside the frame, the coordinates keep getting updated and the box around the person also will change accordingly.

Detection of Social Distancing Violation: Once the detection of people is done, the next step would be to accurately check the social distance between each people. We then initiate by setting the minimum confidence and the minimum threshold values. The confidence level indicated how accurate does the system detect the person. Minimum distance (MIN_DIST) is given as 50. The MIN_DIST is calculated with the focal length(F) multiplied with the width(W) whole divided by the pixels occupied(P).A dot is drawn inside each of the box exactly at the centroid. When the centroids of two people’s boxes reaches below the MIN_DIST, we then say that the social distance is violated.

The centroid is first identified by using the width, of the height of the box that is detected around the person. Then the non-maxima suppression is applied, which makes sure even though two boxes overlap each other, they are not losing their unique identity. After which, we check if the centroids of two boxes are greater than or lesser than the MIN_DIST. Then we detect if there is a breach in the protocol.

OpenCV2 is used for the camera input. It also works similarly to the video feed. Where the camera opens and we can then detect the person. The video feed could have two different camera angles:

Checking the protocol from close distance: This surveillance camera provides a very zoomed-in view of persons around from a very close distance. We recognize the individual from the video monitor and ensure that they are far enough away to be safe.

Checking the protocol from a bird’s eye view:From a very far away distance, each person's distance from the other is calculated.

*Violation Alert System:*The major part of the project is providing the right alert to the people and the health care workers. This will ensure that the people will immediately change their positions and stay at a safer distance, that makes this project standout from rest of the projects. The alerts are given in 3 different ways.

*Alerts in the Video Feed:*Once the people are detected on the video feed or on the camera, a specific-colored light

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box would be displayed around them. Initially it would be green. If the centroids of the boxes cross the minimum distance, the color of the box will immediately change to red around the two people who are very close by. There will also be a section in the video labeled as “Social Distancing Violations” which will show the real time count of number of violations.

Sound based Alert: Video based alert would be helpful if the number of people is very limited and the space is very little. Example a video-based alert will be helpful in a queue of people standing at the billing counter or students sitting in the class. But when this combined with an alert sound such as a beep when there is a violation detected will immediately bring in a sense of tension amongst the people and help them stand in their appropriate positions. We had installed the “Winsound” library and an alert at a frequency of 400 will be played.

*Alert in form of WhatsAppmessage:*Consider a situation where the health care workers are not present inside the security room and the number of staffs are limited or the system is installed inside a SARS-COV-2 contaminated ward in a hospital. In such circumstances, a video feed alert might not be very effective. A sound alert could work but not perfectly. Therefore, we have introduced personalized WhatsApp message that would be sent to the person in the ward that violation has occurred. If all the health care workers are in a WhatsApp group, a message saying violated would help them regulate the people and make them stand in a safe position. For this we have used the library pywhatkit. Instant message would be sent in real time if the system detects that there was a violation.

The combination of Video based alert, sound alert and a WhatsApp message would also benefit the specially abled people to maintain the social distancing.

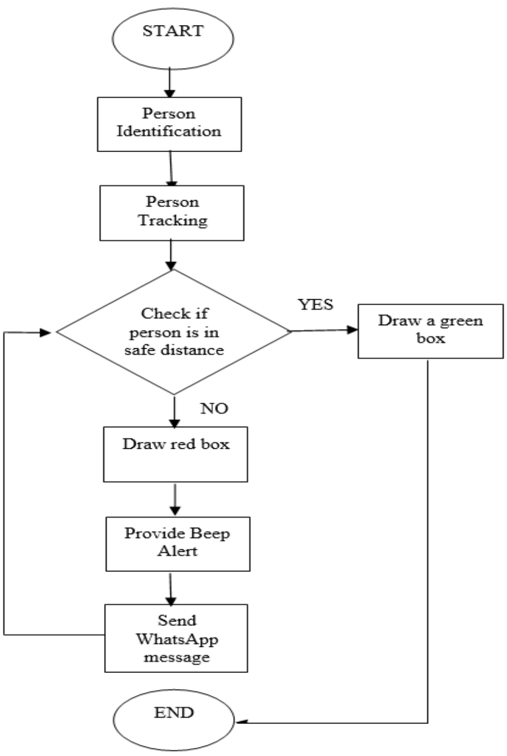

Fig 1: Flowchart of the project

IV. Benefits

The following are the benefits of using our project:

*Help the health careworkers:*Our project’s main motive was to help the public health workers. Usually in crowded places, it is the job of the workers or mark each space with dotted lines as to mark the distance for social distancing. But it eventually becomes difficult as when the crowd increases it becomes for the people to handle so many people. Thus, we have used the monitoring using the surveillance camera to ease out their process and take care of the health of the people.

*Lower the spread of SARS-COV-2:*The major purpose the WHO or The World Health Organization started the concept of social distancing was to govern the escalations of the deadly virus. As it was widely accepted by the people, but very poorly followed, the model we have made can help to effectively follow it.

*Increase the economy:*Due to SARS-COV-2 India as a country lost its entire economy. The project helps to remove the lockdown present in the country. Due to this, even though there is SARS-COV-2, people tend to go to crowded places like restaurants, malls, offices, and educational institutions.

Timely Alerts: The system maintains a proper record of the number violations that occurred to make sure that the institution can keep track of the progress. Whenever a WhatsApp message is sent in the group, it notes it down in its database.

V. Discussions

The major discussions while making this project was done to see, how much helpful the project was going to be for the health care workers. We had spoken to many Health care workers and then we had decided that something had to be done to remove their plight. Thus, we devised this project. There were discussions as to this project using Deep learning or image processing. Image processing becomes easier to do as it consists of less complex mechanisms. As the complexity is less, we can easily perform more integrated components to the project. We can add many datasets to it and check the accuracy of the project. Yolov3 was used in place of the traditional CNN and R-CNN. This is because, R-CNN and CNN are comparatively slow when each frame must be detected frame by frame. Yolov3 is around 8 times faster compared to them. The major difficult that could arise while making the project was how to connect it to a camera and lively capture the movement of the people in the crowded place. OpenCV2 library came handy for us to effectively view the camera mode and capture the live feed. Later the introduction of the messaging feature that was guided by our guide was added. All the feature makes the project very seamless and was done with the motive of making the people around us feel safe.

Specially abled people find it difficult to adapt to the new norms that is being laid by the WHO (World Health Organization). Thus, alerts based on personalized experience will help everyone be safe from the deadly virus safely.

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As the WhatsApp is used to provide mobile alerts, we have made sure that the system is highly secured and there will not be any invasion of privacy or leakage of mobile numbers to third party and will be safe to be used by everyone.

VI. RESULT

The following images depict the expected result that we achieved when we ran the application.

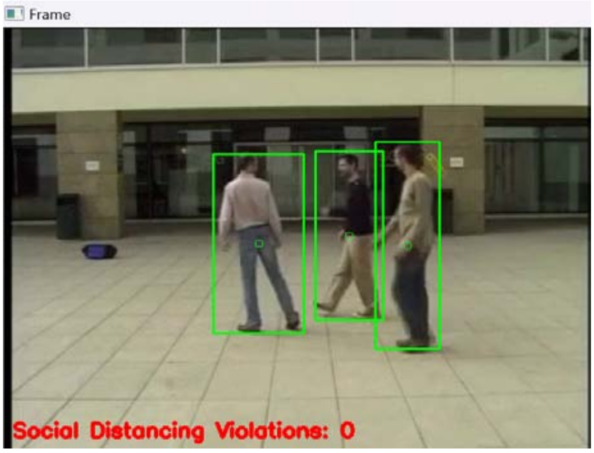

Fig 2: Initial Detection

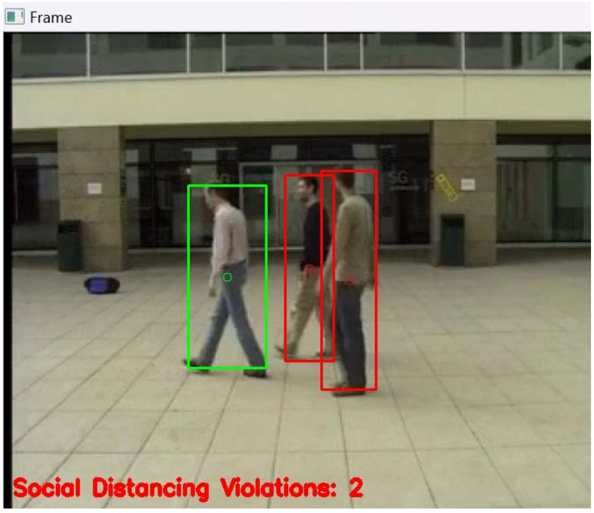

Fig 3: Violation Detected

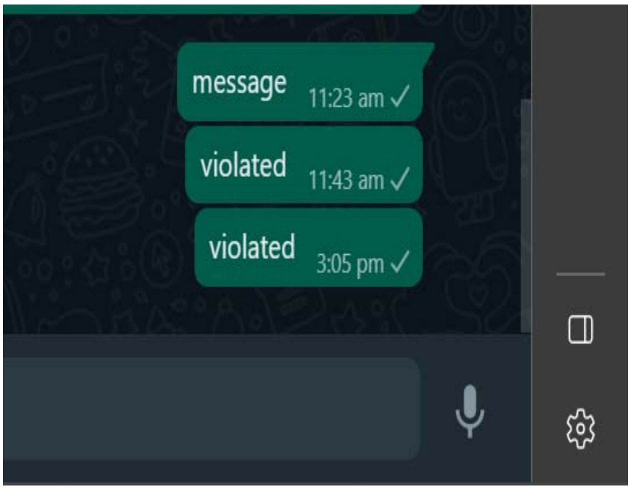

Fig 4: WhatsApp text sent

The above image displays the real time video that was taken and then monitors using the YOLO algorithm to see how many people are exactly following the social distancing norms and how many violations are being made.

The first image (fig 2) displays at a normal condition where the people are standing 1-1.5 meters away from each other and thus, there are no violations. The second image (fig 3) displays that 2 violations have occurred and this is because the people have crossed the minimum distance with themselves.A message is also sent to the group (fig 4). Using this information, we can control the violations. The predictions that came were 100% accurate.

VII. FUTURE ENHANCEMENTS

As technology keeps developing andthe virus getting stronger every day, the following system might not be useful in long run. For this we have planned for few enhancements such as instead of sending a WhatsApp message to the groups, we could send a personalized message to each person's mobile phone saying that they have violated the protocol. This will help in more personalized control of the violation and increase the privacy as well.

We have also planned to use this for the betterment of the society by providing it to the nearest hospitals so that people around us feel safe and SARS-COV-2 could be destroyed completely.

VIII. CONCLUSION

The major motive to consider this project was for a social cause.SARS-COV-2 is a deadly virus which is highly contagious. It easily spreads through air, or even skin contact. Our primary goal in implementing this project is to alleviate this problem, and as a result, our algorithm will subtract social distance between individuals. Since Health care workers are the ones who work every day, this aids them.As there is increased crowding in areas like malls, theatres, beaches, etc., it is difficult to identify those who are keeping social distance and to encourage them to do so. As a result, our model will use a camera to identify every individual in these public spaces, closely observe them, and slap a red mark on anyone who is too near to another person. Also, the YOLO method for our image processing model. Our methodology will thus primarily benefit Health care workers and aid to lower the number of COVID cases.

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Reservoir Water Level Checker

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***Abstract*—Depending on whether they are "service reservoirs" for local storage of treated water, "lakes" that occur naturally and are used for drinking water, or "man-made" reservoirs built by constructing a dam across a valley, water reservoirs vary substantially in size and shape. The technique used to gauge reservoir water levels will vary based on the kind of reservoir being observed. A service reservoir's capacity is often known, and level monitoring allows for control over the flow through the reservoir and the pace of water withdrawal to guarantee a steady supply of water. As reservoir water levels drop due to water demand, level monitoring may be used to activate pumps as necessary to replenish them. In India, there is a serious problem with access to clean drinking water. It could soon start to resemble a global emergency. Therefore, it is crucial to save water. Water waste is increasing daily as a consequence of the pervasive issue of regulating the water level of above reservoirs in home-based water tanks. We all understand the importance of water to us, however. By collecting data on previous water levels and providing a graph that forecasts the reservoirs' future water level, a simple water level checker may manage this issue. Measurement and management of reservoir water levels are done using a Reservoir water level checker(RWL).**

Keywords*— *gauge, service reservoir, level monitoring, forecasts, reservoir water level(RWL) checker

I. Introduction

Cities rely heavily on dams for their water supply, as well as for flood control and river navigation. The vast majority of dams are built to accomplish many goals and therefore have many benefits. It is necessary to create some kind of connection between metering systems and computer models in order to help regulate the intricate systems of hydropower plants. Dams are typically monitored via conventional surveillance methods and water management, with the exception of certain dams' automated monitoring of water levels. Because so many people depend on dams and mayhave opposing interests, managing water resources via dams becomes challenging. Areas that are densely populated are affected by this. Dam monitoring is a laborious and drawn- out process that has to be improved gradually. Areas that are densely populated are affected by this. Dam monitoring is a laborious and drawn-out process that must be improved gradually. Areas that are densely populated are affected by this. Dam monitoring is a laborious and drawn-out process that has to be improved gradually. Using data sent to a control panel, a water level checker may determine if the water level in a body of water is high or low. Some water level indicators use float switches and probe sensors to measure water levels. The level of water in a RESERVOIR is detected and shown by the Water Amount Checker using a straightforward technique.

A reservoir's water levels are monitored and controlled using a water level checker. When water levels drop below a certain threshold, the control panel may also be set up to automatically operate a water pump and top them up.

II. Literature Survey

There are many studies addressing fuzzy or neural network control in water level control systems, and the field of water or liquid level control is quite active. Water level monitoring and control are required.

Through a variety of sensors, the whole dam and major pipeline are monitored here around the clock. These interconnected wireless sensor nodes provide data to a gateway by connecting to one another. Information is stored and made available to the observer online using common storage space, or "CLOUD". The most valuable naturalresource, water, will be saved through the use of IoT for the aforementioned reason[1].

Given that they are commonly used for agricultural reasons, it is clear that Remote sensor systems are a dependable precedent. The use of the web and its applications has grown dramatically in recent years. Since everyone's job is impacted by it, it would be difficult without the internet. In the same way, as today's widely used remote sensor systems, which include a CPU, storage, power supply, a phone, and at least one sensor, are low-power devices. Both have been merged in this application with the aim of acquiring information on the state of the water[2]. There are many studies addressing fuzzy or neural network control in water level control systems, and the field of water or liquid level control is quite active. Water level monitoring and control are required.

Water level detection is made simple by the ease of installation and low maintenance requirements of submersible pressure transducers (wet sensors). They are

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therefore commonly used for temporary installations as well as deployments in far-off locations. They need to be installed permanently and kept submerged at all times. It works by providing hydrostatic pressure to a strain gauge, which converts mechanical motion into an electrical signal that the station can subsequently detect.

As we can see, significant dam safety control nowadays is mostly dependent on measuring crucial variables like absolute and relative displacements, strains, and stresses in the concrete discharges through the foundation, etc., as well as visual inspections of dam structures. In certain dams, the gathered data is analyzed and contrasted with the findings from mathematical or physical models that help with a structural safety assessment.

Artificial neural networks (ANNs) have been shown to surpass conventional methods in the creation of models for predicting river flow. They are quick and versatile. By taking into account the previous operations the structure was put through, these networks may be used to characterize the dams' typical structural behavior. The vast network of neurons in the human brain is analogous to an artificial neural network, which is nothing more than a network of linked nodes. In this network, each circular node stands for an artificial network, and each arrow represents a flow from one node's output to another's input.

A dam may experience extreme water level variations during its lifetime as well as seasonal temperature changes. Delivering the right quantity of water while keeping the water head over a certain threshold is the most important part of water delivery. It is critical to provide the final consumers with the required volume of water at a suitable pressure. The overhead storage tanks are built with a constant water level in mind in order to sustain pressure. The daytime fluctuations in client demand affect the tank's output flow rate. Overflowor pressure drops at the end user are possibilities if water is given at a constant pace.

One such project on the Nile entailed the establishment of national geographical databases, geographical layers, hydro- meteorological parameters, data on the usage of water, and information on land use, the amount of cover on the land, and soil kinds. Acoustic-based Doppler current profilers and automated weather stations are two examples of contemporary monitoring systems that were put into place. For monitoring water flow, this kind of apparatus is suitable. In most rivers, a boat with a Doppler current profiler mounted is used to operate it. As a result, there is no longer a need for an expensive cableway to be built. Additionally, this project includes two buoys that will be used to measure the amount of water evaporation on Egypt's Lake Nasser and to verify the accuracy of satellite-based evaporation estimations. This data format was created in cooperation with the national water resource agencies and has been used by the majority of basin states. This generated data structure enables smooth and rapid data exchange once proper data-sharing techniques are in place. The creation of instruments for basin-wide evaluation, like the Nile DST, also needs a uniform framework [3].

The South-East River Trust, on the other hand, controlled the Teise River's water levels using a weir technique. A weir is simply a wall built across a river to alter the properties of the flow. Weirs are often erected across the breadth of rivers as horizontal barriers that collect water behind them while yet allowing it to gently flow over the top. Weirs are widely used to prevent flooding and to keep track of discharge. Another water level monitoring system was developed, and it is made up of an ultrasonic sensor, a PIC microprocessor, and a GSM module. The distance between the ultrasonic sensor and the liquid's surface is measured. This method suggests using the GSM to create a system for monitoring water levels.

When the water level reaches a critical level, a module that uses Short Message Service (SMS) to alert the person in control switches the pump off automatically. The water level may be checked as needed [4].

China is using computing methods to cut down on water waste and increase financial gains. Additionally, it ensures environmental protection and water cycle stewardship so that water resources may be passed on to next generations. By employing sensors that measure the volume of water in the tank, they automated the pumping of water into tanks using Arduino-based devices. An LED display will alert the user of the condition while the pump mechanism will work automatically based on the water level. To automate water extraction from the sump tank, this system is simply expandable. The same technique may be used to monitor how much water is in the sump using sensors, but if the system notices that there is not enough water, it will stop the engine from running to prevent dry running. To alert the user of the issue in such a situation, an alarm sound may be enabled [5].

The handler commands the gate to open and shut under the manual dam control method currently in use. This permits both unequal water distribution between the two residences as well as human error, which might cause floods orexcessive water waste. Their proposed approach removes these possibilities by providing an automated dam control system. In part, the whole system is self-powered. Because of the architecture, the system is self-sustaining and uses energy collecting.

Systems for remote data collection and monitoring are practical and efficient instruments for monitoring and collecting data from bulk storage tanks. Such systems are helpful in businesses that are designated as safety essential systems and measure the liquid within the tank, which is of utmost importance. The design and preliminary testing findings of a low-power wireless system for tank-level monitoring using ultrasonic sensors are presented in this study[6].

In this system, the water pumping process has been automated using an Arduino board. The Arduino can sense the amount of water in a tank, determine whether to turn on or off the pump, and show the status on an LCD screen. The device further keeps an eye on the sump tank's water level (source tank). Low sump tank levels will prevent the pump from turning on, protecting the engine from dry running. When the sump tank's level is low or if there is a sensor issue, a beep sound is produced[7].

An inexpensive optical water level sensor based on the fibre bending effect and an elastomeric membrane is discussed in this work. The suggested sensor has a specific design that makes it easy to use, dependable, and affordable. It is appropriate for use in reservoirs, tanks, and the tubes of embankment dams. The sensor selects the suitable membrane and can measure the water levels up to 10 m or more using a typical single mode fibre. The creation of the sensor, a theoretical modelling, and the outcomes of lab and field experiments are all covered in this essay. A real-time monitoring system based on optical time domain reflectometry has been using seven sensors that were put in an embankment dam[8].

The system, which consists of several sensors, is used to measure the water's physical and chemical characteristics. They measure the water's characteristics, including its temperature, PH, turbidity, conductivity, and dissolved oxygen. The core controller is capable of processing the measured data from the sensors. They have used the raspberry PI B+ model as a core controller. Finally, cloud computing may be used to see the sensor data online[9].

In this project they have used Zigbee 802.15.4, a 74HC14 inverter, water level sensors, and GSM technology to monitor the water level. Water quality sensors like turbidity sensors and dissolved oxygen sensors may also be used to check the water's quality. In this monitoring system, sensors check the pH level, temperature, turbidity, dissolved oxygen, and water level at predetermined intervals. This strategy would aid in lowering household energy usage and water overflow[10].

In this research, they suggest an Internet of Things (IoT) based real-time water level monitoring system. Their prototype is founded on the notion that, particularly in disaster-prone locations, the water level might be a crucial factor in determining the likelihood of flooding. The requiredparameter is detected using a water level sensor, and if the water level meets the parameter, a real-time signal is sent to a social network like Twitter. Data repository configuration was made on a cloud server. On the remote dashboard, the water level measurements are shown[11].

In order to monitor the water level, the system employs an ultrasonic sensor, an AT89S51 microcontroller, and a SIM300C GSM modem. When asked through SMS, the system may test the water level and provide a measurement report. This system may be installed in a variety of locations since, depending on the installation requirements at those locations, it just requires the first configuration through SMS[12].

An ultrasonic sensor, PIC microcontroller, and GSM module were used to construct a monitoring system for measuring water levels. The distance between the ultrasonic sensor and the liquid surface is measured. With the integration of a GSM module, this system shows the construction of a water level monitoring system that will send a Short Message Service (SMS) alarm to the person in charge when the water reaches the critical level, which will cause the pump to automatically switch off. At any time, it is possible to check the water level[13].

In order to prevent many steps and make the process simpler and faster, they utilised a control approach in this study that validates the hardness of the supply water at the very first phase. The typical process station will also squander a significant quantity of water at each stage of the filtration process. Such wastages can also be reduced in the planned job by employing an effective control method. The experimental investigation carried out using the suggested technique investigates the water saved during the clear water operations as well as the processing time needed for the feed water[14].

This study uses the Linear Discriminant Analysis (LDA) method to show an assessment of the water quality. The Water Quality Index is calculated using a weighted arithmetic index approach (WQI). The final major WQI dynamics are known at that point, and the LDA is connected to the dataset. The LDA then performs Light Gradient Boosted Machine (LGBM) classification after forecasting the WQI. The LGBM classifier is then engaged to assign a water quality label. On a dataset connected to Gulshan Lake, the suggested LGBM with LDA approach is shown and assessed. The results reveal 100% classification accuracy for the Light Gradient Boosted Machine classifier system and 96% prediction accuracy for the LDA, which indicates consistent interpretation connected over the futuristic models[15].

III. Basic Schematics

The main goal of this project is to completely automate the regulation of water levels near all dams using a centralized server [7]. Each dam is first considered to be a single node. Acentral command center, which can keep track of each node's activity, is connected to several of these nodes.

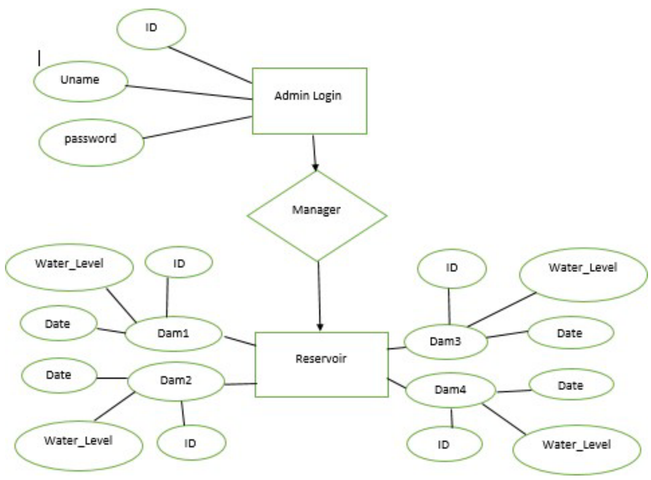

Fig. 1. Basic Schematic diagram

From the Figure 1, we can see that initially, we will have an Admin node with its own ID, Uname, and password. Only the admin will have total access to the database and the data being entered. All scraped data will be placed into the local host to preserve it and utilize it to anticipate water levels.

The admin node is then linked to a common manager, which collects all scraped data, saves it, and manages Dams data on the local host. At regular intervals, it collects all of the IDs, water level data, and dates. This is used to forecast reservoir water levels.

The manager is then linked to numerous nodes, each of which has information on a Dam. Details such as water

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level, ID, and date are required to assess and anticipate before a calamity occurs in the near future using the old stats.

Because the project is modular, we can add additional modules and use them on a large scale. This device is so simple to use that it can assist individuals in the area to evacuate promptly in the event of a disaster.

IV. Water Level Tracking Implementation

The monitoring of reservoir water levels is required for assessing and forecasting a disaster-avoidance plan. The water level was calculated at four distinct sites to test the treatment's efficacy. The procedure consists of four steps:

A. *Web Scraping using BeautifulSoup*

Web scraping, web harvesting, or web data extraction are all terminology for an automated technique of obtaining vast amounts of unstructured data from websites. The user can extract all of the data on specified sites or specific data as needed. The obtained data can be saved in a structured manner for further study.

Web scraping Using BeautifulSoup involves the following steps:

- Locate the URL of the webpage you wish to scrape.
- Examine the specific elements before selecting them.
- Write the code to obtain the content of the chosen components.
- Save the data in the appropriate format.

With this, we collected the required Table data regarding the Dam. The Data collected is stored in a local host called Phpmyadmin using an Apache distribution called Xampp.

B. *GUI Designing using Tkinter*

Tkinter is a typical Python interface for the Python-bundled Tk GUI toolkit. Python was chosen to build the GUI since it is the fastest and most straightforward way to develop GUI apps. Making a GUI using Tkinter is a straightforward process.

To make a Tkinter app, follow these steps:

- The module is being imported Tkinter
- Make the primary window (container)
- Add as many widgets as you like to the main window.
- On the widgets, use the event Trigger.

The Figure 2 , shows the GUI we designed to project.

Fig. 2 GUI of login page

We first created a login page for both admin and user to access the app. In the Figure 3, after login we have options to choose between reservoirs .

Fig. 3 Options tab for reservoirs

V. Results

After all of the reservoir data has been web scraped and saved on the local host, we can examine the reservoir information in the GUI. We will initially have a login for admin and user, then after logging in, we will be able to pick between reservoirs and click go. This is seen in Figure 4.

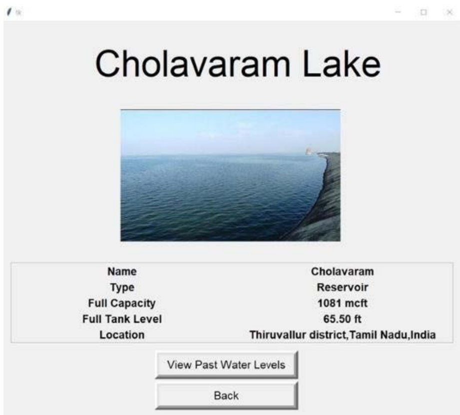

Fig. 4 Data regarding the lake

After clicking go, the newly created page will display reservoir data and give us the choice to "see prior water levels." Using this option, we may view the water level plot for the previous 100 days. This is seen in Figure 5.

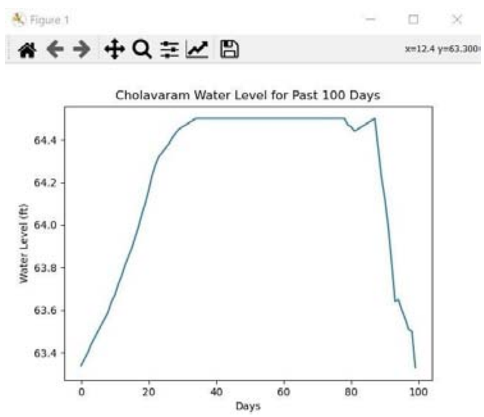

Fig. 5 Plot for water level for the past 100 days

DOI: rp-9788770040723.041

The Figure 6 shows the output of the reservoir water level.

CHOLAVARAM DATAS

Date,Water_Level

26/10/2020,79.14

27/10/2020,79.30

28/10/2020,79.45

29/10/2020,79.61

Fig. 6 Shows the data collected from the last 100 days

VI. CONCLUSION

This project is intended to suit the needs of a reservoir water level checker. It was created in Python with the backend DBMS so that the data input is saved in the DB file and the data stored is utilised in the rwl checker while keeping thesystem specifications in mind. We utilised a simple data entity relationship diagram to create the system. The rwl checker has all of the characteristics of a true water level indication device. This short project taught us how to connect to a database using Python.Overall, the project teaches us important skills such as:In creating the system, system analysis and design approaches such as data flow diagrams are used.

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Smart Electric Vehicle Charging Station Using Solar Power

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***Abstract*—Electric vehicle (EV) charging stations powered by renewable energy sources, such as solar power, can significantly reduce carbon emissions from transportation. In this paper, we propose a smart electric vehicle charging station that utilizes solar power to charge EVs. The proposed system integrates solar panels, battery storage system, and electric vehicle charging equipment to provide a sustainable and efficient charging solution. Additionally, a smart charging system optimizes the use of solar energy and manages the charging sessions to avoid peak demand periods. We describe the system design, implementation, and benefits of a solar-powered smart EV charging station.**

***Keywords*—solar panel, BMS, IOT, EV charging station.**

I. Introduction

With the increasing demand for electric vehicles (EVs), the need for electric vehicle charging stations is growing rapidly. However, the use of traditional electricity sources to power these stations results in significant environmental impact and contributes to the global carbon footprint. Therefore, the implementation of renewable energy sources, such as solar power, is becoming increasingly important.

The combination of solar power and electric vehicle charging stations offers a sustainable solution that can significantly reduce carbon emissions and promote the use of renewable energy sources. The integration of a smart charging system allows for efficient management of the charging process, optimizing the use of solar energy and avoiding peak demand periods. This paper proposes a smart electric vehicle charging station that is powered by solar energy and includes a smart charging system.

The paper is organized as follows: The first section provides an overview of the current status of electric vehicle charging stations and the use of solar power as a renewable energy source. The second section presents the proposed smart electric vehicle charging station and its components. The third section discusses the implementation of the proposed system. Finally,the conclusion summarizes the findings of this research paper and discusses the potential for future research.

II. Current Status of Electric Vehicle Charging Stations and Solar Power

The increasing demand for electric vehicles has resulted in a significant increase in the number of electric vehicle charging stations globally. According to the International Energy Agency (IEA), the number of publicly accessible electric vehicle charging points reached over 1.3 million worldwide in 2020. However, the majority of these charging stations rely on traditional electricity sources, such as coal and natural gas, which contribute to greenhouse gas emissions.

The implementation of renewable energy sources, such as solar power, can significantly reduce the environmental impact of electric vehicle charging stations. Solar power is a clean and renewable energy source that can be harnessed to provide electricity to charging stations. The use of solar power in electric vehicle charging stations not only reduces carbon emissions but also reduces the reliance on the traditional electricity grid, providing energy security.

III. Methodology

A. *Block Diagram*

- The grid-based photovoltaic charging system is an innovative future technology. The photovoltaic charging system is shown in the architecture, which was developed after various studies.
- The above design shows that a DC-to-DC converter and a DC-to-AC converter both produce two stages. The dc bus is more important since it interfaces with additional dc power devices, as well as the PV array and energy storage batteries of electric cars. The fact that the DC bus is meant to connect the PV array, the ESU, the EV battery pack, and other dc powered devices emphasizes its importance.

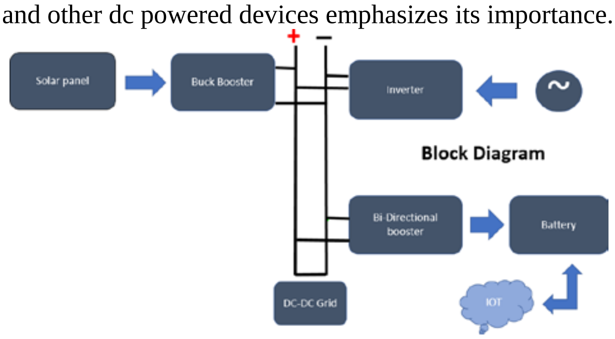

Fig. 1. Block Diagram

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- Standalone PV charging system: With an off-grid station, power is provided directly to the batteries of an electric car. Connection to the power grid An Energy Storage Device (ESD) unit is connected to the charging system to deliver electricity to the EV battery continuously during the night.
- We'll build an Internet of Things project in which the ESP8266 will track its own battery level using the BlynkIoT Cloud. We can monitor sensor data, battery charging/discharging status, battery voltage, and battery % in order to quickly recharge it. This is a simple method that makes use of a voltage divider circuit and the analogue input on the NodeMCU ESP8266 board.

B. Lab Setup

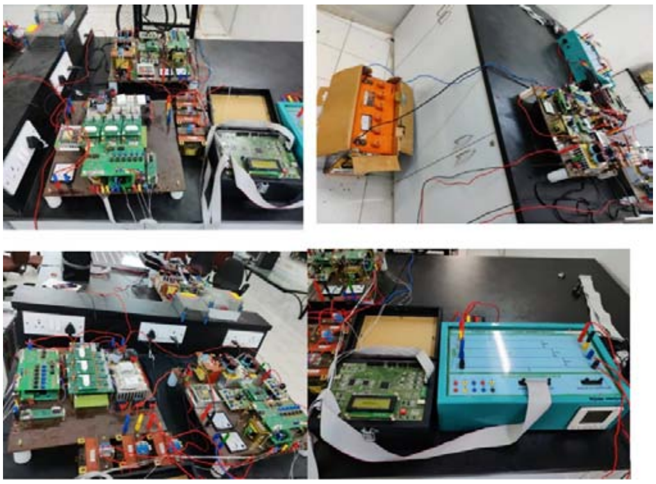

Fig. 2.Lab Setup.

- Solar panel

The solar panels are used to harness solar energy and convert it into electrical energy to power the EVCS. The number and capacity of solar panels depend on the expected charging demand, the geographic location, and the climate conditions.

- Energy Storage System

The energy storage system consists of batteries that store the excess solar energy generated during the day and use it to power the EVCS during the night or periods of low solar irradiance. The energy storage system also provides a buffer to balance the energy supply and demand, and ensure stable and reliable charging services.

- Energy Management

The energy management module is responsible for monitoring and optimizing the energy flows in the system. It uses real-time data from the solar panels, energy storage system, and EV charging stations to predict the energy demand and supply, and adjust the charging rates and schedules accordingly. The energy management module also ensures the safety and stability of the system by regulating the voltage and current levels, and preventing overloading or short-circuiting.

- EV Charging Stations

The EV charging stations are the primary interface between the EVs and the EVCS. The proposed system supports different charging standards such as AC, DC, and fast charging, and can accommodate multiple EVs simultaneously. The charging stations are equipped with sensors and communication devices that enable real-time monitoring and control of the charging process.

C. Battery Management System

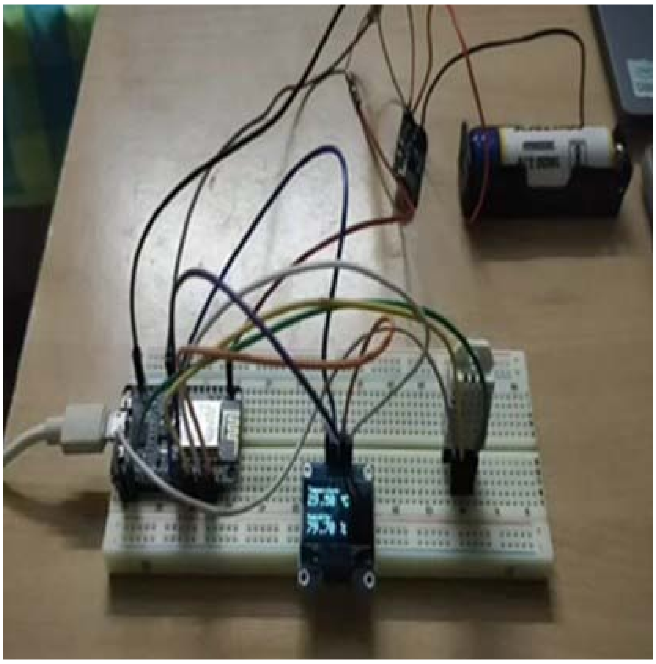

Fig. 3.Battery Management Setup.

- Smart Control System

The smart control system is the brain of the proposed EVCS. It integrates various advanced technologies such as IoT, AI, and cloud computing to optimize the system performance, enhance the user experience, and providevalue-added services. The smart control system consists of four main modules: energy management, charging scheduling, user interface, and communication and security.

- Charging Scheduling

The charging scheduling module is responsible for man- aging the charging sessions and optimizing the charging efficiency. It uses data from the EVs, such as battery capacity, charging status, and location, to prioritize the charging sessions and allocate the available energy resources efficiently. The charging scheduling module also provides real-time updates to the users about the charging status, estimated time of completion, and charging costs.

- User Interface

The user interface module provides a user-friendly and interactive interface for the customers to access the charging services and manage their accounts. It includes a mobile app and a web portal that enable customers to reserve charging spots, track the charging progress, and pay the charging fees. The user interface module also provides personalized recommendations and incentives

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based on the user's preferences and behavior.

IV. Implementation

Fig. 4.Mobile Dashboard.

The implementation of the proposed smart electric vehicle charging station involves several steps:

a) Feasibility Study: Evaluate the solar energy resource at the location, the expected demand for the charging station, and the required capacity of the battery storage system.

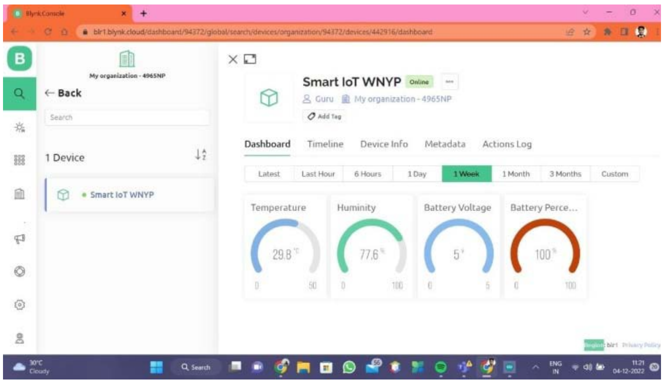

Fig. 5.Website Dashboard.

b) System Design: Develop a design that integrates the solar panels, battery storage system, and electric vehicle charging equipment. Determine the capacity of the solar panels and battery storage system needed to meet the expected demand for the charging station.

c) Equipment Selection: Choose the solar panels, battery storage system, and electric vehicle charging equipment that meet the project's requirements. Consider the efficiency, durability, and cost of the equipment.

d) Installation: Install the solar panels, battery storage system, and electric vehicle charging equipment according to the design specifications. Ensure that the installation follows safety regulations and industry standards.

e) Smart Charging Implementation: Integrate the smart charging system that manages the charging sessions, optimizes the use of solar energy, and communicates with the electric grid to avoid peak demand periods. The smart charging system can be implemented using a variety of technologies, including energy management systems, intelligent algorithms, and cloud- based platforms.

f) Testing and Commissioning: Test the charging station to ensure that it meets safety regulations and industry standards. Commission the charging station to operate efficiently and sustainably.

g) Monitoring and Maintenance: Monitor the performance of the charging station and maintain the equipment to ensure long-term efficiency and sustainability.

V. Benefits

a) Sustainable and Environmentally Friendly: The pro- posed system uses solar power, which is a renewable and clean energy source. It reduces the carbon footprint and contributes to mitigating the climate change effects.

b) Cost-effective: The use of solar power can reduce the operating costs of the EV charging station and increase the return on investment. The energy storage system can also reduce the peak demand charges and provide ancillary services to the electric grid. •

*c) Efficient and Reliable :*The smart control system can optimize the energy management and charging scheduling, and provide real-time monitoring and control of the chargingprocess. It ensures the efficient use of the available energy resources and the reliable operation of the system. •

d) Scalable and Flexible: The proposed system can accommodate different charging standards and protocols, and can be scaled up or down based on the demand and the availability of solar energy. It can also be integrated with other renewable energy sources and energy storage systems.

VI. Drawbacks

a) Initial Investment: The installation and setup of the EV charging station and the solar panels require a significant initial investment. The cost may vary depending on the size, capacity, and location of the system.

b) Weather Dependency: The efficiency and performance of the solar panels depend on the weather conditions, such as sunlight intensity, cloud cover, and temperature. The system may not generate enough energy during periods of low solar irradiance or extreme weather events.

c) Space Requirement: The installation of the solar panels requires a significant amount of space, which may not be available in some urban or densely populated areas.

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The charging station may also require additional space for parking and infrastructure.

d) Maintenance and Operation: The maintenance and operation of the EV charging station and the solar panels require specialized skills and knowledge. The system may also require periodic inspections and repairs to ensure the safety and reliability of the system.

VII. Conclusion

The project addressed the design and development of an IoT-based battery monitoring system for electric cars in order to ensure that online monitoring of battery performance decline was achievable. The objective is to establish the feasibility of the underlying premise of the notion. As part of the system development, the hardware for the battery monitoring device and a web-based battery monitoring user interface are being created. The system may offer information such as position, battery life, and time through the internet by integrating a GPS system to identify the coordinate and display it on the Google Maps application. The system may be developed further by integrating new capabilities. The technology may be utilized in smartphones by developing them.

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Potato Leaf Disease Classification using Deep Learning : A Convolutional Neural Network Approach

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***Abstract*—In this study, a Convolutional Neural Network (CNN) is used to classify potato leaf illnesses using Deep Learning. The suggested approach entails preprocessing the leaf image data, training a CNN model on that data, and assessing the model's success on a test set. The experimental findings show that the CNN model, with an overall accuracy of 99.1%, is highly accurate in identifying three kinds of potato leaf diseases, including Early Blight, Late Blight, and Healthy. The suggested method may offer a trustworthy and effective remedy for identifying potato diseases, which is essential for maintaining food security and minimizing financial losses in agriculture. The model can accurately recognize the various disease types even when there are severe infections present. This work highlights the potential of deep learning methods for categorizing potato diseases, which can help with effective and automated disease management in potato farming.**

Keywords* — potato leaf disease classification, deep learning, convolutional neural network, image processing, computer vision, plant disease diagnosis, agricultural technology, crop protection

I. Introduction

Potato is a vital food crop globally and a significant source of income for farmers. However, potato crops are susceptible to various diseases that can cause significant yield and quality losses. Leaf diseases are among the most common and destructive of these diseases [1]. Early detection and accurate diagnosis of these diseases are essential for effective disease management and control. Traditional methods of disease diagnosis rely on visual inspections, which are subjective and time-consuming. In recent years, there has been a growing interest in the use of deep learning techniques for automatic disease detection and classification.

The potato, **Solatiumtuberosum**, as in Fig. 1 is the fourth-ranked food crop used to feed an increasing global population because of its adaptability in cultivars and high complex carbohydrate content. For the dining and the processing market, potatoes can be kept for a long time, but storage disease issues are common [2]. Wherever potatoes are produced, diseases both in the field and during storage can be a limiting factor in the ability to produce them sustainably and profitably.

Fig. 1: Potato **(SolatiumTuberosum)**

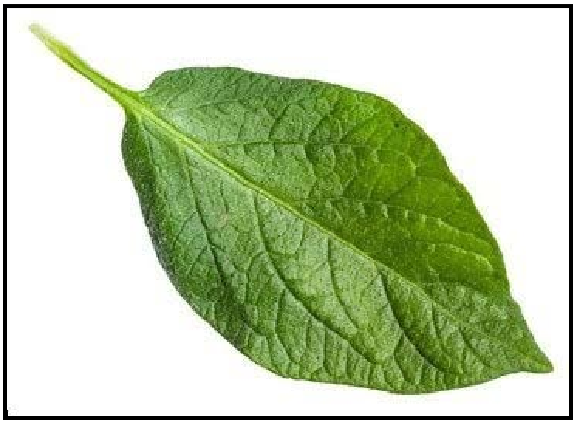

Fig. 2: Healthy Potato Leaf

In this study, we suggest a deep learning method for categorizing potato leaf illnesses. In particular, we investigate the application of convolutional neural networks (CNNs) for the automated detection and classification of various potato leaf diseases.The primary goal is to develop a precise and useful method for the early detection and classification of potato leaf diseases so that farmers can act quickly and control the disease. The suggested method has the potential to greatly increase the effectiveness and accuracy ofmanaging potato leaf disease and increasing crop yields while minimizing financial losses.

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As, due to its capacity to extract intricate patterns and features from sizable databases, deep learning has become increasingly popular in recent years. Deep neural networks known as convolutional neural networks (CNNs) are frequently employed for picture classification and recognition tasks. They can learn hierarchical representations of images, which makes them especially suitable for this job.

It is built with the intention of detecting or identifying the various diseases that can affect potato leaves, because Convolutional Neural Network (CNN) can identify them with ease while the human eye cannot. Unbelievably, some pre- trained Neural Network Architectures have error rates of about **3%**, which is even lower than the best **5%** error rate of human vision. **5.1%** was determined to be the human top-5 error on large-scale images, which is higher than pre-trained networks [3].

II. Literature Survey

Singh et al. (2015) [4] - performed a review of the literature on various image processing techniques for detecting leaf disease. The writers wanted to speed up identification and detection of plant diseases while lowering the subjectivity that comes with naked-eye observation. They presented an algorithm that uses picture segmentation to automatically identify and categorise plant leaf diseases. The impact of HSI, CIELAB, and YCbCrcolour spaces on disease spot detection was examined by the authors. To identify the disease spot, the Otsu technique was applied to the colour component after an image was smoothed using a median filter. The suggested method was not put to the test on any datasets.

He et al. (2015) [5] - deep residual networks were discussed in relation to image recognition challenges. As shallow representations for image retrieval and classification, VLAD and Fisher Vector are cited in the paper's literature review as related concepts. The writers also covered the advantages of encoding residual vectors over original vectors for vector quantization. The Multigrid method was also mentioned as a method for solving partial differential equations (PDEs) by reformulating systems as subproblems at multiple scales, where each subproblem is accountable for the residual solution between a coarser and a finer scale. This method is used in low-level vision and computer graphics.

Islam et al. (2017) [6] - suggested a method to identify diseases from images of potato plant leaves by combining image processing and machine learning. The authors classified diseases using the 'Plant Village' database of openly accessible plant images. Using the suggested method, the research classified 300 images of diseases with a 95% accuracy. The paper also highlights how crucial contemporary phenotyping and plant disease detection are to assuring food security and sustainable agriculture.

Velmurugan and Renukadevi (2017) [7] - describe a research on the creation of software for the automatic detection and classification of plant leaf diseases. Only a few methods were suggested for particular databases, such as satellite images, leaf sets, maps, faces, fingers, etc., the authors discovered after conducting a literature review. The research suggests a novel algorithm that, with 94% accuracy, canidentify and categorise the diseases under study. The processing process consists of four major steps: colour transformation, masking of green pixels, segmentation, and computation of texture statistics from the SGDM matrices. The suggested method was tried on a database of about 500 plant leaves, and the outcomes support the robustness of the suggested algorithm.

Dasgupta et al. (2019) [8] - address the issue of food scarcity in developing countries, particularly in India, due to potato production being affected by diseases such as Early Blight and Late Blight. To tackle this problem, the authors propose the use of deep learning and transfer learning techniques to develop a model capable of accurately detecting these diseases in potato plants. The literature review section of the paper delves into the The fungus AlternariaSolani is responsible for the early Blight disease. The disease has a polycyclic life cycle and requires free water to germinate. Early Blight primarily causes the premature defoliation of potato plants.

Cecilia et al. (2019) [9] - share a research on the use of image processing methods and machine learning algorithms for spotting pests and diseases in blueberry plants. Since there was no openly available database for this kind of fruit, the authors created their own database of images. The research used a variety of filters, including addWeighted and Gaussian Blur to enhance the details in the images and medianBlur and Gaussian Blur to remove noise. Utilizing both normalised and unnormalized versions of algorithms like HOG and LBP, traits were extracted. Using Deep Learning, the findings revealed an accuracy index of 84%. The report does not, however, contain a literature review.

Iqbal and Talukder (2020) [10] - investigated the use of image processing and machine learning methods in identifying and classifying diseases of potato leaf. In order to find diseased regions, the authors processed 450 images of healthy and diseased potato leaves from the freely accessible Plant Village database using image segmentation methods. To differentiate between the sick and healthy leaves, they used seven classifier algorithms, with the Random Forest classifier having the best accuracy (97%) rate. The study also included a review of prior studies that used machine learning and image processing to identify plant diseases.

III. Proposed Methodology

Data collection, pre-processing of the data, data augmentation, and disease classification make up the main four stages of the methodology described in this paper. Fig. 3 mentions the graphical representation of procedure for classifying different diseases of Potato leaf, step by step. So, the four mentioned steps are:

A. Data Acquisition/ Data Collection and Description

Different image resolutions and sizes have been obtained from dataset uploaded on ‘Kaggle’, known as Plant Village by ArjunTejaswi which contains plant diseases of around 15 types. The dataset contains about 20,600 imagesof which 2152 images belong to plant ‘Potato’ andcategorised as Healthy,

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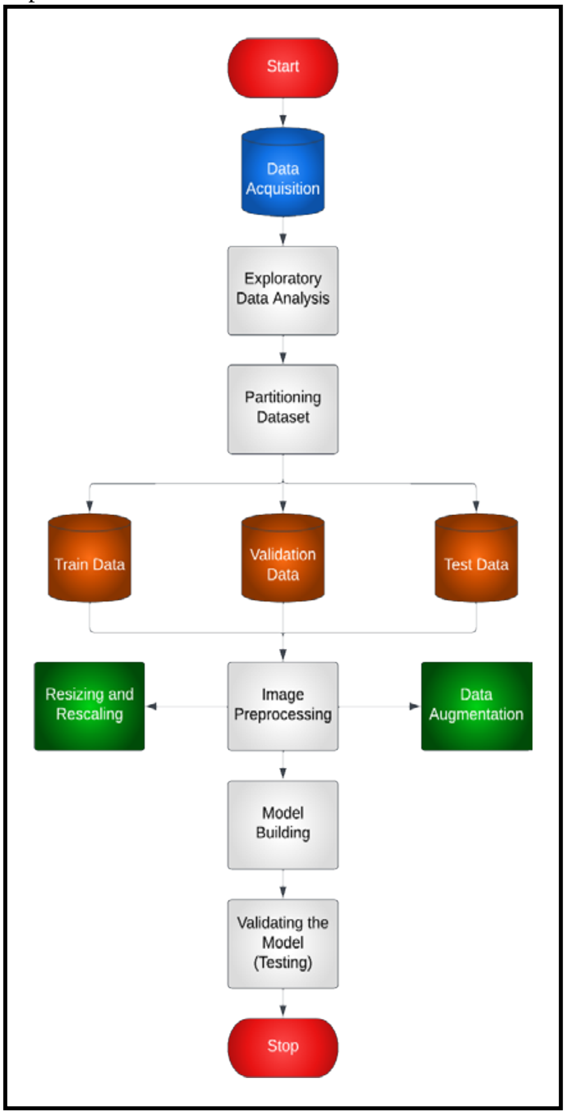

Fig. 3: Methodology Flowchart

Early-Blight, and Late-Blight as in Fig. 4 [11]. The dataset is arranged in Joint Photographic Experts Group data format (.jpg file).

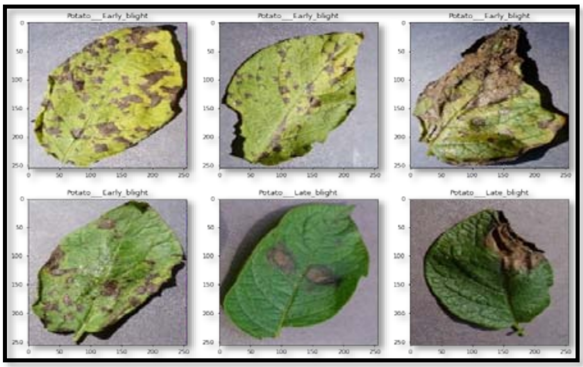

Fig. 4: Images of Potato Leaves with different Diseases

B. *Preprocessing*

The potato-disease dataset is divided into three classes. These classes include Early-blight class (1000 images), Healthy class (152 images) and Late-blight class (1000 images). Hence, the dataset was divided into **46.4%**, **7.06%** and **46.4%** respectively.

The splitting of the dataset for training (70%), testing (15%) and validation (15%) is carried out. Before splitting the dataset, images of dataset were divided into batches for the ease of splitting the dataset. Also, specific functions like: ‘prefetch’ – loads next batch of images into CPU when GPU is busy training the images, ‘cache’ – saves time while reading the images; were applied for better use of resources of the system being used.

The CNN model is practiced on the train set. The validation set is used to fine-tune the hyperparameters (i.e., the design) of a classifier, while the test set provides an objective assessment of the final model fit on the training dataset [12]. Noise in the picture can first be reduced by removing any unnecessary parts. If there is too much disturbance in the image, it won't be used [13]. Pictures collected from various sources and of varying sizes must be resized to **256x256** pixels for the dataset's standardized input photos. The batch size of **32**.

C. *Data Augmentation*

In contrast to the shallow networks used in machine learning, deep learning (Deep Network) needs a lot of data. Machine learning and deep learning frequently encounter issues with a lack of training data and an imbalance in the quantity of data for each class [14]. Data augmentation is the approach taken to solve this issue. Data augmentation is a technique for modifying data without changing its initial meaning. 5100 datasets are still insufficient for this research to achieve optimal performance, necessitating the use of data augmentation. The augmentation factors in this study are generated by the automatic application of simple geometric transformations like translations, rotations, scale changes, shearing, vertical and horizontal flips.

But for this dataset, only the rescaling and resizing of images (**1/255**), horizontal flip, vertical flip and random-rotation of **0.2** degrees is used as the leaves do not have high number of features to be considered.

D. *Disease Classification using CNN*

ML (Machine learning) in Artificial Intelligence (AI) includes DL (Deep Learning), also referred to as deep neural learning or deep neural network, with more levels than machine learning. Its state-of-the-art abilities in a variety of fields, including object detection, speech recognition, object categorization, and picture classification, have been enhanced by deep learning techniques [15]. Convolutional Neural Networks are one of the most popular deep learning courses. In some studies, CNN have been used to detect plant diseases based on the condition of the leaves [16]. CNNs, or Convolutional Neural Networks, usually have a few multi- layer convolutional layers that are arranged according to functions. One or more fully connected layers that are typical of a neural network commonly follow the subsampling layer. The input for the following feature layer is a feature collection that is contained on the preceding layer in a small area. CNN has a lot of expertise with computer vision issues. Compared to ANN (Artificial Neural Network), sharing parameters is one of its features, which lowers the number of parameters needed for the

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model. Additionally, CNN's features are of very high standard content. Softmax is the final output layer as we perform multiclass categorization. The sample model of CNN can be visualized in Fig. 5 [17] as given below.

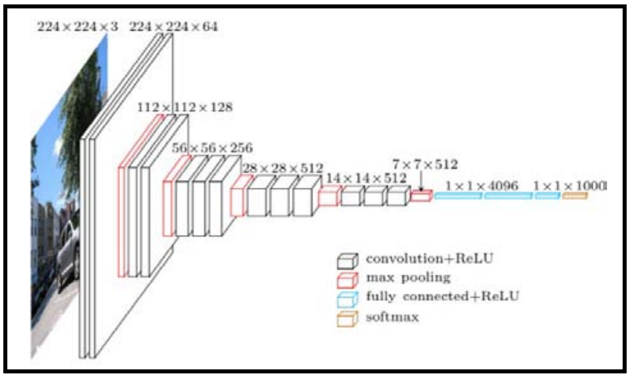

Fig. 5: Convolution Neural Network (CNN)

In our research, we created a feature map by applying convolution to the input picture through a convolution filter. As a convolution filter, a 3x3 filter is employed. For this procedure, padding = "valid" is used. When padding is "valid," it must reflect zero padding. 5 convolution layers (C1, C2, C3, C4, C5) with a kernel/filter size of 3x3 and a subsampling layer (S1) with a max-pooling frame of 2x2 are included in the CNN model.

The input picture with varying sizes is convolved with 32 filters with no padding in the first convolution (C1), producing 32 features that are 254x254 in size. During the training process, the algorithms will learn these parameters. Rectified Linear Unit (reLU) are utilised as the activation function in each convolution layer. It makes the pictures' nonlinearity greater. These characteristics produced by the C1 layer.

64 convolution filters are applied to the features map from the preceding layer in the second convolution layer (C2) to create 64 convolved features maps, each measuring 3x3. The second subsampling layer (S2), which employs max-pooling and a window size of 2x2, receives these features. As a result, 18496 shared features maps, each measuring 125x125, are produced.

The third convolution layer (C3) uses 64 filters to create 64 feature maps, each measuring 3x3. The features are passed to S3, the third subsampling layer, which also employs max pooling with a window size of 2x2. The result is the creation of 36928 shared features maps, each measuring 60x60.

There are 64 filters used in the fourth convolution layer (C4), producing 64 feature maps, each of which is 3x3. With a window size of 2x2, the fourth subsampling layer (S4), which employs maximum pooling, receives these generated features. Consequently, an image of 36928 pooled features with 14x14 pixels is produced.

64 filters are used to create 64 feature maps, each measuring 3x3 pixels, in the fifth and final convolution layer (C5). These features are passed to the fifth subsampling layer (S5), which also employs maximum pooling and a window size of 2x2, using these features. The result is the creation of 36928 shared features maps, each measuring 3x3. So, no dropout layer is employed. Dropout is a regularisation method that lowers overfitting. Only the model's training step uses dropout. Dropout disables some randomly selected neurons' capacity to activate downstream neurons on the forward pass and does not apply any weight updates to the neurons during the backward run. This ignores the neurons during the training phase in line with the dropout rate.

The model adds a flatten layer as it flattens the data into a 1-dimensional array for entry into the following layer [18]. Following that, a dense layer with 64 nodes receives the produced features. A dense layer with 64 nodes feeds these generated characteristics. There are 1,47,520 parameters total here. Finally, for the classification, we used a second dense layer with softmax activation and 4 nodes. Thus, there will be 195 factors in total.

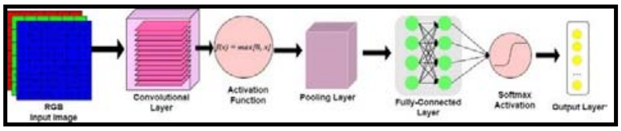

Fig. 6: CNN Architecture of the Model

The algorithm has a total of 277,891 trainable factors and are same shown in Table 1, below.

TABLE IDEPICTION OF LAYERS AND ITS PARAMETERS INVOLVED DURING TRAINING THE MODEL

Layers	Parameters
Conv2D (C1)	896
Conv2D (C2)	18496
Conv2D (C3)	36928
Conv2D (C4)	36928
Conv2D (C5)	36928
Dense (1)	147520
Dense (2)	195
Total	**277891**

IV. RESULTS AND DISCUSSIONS

A. *Training Process*

The CNN model is created, and then the Adam optimizer is used to build the model. It is a highly effective optimisation method used for deep neural network training. It incorporates the benefits of two optimisation techniques, RMSProp (Root Mean Square Propagation) and AdaGrad (Adaptive Gradient Algorithm). The five-layer Convolutional Neural Network architecture model was used for the dataset learning exercise. The study's period specification called for 50 epochs, a 32- batch size, and a learning rate of 0.01 to enhance the model's performance. The suggested method's algorithm searches for values in the image dataset as part of the learning process in order to recognise new images. Each epoch phase's value must correspond to the value of the picture being trained. To calculate the loss and accuracy values, the outcomes of the epochs will be recorded. The accuracy value indicates how accurately the system classifies objects, and the value of the loss gained must be close to or equal to zero. Loss is an indication that the model has a poor value.

In both plots of Fig. 7, the findings of the Accuracy and Loss values are displayed. obtaining values that are near to

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one and other to zero. While training, the early and later epochs show more fluctuation values. After the 250th epoch, the training dataset's accuracy, which includes the original images, achieves **98.189%**.

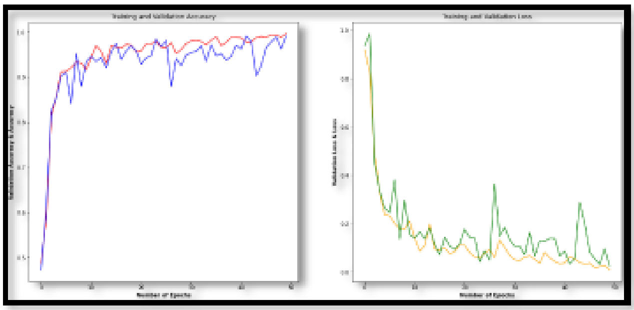

Fig. 7: Accuracy and Loss recorded while training the Dataset

B. *Testing Process*

Following the training procedure using the generated dataset, we retrieve the remaining part of the dataset i.e. testing dataset to be tested with the model. The testing accuracy is recorded as **99.18%** and testing loss as **2.48%**. Refer, to the Fig. 8 below for results.

The learning rate is 0.01, the batch size is 32, and the training period using the epochs parameter is 50. The CNN needed 7000 seconds, or approximately 1.9 hours, to complete 50 epochs at an average speed of 104 seconds per epoch.

Also, the model trained and tested is **capable of signifying** the **confidence** up to what extent it is able to classify or predict the disease.

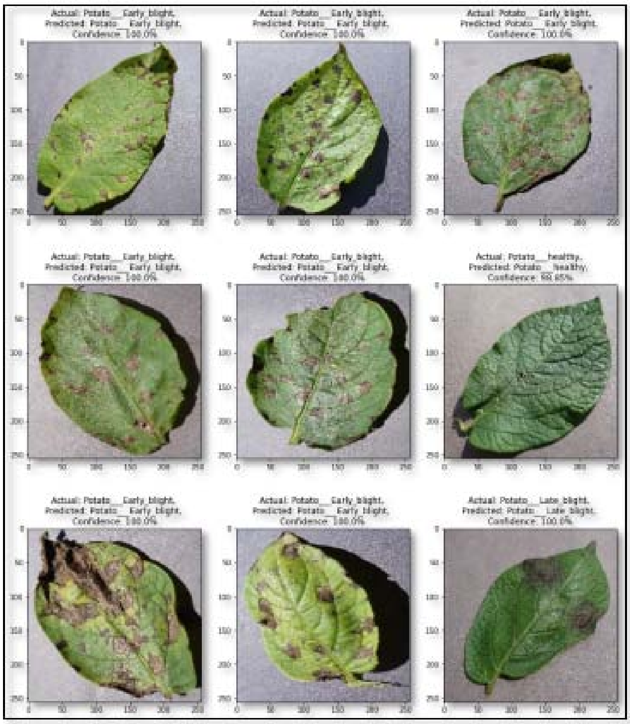

Fig. 8: Testing the Trained Model on Test Dataset for Accurate Classification of Disease

When assessing the model's accuracy with a leaf image object, it is crucial to keep in mind that image noise willresult in subpar classification results. By cutting out everything, but the desired leaf object and ensuring that there is only one leaf in each frame, noise can be removed from a picture.

V. Conclusion and Future Work

In this research, we suggested a deep learning strategy for categorising potato leaf diseases using a CNN (Convolutional Neural Network). Pre-processing the leaf images, training a CNN model on the pre-processed data, and assessing the model's performance on a test set are all steps in the suggested approach. With an overall accuracy of **99.18%**, the experimental findings showed that the CNN model was highly accurate in classifying four different potato leaf diseases, including Early Blight, Late Blight, and Healthy.

The suggested method may offer a trustworthy and effective means of diagnosing potato disease, which is essential for ensuring food security and minimising financial losses in agriculture. This approach can be further extended to other plant species, enabling early detection of diseases, and facilitating prompt interventions to prevent further spread.

Overall, the findings of this research show the efficacy of deep learning-based methods for identifying plant diseases and their potential to revolutionise the agricultural technology industry [19]. The proposed approach can assist farmers and experts in the early detection of diseases and timely implementation of control measures, thereby improving crop yields, reducing losses, and contributing to global food security.

Furthermore, the proposed deep learning-based approach offers several advantages over traditional methods of plant disease diagnosis. Unlike manual inspection, which is time- consuming and prone to human error, deep learning-basedapproaches can provide accurate and consistent results with minimal human intervention. Additionally, this approach can process large amounts of data in a short amount of time, making it ideal for real-time monitoring and detection of plant diseases.

While the proposed approach achieved high accuracy in identifying potato leaf diseases, further research is necessary to investigate its performance on other plant species and under different environmental conditions. Additionally, the proposed method can be further improved by incorporating additional data sources and developing more complex models.

In conclusion, this study demonstrates the potential of deep learning-based approaches for plant disease diagnosis and management. Early detection of potato leaf diseases is made possible by the suggested technique, which can have a significant impact on crop protection and global food security. With further research and development, this approach can be extended to other crops and environmental conditions, enabling the development of more effective and sustainable agricultural practices.

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Gramcorrector: Improve English writing skills using Deep Learning

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***Abstract*— English has now become a global language and is commonly spoken even amongst non-indigenous English societies. Grammar can be understood as an arrangement of words to form proper and meaningful sentences. English has a vast vocabulary and hence grammatical errors and typos are likely to happen for an average person. It is therefore important to have a medium that can help correct these errors and in doing so can help users improve their writing skills. The proposed work called Gramcorrector is an application that does both Grammar & spell correction. The availability of large volumes of data and good compute power paved the way for the development of such deep learning models. Gramcorrector is based on the Gramformer model, which uses the state of art transformer architecture. The core of this application is a Grammar & spell corrector model that has the capability to understand the intent of the sentence, identify all the possible errors and also apply accurate corrections. The corrected sentence or paragraph is displayed in the application UI along with the edits made on each sentence. This helps users to learn from their mistakes and also to improve his/her proficiency in English.**

***Keywords*— Grammar Correction, Natural Language Processing, Deep Learning, Transformer, SymSpell, Gramformer**

I. Introduction

English today has become a global language for communication. As a result, the number of English speaking people is increasing drastically even among the non-native communities. Learning the syntax and semantics of the English language is asignificant barrier for non-native speakers since it is a language with a big vocabulary as well as pre- defined grammar rules. This is made much more difficult when there aren't enough resources available to non-native English-speaking communities' education institutions to successfully teach the languages. Another significant barrier for amateur English language learners is the absence of proper contact with knowledgeable and deep English speakers. [1]

English is mostly learned by international students in academic settings including schools, universities, and other related institutions. Additionally, these students are more likely to engage with native speakers, which facilitates effective learning. On the other hand, educational institutions that help non-native groups learn English typically have few resources and a shortage of staff members who have the necessary training to impart English language instruction. The effectiveness with which the pupils learn the English language is directly impacted by these issues.

It is highly probable that non-native pupils who are enrolled in a school in a nation where the language is widely spoken will not have the chance to interact freely among native speakers. When given the chance to interact with native speakers, fresh language learners are often cognizant of and reluctant to use bad sentence structure and grammar. This not just impedes the process of learning but also has an impact on the pupils' self-confidence. Unrestricted and unfettered access to conversationalpractice significantly enhances and accelerates language learning. Moreover, this also prepares the users/students for effectivecommunications. Therefore, it is important to develop a system that addresses this scaled educational problem and also offers an unrestricted chance to learn English quickly and effectively.

Artificial Intelligence (AI) techniques are widely used today to solve grammar and spell correction [2]. With the development of Deep Learning (DL) architectures in NLP, rapid advancements were made in this area. The complex architectures such as Transformers have enabled models like Gramformer that work well on such problems. Gramformer can take as input any sentence or a group of sentences (2 or 3 sentences at max), apply grammar and spell correction and output the result. Gramformer works well when the number of input sentences or the sentence length are small. As sentences get bigger, the accuracy of the predictions also goes down. The proposed work identifies and addresses the shortcomings in such existing models and develops a new model that is more effective for grammar and spell correction.

The system developed in the proposed work consists of a UI where the users can type in or paste any text which needs to be evaluated. The text size can vary from a single sentence to a few paragraphs. The system uses deep learning to identify and correct both spelling and grammatical errors in the input text. The corrected text will be displayed in the UI. The UI contains an additional section that lists the edits or corrections made on each sentence in the text. This is useful for the users to understand their mistakes and learn from them. Thus, the proposed work can improve the language skills among users and in doing so effectively

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eliminate the aforementioned barriers to language acquisition in English.

II. Literature Survey

Every language has a predefined set of rules in which words can be arranged, called grammar. Following proper grammar is important in all languages to convey the required information. English is a language having a large vocabulary and as a result there can be frequent errors related to grammar and spelling when writing in English. Having a system that can identify and correct these errors is hence important. Such systems help users to see their mistakes, learn from them and in turn improve their language skill. At present, there are tools like grammarly that serve the need, but they still miss out on several errors and might sometimesconvert a grammatically correct sentence to an incorrect one. So, grammar correction is indeed a domain that still needs a lot of improvement.

In the English language, the same words can have different meanings depending on the context it is used. It is hence important for the system to have intelligence to understand the context and to make appropriate corrections. Intelligence stands the capacity to pick up information and abilities, and also to use them to solve a well-defined problem [6]. As described, it is difficult to find human intellect to teach English to non-native speakers. So it is key to develop an AI to overcome the lack of human resources. Even Though a few AI based solutions have emerged for the same cause, AI has never been successfully used to create cutting-edge instructional technologies. This is proven by looking at research literature that clearly describes the practices for promoting high-quality education as well as conversational language learning systems.

The authors of [4] argue that as new applications of AI are discovered and difficulties in educating and learning arise, a direct impact of AI on the subject of education is quickly approaching. The authors also mention how the area of education will be affected by the present wave of AI developments and how it will be changed in the future by new technologies and even the processing power of intelligent devices, one of which this research effort is modelled on. The success stories that have been achieved via the use of AI applications in education are highlighted by the authors in [8]. The outcomes are clear in the promotion of self-learning or self- development, virtual classrooms or laboratories, innovative schools that offer alternatives to traditional curriculum to all students, as well as virtual teaching [9]. In a study delivered to the Joint Research Centre of the European Union, the authors of [10] discuss the effects of AI on learning, teaching, and education. The adoption of customized and proactive students learning spurs the creation of ITSs based on AI algorithms [11].

English dialogue accompanies the Spanish dialogue in [12]. (EDC). The suggested EDC system supports elementary pupils in learning English as their second language of choice by taking the English language into account. The EDC approach motivates students by dividing English language instruction into two segments, namely the teaching phase and the discussion phase. The authors perform a pilot study to gauge the effectiveness of the EDC system. The findings indicate that the study's participants benefited from it. Additionally, theauthors note that most participants favoured the teaching phase over the conversing phase.

In [15], a more consistent body of research is given. The authors evaluate the 250 participants' English language acquisition using the Rasch model. Similar to [16], authors conduct research to look at how reading comprehension among non- native English-speaking students who are studying the language relates to lexical and grammatical understanding. 825 students who undertake the English as a Foreign Language (EFL) exam are included in the research. On the basis of grammar and vocabulary, the authors divide participants into high skills and low intelligence readers using a multi-layered neural network (NN). The study described in [17] is characterised by artificial language learning (ALL). As it focuses with the linguistic systems and researches the ecological validity of assessments of natural language ability, ALL examines language concepts as well as language development. Thus, it is clear from the analysis of current approaches that a fresh approach to enhancing language acquisition is feasible.

A neural network may be created in a manner similar to other Machine Learning applications to process unstructured text input. However, text data's large dimensionality will be a significant factor to consider while developing a solution. Neural network manipulation of high dimensional objects is challenging. Language modelling is the next significant NLP issue to be addressed. Any word sequence is given a probability by a language model, which is a probabilistic model. Learning a language model that gives strong probability to very well sentences is regarded as the task at hand.

The input of the neural network, that is the text data has to be converted to numerical form like vectors so that the network can process the data. The text data may be described mathematically using word embeddings, in which each word is represented by a higher-dimensional vector. Thus, the relationship between the words may be determined with the use of these word embedding approaches. Word embeddings are, in essence, learnt representations in which words with similar meanings have similar representations.

Word embedding can be done using standard techniques such as one hot encoding, count vectorizer etc. Each unique word in the corpus constitutes a dimension of the final word vector in a single hot encoding. Every dimension could have a value of zero or one when creating word vectors, depending on whether the word is present or not. Asentence is vectorized in Count vectors depending on the number of words in the sentence. Regarding word embeddings, the full vocabulary may be taken into account, or it may be limited to a select few top terms that are taken into account depending on its frequency. This gives control over the created word vector's dimensionality.

Apart from the standard techniques, pre-trained word embedding models can also be used to generate word vectors. These models are trained on large volumes of data and hence such models RNN+ LSTM + Transformer comparison

DOI: rp-9788770040723.044

There also exists python libraries that assist in correcting grammar. These libraries take in the input sentence, apply respective algorithms and return as output either the corrected sentence or the list of possible edits. Gingerit is an open-source python library that can be used for correcting grammatical errors. It is a wrapper around the gingersoftware.com API. Ginger software is an AI- powered writing assistant that corrects texts, improves and boosts the style and creativity of writing. It corrects spelling, punctuational and grammatical errors. The major drawback of Gingerit is that it is dependent on gingersoftware.com API. Updates in this API can cause the library to stop functioning.

Gramformer is a different open-source python library that can detect, highlight and correct grammatical errors. Gramformer exposes three separate interfaces to a family of algorithms used for detecting, highlighting and correcting grammar errors. Gramformer is a generative model even though its goal is to post-process generative model results. In general, all generative models have an uncontrollable tendency to occasionally produce erroneous text. A quality estimator (QE) is therefore introduced to ensure that the gramformer grammar fixes (and highlights) are as accurate as feasible. To return just the top-N candidates, it calculates an error correction quality score and applies it as a filter on the candidates.

According to the official documentation some of the use cases of Gramformer includes post- processing machine generated text, Assisted writing for humans, Custom Platform integration etc.

The major shortcomings of the Gramformer library is in dealing with multiple sentences. When more and one sentence is fed to the Gramformer model, the performance drops rapidly. Also, Gramformer is not efficient at correcting spell errors and in some cases, the incorrect spelling errors can lead to the model not being able to correct grammar.This objective of the research is to address these issues observed in the existing work.

III. Methodology

A. Grammar Correction Application

Grammar correction application is one that helps the user check for grammatical errors in the text they type. The text can either be a sentence or a few sentences or even paragraphs. The users can type in or paste or text for which they perform grammar checks. The application pre-process the input text and uses a deep learning model to check for grammatical mistakes and correct the input text. The corrected text along with the list of corrections for each sentence in the text are displayed in the application UI. The list of corrections for the input text helps people to understand their mistakes and in turn help them improve their language. Fig 1 shows the architecture of the proposed grammar correction application.

The application makes use of the Gramformer model at its core for performing grammatical corrections. One limitation of using the Gramformer model is that it fails to do well when dealing with text having multiple sentences. Gramformer, on the other hand, works well when the text contains only a single sentence. For real world scenarios, the user inputted text can have multiple sentences and or even a few paragraphs. This application assumes that the grammar of a particular sentence is independent of the other sentences in the text. Taking this assumption into consideration, the input text is tokenized to separate out each sentence in the text. This process is taken care of by the "Sentence tokenizer" component shown in Fig. 1. This component uses the sentence tokenizer function in NLTK library to split the input text to different sentences. This function loads a saved tokenizer model for the English language and uses the model to generate a list of sentences. The model uses whitespaces and punctuation marks to tokenize sentences. It also realigns punctuation that falls after the period but should otherwise be included in the same sentence.

The second limitation of the Gramformer model is in correcting spell errors. Gramformer is able to correct some words that are spelled incorrectly but it fails to do so for the majority of the words, especially those words that are not frequently used. The typo related errors can have a significant impact on the grammar. For example, a word having spell error "ther" can be corrected to "there" or "their" or be used as it is. Using any of the mentioned words will have a different impact on how the Gramformer model treats the sentence. Hence, it is important to have a check on the typo errors in the words belonging to the input text.

To handle spell errors, the Symspell module was added to the pipeline. Symspell is yet another open-source python library for spelling correction and fuzzy search. It makes use of the Symmetric Delete spelling correction method, which lessens the difficulty of creating edit candidates and looking them up in dictionaries for a certain Damerau-Levenshtein distance. Compared to the conventional method of deletes, transpositions, replacements, and inserts, it is six orders of magnitude quicker and language agnostic. In contrast to other algorithms, only deletions are necessary; there are no transpositions, replacements, or additions. Deletes of the dictionary word are created by transposing + replacing + inserting the input phrase.

As mentioned, the input text will be divided into different sentences. Each sentence is made up of several words and each word has to be checked for any errors. NLTK library is again used here to tokenize the sentence to a list of words. Each word is then fed to the Symspell model which uses a look up dictionary to suggest alternative words if any error is identified. Among these suggested words, the word that is closest to the word having error is chosen. The following configurations are possible for Sympell module:

- Return the closet word to the error word
- Return back the original word if no correct words are found within an edit distance
- Avoid correcting words that follow a predefined pattern
- Maintain origins casing (for example the word pATTern should be maintained as it is without correcting it to pattern)

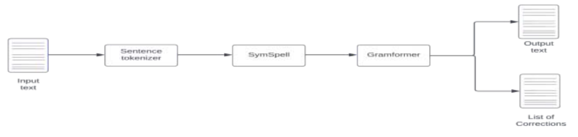

Fig. 1: Grammar Correction application architecture

The current implementation uses the second configuration that returns the original word if no matches are found within an edit distance of 2. Once the spell errors are corrected for each word, then the words are combined back to generate the original sentence. The new sentence will hence be free of spell errors. These corrected sentences are then fed to the Gramformer stage.The individual words present in the sentence; it is important to perform spell correction.

Once the spell correction is done for each sentence, it is then fed to the Gramformer model. Gramformer model is a pre-trained transformer model which is available as an open-source python library. Gramformer is a library that exposes 3 separate interfaces to a family of algorithms to detect, highlight and correct grammar errors. Also, to ensure the corrections and highlights recommended by the model are of high quality, it comes with a quality estimator. Gramformer can detect, highlight and correct grammatical errors. Gramformer is a generative model, and it has been noted that generally speaking, all generative models occasionally have a tendency to produce erroneous text that is impossible to control. Therefore, a quality estimator (QE) is introduced to ensure that the quality of the predictions (grammar correctionsand highlights) from the gramformer model remain as accurate as feasible. The error correction quality score may be estimated using the quality estimator, and it is used as a filter on the Top-N candidates to just return the top options.

Gramformer model takes in each input sentence and it has in-built functions to correct the grammatical errors as well as to return the list of edits made in each sentence. Having a sentence tokenizer overcomes one of the major limitations of the Gramformer model, where it was not able to do grammar correction properly if there are multiple sentences. With a sentence tokenizer component in place, the input text can contain any number of sentences since this component ensures that only one sentence is processed at a time. The application process and corrects one sentence at a time. The output from Gramformer stage is finally rendered in UI. The UI contains the sentence that is grammar corrected and also the list of edits done for each sentence. The list of edits helps the users easily understand the mistakes made in the input text, rather than having to compare both input text and corrected output to retrieve the list of corrections. The screenshot of the application is displayed in Fig. 2.

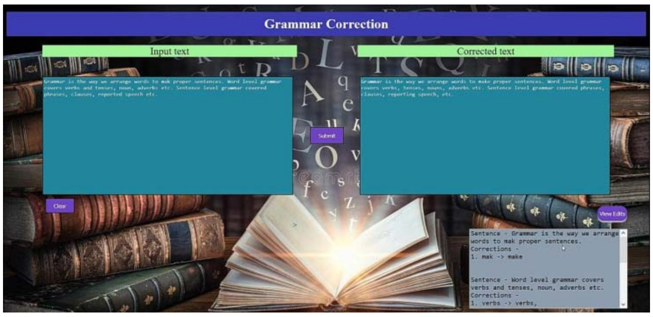

Fig. 2. Grammar Correction Application

The application was developed using the Flask framework in python, along with HTML and JavaScript. Flask is a web application framework written in python. The landing page of the application is as shown in Fig.2. The user has a text box under the ‘Input text’ section where they can either type in the required contents or copy paste from any document. Once done, they can click on the submit button to perform grammar correction. The corrected text will be displayed in the text box under the ‘Corrected text’ section. This text box is disabled and cannot be edited by the user. They can only view or copy the contents in the corrected text box. There is a clear button that can be used to clear the data from input text box, corrected text box and view edits window. The view edits button on thebottom right hand side of the screen can be used to view or hide the list of edits. The data in the ‘View Edits’ section will have the sentence and the list of edits made for each sentence is displayed right below it. This will be followed by the second sentence and so on. Thus, the application can be utilized to perform grammar correction and also view the errors in the input text.

IV. Results and Discussion

The grammar correction application can be used to both correct the grammatical errors and also view the corrections. It can correct errors in a single sentence, multiple sentences and even multiple paragraphs. Fig. 3 shows a few examples of input text containing just one sentence and the corrections made by the grammar correction application.

	Input text	Corrected text	List of edits
1	Matt like fish	Matt likes fish.	like -> likes fish -> fish.
2	the collection of letters was original used by the ancient Romans	the collection of letters was originally used by the ancient Romans.	original -> originally Romans -> Romans.
3	We enjoys horror movies	We enjoy horror movies.	enjoys -> enjoy movies -> movies.
4	Anna and Mike is going skiing	Anna and Mike are going skiing.	is -> are skiing -> skiing.
5	I walk to the store and I bought milk	I went to the store and bought milk.	walk -> went I -> milk -> milk.
6	I will eat fish for dinner and drank milk	I ate fish for dinner and drank milk.	will eat -> ate milk -> milk.
7	what be the reason for everyone leave the company	what is the reason for everyone leaving the company?	be -> is leave -> leaving company -> company?
8	Everyon is happy	Everyone is happy.	Everyon -> Everyone happy -> happy.

Fig. 3. Input text, Corrected text and list of correction for single sentence text by grammar correction application

From Fig. 3, the single sentence input text, the corrected text and the list of corrections can be observed. For sentences 1-4, the application was able to correct the errors such as using proper singular or plural form of the word and also adding fullstops at the end of each sentence. In sentences 5 and 6, the application was able to correct the sentence to maintain the past tense. Multiple corrections were also made for each sentencedepending on the necessity. For sentence 7, the application was able to rephrase the question such that it becomes more meaningful and correct the tense. It was also able to identify that the text is a question and added a question mark symbol at the end.

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For sentence 8, it was able to identify a spell error for the word “Everyone” and correct it accordingly.

	Input text	Corrected text	List of edits
1	How is you? Where is you going?	How is your work? Where are you going?	your work? is -> are
2	Because of new computing technologies, machine learning today are not likes machine learning of the past. It is born from pattern recognition and the theory that computers cans learning without being programmed to perform specific tasks; researchers interested in artificial intelligence wanting to see if computers could learn from data. The iterative aspect of machine learning are important because as models are exposed to new data, they are able to independently adapt. They learn from previo computations to produce reliable, repeatable decision and results. It’s a science that’s not new – but one that has gained fresh momentum. While many machine learning algorithms have been around for a long time, the abilities to automatically apply complex mathematical calculation to big data – over and over, faster and faster – is a recent development. "	Because of new computing technologies, machine learning today was not like the machine learning of the past. It is born from pattern recognition and the theory that computers can learn without being programmed to perform specific tasks; researchers interested in artificial intelligence wanted to see if computers could learn from data. The iterative aspect of machine	are -> was likes -> like -> the cans -> can learning -> learn wanting -> wanted machine learning are important because as models are exposed to new data, they are able to independently adapt. They learn from previo computations to produce reliable, repeatable decision and results. It’s a science that’s not new – but one that has gained fresh momentum. While many -> learning algorithms have been around for a long time, the abilities to automatically apply complex mathematical calculation to big data – over and over, faster and faster – is a recent development. " ->

Fig. 4. Input text, Corrected text and list of correction for multiple sentence text by Gramformer model

Fig. 4 highlights one of the shortcomings of the gramformer model. Due to technical constraints, it was not made very complex or trained on a very large dataset and hence it fails to interpret certain sentences properly. Thus, it is not suitable for input texts having multiple sentences. In the first example, the first sentence “How is you?” is incorrectly updated as “How is your work” rather than correcting it to “How are you?” The second sentence is corrected properly. The second example hasseveral sentences and it makes the gramformer limitations clearer. Few of the words in the first two sentences are corrected and the remaining data is just ignored. The sentences towards the end of the input text are replaced with an empty string as shown in Fig. 4. This shows the importance of having the sentence tokenizer component.

	Input text	Corrected text	List of edits
1	How is you? Where is you going?	How are you? Where are you going?	is -> are is -> are
2	Because of new computing technologies, machine learning today are not likes machine learning of the past. It is born from pattern recognition and the theory that computers cans learning without being programmed to perform specific tasks; researchers interested in artificial intelligence wanting to see if computers could learn from data. The iterative aspect of machine learning are important because as models are exposed to new data, they are able to independently adapt. They learn from previo computations to produce reliable, repeatable decision and results. It’s a science that’s not new – but one that has gained fresh momentum. While many machine learning algorithms have been around for a long time, the abilities to automatically apply complex mathematical calculation to big data – over and over, faster and faster – is a recent development. "	Because of new computing technologies, machine learning today is not like the machine learning of the past. It is born from pattern recognition and the theory that computers can learn without being programmed to perform specific tasks; researchers interested in artificial intelligence want to see if computers could learn from data. The iterative aspect of machine learning is important because, as models are exposed to new data, they are able to independently adapt. They learn from previous computations to produce reliable, repeatable decisions and results. It’s a science that’s not new – but one that has gained fresh momentum. While many machine learning algorithms have been around for a long time, the ability to automatically apply complex mathematical calculations to big data – over and over, faster and faster – is a recent development.	are -> is likes -> like -> the cans -> can learning -> learn wanting -> want are -> is because -> because, previo -> previous decision -> decisions abilities -> ability calculation -> calculations " ->

Fig. 5. Input text, Corrected text and list of correction for multiple sentence text by grammar correction application

Fig. 5 shows the benefits of having the sentence tokenizer component. In a text having multiple sentences, each sentence is separated and treated independently. As a result, it can work around the limitations of the Gramformer model to deliver better results. Comparing Fig. 4 data with Fig. 5 data proves that the grammar correction application is able to generate more accurate predictions than the standalone Gramformer model. It can correct spell errors, punctuation errors and also take care of the grammatical mistakes. Hence this can be used by anyone who is willing to improve their language skills by understanding and learning from the mistakes.

V. CONCLUSION AND FUTURE WORK

English has a vast vocabulary and hence grammatical errors and typos are likely to happen for an average person. It is therefore important to have a medium that can help correct these errors. We proposed a new application called Gramcorrector that can help users improve their writing skills. The users can type in the required text and get it validated and also corrected in case of any grammatical errors. Transformer architecture has brought a lot of advancements in the field of NLP. As a result the proposed application uses a transformer based model called Gramformer to correct grammatical errors.. Corrected sentences and the edits made are displayed in the application UI. This helps users to understand the mistakes they made and in turn improve his/her proficiency in English. Even Though the application can handle the majority of language errors, there is a scope for further improvement, especially when dealing with spell errors. As a future scope, the spell correction module SymSpell needs to be improved so that it can suggest propercorrections also taking into account the context where the particular word is used in. Also, the training data can be enhanced to improve the vocabulary of this module. Similarly, the Gramformer model can be improved using larger datasets and also using more complex architecture such as GPT. Availability of good quality datasets in other languages other than English can also drive the development of this application towards such languages. This is also in the future scope of the Gramcorrector application.

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Supercapacitor Based Electric Vehicle

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***Abstract* -By steadily lowering carbon emissions from our planet,we can preserve a greener and safer world. The usage of electric automobiles,that utilize generated fuel for electricity,emits fewer emissions than a typical vehicle,and if renewable electricity is utilised, it is emission-free.,will generally result in a significant reduction in the mount of fossil fuel-powered vehicles on the road. Now adays, supercapacitors are frequently employed. These ultracapacitors or electrochemical double-layer capacitors are high-pressure, high-efficiency energy storage devices (EDLC). They can be quickly charged and discharged without sacrificing performance an extended length of time, which is one of their advantageous qualities that makes them perfect for use in energy storage systems. HESS, which incorporates multiple power reserve methods, can use a supercapacitor pack.**

I. Introduction

Electric powered vehicles (EV) of all types may be seen more frequently in modern deliveries, including electric-powered motorbikes, electric-powered scooters, and electric powered buses. The ecology and performance of each EV are the driving forces behind the increase in the number of them on the road. Therefore, EVs consume substantially less electricity and are less expensive to operate even though they are more expensive to purchase. In order to improve garage performance, it is important to Highly effective additives for electric energy storagein terms of their length, cost, cycle performance, longevity, power density, and energy density. By storing the energy from acceleration to deceleration, a hybrid energy storage system (HESS) made of battery and supercapacitor components could improve the overall performance of electric vehicles.

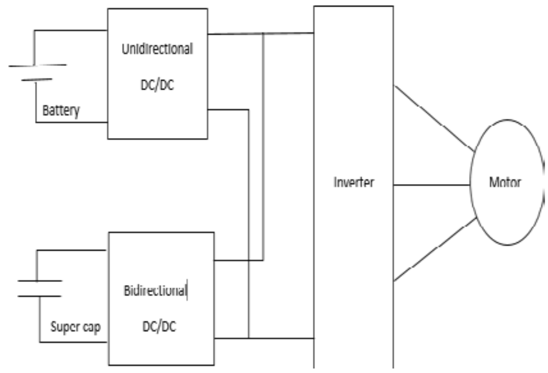
II. Existing System

Maximum amount of power may often be extracted from an ambient energy sourc e in two steps, followed by a DC-DC conversion.It is difficult to regulate the output at the same time because the input impedance of an energy harvesting circuit needs to be regulated for maximum power extraction.Due to its parasitic series resistance, the additional inductor results in a larger form fa ctor, higher price, and greater power loss.

III. Methodology

Applications forEV andHEVhave been present. Energy storage used an auto-motive application must meet a variety of criteria, including particular energy, specific power, efficiency, affordability, environmentalfriendliness, and safety.Specific energy allocation for EVs is prioritised because it affects the vehicle's range. However, since all of the energy in a HEV application comes from theenergy source and sufficient power is required to ensure vehicle performance, particularly during acceleration, hill climbing, and regenerative braking, specific energy becomes less significant and the first factor is specific power. Battery manufacturers frequently specify battery capacity (amp-hours), which is calculated as the number of amp-hours acquired after draining the battery from a fully charged condition until the terminal voltage hits the cut-off voltage.The specific energy of an ultracapacitor is in the region of a few watt-hours per kilogramme. However, it has a far higher specific power than any battery, up to 3 kW/kg. It is challenging due to their low specific energy density and reliance on the SOC to use ultracapacitors alone as an energy storage for EVs and HEVs.The ultracapacitor's load levelling effect reduces the battery's high-current charging during reverse braking as well as high-current discharging from the battery, which greatly extends the battery's life and energy capacity. We attached the lithium-ion battery and ultracapacitor for that reason.

Block Diagram



IV. Components

DOI: rp-9788770040723.045

A. Super Capacitor

Super-capacitors, a novel technology in the field of transportation, are suitable power components for HEVs' energy storage systems. They are dense in power is substantially superior to batteries and they have a lifespan of over 500,000 cycles.Ten times more energy can be held in a supercapacitor than can be in an electrolytic capacitor. Their quick adoption for automotive applications is a result of theirpower and life cycle properties, which are far superior to high power batteries.Two theories are put out in the literature to model the behaviour of super-capacitors. The first approach, which in accordance with the transmission-line model, suggests a circuit equivalent that uses distributed capacitance Ci and pore resistance Ri, which characterises the behaviour of the supercapacitor by means of an electrical equivalent circuit with two RC branches. C1 is modelled as a differential capacitor with voltage dependence., the first branch. It consists of a constant capacitor C0 and a variable capacitor Cv whose value changes linearly with voltage V1. Serial resistance comparable to R1 is R1. The two branches model is a simpler design and requires less simulated period than the first solution.

The major and rapid branch that replicates the predominate supercapacitor charging and discharging behaviour is represented by the R1C1 branch.

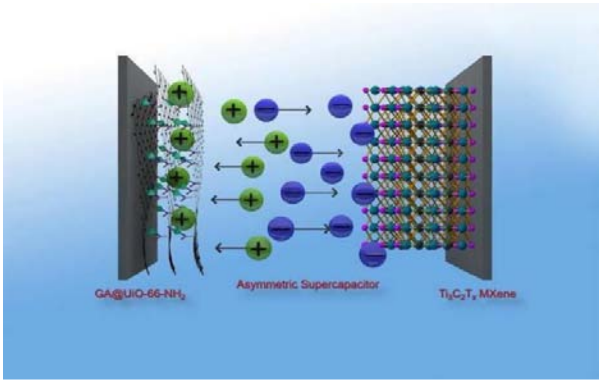


Fig 1. Schematic diagram of super capacitor

B. Lithium Ion Battery

By creating a difference in potential between two electrodes—one negative and the other positive—that are immersed in an electrically conductive ionic liquid known as the electrolyte, the lithium-ion battery operates on the principle of circulating electrons.The discharging phase of a battery occurs when a device is powered by it; during this time, electrons that have accumulated in the negative electrode are freed and move to the positive electrode via an external circuit.The opposite hand, as soon as the battery being charged, Electrons are moved back from the positive electrode to the negative electrode by the energy from the charger.Ion types, electrode substance, and related electrolytes are variable between the various battery kinds.For instance, a combustion engine vehicle's starter is typically powered by a 12-volt lead-acid battery that uses lead-based electrodes and an electrolyte containing lead ions. The lithium-ion battery uses lithium ions (Li+), which is how this technology got its name. A lithium-ion battery, like the one found in a vehicle like the ZOE, is made up of a collection of separate battery units (cells), which are interconnected and under the control of a specific electronic circuit.The battery's capacity, or the quantity of electricity it can store, is determined by quantity of cells, how big each cell is, and arrangement where they are placed.

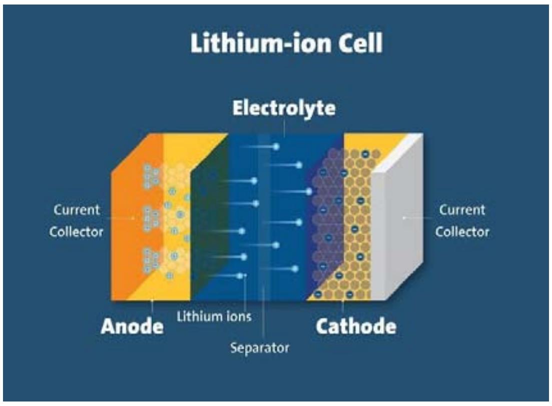


Fig 2.Schematic Diagram of Lithium IonBatteries

C. DC-DC Convertor

A circuit or electromechanical device called a DC-to-DC converter adjusts a direct current source's voltage level. Low to extremely high power levels.These days, electric vehicles are the principal applications for this bidirectional converter. Another name for It's a DC-DC.half-bridge converter.The circuit that results, which generally similar structure to the basic Buck and Boost structure though with the combined bidirectional power flow properties, is known as a dc-dc converter that operates both ways when the boost converter and the Buck are connected in opposition to one another across one another. It functions both ways.Automobile manufacturers typically use electric propulsion based on renewable energy sources rather than engines with combustion, which is the main source of emissions of greenhouse gases. Hydrogen is converted into electrical energy via FC, a clean, economical, and effective renewable energy source. A DC-DC boost converter must be used as the interface for power due to the requirements for driving, longevity, and Reliability of FCs and electric cars based on FCs

Fig. 3 DC-DC Converter

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V. MATLAB Output

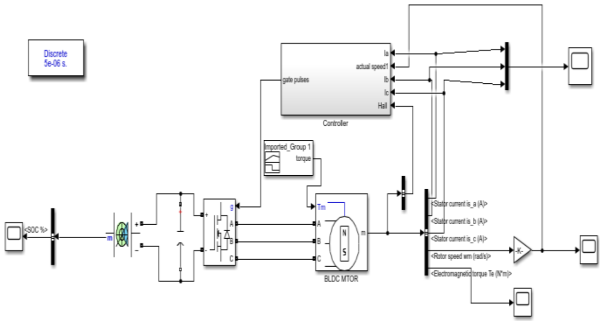

Fig 4. Circuit diagram of Supercapacitor based electric vehicle

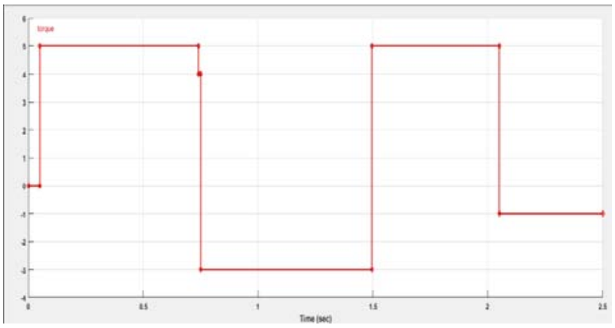

Fig 52. Measurement of torque

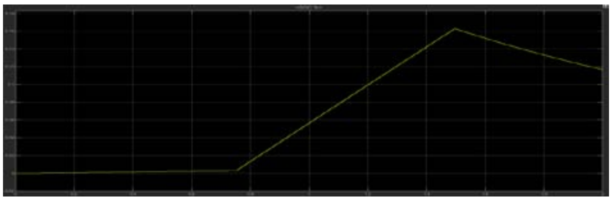

Fig 6. State of charge graph

VII. Conclusion

The hybrid energy storage system (HESS) design case for the application of a hybrid electric vehicle is described and analysed in this paper. A set of super-capacitors and a set of Li-ion batteries make up HESS. The design process seeks identify best device parameters in accordance with a suggested set of standards. It is also done to compare the two topologies for DC/DC convertersthat connect the To the DC, HESS connection. A traditional Buck/boost and DC/DC boost TL boost, buck/boost, and converter are two topologies were explored. According to the results, TL converters provide the optimum exploitation for high energy and high power densities, as well as decreased cost, weight, and volume in the vehicle, of battery and supercapacitor technologies. Models of batteries, supercapacitors, and Several DC/DC converter topologies are used using Matlab/Simulink. Results of the system performance and behaviour are obtained and discussed.

These results validate the TL topology's cost effectiveness and design assumptions.

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Alcohol Detection System for Vehicle Control

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Abstract— In the recent years, whole world has seen so many accidents due to drinking. Problem persists even after strict laws or policing. Hundreds of people lose their lives due to driving drunk or coming in the way of someone else who is driving drunk. Drunk drivers not only put themselves at risk, but also those in their vicinity. In this modern era the requirement of automatic device for alcohol detection is essential.With that goal in mind, we worked on an Alcohol Sensor for Vehicle Control using Arduino. We have used Arduino Uno, MQ3 alcohol sensor, a DC Motor (as car), piezoelectric buzzer, LED and resistors. This study developed a prototype of alcohol detection and engine locking system by using an Arduino Uno microcontroller interfaced with an alcohol sensor along with an LCD screen and a DC motor to demonstrate the concept. The system uses MQ-3 alcohol sensor to continuously monitor the blood alcohol content (BAC) to detect the existence of liquor in the exhalation of a driver. Results from testing the proposed system adequately matched the requirements for starting a car's engine once the level of alcohol detected in the breath of the driver is higher than the prescribed level that is permissible by law.

Keywords— Arduino, Alcohol detector, Parts per Million, USB.

I. INTRODUCTION

INDIA has earned the dubious distinction of having a greater number of fatalities due to road accidents in the world. Road safety is emerging as a major social concern around the world especially in India. Drinking and driving is already a serious public health problem, which is likely to emerge as one of the most significant problems soon.

These days, majority of road accidents are caused by drink-driving. Drunken drivers are in an unstable condition and so, rash decisions are made on the highway which endangers the lives of road users, the driver inclusive. The enormity of this menace transcends race or boundary. In India, the problem is being tackled by issuing laws prohibiting the act of drivers getting drunk before or while driving as well as delegating law enforcements agents to arrest and persecute culprits. However, effective monitoring of drunken drivers is a challenge to the policemen and road safety officers. The reason for this stems from the natural inability of human beings to be omnipresent as well as omniscience within the same space and time. This limited ability of law enforcement agents undermines every manual effort aimed at curbing drink-driving. There is therefore the need for an automatic alcohol detection system that can function without the restriction of space and time.In earlier executions of this project, a prototype of road accident avoiding system that havean alcohol sensor MQ-2 which detects the presence of alcohol in human breath was integrated with a PIC16F877/874 microcontroller which acts as the controller, and an LCD as the output. Other proposed systems for detecting drivers that are drunk so as to track them down have been 2 developed. The system uses Advanced RISC Machine (ARM) processor and MQ3 that detects liquor. The MQ3 sensor senses the intensity of liquor by means of an analog to digital converter which is inbuilt in LPC2148 ARM controller. Understanding the current situation regarding traffic safety, we have decided to go for an automated approach using Arduino UNO, as opposed to a traditional microcontroller approach. The Arduino system was selected over a microcontroller due to the following reasons:

- An Arduino board is cheaper in cost, thus reducing manufacturing cost.
- It is easily programmable, which offers flexibility regarding functionality.
- Due to the customizability of an Arduino Board, there is relatively lesser wiring and hence, lesser room for connectivity errors.
- The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

The objective of this project is to implement a low-cost, scalable, and reliable alcohol detection system in the dashboard/steering wheel of a car. An alcohol sensor will continuously detect theBlood-Alcohol level of the driver and stop the car engine at any time when it detects a hike inthe level compared to the legal limit of consuming alcohol, as set by the government.

II. RELATED WORK

Nowadays in many civilized culture consumption of alcohol is taken as a tradition. The habit is coined with many occasions such as parties and celebrations [3]. Even a small amount of alcohol consumption can change the human behavior as well as his bodily behavior. This type of boddy inability to control can be highly dangerous and can involve car accidents which will risk the persons sitting inside the car also on the persons on the road [5]. Government made several laws like fine, cancellation of license etc. so that this can be minimized. The above mentioned problems shows that there is a need of simple, accurate and instrument to be used by the automobile manufacturers, vehicle users and so that vehicle will not start due to alcohol content in the air inside the vehicle [6,7]. The alcohol consumption is more in younger generation and they drink and cause accidents due to rash driving. Due to the alcohol consumption changes the bloodalcohol concentration and thus changes the body actions. There is a direct connection between blood alcohol and breathe alcohol concentration [4].

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By taking blood samples blood alcohol concentration can be measured and by using sensors breath alcohol content can be measured [7], [8].The first method is done by traffic policeman by taking blood samples of the drivers. The second method uses breath analyzers to sense the breath of the drivers. This method itself is not enough this can be integrated with the car system so that presence of any alcohol content in the vehicle also can be detected [9]. The proposed system is developed on embedded system using Arduino. Ashish Singh et.al [11] developed a alcohol detection system which facilitates the human driving system.

Deepak Garget. al [12] discussed on the development of alcohol detection system using various circuitry.

G. Sudha et.al [13] described in their paper on alcohol sensor based ehicle ignition control using Arduino UNO. Jagadeesh G et.al [14] in their paper explained the development of alcohol detector to minimize traffic accident cases based on alcohol consumption. Mrs. K. Niroshaet. al [15] discussed in their paper on amount of alcohol detection in vehicles and the system is developed using various sensors for the safety of people seating inside the vehicle.

III. Methodology

Main aim of this work is to develop a hardware to detect alcohol content in drunken driver while driving. Methodology describes the various steps that are followed in developing the prototype. It comprises various steps such as developing the hardware, simulating the circuitry through software, Testing the hardware for results.

A. Block Diagram

Block diagram of the proposed system is shown in Fig.1 which comprises following parts such as Power supply, Alcohol sensor and Ignition system on the input side. Indicating Unit, Alarm and DC Motor on the output side. Power supply consists of various sources for different sections of hardware.

Our system is powered with a 9V battery. A 5V DC supply as required by the microcontroller, sensor and display unit. While other components like DC motor require 1.5V and the LEDs need 2V. The Arduino Uno board has already been designed to operate without the use of transformer, the system can be powered via the USB connection from computer or with an external power supply of 7 to 12V. The External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. Any voltage that is above 12V will make the control device to burn thereby destroying the board. Itis advisable to use voltage between 7 - 12V.

B. Architecture

Figure 2 illustrates the architecture of the system. For the purpose of ensuring the success of this project, we thought it best to simulate our circuitry and code before executing on any hardware. For our simulations, we used an online platform by Autodesk Education–Tinkercad.

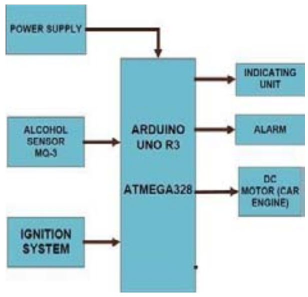

Fig. 1. Block Diagram arrangement

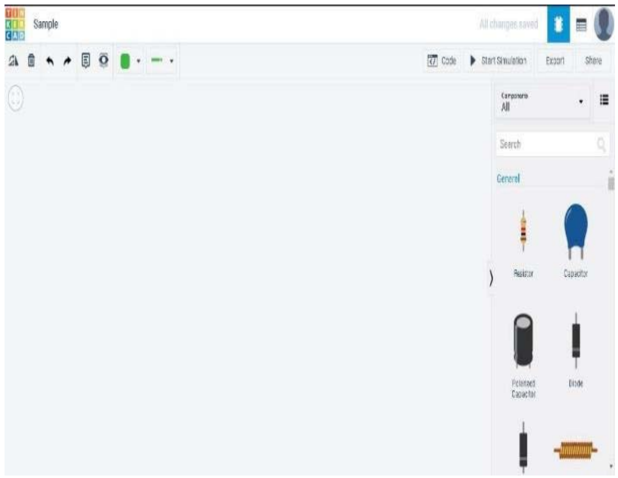

Fig. 2. Architecture of the proposed system

Tinkercad is a multipurpose educational online platform in which students, professionals and any curious minded individual can simulate and design – codeblocks, circuits and 3D designs. For the purpose of this project, we found it most hands-on and practical to use this website for designing and simulating our circuitry. There are multiple blocks of electric circuit designing components in a very diverse and vast library included on the platform, to name a few – resistors, motors, sensors, Diodes and other various electronic components. Here, we used the Arduino board (Arduino UNO R3) and were able to code the board for the simulations using the platform's in-built IDE (Integrated development environment).

C. Arduino Board

Arduinois an open-source hardware and software company, project and user community thatdesigns and manufacturessingle-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form oras do-it-yourself. (DIY) kits.

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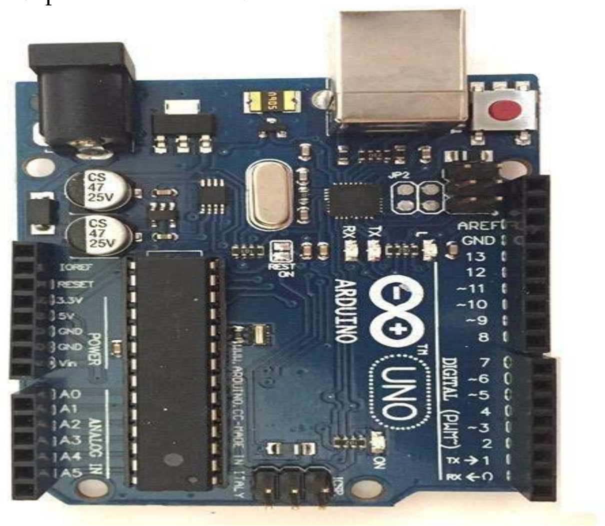

Fig 3.Arduino Board ATmega 328

D. Alcohol Sensor

Fig. 4. Alcohol Sensor- MQ3

MQ-3 gas sensor has high sensitivity to Alcohol, and has goodresistance to disturb of gasoline, smoke and vapor. It has fine sensitivity range around 2 meters. The sensor could be used todetect alcohol with different concentration; it is with low cost and suitable for different application. It has a clear interface type. On the sensor, port pins 1, 2 and 3 tends to the yield, GND and VCC independently.

MQ3 is a heater-driven sensor. That's why it is enclosed in two layers of fine stainless-steel mesh called an Anti- explosion network. It ensures that heater element inside the sensor will notcause an explosion, as we are sensing flammable gas (alcohol).

When SnO2 semiconductor layer is heated at high temperature, oxygen is adsorbed on the surface. In clean air, electrons from the conduction band in tin dioxide are attracted to oxygen molecules. This form an electron depletion layer just below the surface of SnO2 particles and forms a potential barrier. As a result, the SnO2 film becomes highly resistive and prevents electric current flow.

E. Connections with Arduino (Digital)

The module has a built-in potentiometer for calibrating the digital output (DO). By turning the knob of the potentiometer, you can set a threshold. So that when the alcohol concentration exceeds the threshold value, the Status LED will light up and the module will output HIGH.

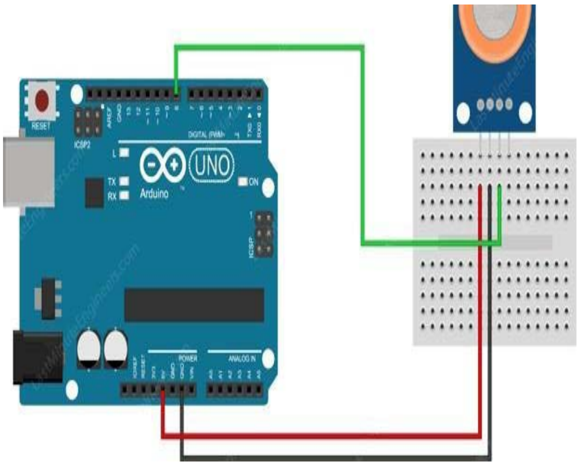

Fig. 5. MQ3 Connection with Arduino (Digital)

F. Piezoelectric buzzer

A piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It'slightweight with a simple construction, and it's typically a low-cost product. Yet at the same time, depending on the piezo ceramic buzzer specifications, it's also reliable and can be constructed in a wide range of sizes that work across varying frequencies to produce differentsound outputs.

G. System Flow Chart

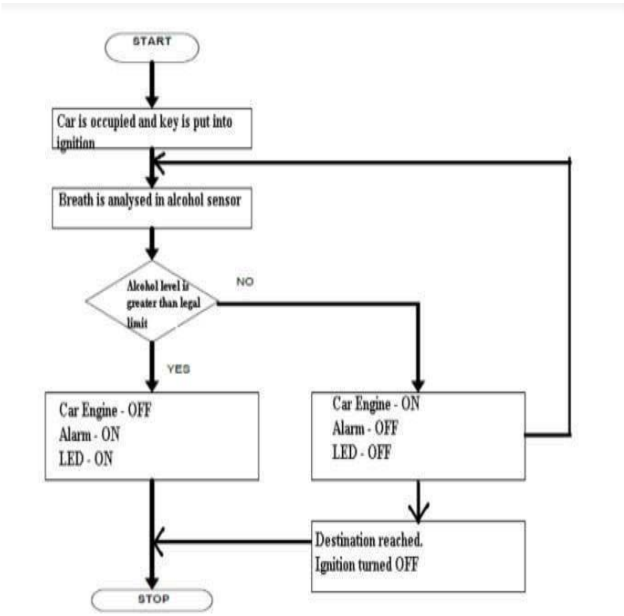

Fig. 6.System Flow Chart

Figure 6 shows flow chart of the system where when an alcohol sensor detect the presence of alcohol the ignition will start and simultaneously the LCD panel will show the presence of alcohol and buzzer will start ringing. In the absence of alcohol the ignition will start and buzzer will be silent.

IV. Result Analysis

The legal limit for alcohol percentage (permissible blood alcohol content) on a driver's breath is given to be 0.03% per 100 ml of blood, which comes out to be 0.03mg of alcohol per 100ml of blood.

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Now, considering ratios 0.03mg Alcohol: 100 ml blood

=> 0.3 mg Alcohol: 1000ml blood (1 litre)

TABLE I: SIMULATION RESULT

S.No	Readings	Actions
1	109	Engine ON, LED OFF, AlarmOFF
2	116	Engine OFF, LED ON, AlarmON
3	187	Engine OFF, LED ON, Alarm ON
4	42	Engine ON, LED OFF, AlarmOFF
5	90	Engine ON, LED OFF, AlarmOFF

Permissible Blood alcohol content is = 0.3 mg/L Toconvert that to parts per million :

We first refer to this formula -

%= mg/L ×(22.4 / M) ×((273+T) / 273) ×(1 / 10)×(1013 /P)

Where:

22.4 = The volume of 1 mol at 1 atmospheric pressure at 0ºC273(K): K stands for Kelvin, the unit used to measure thermodynamic temperature; as 0ºC Corresponds to273.15K.

T = The average temperature of the country assumed to be 25 degrees Celsius. 1013(Pa): One atmospheric pressure

P: denotes the atmospheric pressure at the point of measurement (Pa), which is assumed to be 1 atm on average, in India.

On substituting mg/L as 0.3mg/L in the above equation, we get:

% = 0.0159119%

Therefore,

PPM (parts per million) = 159.119

The above calculations tell us, that when the blood alcohol content reaches or crosses a threshold of 159.119ppm, the engine locking and alarm system will be engaged.

On experimentation, we find the above criteria to be matching and conclude the experiment to be a success.

Table 1 shows readings of simulation which respective action of LED, Alarm and Engine.

V. CONCLUSION AND FUTURE SCOPE

Drunken driving is considered as one of the major reason of accidents in worldwide. Drivers under the influence of alcohol shows a clear failure of perception recognition and vehicle control. This causes possibilities for hazardous situations and road accidents involving vehicles and pedestrians causing damage to both.

This paper defines the development of alcohol detection system for vehicle control using Arduino. The main important core element of this device is Arduino. Since the sensor which is used in the system has sensitivity of around 2 meters, it can suit to any vehicle and can easily be hidden from the suspects. The whole system has also an advantage of small volume and more reliability. As the growing public perception is that vehicle safety is more important, advances in public safety gaining acceptance than in the past.

The main advantage of the developed system is to control the number of accidents caused due to alcohol consumption. This system improves the safety of human beings and their property (vehicles, personal belongings in the vicinity of damaged area) and hence providing the effective development in the automobile industry regarding reduction in the accidents caused due to alcohol.

Implementing this project through Arduino allows global access to academics who might take up interest in this project and might want to update the system with new ideas, either innovative or with respect to execution and efficiency. This Arduino code can be accessed easily and built upon further.

This type of a system can also be used outside of the automobile industry, one such application could be automating exhaust fans in certain situations, like professional 10 kitchens, or in cases of fire, as the MQ3 gas sensor is also sensitive to Benzene, CH4, Hexane, LPG and CO. It can also be used for detecting gas leaks in factories by adjusting the impedances and sensitivity accordingly. Once a gas leak is detected the system can internally turn on exhausts and through the means of IOT, can shut down other appliances/devices which may potentially be cause for hazard

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Enhancing Intrusion Detection in Internet of Vehicles through Federated Learning

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Abstract— *Federated learning* is a technique of decentralized machine learning that allows multiple parties to collaborate and learn a shared model without sharing their raw data. Our paper proposes a federated learning framework for intrusion detection in Internet of Vehicles (IOVs) using the CIC-IDS 2017 dataset. The proposed framework employs SMOTE for handling class imbalance, outlier detection for identifying and removing abnormal observations, and hyperparameter tuning to optimize the model's performance. We evaluated the proposed framework using various performance metrics and demonstrated its effectiveness in detecting intrusions with other datasets (KDD-Cup 99 and UNSW-NB-15) and conventional classifiers. Furthermore, the proposed framework can protect sensitive data while achieving high intrusion detection performance.

Keywords— Internet of Vehicles, Intrusion Detection Systems, Federated Learning, Machine Learning.

I. Introduction

With its ability to analyse large amounts of data and identify patterns that humans do not readily recognize; In recent years, machine learning has become increasingly popular as a methodology for intrusion detection. On the other hand, traditional machine learning techniques rely on centralizing data, which poses significant risks to individuals' and organizations' privacy and security. Federated learning is an approach of collaborative machine learning technique in which multiple parties collaborate and learn a shared model without sharing their raw data. This method addresses privacy concerns and allows for the inclusion of data from multiple sources, which can result in improved performance and robustness.

In this paper, we present the following.

1. A federated learning framework for intrusion detection using the CIC-IDS 2017 dataset.
2. The proposed framework employs SMOTE for handling class imbalance, outlier detection foridentifying and removing abnormal observations, and hyperparameter tuning to optimize the model's performance.
3. The proposed framework was evaluated using various performance metrics and demonstrated to detect intrusions in different datasets effectively.

II. Literature Review

Recent studies are looking at the application of federated learning in Internet of Things (IoT) networks for intrusion detection [1-4]. These approaches take advantage of the distributed nature of IoT devices to collect network data and train deep learning models in a decentralized manner. Doing so allows for real-time adaptation to changing network conditions and enhances privacy and security compared to traditional centralized methods. For instance, one approach proposed in [3] uses an efficient communication method and an on-device federated learning technique for deep anomaly detection of time-series data in industrial Internet of Things (IoT), where models are trained on individual IoT devices, reducing communication overhead and preserving privacy. Another ensemble multi-view federated learning technique for intrusion detection in Internet of Things (IoT) networks was presented in [4], which combines multiple views of network data to train an ensemble of federated learning models that detect anomalies in network behavior indicative of security attacks. In [2], a federated learning-based approach to anomaly detection for security attacks in Internet of Things (IoT) networks was proposed, leveraging decentralized data from multiple Internet of Things (IoT) devices to train a federated learning model that detects anomalies in network behavior. Moreover, [5] use deep reinforcement learning to create training data in IOV with prioritized experience and states, as well as a federated learning experience sharing mechanism to protect vehicle privacy. Other works propose specific applications of federated learning for different tasks, such as resource allocation [6], privacy-preserving learning models for vehicles [7], and outlier detection techniques for machine learning [8-10]. Additionally, the Synthetic Minority Over-Sampling Technique (SMOTE) proposed in [10] addresses the class imbalance in machine learning datasets, while [9] provides a comprehensive survey of outlier detection techniques for temporal data.

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Regarding blockchain and federated learning, [14] offers a hybrid architecture that combines a restricted blockchain and a locally directed acyclic graph (DAG) with a deep reinforcement learning-inspired asynchronous federated learning scheme. A blockchain-based federated learning pool (BELP) framework is presented in [15], allowing models to be trained without sharing new data and choosing the most suitable learning. Furthermore, [16] integrates federated learning and local differential privacy (LDP) for crowd- sourcing applications, [17] proposes a federated learning collaborative authentication protocol for shared data to prevent data leakage and reduce the propagation delay of data. Lastly, [18] introduces a semi-synchronous federated learning (Semi-Syn Fed) protocol to improve machine learning performance.

Our article emphasizes the use of the CIC-IDS 2017 dataset[11] for intrusion detection, which incorporates seven publicly accessible shared attack network flows that satisfy real-world requirements. While there is some missing and redundant data in this dataset, which can lead to significant imbalance and poor model performance [12, 13], these difficulties can be overcome by more stringent data preparation.

III. Proposed Framework

A. *Framework Proposed*

Our study explores the implementation of Federated Learning using two edge devices, namely Internet of Vehicles (IOVs), and a central server. The edge devices train their models locally using their own datasets, and only the trained model is transmitted to the central server. The central server combines the received models and trains a resulting model on its dataset.

To ensure data privacy, the original dataset is partitioned into three distinct parts, with each partition assigned to an edge device and the central server. Each partition adheres to an (80:20) training-testing ratio, which helps protect sensitive data while allowing models to learn from the collective experience of all edge devices. This partitioning principle serves as a secure and efficient framework for learning from distributed datasets, leading to the development of robust models that generalize well across different edge devices.

The models from the edge devices are pickled and transmitted to the central server. The central server trains a super global model with its share of the dataset, and the resulting trained model is then sent back to the edge devices as global model updates. This iterative process continues until satisfactory performance is achieved in the edge devices.

Overall, the study's approach to “Federated Learning” provides a practical solution for addressing the challenge of data privacy in distributed datasets while allowing edge devices (IOV’s) to contribute to the collective experience of training robust models.

*Figure 1.*illustrates the architecture of a federated learning-based Intrusion Detection System (IDS) in an Internet of Vehicles (IoV’s) network.The network consists of two Internet-connected vehicles (Edge Devices) that transfer models to a central server. The IDS is placed before the Controller Area Network (CAN) bus to monitor and analyze network traffic.

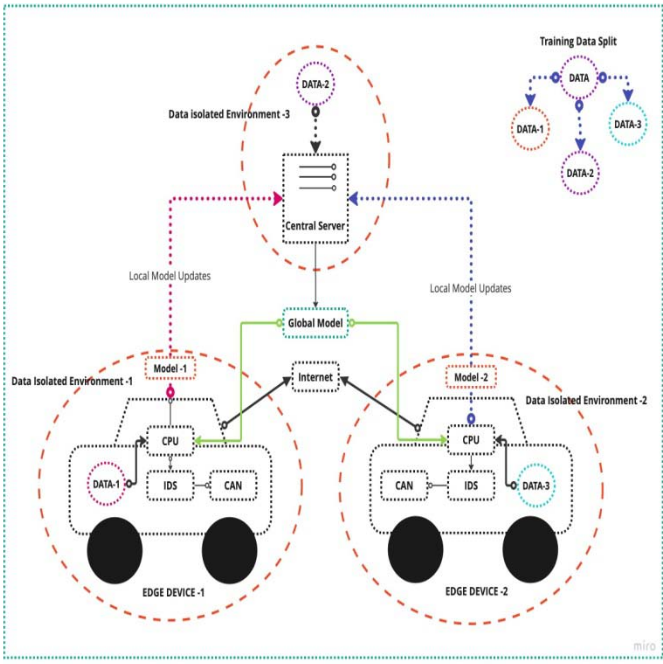

Fig. 1 IOV – Federated Learning Architecture

The edge device trains and optimizes the machine learning models using the preprocessed data and sends the model updates to the central server. The central server aggregates the model updates and sends periodic global model updates to the edge devices for retraining. This architecture enables distributed machine learning while maintaining data privacy and enhances the accuracy of IDS in Internet of Vehicles (IoV’s) networks.

B. *Description of the dataset*

CIC-IDS 2017 (Cyber Intrusion and Cyber Attack Intrusion Detection) is a dataset of network traffic data obtained in a controlled environment that is publicly available. It includes tagged network traffic data that may be used to train and test intrusion detection systems.

For the scope of our research, we used a different variant of the dataset that covers traffic like benign, DoS, port scan, brute force, web attack, bot, and infiltration.

Normal, non-malicious network activity is referred to as benign traffic. On the other hand, DoS attacks seek to make a network resource inaccessible to its intended consumers. Inspecting a computer's open ports for security considerations is referred to as port scanning. To guess passwords or keys, brute force attacks employ trial and error. Web-based systems, applications, or services are the targets of web-based attacks. A *bot* is a computer program that automates chores or performs activities on behalf of a user. Unauthorized access to a network or computer system is referred to as infiltration.

TABLE 1.Network Traffic Classes in the dataset "CIC-IDS 2017"

Si. No	Network Traffic Type	Quantity
1	Benign	22728
2	DoS	18984
3	Port scan	7946

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4	Brute force	2767
5	Web attack	2180
6	Bot	1966
7	Infiltration	36

From **TABLE1**, it can be inferred that the dataset is highly imbalanced (the "Benign" class has the most significant number of samples, while the "Infiltration" class has the smallest number of samples) and can have significant effects on the performance of the machine learning model trained on this dataset. We encounter this issue in the next section with specific pre-processing techniques.

C. Preprocessing Techniques

The proposed framework employs the Synthetic Minority Over-sampling Technique (SMOTE) to address the class imbalance in a dataset composed of seven distinct classes. The dataset consists of 22728 benign instances, 18984 Denial-of-Service (DoS) instances, 7946 Port Scan instances, 2767 Brute Force instances, 2180 Web Attack instances, 1966 Bot instances, and only 36 Infiltration instances. To obtain a balanced data set, we oversampled the minority infiltration class by generating 20000 synthetic instances. Similarly, the other classes, including Port Scan, Brute Force, Web Attack, and Bot, were also oversampled to 20000 instances each. The resulting balanced dataset allows a more accurate and representative evaluation of the classification models. Overall, the SMOTE technique effectively improves the dataset's balance, thereby increasing the reliability of the results obtained from the subsequent analyses.

Despite its effectiveness in balancing imbalanced datasets, oversampling can introduce outliers that may negatively impact the classification models' performance. The proposed framework employs Isolation Trees to identify and remove outliers in the oversampled dataset. Isolation Trees are decision tree that partitions data points based on their isolation depth, which measures the average number of splits required to isolate a data point. The algorithm identifies outliers as instances with high isolation depths, indicating that they are highly distinct from the rest of the data.

TABLE 2. QUANTITY OF NETWORK TRAFFIC AFTER PREPROCESSING

Si. No	Network Traffic Type	Quantity
1	Benign	20949
2	DoS	18984
3	Port scan	20000
4	Brute force	20000
5	Web attack	19152
6	Bot	19940
7	Infiltration	9105

By removing these outliers, the dataset (**TABLE2**) is better prepared for further analysis and modelling, as it reduces the risk of overfitting and improves the robustness of theclassification models. Overall, combining SMOTE with Isolation Trees provides a reliable and practical approach to handling class imbalance while ensuring the dataset's quality.

IV. RESULTS AND ANALYSIS

The study utilizes a Cat Boost model, gradient boosting algorithm that utilizes decision trees, as the classifier model for edge devices. The initial hyperparameters for the model are set to a base "depth" of 3, "epochs" of 50, and a "learning rate" of 0.50. To improve the model's accuracy further, the study applies grid search, a hyperparameter tuning technique that exhaustively searches over a specified set of hyperparameters. The search space consists of the "depth," "iterations," and "learning_rate" hyperparameters, where "depth" ranges from 3 to 7, "iterations" ranges from 50 to 200, and "learning_rate" ranges from 0.1 to 1. The resulting model exhibits a significant improvement in accuracy, demonstrating the effectiveness of hyperparameter**(TABLE 3)** tuning in optimizing deep-learning models for edge devices.

TABLE 3. ACCURACY OF EDGE DEVICE CLASSIFIERS

Si. No	Device	Base Model Accuracy	Hyperparameter tuned Model Accuracy
1	Edge Device 1	94.7 %	96. 251 %
2	Edge Device 2	95.5 %	96. 525 %

In this study, we transfer the best models from edge devices for the central server. It is crucial to note that only the models are transferred, not the data, thereby preserving the fundamental aspect of Federated Learning, i.e., "data privacy." The loaded models from the edge devices are used to create a supermodel utilizing the Bagging Classifier technique. This technique aggregates the predictions of multiple models to produce a single, more accurate model. The resulting supermodel exhibits better robustness than either of the individual edge device models, showcasing the effectiveness of ensemble methods for combining models trained on distributed data. We fit the central server's model using the partitioned dataset previously divided into three parts and validate it accordingly to ensure that the model is accurate and generalizable. The central server aggregates the model updates from the edge devices and broadcasts the new global model, which is then used for further model training on the edge devices. This process is repeated iteratively, allowing the global model to be continuously refined based on the new data collected by the edge devices.

TABLE 4.has the network traffic types and their corresponding confusion matrix labels.

TABLE 4. NETWORK TRAFFIC TYPES - CONFUSION MATRIX LABELS

Network Traffic Type	Confusion Matrix Label
Benign	0
Bot	1
Brute Force	2
DoS	3
Infiltration	4
Port Scan	5
Web Attack	6

TABLE.5, **TABLE** 6 &**TABLE** 7 are confusion matrices for edge devices (1&2) and central server respectively.

TABLE 5. CONFUSION MATRIX FOR EDGE MACHINE 1

	Virtual Edge Machine 1

DOI: rp-9788770040723.047

Ground Truth	0	2491	90	111	80	7	4	63
	1	4	2616	0	0	0	0	0
	2	28	0	2621	2	0	0	21
	3	26	1	5	2416	2	0	4
	4	12	0	0	0	1197	0	0
	5	3	0	0	6	0	2737	0
	6	37	0	134	2	0	1	2430
		0	**1**	**2**	**3**	**4**	**5**	**6**
	Prediction							

From the above confusion matrix (**TABLE 5.)**, it can be calculated that

a) Average Precision for edge device 1: 0.9654
b) Average Recall for edge device 1: 0.9652
c) Kappa Score for edge device 1: 0.956
d) Overall Accuracy for edge device 1: 96.229 %

TABLE 6. CONFUSION MATRIX FOR EDGE MACHINE 2

		Virtual Edge Machine 2						
Ground Truth	0	602	23	32	17	2	0	3
	1	0	652	0	0	0	0	0
	2	6	0	643	0	0	0	5
	3	6	0	3	615	0	0	4
	4	1	0	0	0	303	0	0
	5	1	0	0	1	0	631	0
	6	10	0	28	1	0	0	610
		0	**1**	**2**	**3**	**4**	**5**	**6**
	Prediction							

From the above confusion matrix (**TABLE 6.)**, it can be calculated that

a) Average Precision for edge device 2: 0.9689
b) Average Recall for edge device 2: 0.9689
c) Kappa Score for edge device 2: 0.96
d) Overall Accuracy for edge device 2: 96.594 %

TABLE 7. CONFUSION MATRIX FOR CENTRAL SERVER

		Central Server						
Ground Truth	0	631	26	18	32	4	1	10
	1	1	629	0	0	1	0	0
	2	16	0	623	1	0	0	2
	3	16	0	1	596	0	0	1
	4	5	0	0	0	299	0	0
	5	2	0	0	2	0	643	0
	6	17	0	21	1	0	0	610
		0	**1**	**2**	**3**	**4**	**5**	**6**
	Prediction							

From the above confusion matrix (**TABLE 7.)**, it can be calculated that

a) Average Precision for central server: 0.963
b) Average Recall for central server: 0.9624
c) Kappa Score for central server: 0.953
d) Overall Accuracy for central server: 95.999 %

The results obtained from the confusion matrices indicate that the proposed federated learning framework demonstrated high accuracy and reliable performance in detecting intrusion attempts. The average precision and recall scores for all three devices were found to be above 0.96, indicating a low rate of false positives and false negatives.

The overall accuracy of the framework was found to be above 95%, suggesting a high level of accuracy in predicting intrusion attempts. The kappa scores obtained were also high, with all devices scoring above 0.95, indicating strong agreement between the predicted and actual classifications. These results suggest that the proposed framework is effective in enhancing the accuracy and reliability of intrusion detection systems in Internet of Vehicles (IoV's) environments.

TABLE 8.ACCURACY OF DIFFERENT CLASSIFIERS IN THE FRAMEWORK WITH CIC-IDS 2017 DATASET.

Si. No	Device	Accuracy
1	Edge Device 1	96.229 %
2	Edge Device 2	96.594 %
3	Central Sever	95.999 %

The above accuracy, precision, recall and confusion matrices are measured concerning testing dataset split, as mentioned earlier in "Proposed Framework."

In the results obtained in **TABLE** 8., the accuracy of the Central Server is slightly less than that of the individual Edge Devices. There are several reasons for this, including the fact that the Central Server model is created by combining the models of the two Edge Devices, which could introduce noise or inconsistencies in the data. Furthermore, we train the Central Server model on a smaller subset of the data than the individual Edge Devices, which could decrease accuracy.

However, Similar Trends (**FIGURE** 2.) are observed in **TABLE** 9. and**TABLE** 10. when the proposed framework is tested on different Datasets (KDD Cup -99 and UNSW-NB-15)We tested it on other network datasets similar to the CIC-IDS 2017 dataset to further validate the proposed framework and benchmark its performance. Specifically, we conducted experiments on the KDD Cup-99 [20] and UNSW-NB-15 [19] datasets, which also contain network traffic data and share some similarities with the CIC-IDS 2017 dataset. By testing the proposed framework on multiple datasets, we aim to assess its generalizability and effectiveness in a broader context. Through these experiments, we hope to provide a more comprehensive evaluation of the proposed framework and its applicability to a range of network traffic datasets.Despite different datasets used, similar trends can be observed in the accuracy (**TABLE** 9. &**TABLE** 10.) of the proposed framework when tested on the KDD Cup -99 and UNSW-NB-15 datasets, as shown in **FIGURE** 2. This suggests that the performance of the framework is robust and consistent across multiple datasets, thereby increasing its applicability and reliability in real-world scenarios.

TABLE 9. ACCURACY OF DIFFERENT CLASSIFIERS IN THE FRAMEWORK WITH KDD CUP -99 DATASET.

Si. No	Device	Accuracy
1	Edge Device 1	94.98 %
2	Edge Device 2	95.27 %
3	Central Sever	94.59 %

TABLE 10.ACCURACY OF DIFFERENT CLASSIFIERS IN THE FRAMEWORK WITH UNSW-NB-15 DATASET.

Si. No	Device	Accuracy
1	Edge Device 1	72.74 %

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2	Edge Device 2	71.63 %
3	Central Sever	71.53 %

To ensure consistency in our approach, we followed the same methodology as in the original experiment with the CIC-IDS 2017 dataset. This included using the SMOTE technique for oversampling, Isolation forests for outlier detection, and dividing the data into three sets for each edge device and the central server maintaining data privacy. By following this standardized methodology, we aimed to maintain consistency in the experimental setup and ensure that any observed differences in performance across datasets could be attributedto the nature of the data rather than differences in methodology.

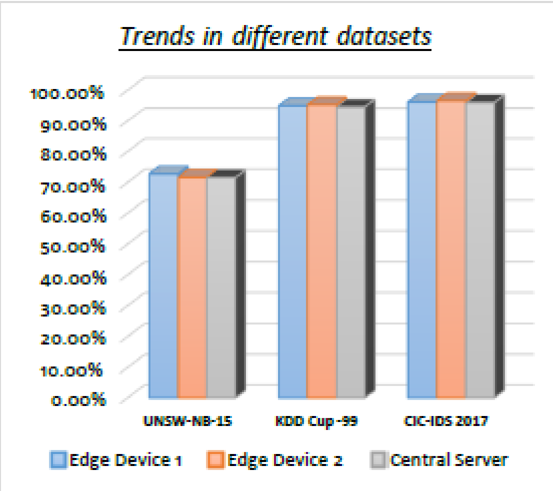

Fig..2 Trends Observed in Different Datasets

FIGURE.2 provides a comprehensive view of the comparative performance of the edge devices and the central server in terms of accuracy across the three datasets used in the study, namely CIC-IDS 2017, KDD Cup -99, and UNSW- NB-15.

The proposed framework was developed as an attempt to enhance the existing Intrusion Detection Systems (IDS). The proposed framework was rigorously tested against various conventional classifiers, including Naive Bayes, KNN, Adaboost algorithm, and Gradient Boost algorithm, to assess its efficacy (**TABLE** 11.) in improving the performance of IDS.

TABLE 11. ACCURACY OF DIFFERENT CLASSIFIERS WITH CIC-IDS 2017 DATASET

Si. No	Classifier	Accuracy
1	Proposed Framework	96.23 %
2	Random Forest	94.99%
3	KNN	86.21 %
4	Gradient Boost	63.68 %
5	Ada Boost	59.47 %
6	Gaussian NB	40.04%
7	Multinomial NB	31.18 %

TABLE 11., presents the accuracy results of different classifiers when tested on the UNSW-NB-15 dataset. The proposed framework achieved the highest accuracy of 96.23%, outperforming all other classifiers by a significant margin. The next best performing classifier was the Random Forest algorithm, with an accuracy of 94.99%. The K-Nearest Neighbor (KNN) algorithm achieved an accuracy of 86.21%, which is significantly lower than that of the proposed framework. The accuracy of the remaining classifiers, including Multinomial NB, Gradient Boost, Ada Boost, and Gaussian NB, was considerably lower, with values ranging from 31.18% to 63.68%.

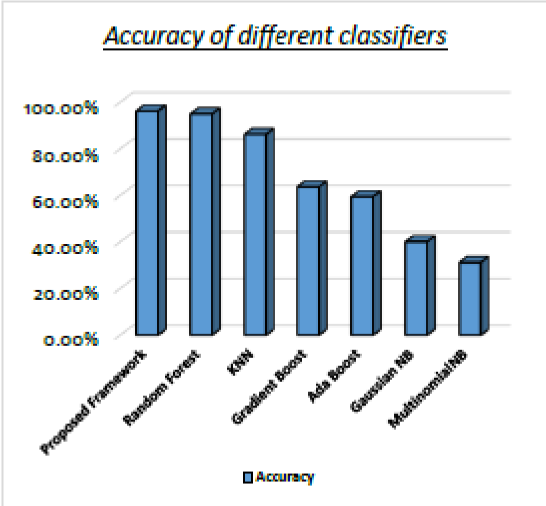

Fig.3. Accuracy of Different Classifiers

These results (**FIGURE.**3**)** indicate that the proposed framework is a highly effective method for "*enhancing*" the performance of Intrusion Detection Systems. The high accuracy of the proposed framework demonstrates its ability to accurately classify different types of network traffic, whichcan help in identifying potential security threats and preventing security breaches.

V. CONCLUSION

In conclusion, this study presents a promising approach for improving the performance of intrusion detection systems in IOVs through federated learning using an imbalanced dataset. The CIC-IDS 2017 dataset, comprising seven distinct classes, was preprocessed using Synthetic Minority Over- sampling Technique (SMOTE) and Isolation Trees to address the class imbalance and to remove outliers. The dataset was partitioned into three parts for two edge devices and one central server to ensure data privacy. The edge devices used a Cat Boost classifier model with hyperparameters optimized through grid search. The resulting model showed a significant increase in accuracy, highlighting the effectiveness of hyperparameter tuning. The edge device models were combined using the Bagging Classifier technique to create a supermodel that demonstrated better robustness. However, the central server model showed slightly less accuracy than the individual edge device models, likely due to noise or inconsistencies in the data or training on a smaller subset. Testing the proposed framework on other network datasets, such as KDD Cup-99 and UNSW-NB-15, provided a comprehensive evaluation of the framework's generalizability. The results showed that it effectively

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improved accuracy for different network traffic datasets. Furthermore, the proposed framework was compared with existing conventional classifiers, and the results demonstrated that it achieved the highest accuracy among them.Overall, the proposed framework presents a promising approach for federated learning in distributed networks while maintaining data privacy and enhancing the accuracy of intrusion detection systems.

Code Availability

The code for the proposed framework, which utilizes federated learning for intrusion detection systems on Internet of Vehicles, is available at the GitHub repository: https://github.com/abby1712/Federated_Learning_IDS_On_IOV.

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Democratising Election Process

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***Abstract*—In democratic countries like India, voting is a fundamental right through which people choose their leaders. Traditionally, voting has taken place in centralized or distributed locations known as polling booths or stations. All citizens of India above the age of 18 years can cast their vote and choose their leaders. Voters go to polling booths and cast their votes under the supervision of an authorized person. Some of the main issues encountered with this traditional voting system include fewer voting percentages and false votes. To overcome these, an online voting web application is proposed in this paper. Any registered eligible voter can cast his/her vote through this application by logging in to the application. Before casting the vote, the application authenticates every voter on 2 levels. The 1st level of verification is carried through One Time Password (OTP) and 2nd level is through voter identification (ID) and any other government-issued ID cards such as Aadhaar, Permanent Account Number (PAN) card etc.,. The Aadhaar card is a government- issued unique identification card for every Indian citizen. Through this proposed online voting application, any eligible voter can cast their vote within minutes from any corner of the world by logging into the application using a gadget (mobile, laptop, tab, etc.,) connected to the internet. The main objectives of this document are to increase vote rate and reduce false votes. The conduction of elections through this application also reduces the workforce.**

Keywords—Encryption, One Time Password (OTP), Online voting system (OVS), Security, Web application.

I. INTRODUCTION

As per the International Institute for Democracy and Electoral Assistance (IDEA), Rwanda has reported 98.15%, the highest voter turnout or record during the recent national election conducted in the year 2017 [13]. Laos recorded 98.02%, the 2nd highest voter turnout in the year 2021, during theparliamentary elections. Turkmenistan recorded 97.17% of the voting, during the Presidential elections conducted in the year 2022 and Singapore recorded 95.81% of voting in the year 2020 during their Parliamentary elections. Haiti has recorded 17.82% of voting, the lowest voter turnout during the 2015 Parliamentary elections. Afghanistan recorded the 2nd lowest voting percentage in the year 2019, during the Presidential elections. Algeria, during the 2021 Parliamentary elections recorded 23.03% of voting.

In India, between 1951 and 2019 parliamentary elections conducted so far, an average of only 51.94% voting has been recorded. India is a rule-based country with a population of 1.4 billion [13]. The Government of India includes "all communities, individuals and institutions". Every citizen of India aged 18 years and above is an eligible voter and has the right to vote and choose their leader. The voting system started in India in the 18th century [1]. In the traditional voting system adopted in India, a voter will only be able to vote if his or her name is enrolled in the list of voters. This is done by providing a voter ID card issued by the Election Commission of India (ECI). Since many years till today, elections are being conducted in each country differently. Some of the most common ways of conducting elections around the world are paper voting, electronic voting machines, live recording electronic voting machines and optical voting machines.

The paper-based voting system or paper ballots was the first voting system introduced in 139 BC in Rome. Paper ballots or election ballots were first used in Rome in the year 139 BC to conduct the elections. In the paper-based voting system, the voter receives a blank ballot. The voter uses a pen or marker to vote for the candidate. Although paper ballots are easy to make and can be retained for verification, counting these paper ballots is a time and labor-consuming process [10]. This type of voting system was followed and is still in use in most of the developed countries like the United States of America (USA), France etc., [14]. This method is the most popular way of voting in most developing countries like India and African countries like Kenya, Botswana etc. [14].

The Electronic Voting Machine (EVM) was invented during 1990 in India by a team led by V. Hari Prasad. During 1998, elections were conducted using EVMs. These EVMs do nothave any mechanism to verify the identity of the voter before voting, therefore the fake voter can vote more than once. It takes a lot of effort and time to implement this sort of voting mechanism. There is a possibility of tampering with EVM during production and votes can be manipulated to change the result [8].

Recently, general elections were held in India in seven phases from 11th April to 19th May 2019 to elect members of the 17thLokSabha using EVM. Votes were counted and the results were announced on May 23rd.Around 912 million people were eligible to vote during this election, but only 67% of voting was recorded. However, this is the highest-ever voter percentage recorded, as well as the highest female voter turnout ever recorded in India during general elections [2].

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In Brazil, direct recording EVMs were used massively in 1996, where all the elections in Brazil were conducted using these machines. The device is integrated with a keyboard, touch screen, or buttons. The voters can ballot their vote by pressing the buttons and this machine in parallel counts the votes casted [6]. Whereas the voter must come in person to the place where the elections are conducted. Also, this voting mechanism is a time and labor-consuming process. Furthermore, there is a possibility of equipment failure.

The earliest optical-scan voting system was introduced in the USA during the 1960s. To scan ballots, it employs optical mark recognition scanners. The voter can cast the vote by filling the circle corresponding to their favorite candidate on the ballot. Then the machine considers the boldest mark on each ballot as a vote and counts. This machine counts votes very quickly. However, if the voter doesn't fill the circle properly, those voteswill end as erroneous optical scan results. Optical voting systemwas used until the 19th century [15].

A.D. Rubin's 2002 study states that an online voting system is a better option for voting which would increase the voting percentage. The verification of the Aadhaar [23] card is the security measure used in their study. As a part of the proposal, the authors tried to build a secure online voting system. This system is free from unauthorized access while voters casting their ballots [6], [18].

HimanshuAgarwal and G.N. Pandey, 2013 study states that the online voting system needs to have high security and reliability compared to that of traditional existing voting systems. To achieve this the authors proposed OTP, which would let the authorized user vote only once [5].

Ch. SaiPratap, D. Sumanth Rahul and Jithina Jose (2020) study states how an online voting system would bring an impact on the nation's development. This system monitors voting programs in a less complicated way and is safe to use. Their approach is better and faster than the traditional voting systems. This online voting system ensures transparency and continuity and maintains accurate voting procedure using Aadhaar that provides each voter with a special ID to avoid security breach. It allows a voter to vote from any location around the globe [1],[2]. From the year 1973, many countries including the USA, Belgium, Japan and Brazil began to adopt electronic voting, also known as E-voting, for their official elections.

II. Methodology

The proposed online voting application verifies the registered voter through OTP while voting [11]. The user interface of this application is implemented using Hypertext Markup Language (HTML) and the backend of this application is implemented using Cascading Style Sheets (CSS), Hypertext Pre-processor (PHP).

The architecture of the proposed online voting web application is represented in Figure 1 and the workflow of the online voting application is given in Figure 2. As an initial step, the voter needs to register in the portal. After registration, the user can log in to the portal using the credentials. Then, the application generates OTP and sends it to the registered mobile number of the voter [4], [11]. After the user enters the OTP and the application validates, the user can cast their vote [11]. After the voting, user votes are stored in the database for counting purposes.

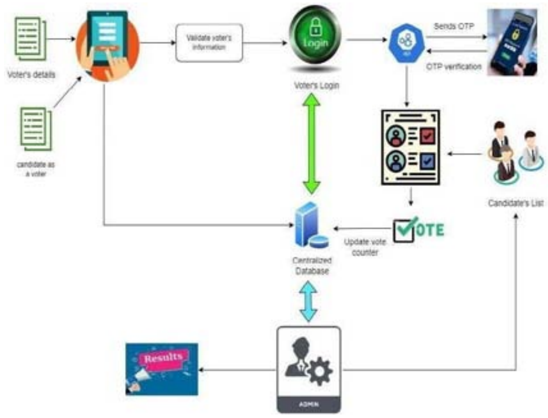

Fig. 1. Architecture of the online voting web application.

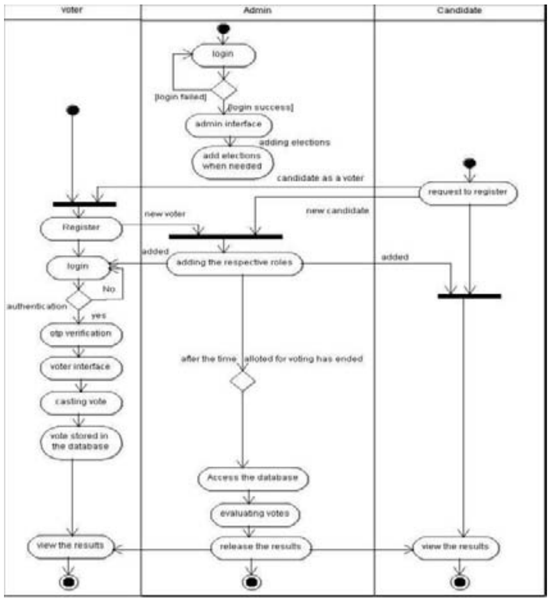

Fig. 2. Workflow of online voting system application.

The Admin/ECI is the official body responsible for registering the voters and manages the candidates during elections (refer with: Fig. 2). After the conduction of elections, the admin publishes the results in the application, which can be viewed by voters and candidates[4].

III. Results and Discussions

The proposed online voting web application will manage voter information, allow voters to login and exercise their right to vote online. This application integrates all the functions of the voting system. Each party's votes can be tracked through this application and the total number of votes for each party is counted. The database maintained by ECI through this application stores all the names of voters with their details [12].

An Indian Citizen aged 18 years and above should register in this application. Then the voter will be allowed to vote after logging in with his username and password and OTP verification. Each registered user will be allowed to vote only once. The details of the votes are stored in the

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application's database and the results can be published after elections [12]. Through this online voting system, voting turnout will increase, as the registered user can vote from any corner of the globe using the gadget connected to the internet. This application helps in reducing the cost and time of the voting process.

Fig. 3. Sign-up page.

Figure 3 represents the registration page of the online voting application. By entering the details such as username, contact, password, and retype password in the respective field's user can register. Once the user gets registered successfully, the registered user data is stored in the application's database [19]. The password will be stored in an encrypted format [4]. The encryption is carried out by applying Secure Hash Algorithm (SHA1) [20].

Fig. 4. Login page.

After successful registration, the user can log in to the portal [4]. Figure 4 depicts the website's login interface, where the user or administrator can log in. This page contains the fields Contact No., and Password, as well as the "Login" button. If the user does not have an account, then the user is redirected to Figure 3 for registration [4].

Fig. 5. OTP verification page.

Figure 5 illustrates the OTP verification page. An OTP will be sent to the user's registered mobile number. After verification, the page is redirected to Figure 9[11], [24], [21].

Fig. 6. Admin home page.

Figure 6 shows the Admin Home Page of this application. The admin dashboard displays the number of elections that are currently taking place. This page has details like election name, the number of candidates, the starting and ending dates of the elections, the status of the elections, and an action button for viewing results after the elections. The admin can only add election and candidate details and can publish the election results.

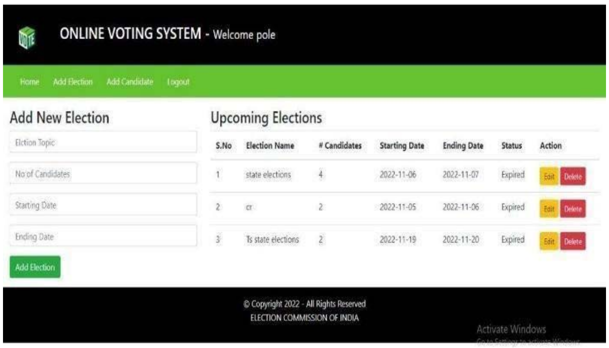

Fig. 7. Election Page.

Figure 7 depicts the Election Page of this application, which contains the details of upcoming, ongoing, and completed elections. On this page, the admin can check, add, edit or delete election details. While adding the elections the admin needs to fill up all the required details about the elections (refer Fig. 6).

Fig. 8. Candidate page.

The Candidate page of this application is shown in Figure8. The admin can add candidates and edit or delete the details of the candidates on this page. The details such as candidate name, party name, and party symbol of each candidate will be collected from the respective party candidates by the admin [12].

Figure 9 represents the voter's page. The voter page displays the current elections, by which voters can vote. A voter can cast the vote only once, through this application.

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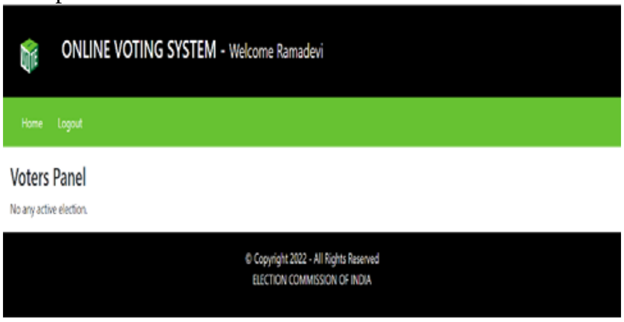

Fig. 9. Voter's page.

IV. CONCLUSION

In this paper, a secure online voting web application is proposed. This application has 2 levels of authentication through OTP, voter ID and any other government-issued ID card. This application is secure compared to the traditional voting system. With the application features, it is easier and convenient for the voter to use. A gadget with an internet connection and valid credentials is required for the user to vote securely from anywhere in the globe. This application also increases transparency and reliability in the voting system as all the details of the registered user's data are securely stored in the application database. As future enhancement, few more security features related to authentication, and authorization features can beadded.

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A Novel Approach for Live Image Capture and Estimation of Coordinates for Augmented Projection Using Machine Learning

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Abstract—In recent times, augmented reality (AR) has emerged as one of the most promising technologies that can provide a high degree of adaptation and independence to facilitate the transfer of knowledge in the majority of different sectors. AR is being used in the process of projecting objects into an augmented environment to demonstrate to customers how those objects will seem in the setting of their choice. Even though there have been and will continue to be significant advances made, the visuals are still being projected in a three-dimensional environment. In order to circumvent this process and project a live image that has been caught in reality, an innovative strategy that makes use of modified machine learning algorithms is currently under consideration. Additionally, a brand-new method known as the "universal clipboard" is suggested, which makes it much simpler to copy and paste photographs between different devices.

Keywords—Augmented reality, Machine learning, Unsupervised Learning, Deep Learning.

I. INTRODUCTION

As technology keeps getting better, more and more people's daily tasks are being done digitally, which makes life easier in every way. Even if a lot of shortcuts are shown to people, there are still a lot of things that are easy but annoying to do. Different ways that Photoshop can be used to change documents. This got us used to the drag-and-drop feature, which lets us add records to an online site or link them to our emails by dragging them from where they are to where they should be on the web. It is a feature that saves minutes of time that would have been spent browsing through the pop-up window, which doesn't let us switch to a different screen until the file is chosen or the user quits. All in all, Augmented Reality can be very interesting and help you see things from a different point of view. The goal of the project is to change how people interact with and understand the real world by adding virtual information to their immediate surroundings and how they interact with the real world as a whole. Users use the drag-and-drop feature all the time to add records to an online site or link them to our emails. Users do this by dragging the records from where they are to where the web application is. But if users could copy and paste things from the real world onto digital screens, it would save us a lot of time and make our work easier. Expanded reality lets us copy and paste things from the real world into our high-tech screens with just a few clicks.

Through different features on our screens in the digital world, augmented reality has made our experiences better. But the idea of bringing real-world objects into the digital world changes the way users think about and use Augmented Reality Apps in a few big ways. Real-world objects can be pasted by clicking on the object's snap, getting its background, and then sharing it with your desktop. This can be a time-consuming process. With this Augmented Reality app, you just point your camera at the object you want to select. This saves time because the user doesn't have to snap, mask, save, or switch windows. This is a really efficient AR copy-paste Photoshop tweak. AR is the intelligent use of a real-world environment in which items are. AR is often described as a system with three key features: a mix of real and virtual worlds, interaction in real-time, and accurate 3D modeling of both real and virtual objects. The extra sensory information can be helpful, or it can be dangerous. This kind of involvement is always tied to the real world in a way that makes it seem like an immersive part of the vital environment.

Our application has 2 features: Using Augmented reality and machine learning - their project and process images in our application. For processing, Human-computer interaction (HCI) and interface design use commands like "plan," "cut," "copy," and "glue" to transmit information between processes. The cut command takes the information you've chosen out of its original position, while the duplicate command makes a copy of it. Both situations store selected data temporarily (the clipboard). The information from the clipboard is subsequently incorporated whenever a glue command is issued. Machine learning can now reliably locate people and objects, automatically eliminate the backdrop (background removal), and communicate the output to a computer. Considering image projection, AR has so far been utilized to bring enhanced visuals into the actual world. AR Cut & Copy works in reverse, digitally translating tangible objects. This study presents a novel approach to using augmented reality to make life easier by making things happen at the fingertips of a human being. It helps in visualizing objects without the tedious efforts of moving as they use coordinates and SIFT.

II. RELATED WORK

Gang Wang[1] has proposed a system Prior to performing saliency detection, a background estimate is

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applied. To gather background information, they use the bounding boxes approach. The model the saliency, there are 3 background works that are primarily addressed, including background connectivity prior, background contrast prior, and spatial distribution prior, enabling the proposed technique to emphasize the salient item as a whole and reduce background clutters.Experiments on two benchmark datasets show that our solution beats 11 leading methods while being more efficient than the majority of them.

They increase convolutional neural network pooling in order to identify prominent items. On the bottom-up route, they develop a global guidance module (GGM) using a U-shaped architecture to supply layers at various feature levels with salient item location information. To combine coarse-level semantic information with fine-level top-down route characteristics, they offer a module for feature aggregation (FAM). Following top-down fusion processes, FAMs are able to readily fuse coarse-level GGM data with features of several scales. These two pooling-based modules enhance detail-rich saliency maps by refining high-level semantic properties. In comparison with the other models, they find significant objects with sharper characteristics more effectively. Our approach handles 300 *400 photos at above 30 frames per second[3]. They determine how to extend the function of pooling in convolutional neural networks. Some instances, this disregards the crucial spatial information of the whole input picture.

Bi-DAINet[6] This research presents the Bi-directional Discard-Accept-Integrate Network, often known as the Bi-DAINet, for SOD. To begin the process of incorporating multi-scale feature maps into the network, they begin by constructing a Discard-Accept-Incorporate (DAI) module. In order to reduce the amount of congested noises, the DAI module will remove any redundant information from the layer below it, pull useful information from the layer above it, and then integrate the remainder. They construct a CNN that is capable of enforcing message flow in both the low-to-high and high-to-low directions. Foreground and background regions may be inferred using bi-directional networks. A saliency map that contains fine-grained boundary predictions is produced as a consequence of these findings. A supervising role is played by the edge-preserving loss function in object edge prediction. The effectiveness of our method is shown across five important criteria. They examine the contributions made by every Bi-DAINet component.

For this goal[9], the context-aware refining approach of angular embedding is used. The experimental findings demonstrated the effectiveness of the suggested framework. Moreover, a comparison of the framework with several cutting-edge deep learning-based approaches revealed that it may provide similar and intriguing outcomes.

This study[15]FanjieMenga introduces a novel fusion methods pictures by integrating object area recognition with the Non-Subsampled Contourlet Transform (NSCT). Saliency detection creates the IR image's saliency map. Second, a free areas removal approach extracts the IR image object region. Third, NSCT decomposes source pictures and uses distinct fusion algorithms for low- and high-frequency sub bands. Inverse NSCT generates the principal fused picture. Integrating the original fused picture with the object area yields the final fused image. they compare our technique to others using numerous criteria and find that it improves fused picture quality.

TiantianWang[16] proposes a unique Localization-to-Refinement network. A contextual module is used in the Recurrent Localization Network to weight feature mappings at each point. A recurrent technique is also suggested to obtain contextual information for repeatedly enhancing the convolutional features. A refinement module is used in the Boundary Refinement Network to learn local context knowledge via efficient transmission.

HolgerCaesar[18] discusses When they compare the mean entropy of various datasets, they discover that it demonstrates COCO-linguistic Stuff's richness. They are presently investigating how well a contemporary semantic segmentation algorithm works on COCO-Stuff. They evaluate performance across things and thin classes in the hopes of establishing a baseline for future studies on this dataset.

Projected Augmented Reality is a technique that uses projectors to directly overlay digital material on real things. When texts are projected as AR contents, readability is one of the most important considerations. As a result, numerous projector-camera systems for increasing projected content readability have been developed, in which projection settings are modified based on estimated legibility from taken pictures of projected contents. In this study, NaoyukiKazuta[23] introduces a unique approach for determining projected content readability that accounts for the influence of a patterned projection surface by exploiting edge information in collected pictures of projected contents.

IvonaTautkute[24] proposes a multi-modal search engine, which mixes the linguistic inquiries in this study. Our engine's purpose is to retrieve inside items. Their project enables customers to snap one picture of a room and receive products that are similar/aesthetically shot with a high recall. It also enables you to return goods that complement one other visually and artistically. To do this, our technology combines the findings gained via textual and visual modes. We enhance the mean common score from recovered products around 11 percent thanks to our blending method. Our work is being developed into a Web-based application that will be made available to the public.

ShreyashJoshi[27] presented a smartphone application to allow clients who purchase interior items online virtually view how their space would appear after buying the product.For augmented reality, it makes use of Google ARCore. The picture from the device camera will be accepted as input by ARCore. It will detect planes and then digitally overlay 3D models of the product over the picture, displaying it to the viewer in real time.This will provide a nearly genuine experience of putting the product in the user's house. Products such as wall art, furniture, accessories, and electrical equipment may be shown. The application's intelligence will give appropriate recommendations to the user to assist in the purchase of connected things. This will assist a person in decorating even an empty room from the ground up. The Apriori algorithm was used to propose goods to the user during

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association mining. This algorithm will discover the most commonly purchased set goods in order to provide recommendations.

Smartphones may show virtual things into the physical environment at a precise area indicated by a marker thanks to the augmented reality capability. In order to view a 3D home design[33], this study creates a smartphone application for augmented reality. A marker is selected on the floorplan picture that was taken by the smartphone camera, and it is then sent to the server. The server-side application recognises the corners of the picture and generates a vector with 2D coordinates using deep learning and integer programming methods. Utilizing Unity 3D, the client application on the smartphone creates a 3D home model using the 2D coordinates. The model is then overlayed using Vuforia over the floor plan picture marker. According to test findings, it is possible to generate 3D home models that are somewhat accurate and that correspond to the given layout. The augmented reality programme provides a different way to look at a floor plan so that a user may comprehend and interact with the design more fully.

In Ivonatautkute[36] research, they present a multimodal search engine to find objects from a multimedia library that are aesthetically related to the query by combining visual and linguistic clues. Our engine aims to make it possible to quickly retrieve fashion items like furniture or clothing. They merely consider it as an extra detail of the picture in the search and do not account for the situation in which a user searches for "the same blouse but in denim." By modeling contextual connections between aspects of various modalities using a combined neural network architecture, our unique approach, named DeepStyle, addresses these drawbacks. On two distinct, difficult datasets of clothing and furniture, demonstrate the resilience of our strategy. On the evaluated datasets, the engine beats the other approaches by above 20 percent. It is offered via a Web-based application and has been commercially implemented.

These two topics took up the majority of PoonpongBoonbrahma's[38] study. The first involves creating a sizable, stable 3D model or altered by participants who can do collaboration utilizing AR technology and a multiple-markers idea. Creating a smartphone plan for collective augmented reality creation.

Through the use of augmented reality technology, Kaimaris's[40] suggested apps seek to digitally resurrect cultural heritage sites and aid the user in locating locations where areas of interest are partially or completely obscured. Tourists utilize these programmes, which are loaded on mobile devices like smartphones and tablets, to enhance their surfing. The inserted virtual objects into rangu using augmented reality technology are typically 2D or 3D reproduction which serves as the additional objects in space or points of interest that help the user get around more easily and thus revitalize the environment. The most well-known frameworks are also addressed in detail in this article. This report includes data that was experimentally gathered from a number of minor projects that were tried on a variety of expensive and inexpensive equipment.

III. System Architecture

The system architecture of an application refers to the high-level structure of the software, including its components, modules, data stores, and the relationships between them. It provides a blueprint for the design and implementation of the application and helps in determining how the different components will interact with each other.User Interface (UI) component is responsible for presenting the information to the user and receiving input from them.

The UI can be built using react native/Expo user interface elements for mobile applications.Application Server component is responsible for processing requests from the user interface, accessing data from the database server, and returning the results to the UI. The application server can be built using technologies like react native,python.In this the local server act as a database to store the processed imageand then for copy and paste features use predefined python libraries like screenpointer and paste.

For API (ARcore/ARkit) calls our application typically have the components like client,api gateway,API endpoints,And store area.The client component is responsible for making API request to the server and presenting the data to the user.The client can be a mobile application.The API Gateway component serves as the point of entry for API requests and is in charge of forwarding them to the proper API endpoint. Additionally, the API gateway is capable of handling operations like request/response transformations, rate restriction, and authentication. This component, known as the API Endpoint, handles processing API calls and returns the desired data. Building API endpoints is possible with the use of tools like Python.After that our application projection is done use that APIs.

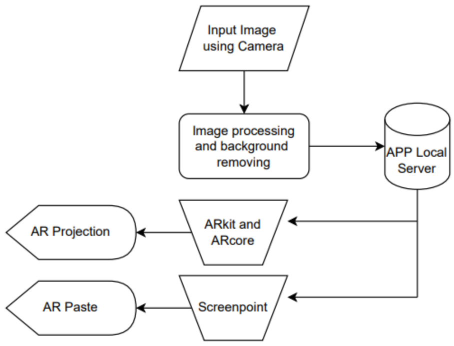

Fig. 1. System Architecture

IV. Methodology

A. Mobile Application - Expo/React Native

Expo is an open source framework which comes handy for developers who want to create native universal applications, i.e., android, iOS and the web. The hosted service is known as EAS - Expo Application Services. The applications are coded in javascript and React which has many universal libraries. Expo has a large variety of perks considering one can use it individually or as a team work.

DOI: rp-9788770040723.049

There are many functionalities in expo like camera, location, gyroscope and other useful features in the form of packages.

To install packages, the commands used are :

1) Expo SDK package : npx expo install
2) Camera : npx expo install expo-camera
3) To import into code : import {Camera} from 'expo-camera'

B. Object detection / Background removal

In order to identify unique areas or items that individuals are likely to focus their eyes on in visual situations, saliency detection models the human visual attention mechanism. For this visual job, contextual information is crucial[2].Traditional approaches use specifics concurrently or divided, but their capacity to identify the essential prominent objects in complex scenarios is constrained by the absence of high-level semantic information. As the extraction is in a higher level of systematic news, convolutional neural networks (CNNs) fortunately considerably encourage the models which can detect objects using salient object detection (SOD)[3].From a high level perspective, there are three basic methodologies for saliency detection: bottom-up, top-down, and mixed[9].The main challenge is accuracy of object localization has always been impacted by the complexity of the settings and the variety of the targets themselves. CNNs' deep feature layers are more semantically rich than their shallow counterparts, which is better for object location. The retrieved deep features require a clear separation between the salient regions and the background in order to correctly discover whole objects[14]

- *Deeplab:*Deeplab is an independent service that is in charge of managing the salience detection as well as the background removal tasks. Deeplab makes available an application programming interface (API), which allows you to run our Visual Relationship Detection (VRD) demo on your own photos by using an environment that is controlled by programming instructions. The VRD Application Programming Interface (API) is built using a REST-based architecture and makes use of the standard HTTP response codes. In addition to that, it accepts requests with form-encoded contents, gives results in JSON format, and supports the format.

C. Augmented Reality

The term "augmented reality" refers to techniques and technology that realistically incorporate virtual items into a series of actual photographs taken with a device's camera In contrast to VR. The customer is completely submerged in a digital world. It often takes place in a 3D environment and seeks to add some virtual content to the real world while still providing them with more choices. Virtual objects are designed to provide the user of an augmented reality system with relevant and context - dependent information. Utilizing technological devices with camera sensors, such as glasses, smartphones, tablets, etc., makes this combination conceivable[26].Language and visuals are the most common forms of human information transmission in everyday life, followed by scientific texts.75% of the information that people acquire visually are got by images[31]

- *AR Paste:*Photoshop is the software to be used in this project. Given that the user should transfer the captured image from the phone to the software, user have certain procedures to follow : Firstly, the image is captured by the camera of the device. When the device is pointed towards the screen, the centroid of the picture (x,y) is found by the software using OpenCV SIFT. This module can also be called Screenpoint.
- *AR Projection* Augmented Reality is always portrayed as a headset being worn with a small field of view. But our approach is to use an external camera and project it on the device. The implementation is done using technologies such as ARkit and ARcore. This helps in seamless projection of the image in the desired location or spot. Our project aims to project with adjustable dimensions of the image as needed.

D. Local server

In contrast to a local server, which operates on a different system, a local server in an application is a server that runs on the same physical machine as the programme. Data for an application may be managed and stored on a local server.The local server component handles storing and retrieving data for the application while the application component is in charge of sending requests to the local server and displaying the data to the user. Python-based technologies may be used to create the local server.The main purpose of the server is to store the data and provide to the application when thers is a requested for the process is needed.This system architecture gives a local server in an application a simple layout. The unique specifications of the application being created will determine the components' exact locations and the nature of their connections. On the other hand, this architecture offers a solid foundation for creating a local server that can efficiently handle and store data for an application.

V. CONCLUSION

The surveyed papers have certain downfalls and some of them are Occlusion - two or more objects are too close and seemingly merge or combine with each other.Lighting difficulties - contrast amplification in image-processing applications. Time complexity is high. The suggested systems in the examined publications come from a variety of fields. It is challenging to maintain correct spatial registration of actual and virtual objects. Systems with high accuracy are mostly experimental results.Our proposed system will be an ensemble model which uses both image processing and Augmented reality.

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Mobile APP for Banana Leaf Spot Disease Detection and Classification using Convolution Neural Network Model

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***Abstract*—Agriculture is the backbone of our economy in India. Crop disease affected in leaves and stems are not identified and cured leads to the reduction in the crop production. If the diseases are identified at the earlier stage, we can safeguard the crops from major crop damage which in turn yields better crop production. Right in global economy, not only farmers do agriculture, many youngsters from corporate companies and many entrepreneurs enter into agriculture. Major problem faced by youngsters and entrepreneurs are identification of crop disease. But the youngsters did not have a well knowledge about the plants, crops or even the plant disease. Each and every time getting the input from the farmers or domain experts involves time, effort and money. The most common fruit liked by all categories of people is banana which is grown all over India. The banana leaves are affected by both bacterial and fungal disease which affects the growth of the plants. Farmers are able to find the remedial measures based on the experience but youngsters and entrepreneurs are unable to predict the disease. So to help the layman we are developing a mobile app which can detect the agriculturalist, banana leaf spot disease are identified in an early stage and recommend the remedies to cure the disease through voice assistance. The supervised machine learning algorithm - convolution neural network is very successful in identifying the image and classification of leaf spot disease. So in our proposed system Convolution Neural Network are used to detect and classify disease based on banana leaf spot.**

Keywords*— Banana leaf spot disease; Convolution Neural Network; Mobile Application

I. INTRODUCTION

Agriculture is the backbone of our economy and plays a vital role in living life. Crop harvesting helps the economy of a country and is also necessary for the survival of each and every human being. In the world economy, India is the second largest producer of various agriculture products and produces more than 280 million tons of crops. Agriculture forms more than 70% of India's export capacity. Agriculture not only supports food but also provides people with employment opportunities, resources and technology. Agriculture is a rich source of food, nourishment and medicine for everyone and everywhere in all walks of life for several thousand years.

Banana is economically important fruit crops occupies 20% of the total crop area of India. Banana cultivation and harvesting is an important source of income and employment for many Indian citizens. Bananas is a rich source of nutrition fruit and consumed by more than 400 million people and 13% of worldwide banana production is exported to other countries. The plant disease found on banana leaf is black sigatoka and pestalotiopsis which are caused by fungi species. The leaf spot disease grow inside banana organs and drains away the nutrients thereby reducing their ability to photosynthesis by affecting leaves.

Black Sigatoka is a banana leaf spot disease when infected leaves can die and reduces the yield. The leaf spot disease can be controlled by applying fungicides and removal of affected leaves. The banana plants should be maintained with an sufficient spacing and efficient drainage within the plantation to be maintained. The symptoms of Pestalotiopsispalmarum is a tiny yellow, brown or black discoloration of the leaves. The spots or discoloration are0.25 inches in size which grow much larger forming lesions. The spots will turn into grayish color with a black outline. The banana leaf with wilting and a drying appearance is also the symptom of Pestalotiopsis palm. The disease spread can be controlled by applying pesticides to the banana plants but infected leaves cannot be recovered will stay infected until the leaf dies. The most important fungal disease widely spread around the world are Sigatoka, pestalotiopsis and cordana. So we are detecting and providing remedies to this disease.

The banana leaf spot disease are identified by the farmers based on their domain knowledge but existing youngsters or entrepreneurs could not identify the disease. They depends on the expert to get the information and remedial measures. To help the novice users to handle the issue, we proposed a mobile app to detect the leaf disease and also inform the remedial measures through voice assistance. The proposed system predicts the banana leaf spot disease with improved accuracy and also provides remedies for the disease cure through voice assistance.

The main focus of the paper is to apply mobile captured banana leaf image on the trained convolution neural network model to detect banana leaf spot disease. Our proposed system detects banana leaf spot disease in different illumination, varying complex background, resolution, size, pose and orientation.

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The rest of the paper focuses on the related work of researchers to detect the banana leaf spot disease. Based on the summary of the issues identified in the state of art, a proposed system is designed and developed under the section materials and methods. The proposed system is trained and tested with real time multiple banana leaf images and the accuracy of the system is measured. Finally after the discussion of the results achieved the final work is concluded with future work.

II. Related Work

SahilGandhi[1] developed a project to support farmers for detection of banana leaf spot diseases using machine learning techniques. The project helped the farmers to detect diseases and carry out necessary precautionary measures to prevent further spread of diseases. K. Lakshmi Narayanan[2] proposed a hybrid convolution neural network (CNN) for banana leaf disease detection. The system guides the farmers to apply fertilizers for prevention of disease in the initial stages.

PriyankaV[3] designed a convolutional neural network (CNN) model to train 50 epochs of batch size 64 to classify banana leaf diseases. The proposed model produced an accuracy of 90% for training and 89% on testing which can be further improved by tuning the hyper parameters of the model.

N V K Ramesh;Mohanpradeep Reddy B [4], proposed a system which can detect the disease in tomato plant leaf. The system uses the simple deep learning technique to identify the disease.The main aim of the system is to uses simple technique and limited resources to detect the disease. The proposed system give an accuracy of 94% on average.

Ravi Kishore Kodali [5], designed a system using CNN for classification and identification for tomato plant leaf disease. The accuracy of the system varies from 76% to 100% based on the class. The proposed system classified nine disease class and one healthy leaf class. R Swathika and S Srinidhi.[6] providesa architecture using convolution neural network layer. This paper introduces a new module for paddy disease classification.The dataset for the module are taken from public platform consists of 3500 images and give an accuracy of nearly 70%.

Wondatir, Dila[7] proposed a conventional neural network model to automatically classify banana leaf spot disease. The test image is segmented into infected area by applying K means clustering and texture features of gray level co- occurrence matrix (GLCM) are extracted from the infected leaf. The system is trained by using convolution neural network model which used 615 banana images collected from Arba Minch banana crop farms and other image repository. The classification accuracy based on CNN model is 91.41%. The accuracy based on texture feature for class healthy, yellow sigatoka, and panama are 82.3%, 70.7%, and 63.5%. SonerKiziloluk[8] used several deep learning models such as DarkNet, GoogleNet, Inception, Resnet and ShuffleNet to classify disease of potato, banana, cotton, and bean plants. The applied standard CNN models increased the accuracy from 7% to 25% with the transfer learning method of 5 epochs.

Sophia L. Sanga [9] proposed a methodology for early detection of banana diseases based on deep learning models. The deep learning architectures used to develop models for banana leaf spot disease identification are VGG16, Resnet18, Resnet50, Resnet152 and InceptionV3. The accuracies are 95.41% for InceptionV3 and 99.2% for Resnet152 with a confidence of 99% from the real environment. The proposed learning model helped the small scale farmers to detect banana leaf spot diseases at the early stage to enhance productivity.

Pruthvi P. Patel and Dineshkumar B. Vaghela [10] proposed system which detect both plant disease and pest identification. The proposed system uses deep learning technique to detect both crop disease and pest. V Suma and R AmogShetty [11], proposed a system which uses CNN and semi supervised technique to identify the crop diseases and detect the sickness of the plant. The proposed system will detect the sickness status of 4 distinct classes.

Prof.D.D.Pukale[12] proposed a system to identify, detect and rectify the banana leaf disease. The system also updates about the banana leaf disease to the farmer. An analysis report is produced which includes the symptoms and remedies of predicted disease and given to farmers for further actions. The system developed is an alert system which will notify the farmer through alert message about banana leaf spot disease.

Prof.N.A.Auti,ShraddhaKadam,[13], used deep learning approach to classify banana leaf using LeNetrchitectures. The proposed system efficiently classify banana leaf disease and give the remedial measures to prevent the leaf from further damage and destroy. Prof.D.D.Pukale[14] proposed a system to identify, detect and rectify the banana leaf disease. The system also updates about the banana leaf disease to the farmer. An analysis report is produced which includes the symptoms and remedies of predicted disease and given to farmers for further actions. The system developed is an alert system which will notify the farmer through alert message about banana leaf spot disease.

Jihen Amara[15] predicted two famous banana diseases banana sigatoka and banana speckle in real scene based on deep neural networks under varying challenging conditions. BassemBouaziz proposed an automatic LeNet deep neural network to classify banana leaves diseases.

From the above papers reviewed, we can conclude many researchers have done banana leaf spot disease detection and classification using Convolutional Neural Network (CNN) and its variant of deep neural network learning algorithms. The main issue of Convolution Neural Network fails to capture the pose, view and orientation of images. The CNN model requires large training data to build up the model and fails to learn the spatial relationship of the features. The future work is planned to target the automatic severity estimation to help the farmers to recover the plants from the disease.

III. Proposed system

In this system, first the image of the banana leaf is taken by the camera on the mobile phone. The captured image is pre-processed to resize to fixed size. The output of

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the pre- processing will be the input for the Convolution Neural Network (CNN) including two layers convolution and max- pooling. Through this CNN model, the features are extracted and the model is identified.

The data sets chosen for the proposed model includes balanced 937 leaf images with high resolution of banana plants, both infected and healthy leaves. The source data-set originated from GIS & Remote Sensing Lab, Agricultural University, Bangladesh. The input images are for three common leaf spot diseases - cordana, sigatoka and Pestaliopsis with high resolution are taken for study. The data sets descriptions under study for each class are shown in table 1. The total images taken for training, test and validation are depicted in table 1.

TABLE 1: BENCHMARK DATASETS DESCRIPTION

Image Category	***Total Images***	***Train Images***	***Test Images***	***Validation Images***
Healthy	129	89	20	20
Cordana	162	122	20	20
Pestaliopsis	173	133	20	20
Sigatoka	473	433	20	20
Total Images	**937**	**777**	**80**	**80**

The sample images used for study to classify banana leaf images as healthy, cordona, sigakota and pestaliopsis are shown below in figure 1.

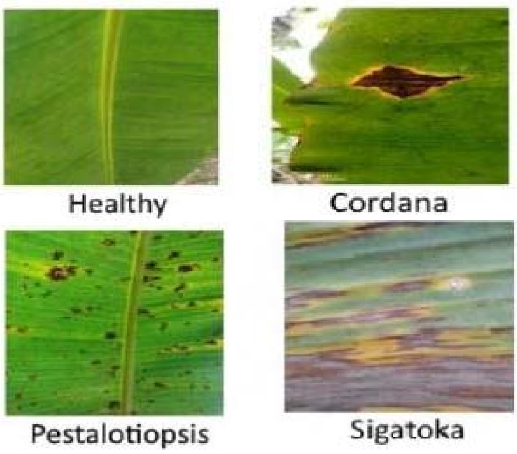


Fig.1. Banana Leaf Images

The hardware requirements may serve as the basis for a contract for the implementation. The hardware requirement for development are High Style Laptop with Intel Processor Core i3-4030U @ 1.90GHz with 8 GB RAM. The proposed system GUI is developed on Android Mobile Phone with high resolution camera facility to capture banana leaf image. The architecture of the proposed system is shown in figure 2.

A. Image Preprocessing

Image pre-processing is the initial stage for the classification of banana leaf spot disease. Image Preprocessing is applied to resize the image into standard size for efficient processing which in turn improve the image quality.

B. CNN Model Building

Convolution Neural Networks has three layers which are Convolutional layer, Pooling layer and Fully-connected (FC) layer. When the image data progresses through the CNN layers the objects shape and size are identified and forwarded to further layers till identifies the intended object. Convolution is the process in which the feature detector moves across theimage based on filter size. The filter size of 3*3 matrix is applied to the image area. A dot product is calculated between the input pixels and the filter and the resultant value is fed as an output array. The process is repeated until the kernel has swept across the entire image. The final output from the input image and from the filter is known as a feature map or activation map. CNN applies a Rectified Linear Unit (ReLU) transformation to the feature map.

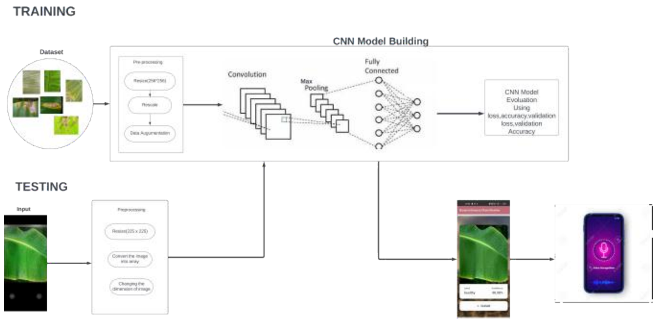


Fig. 2. Banana Leaf Spot Detection and Classification using Convolution Neural Network

The pooling layers sweeps a filter across the entire image used to reduce the number of parameters in the input. The image filter also termed as kernel applies an aggregation function either max pooling or average pooling and generates the output array. The filter moves across the input and selects the maximum pixel value which is shown in Figure 3. The filter moves across the input, and calculates the average value and sends to the output array. Pooling layer is used to drops lot of unwanted information, reduce complexity, improve efficiency, and limit risk of over fitting.

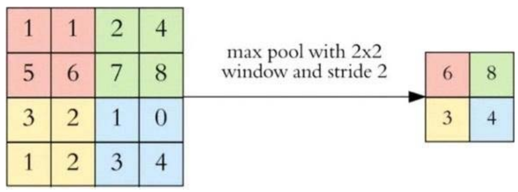


Fig 3. Max Pooling Operations

The proposed model is developed with convolutional and pooling layers with ReLu activation functions. Fully Connected layers use softmax activation function to classify inputs into its corresponding class labels. The proposed system takes the input image of the fixed size 256*256. The first layer is the preprocessing layer which includes resize and rescale. The input image is first resized to 256*256 and the image is rescaled to pixel size of 0 to 1. After the first layer the size of the image is (32, 256, 256, 3). The second layer is the data augmentation where the image is randomly flipped in both horizontal and vertical directly. The image is

DOI: rp-9788770040723.050

randomly rotated to 0.2 degree for better performance. After completing data augmentation process, the size of the image is (32, 256, 256, 3). There are totally 6 convolution layers with kernel size3*3and the activation function used is Reluand the batch size is (32,64). There are 6 max pooling layers with 2*2 kernel size and a softmaxlayer. After each layer the size of the image is reduced. In the flatten layer the images are converted to a single array of size 256. In dense layer, the final image is reduced to the output of 4 classes such as healthy, cordanasigatoka and pestalotiopsis.

…..

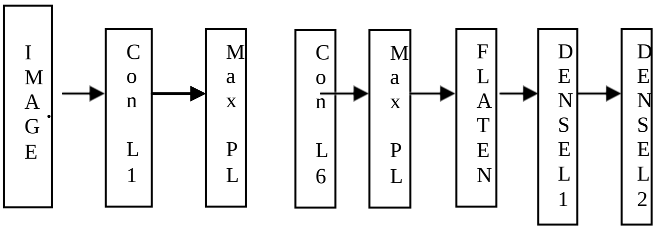
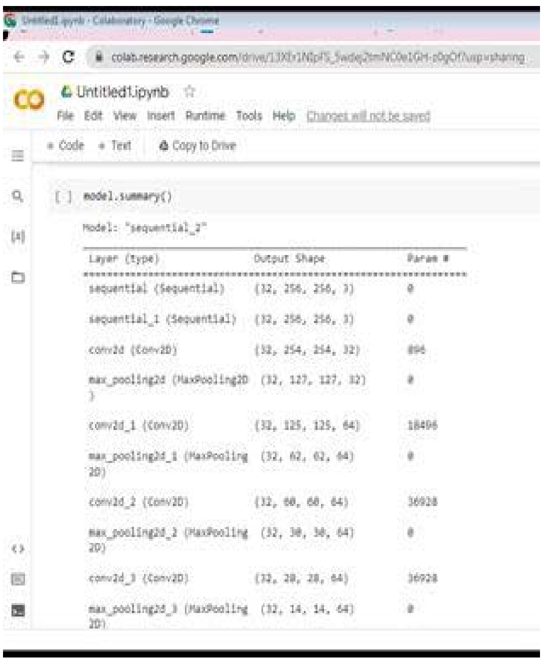


Fig. 4. Proposed Convolution Neural Network Layers

The proposed system takes input of resized image of 256*256*3 into convolution layer. After passing through multiple convolutions flatten and two dense layers, the final output are achieved of image size of 32 with 4 classes. The model is trained for 50 epochs, the training loss and validation loss is decreased. The model produced improved classifier and validation accuracy and finally the trained model is saved.

IV. Results and Discussion

The proposed system captures the image through smart phones and extracts the features from the image using Convolutional Neural Network (CNN). Then with the extracted features, the image is classified into healthy leaf or infected leaf. If the image is an infected leaf then it is classified as either one of the three classes such as cordana, sigatoka, pestalotiopsis.



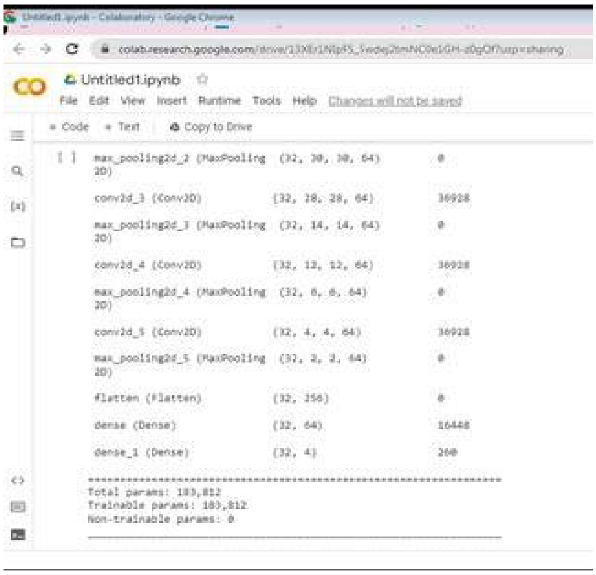


Fig. 5. Proposed Convolution Neural Network Model

The sample test images taken for the study for different banana leaf spot detection and classification are shown in figure 6 – figure 8.

Fig.6. Sigakota Leaf Spot Disease

Fig. 7. Cordana Leaf Spot Disease

Fig. 8. Healthy Banana Leaf

DOI: rp-9788770040723.050

The performance of the system is measured b y accuracy based on confusion matrix. A confusion matrix is a table of rows and columns and diagonal value denotes the correctly classified values for the test input samples.

The 4 elements used in the 2*2 confusion matrix are shown in Figure 9 as true positive (TP), true negative (TN), false positive (FP) and false negative (FN).

TP	FP
FN	TN

Fig. 9. Confusion Matrix

The proposed convolution neural network model confusion matrix for the test data sets is shown in figure 10.

```
Confusion Matrix
[[20 0 0 0]
 [ 0 18 2 0]
 [ 0 0 19 1]
 [ 0 0 0 20]]
```

Fig. 10. Confusion Matrix

The overall correct prediction of the proposed model is measures through accuracy. The recall measure is used to calculate the misclassification of negatives whereas precision is used to measure the misclassification as positives, F1 score is the harmonic mean of precision and recall. The classification accuracy report for the proposed Convolution Neural Network model is shown in figure 11.

Classification Report

```
precision recall f1-score support
cordana 0.19  0.19  0.19  122
healthy 0.11  0.10  0.11  89
pestalotiopsis
         0.14  0.15  0.15  133
sigatoka0.57  0.58  0.57  433
accuracy   0.39  777
macro avg0.25 0.25  0.25  777
weighted
avg  0.38  0.39  0.39  777
```

Fig. 11. Classification Performance Report

For a multi-class classification problem, precision is calculated as the sum of true positives across all classes and recall is calculated as the sum of false positives across allclasses. Both precision and recall numerator value is divided by the sum of true positives and false positives across all classes.

$$Precision\_c = \sum TP\_c / \sum (TP\_c + FP\_c) \quad (1)$$

$$Recall\_c = \sum C\ FP\_c / \sum (TP\_c + FP\_c) \quad (2)$$

F-Measure combines both precision and recall into a single measure and calculated using equation 3.

$$F\text{-}Measure = (2 * P * R) / (P + R) \quad (3)$$

Validation accuracy depicts how the model is able to classify the images with the validation dataset. Loss functions are the important aspects of neural networks which are responsible for fitting the model to the given training data. The accuracy graph for training and validation is shown in Figure 12. The validation loss is measured based on the performance of a deep learning model on the validation set.

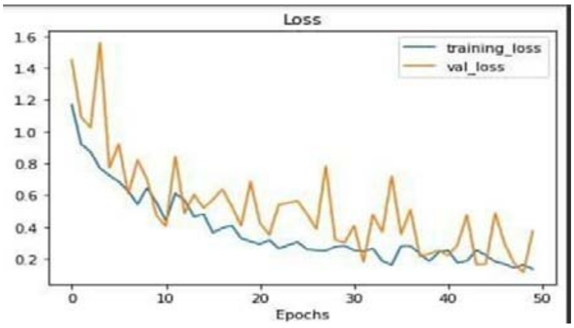


Fig. 12 . Accuracy Graph for training and validation

A loss function is used to compares the target and predicted output values. Loss function shows how well the neural network models fit the training data. Loss value should be minimized between the predicted and target outputs. The Loss graph for training and validation is shown in Figure 13.

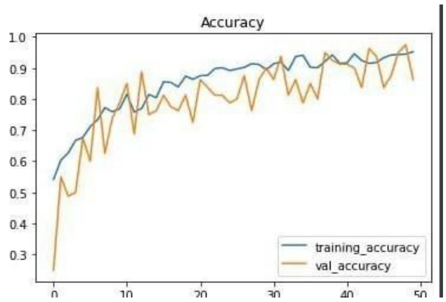


Fig. 13 . Loss Graph for training and validation

V. Conclusion

Farmers should monitor the banana plants to identify for leaf spot disease regularly. If the leaves are affected by fungal disease and not monitored by the farmers reduces the production and quality yield. Hence, the banana leaf spot diseases should be identified at the early stage. So, this paper presented a convolution neural networks model to identifyand classify banana leaf spot fungal diseases. The proposed system helped farmers or any agriculturalist as a decision support tool to identify the disease in the banana plant.

In our future work the model should be enhanced to identify more banana leaf spot diseases. To identify and learn the spatial relationship of the features in an object, a large training data sets are required. To overcome the shortcomings of Convolution Neural Network in learning spatial features, Capsule Neural Network can be trained to identify the spatial and orientation of the object. After detecting the disease we are providing remedies to the disease for the farmers in text format and voice format. The

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voice assistance help the layman in agriculture to clearly understand about the banana leaf spot disease.

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Detection of Virulent Messages Written in Code-Mixed Hindi-English Language

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***Abstract*—Social media as a medium of communication has opened countless possibilities for individuals around the globe to express their opinions on various topics ranging from politics to entertainment, thus reducing the gap in the accessibility of information. However, this has also led to social media becoming a hub for spreading hateful messages. These virulent messages spread online result in the rise of cases of cyberbullying, leaving an enduring impact upon the victims. Manually classifying and reporting these messages is a challenging task and has therefore created an interest in the research community to incorporate machine learning-based techniques to ease up the hand-operated process. The study's goal is to play a small auxiliary role in the prevention and ultimate eradication of cyberbullying. The proposed work in this research primarily focuses on the users from the Indian subcontinent by experimenting with Code-Mixed Hindi-English language. This research achieves this by performing the task of developing a Code-Mixed Hindi-English hate speech dataset containing 4014 tweets, out of which 2000 tweets contain hate, using the publically available tweets from the Twitter platform and classified on the basis of a set of guidelines. These languages are employed in the training of the models to create a more reliable hate speech prediction system for the targeted audience. The use of pre-trained multilingual models are explored by fine-tuning on the collected dataset. This research discovered an accuracy of 80.6 on the fine-tuned BERT Multilingual Base model when trained and tested on the combination of all the three languages and an accuracy of 82.2 on theXLM-RoBERTa model upon the same dataset. The goal of the study is to play a small auxiliary role in the prevention and ultimate eradication of cyberbullying.**

Keywords*—Natural Language Processing, Hate Speech Classification, Virulent Messages, Code-Mixed, Dataset Creation, BERT.

I. Introduction

One of the greatest gifts of modern technology to humankind is social media. This gift has truly unlocked the potential of communication by enabling people to discuss and debate on topics and issues that were once considered off-limits due to a number of reasons, like social stigma or regulations prohibiting free speech. In that way, social media has empowered individuals across the globe with the opportunity to express their opinions, views, criticism and experiences on a wide variety of topics, ranging from politics to entertainment. One such popular social-media platform in today's time is Twitter. In the past few years, Twitter has been extensively used by politicians, media houses, organizations, and individuals to share information such as facts, reports and updates regarding the events taking place in the real world, and correspondingly has been used to debate on the same.

Unfortunately, there is always a flip side to the coin. It cannot be denied that online social media platforms allow users to adopt personas and pseudonyms without providing any accountability for what they say. This lack of restrictions and the faceless nature of the internet have made it easy for people to post content online that can be deemed as hate speech. Generally, Hate speech is conveyed as the depiction of communication that is hateful, demeaning, intolerant, and in some way is degrading and inharmonious. There is no proper definition of the virulent message but in many instances accepted meaning deals with communication in speech, behavior, or writing, remarks which are insulting or abusive concerning an individual or a group of individuals, either directly or indirectly. Rise in spread of hate speech has contributed to a rise in reports of cyberbullying, wherein certain individuals and groups of individuals have emerged with the purpose of spreading misinformation and hate online by attempting to silence dissenting voices and harassing them through repeated threats and abuse. This results in a damaging and usually enduring impact on cyberbullying victims, which may lead to low self-esteem, depression, and other mental health issues. The situation has further deteriorated due to the effects of the Covid-19 pandemic. The Covid-19 pandemic has forced the majority of the globe to shift to online mode of education, work and other interactions, exposing more individuals to the kind of hate speech mentioned earlier, especially children who have moved to the online medium for their educational requirements.

Classifying such hate speech is inherently a challenging task since it is difficult to develop universally accepted guidelines and definitions for hate speech. The precise description of what can be cited as hate speech varies widely based on the language used to convey the message, its context, and the time and location when the message was given, making it an extremely subjective issue. It is hence stated that some may disagree with what others find offensive. Therefore, it has sparked a conversation in the research community, drawing an active interest in the field of hate speech classification, which is considered to be one of the most prominent real-life use-cases of sentiment analysis in Natural Language Processing (NLP). As mentioned earlier, the task of hate speech classification is highly subjective, and one of the factors affecting it is language. Therefore, it is essential to understand the language used to convey a message. When discussing the Indian subcontinent, one of the prominently used languages is Hindi, which is approximately 520 million people speak. It is observed that with respect to the language utilized in social media conversations, the use of a Code-Mixed

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language in Roman (Latin) script is favored over the use of native language structure. The same holds valid for the Hindi language, wherein the Code-Mixed Hindi-English is commonly used in online conversations over the conventional Devanagari Hindi structure. Thus, this study focuses on Code-Mixed Hindi-English, and Hindi languages along with the English language.

This research deals with the procedure of gathering publically available tweets from the Twitter platform to create a reliable Code-Mixed Hindi-English dataset. This dataset can then be used to train the state-of-the-art deep-learning model(s) to identify hate text written in the same language.

Over the course of this research, a lot of challenges and limitations were encountered while trying to identify virulent texts from a given set of texts. Some of the identified challenges are as follows:

- First, due to the code-mixed nature of Hindi, there is a lack of pre-existing datasets for Hindi. This required us to create our own dataset from scratch, which was challenging. Our dataset was limited in size and scope, so we had to combine multiple datasets into one. This posed a bit of a challenge because we needed to ensure that the data was not overlapping or conflicting with other sources.
- In addition to this, we also experienced difficulty with the NLP libraries. Although Indic NLP and iNLTK are available for pre-processing Hindi Language, the same doesn't work effectively with Hindi Code-Mix. We were required to do some hand coding and development in order to get it working properly.
- Additionally, strong biases against particular religions like "Islam" and "Hinduism", and particular communities like the LGBTQ community are usually observed and needs to be eliminated, so as to avoid creating a biased model.
- Due to the heavy computation required to train deep neural network models, a lot of computational power was required. It prompted the use of Graphics Processing Unit (GPU) to accelerate the training process by utilizing the principle of parallel computing.
- Also, a few individuals are aware of such techniques, and actively try to evade detection by using slangs or misspelled words. It also needs to be taken into account.

The remainder of the paper is organized as follows. Section 2 describes the related work and section 3 explains about the dataset creation. The proposed work is described in section 4 and results are discussed in section 5. Section 6 explains the conclusions and future work.

II. Related Work

In this section the works done on the hate speech classification in English language and and code mixed language in Indian subcontinent are discussed.

A. *Works Done on the Hate Speech Classification in English Language*

In recent times, with the advancement of computation technologies and the introduction of more advanced machine learning techniques, there has been an increased interest in the field of NLP to classify textual data into various classes. One of the most prominent classes in this is that of hate speech. A considerable amount of research work has been done in the past decade to understand and create highly reliable and sophisticated machine-learning-based models to classify the data as hate speech or not.

A major contributing factor in this task was done by Waseem Z. and Hovy D. [1] in 2016 when they analyzed a publicly available corpus of 16k tweets to classify hate speech based on various criteria for the English language. Furthermore, the authors examined the influence of numerous extra-linguistic features in accordance with the character n-gram. The authors collected tweets over a span of two months and created an annotated corpus of 16.9k tweets containing 1.9k racist and 3.3k sexist comments. The authors further explored the data by analyzing diverse aspects such as the demographic, geographical and lexical distribution. Lastly, the authors derived a list of criteria helpful to identify racist and sexist comments.

In the year 2017, Ji Ho Park, et al. [2] used the same dataset to suggest one-step and two-step classification of hate speech. The authors received an F-measure of 0.827 on the HybridCNN in one- step and an F-measure of 0.824 on Logistic Regression (LR) in two-steps. The authors also implemented Convolutional Neural Network (CNN) models on character, word and hybrid level. Apart from the three CNN models, SVM and FastText were also used to observe the performance for comparative purposes. The same dataset was further used by Pitsilis G.K, et al. [3] in 2018 to experiment on various features related to the user, which includes the past mentions of racist and sexist comments by users on an ensemble of Recurrent Neural Network classifiers. The authors also used word frequency vectors derived from the textual content of tweets. Furthermore, the authors compared performances with single classifiers along with the performances noted by past researchers. The results proved to be comparable and sometimes even better than the state-of-the-art algorithms at the time.

MacAvaney S, et.al. [4] in 2019 in their research discussed the technical and practical challenges when it comes to hate-speech detection. This comprised challenges such as the limited availability of data for training and the discussion about the non-existence of a universal definition for hate speech. The authors proposed a multiview SVM approach that was able to achieve performances similar to the state-of-the-art architecture whilst having a more straightforward, easy to interpret decision-making structure. The authors also used an array of datasets such as the Waseem A [5] and B dataset [6], Stormfront dataset [7], TRAC dataset [8] etc.

Using the HASOC 2019 data, GyörgyKovács, et. al. [9] further explored the challenges involved in identifying hate speech on Social Media and have explored in their study various opportunities, such as leveraging unlabeled data, similarly labelled corpora, as well as the use of novel models. The authors proposed a deep neural network

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comprising both the recurrent and the convolutional layers, making the use of CNN - Long-Short Term Memory (LSTM) architecture. The authors also deployed the use of the FastText classifier and the pre-trained RoBERTa model to evaluate its result. Lastly, the authors also experimented with an ensemble of different models to assess and compare the performance with single systems.

Marian-Andrei Rizoiu, et al. [10] in 2019 used the dataset provided by Waseem and Davidson to train a state-of-art model to classify the texts present. It was achieved by using a deep neural network along with transfer learning to create a model that can create word and sentence embedding specific to the task of hate speech classification. The authors further discuss using the models to generate a two-dimensional text visualization process termed Map of Hate. This process can separate different kinds of hate speech and try to illustrate what makes those texts dangerous for the users. The authors aimed to propose models that can reduce the manual work performed by human moderators on chat platforms and automate the same process.

It is clearly evident that a great deal of research has been done for the identification of hate speech in the English language with the use of state-of-art classification techniques. This has further sparked the interest to experiment and extend the same to other languages around the globe. One of the most prominent currently spoken on social media in the Indian Subcontinent is Code-Mixed Hindi-English.

B. *Works Done on the Hate Speech Classification in Code Mixed Language in the Indian Subcontinent*

In the year 2016, Prabhu A., et al. [11] performed sentiment analysis on Code-Mixed Hindi-English and proposed an annotated dataset for the same. Further, the authors introduced sub-word level representations in Subword-LSTM [12] architecture as compared to the traditional approach of character-level or word-level representations. This proved useful even in the case of highly noisy data, i.e. with a lot of misspellings and/or other mistakes. The authors were able to achieve higher accuracy by the margin of 4 % to 5 % as compared to the traditional approaches.

A major contributor in the classification of the code mixed Hindi-English language is the work done by P. Mathur, et al. [13] in 2018 wherein they created a dataset for Code-Mixed Hindi-English language and used transfer learning coupled with multiple feature inputs to identify hate speech. It was successful using the concept of Multi-Input Multi-Channel Transfer Learning Based Model (MIMCT) that was used to detect hate or abusive content. The authors proposed the Hinglish (Hindi-English) Offensive Tweet (HOT) dataset in the study. A comparison was also shown with the baseline supervised classifiers and transfer learning-based CNN - LSTM models. The prescribed MIMCT model by the authors contained two primary components, which included primary and secondary inputs, and CNN - LSTM binary neural network. The author included the Sentiment Score (SS), LIWC Features, and Profanity Vector in the primary and secondary inputs. Here LIWC features included linguistic statistics, current concerns, spoken categories, textual categories, psychological processes, and grammatical structures.

In the same year 2018, AdityaBohra, et al [14] made a significant contribution by presenting a Code-Mixed Hindi-English dataset with word level annotation. The authors examined the difficulties related to recognizing hate speech in code-mixed texts. The authors further presented a supervised classification system that included numerous components such as character level, word level and lexicon-based features. The authors extracted features such as character N-gram, word N-gram, punctuations, negative words, and lexicon. The authors tested the support vector machine-based classifier on each feature separately and on all combined features. The authors achieved an accuracy of 71.7% using the support vector machine-based classifier. The authors also compared the results with the random forest classifier.

In the year 2018, Kamble S., et al. [15] observed that using domain-specific embeddings results in an improved representation of target groups mentioned in the Code-Mixed Hindi-English dataset by Bohra A., [14]. The models proposed by the authors resulted in an F-score that was 12 % higher as compared to the F-score achieved in the past using statistical classifiers. Instead of utilizing the pre-trained word-embeddings, the authors trained word-embeddings on an enormous corpus of pertinent code-mixed texts. The deep learning models proposed by the authors included the CNN-1D,LSTM and BiLSTM models. The authors also used characteristics that included features like number of tweets, number of timelines extracted, number of retweets, the total number of words, size of vocabulary, and percentage of Hindi words per tweet.

Santosh T.Y.S.S, et al. [16] in 2019 further explored various techniques such as attention based on phonemic sub-words on two architectures that are hierarchical LSTM and sub-word level LSTM. This was accomplished with the help of the publicly available code-mixed dataset. The authors also compared the results with a support vector machine-based classifier and random forest classifier. The hierarchical LSTM model with attention based on phonemic sub-words contained the embedding layer, the syllable encoder, and the word encoder, along with word attention and an output layer.

Sreelakshmia K., et al. [17] in 2020 used Facebook’s pre-trained word embedding library, fastText to represent 10000 data samples collected from different sources as hate and non-hate. The authors carried out the experiment for the Code-Mixed Hindi-English language. The authors also compared the results with the word2vec and doc2vec features. With this, the authors achieved an accuracy of 85.81 % by using the proposed methodology with a Support Vector Machine (SVM)-Radial Basis Function (RBF) classifier.

By the end of the same year 2020, Vashistha N., et al. [18] combined multiple datasets available for the English and the Hindi language along with the dataset available for the Code-Mixed Hindi-English to test on a variety of deep neural networks. The author firstly built a baseline model and then used several optimization strategies to increase the

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model's performance. The authors developed a tool that detects and rates a given comment with an effective metric in near-real-time and uses the same feedback to further re-train the model, following which the authors achieved a competitive performance score. In two languages, English and Hindi, the authors demonstrated the efficiency of their multilingual model.

The frequency of harsh language on social media motivated Gaikwad S., et al. [19] in the year 2021 to develop techniques that could detect such content automatically. Apart from a few oddities, the majority of research studies have focused on the English language; hence the dataset termed MOLD, which stands for Marathi Offensive Language Dataset, was created to address this issue. It's the first of the kind dataset created for the Marathi language, and it's opened up a whole new field of study for low-resource Indian subcontinental languages. The authors used state-of-the-art cross-lingual transformers to explore machine learning models, including zero-short and other transfer learning experiments, using existing Bengali, English, and Hindi data.

In the year 2021, Sazzed S. [20] proposed the study taking into account the Indian regional languages used in the Indian Subcontinent. The author created a Bengali language corpus of 3000 comments divided into hate and non-hate, having a ratio of 1:1. Furthermore, the author tested the proposed dataset on various machine learning and deep learning classifiers such as support vector machines to detect abusive comments.

In the year 2022, Arushi S., et al. [21] proposed a study that focuses on identifying hate speech in Hindi–English Code-Switched languages. The authors' research entails experimenting with transformation strategies to obtain an accurate text representation. The authors constructed 'MoH', which stands for Map Only Hindi. The term MoH conveys 'love' in the Hindi language. The proposed 'MoH' is a Hindi language pipeline, which consists of language identification that assists with the process of transliteration of Roman formatted Hindi to Devanagari Hindi language using a knowledge base of Roman Hindi terms. Furthermore, the authors fine-tuned Multilingual Bert and, as an extension of that, the [22] Multilingual Representations for Indian Languages (MuRIL) model, as a part of the 'MoH' pipeline.

Based on the research and study performed during the work process for this research, a list of demerits of past implementations was compiled to better understand the requirements and need for this research. In today's time, most of the communications that are happening on social media platforms online are carried in the code-mixed version of the languages. Therefore, it is crucial to develop a system that can process these code-mixed languages. A number of models have been proposed in the past that are created by training on the native alphabet format of the languages. However, these models cannot be applied directly to process code-mixed languages due to their limitations on language modeling and translation. Hate speech classification is a crucial task to be performed in today's era. Therefore, it should not be taken lightly. One of the most noteworthy things to consider when dealing with hate speech is the context in which it was said. There are many resources and publicly available datasets for the English language that contains annotations to classify a sequence as hate or not hate, and which categorize the hate sequences into multiple categories like abusive, offensive, racist, sexist, ethnic, etc. Unfortunately, the same isn't available in abundance in other languages, especially in the code-mixed languages.

A majority of model proposed in the past were monolingual, primarily focusing on the English Language. Whilst, this research mainly concentrates on the vast majority of users from the Indian subcontinent, who speak Hindi and, as an expansion, Code-Mixed Hindi. In this research, various machine learning models are tested alongside with advance d deep learning models on the English, Hindi and Code-Mixed Hindi-English Dataset. This study also includes the process of collecting and creating a new dataset for the Code-Mixed Hindi-English Dataset, by establishing a set of guidelines and rules that can be followed to annotate Code-Mixed Hindi-English texts as hate speech or non-hate speech.

III. Dataset Creation

A wealthy amount of pre-annotated data is available for the task of hate speech classification when it comes to the English language and also the Devanagari Hindi language. The same doesn't hold true for Code-Mixed languages such as Code-Mixed Hindi-English. Hence, this prompts the need to gather and prepare datasets for Code-Mixed languages. This section details the complete strategy followed during the span of the creation of the presented Code-Mixed Hindi-English dataset. This strategy involved scraping publicly available tweets from the Twitter platform, manually classifying the dataset based on a specific set of rules and guidelines set by the annotators before the commencement of the data annotation stage, and lastly, documenting the statistics of the combined dataset.

A. *Data Collection*

As stated earlier, the dataset proposed in this study is created from the publically available tweets on Twitter. The task of scrapping the tweets can be accomplished using Python libraries that access the official Twitter API, for example, the open-source library, Tweepy[18]. Apart from the Tweepy, a few more additional Python libraries are available that provide similar functionality. To build the Twitter dataset for this study, the Snscrape Python library was used. Snscrape is a scraper for social networking services (SNS), providing the feature to scrape data from a plethora of social media platforms, including Facebook, Instagram and Twitter.

A set of keywords and hashtags was chosen, accounting for various current and past events, topics, and discussions occurring on Twitter. The aforementioned set of keywords and hashtags was created with keeping the objective of fetching as many Code-Mixed Hindi-English language tweets as possible in mind. This set was then used with Snscrape to scrape 25,303 tweets from Twitter.

It included the original tweet text, the username of the

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person who posted the tweet, the timestamp (date and time) of the tweet, and the tweet's unique tweet ID.

B. *Data Annotation*

The step of classifying the collected data into the hate and the non-hate class was carried out manually by reading and examining all the tweets. This process was performed by bilingual authors who are well versed in both the English and Hindi language. In order to avoid any type of bias from the authors, a set of policies and rules were debated and agreed on before initiating the task of manual classification.

Firstly, apart from the original tweet text, other data values such as the author of the tweet, the tweet ID, and the timestamps were hidden during the course of manual classification. It was done to avoid any bias that may arise based on the tweet's author. Furthermore, the data was shuffled before splitting among the authors to allow each author to get tweets based on diverse keywords and hashtags instead of just a few. As discussed previously in the paper, it is hard to define a standard definition of hate speech, so to acquire a uniform approach to classification by the authors, the following set of guidelines was followed.

1. Any tweet containing severe profanity, abuse, threat, offensive remarks, personal insult, harassment, promotion of violence and harm were classified as hate.
2. Any tweet not following in the above category was classified as non-hate.
3. Tweets containing texts written with some sense of sarcasm were handled on a per tweet basis, where tweets without any malign intent or explicit depiction of hate were marked as non-hate, whilst others were labelled as hate.
4. A tweet containing criticism about any community, group or person was classified as non-hate as long as the tweet didn't include any offensive remark, use of extreme profanity or the intention to denigrate the targeted individual or group of individuals.
5. A maximum threshold was set for the number of words allowed in a tweet belonging to the English and Hindi (Devanagari Format) language with respect to the total number of words in the same tweet. If the use of such words were within the threshold, the tweet was considered for classification; otherwise, the tweet was removed from the data.
6. Tweets not following the above guidelines were considered garbage tweets.
7. Tweets that were challenging to classify were flagged for reexamination and were reviewed later by all the authors.

Once the authors completed the initial data classification stage, the tweets marked as garbage were removed, and the rest of the data was compiled. The authors reviewed and weighed on the classification performed by their peers, which was later used to calculate the inter-rater reliability score. During this step, thorough discussion was conducted on all tweets previously flagged for reexamination.

C. *Dataset Statistics*

The dataset produced from the manual classification task contains 2000 hateful tweets out of a total of 4,014 tweets, resulting in the percentage of hateful tweets being 49.82%. Table 1 shows the hate class distribution. The example data in the dataset are given in Table 2. As stated earlier, the inter-rater reliability (IRR) score was tallied to gauge the consistency of the data classification performed by the authors, using the Cohen’s Kappa coefficient. The resulting value of 0.964 indicated a high level of agreement.

TABLE 1: HATE CLASS DISTRIBUTION

Class	Data Entries
Non - Hate	2014 (50.18%)
Hate	2000 (49.82%)
Total	4014

TABLE 2: Dataset Values (Censored)

Text	Class
Yaaraajkalkisicheezmeinmaan hi nahilagta, bas alas alasrehtahaihar time	Non - Hate
Waqtlgjaata h duniyakobsbaatsamjhne me, Zamanalgjaataunhejazbaatsamjhne me #khushi https://t.co/zLOqhSaqK8	Non – Hate
@karanjohar Are m*dherch*d hi*rasa*a tu hi*ra m*adherch*d teri sari movie kaboycotttkrunga hi*re kipaidaish m*adherch*d ha*ala	Hate
@TwitterIndia tum ga*du follower kyuapnega*d me ghusalete ho	Hate

IV. MODEL ARCHITECTURE

This section will discuss the various procedural steps that were followed to evaluate the created dataset by utilizing it to fine-tune an array of pre-trained deep learning models. It involved the process of cleaning the dataset by removing all the not required data, performing a basic exploratory data analysis on the dataset, fine-tuning the hyper parameters during the period of model re-training and evaluation.

A. *Data Pre-Processing*

To process the text data for use in a deep-learning model, first, it was necessary to clean the data and remove all extraneous information. This step was accomplished by removing all nonessential columns from the dataset (tweet ID, tweet author, tweet timestamp). Furthermore, publicly available text processing Python libraries were used to streamline the cleaning and preprocessing of the tweets' textual data. This set of tools includes the Natural Language Toolkit (NLTK) and Ekphrasis library. With these tools, the tweets were processed by removing stopwords (For English Words present in the tweet), unpacking the hashtags and contractions, annotations of URLs, users, emoticons, date, time and hashtags. Table 3 shows the example data before and after cleaning.

TABLE 3: DATA EXAMPLE BEFORE AND AFTER CLEANING

Data Cleaning	Text
Before	@ANI Khudkegharmeinbijlinahiaurchaledusrokora ahdikhane #powergrid failure
After	user khudkegharmeinbijlinahiaurchaledusrokora ahdikhane power grid failure

B. *Pre-trained Deep Learning Models*

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The resulting preprocessed dataset was then fed into a range of pre-

C. trained deep learning models, including the Multilingual Bert and XLM- RoBERTa [19, 20].

i. Multilingual BERT - BERT stands for Bidirectional Encoder Representations from Transformers. It was first introduced by Google AI Language. Bidirectional means that the model can read text from both left-to-right and right-to-left. One of its iterations is Multilingual BERT, a transformers model pre-trained on a large set of multilingual data in a self-supervised manner, enabling comprehension of multiple languages.

ii. XLM - RoBERTa - RoBERTa is a robustly optimised method for pretraining self-supervised NLP systems proposed by Facebook AI. These models can be tuned for various tasks such as document similarity and classification. One variety of this model is XLM - RoBERTa (XLM-R). XLM denotes a Cross-lingual Language Model [21]. XLM-R is a multilingual model pre-trained on 2.5 TB of filtered CommonCrawl data in 100 languages.

Several renditions of XLM-RoBERTa are available, which includes XLM-RoBERTa-base and XLM-RoBERTa-large.

For the purposes of this study, bert-base-multilingual-cased model and xlm-roberta-base model were selected from the Hugging Face platform.

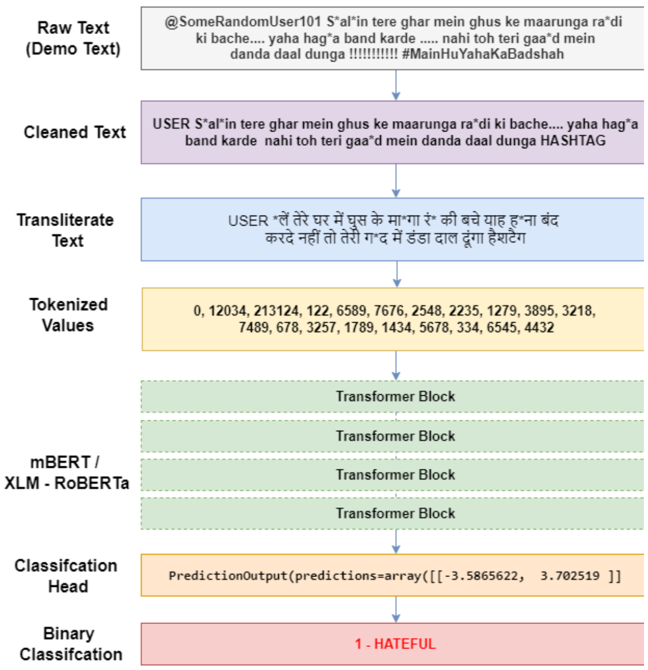

Fig. 1. System Architecture

Fig. 1 shows the system architecture which tells the step by step procedure.

V. Results and Discussion

This section will cover the performance of the machine-learning and deep-learning algorithms used during this study. The results are presented in a tabulated order, and noteworthy observations are drawn from the above-stated results of the research. This section also details the various parameter and hyper-parameters used during the training phase of this study.

A. *Basic Machine Learning Classifiers*

The feature generated from the data for all three languages were individually divided into a train and test set of 70% and 30%, respectively. The extracted features were thenpassed on as an input to an array of machine-learning-based classification techniques. Different parameters such as the number of estimators or the penalty were experimented for the various classifiers.

- Mainly, the models were trained with a K-Folds cross-validator having a value 5 for the number of folds and also, using the method of grid search.
- For the Logistic Regression (LR) classifier, the penalty was chosen as ‘l2’, an inverse of regularization strength of 0.02, and class weight was chosen as ‘balanced’ to give equal weightage to both the classes.
- For the Support Vector Machine (SVM) classifier, the regularization parameter was set to 0.01, and the kernel was chosen as ‘linear’ because of the number of features used in the input.
- For the Random Forest Classifier (RFC), depending on the language, the number of decision trees varied from 120 to 150. Also, the ‘gini’ criterion was used.

Tables 4, 5 and 6 show the machine learning (ML) Classifiers’ accuracy, precision, recall and F1-score for English, Hindi, and Code-mixed Hindi-English languages.

TABLE 4: ML Classifier Results for English Language

Classifier	Accuracy	Precision	Recall	F1-Score
LR Classifier	0.779	0.774	0.775	0.774
SVM Classifier	0.798	0.794	0.790	0.792
RFC Classifier	0.821	0.816	0.819	0.817

TABLE 5: ML Classifier Results for Hindi Language

Classifier	Accuracy	Precision	Recall	F1-Score
LR Classifier	0.785	0.784	0.784	0.784
SVM Classifier	0.814	0.807	0.809	0.808
RFC Classifier	0.834	0.832	0.831	0.831

From the results mentioned above, several observations can be made. Broadly, the Random Forest Classifier (RFC) model appears to yield the best results in all the languages.

TABLE 6: ML Classifier Results for Code-Mixed Hindi-English Language

Classifier	Accuracy	Precision	Recall	F1-Score
LR Classifier	0.712	0.710	0.711	0.710
SVM Classifier	0.735	0.734	0.734	0.734
RFC Classifier	0.753	0.750	0.751	0.750

The reason behind this may be related to the fact that RFC operates on multiple decision trees reducing any bias or over-fitting that may occur when working with only one decision tree or a single procedure classifier. Also, important to note that the results for the English and the Hindi language are considerably better than that for the

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Code-Mixed Hindi-English language. This can be substituted to the fact that the more robust techniques and tools for data cleaning and pre-processing are available when it comes to the English and Hindi languages. One other reason that may contribute to this is that the Code-Mixed version of Hindi doesn't have a fixed vocabulary, and due to variation in the method of writing code-mixed language, a single word in Devanagari Hindi may have several spellings in Code-Mixed (Roman) Hindi, resulting in a vast vocabulary and thus, reducing the performance across the board. The results are assumed as the baseline performance achieved on the dataset.

B. *Fine-Tuned Deep Learning Models*

This section presents the results of the experiments performed on the pre-trained deep learning models using the created datasets. Since the dataset was tokenized using the sub-word tokenizer available with the respective models, the dataset was first translated to Hindi (Devanagari) Language using the Google translate library available for Python, and then it was tokenized. The dataset was tokenized with a maxed length of 256 and padding based on the same. It was further encoded using the transformer function available on the above-mentioned platform. The encoded dataset values with corresponding class labels were then transferred as an input to the models.

A set of hyper-parameters was tested during the model fine-tuning period; this includes a learning rate of 2e-5, batch size of 16, weight decay of 0.01, and train-validation-test split of 70-10-20. The models were terminated with a classification head to produce the binary hate speech classification results.

Tables 7, 8 and 9 show the deep learning (DL) Classifiers' accuracy, precision, recall and F1-score for English, Hindi, and Code-mixed Hindi-English languages.

TABLE 7: DL MODEL RESULTS FOR ENGLISH LANGUAGE

Model	Accuracy	Precision	Recall	F1-Score
mBERTModel	0.834	0.830	0.831	0.830
XLM-RoBERTaModel	0.851	0.848	0.849	0.848

TABLE 8: DL MODEL RESULTS FOR HINDI LANGUAGE

Model	Accuracy	Precision	Recall	F1-Score
mBERTModel	0.857	0.856	0.856	0.856
XLM-RoBERTaModel	0.879	0.876	0.878	0.877

TABLE 9: DL MODEL RESULTS FOR CODE-MIXED HINDI-ENGLISH LANGUAGE

Model	Accuracy	Precision	Recall	F1-Score
mBERTModel	0.771	0.770	0.769	0.769
XLM-RoBERTaModel	0.784	0.782	0.783	0.782

A considerable improvement has been observed when compared to the performance delivered by the baseline machine-learning-based classifiers. There have been significant improvements for all the languages separately. But, when observing the results acquired from the models that were fine-tuned on all the datasets combined, the evaluation score appears to be an average of the results of the separate models. This further solidifies the theory that has been proposed regarding one of the drawbacks of the multilingual model approach. Also, it has been observed that the XLM-RoBERTamodel performed better as compared to the mBERTmodel across all the languages. This may be because of the use of Byte-Pair Encoding (BPE) used by XLM-RoBERTa which allows it to have an increased shared vocabulary between languages, which in the case of this research, benefits the Devanagari Hindi and the transliterated Code-Mixed Hindi-English languages.

VI. CONCLUSIONS AND FUTURE WORK

As iterated earlier, this study aimed to play a small auxiliary role in the prevention and ultimate eradication of cyberbullying. The first step towards that direction is the creation of state-of-the-art classifications models that can classify hate messages. The recent interest in this field of research has yielded some promising results, especially in the realm of English language with enormous amounts of data available for training. But, as demonstrated in recent research efforts, this success can be taken further into the domain of other languages. It can thus be applied to a broader audience who speak different languages. The study also emphasizes the fact that the communication that is taking place in today's time on social media forums and platforms usually contain a mix of various languages, some of which are code-mixed versions of English and the native language of the region.

This study delivered a hate speech (virulent text) classification dataset for Code-MixedHindi-English language with 4,014 values, with an even distribution of hate and non-hate entries manually classified from a scraped Twitter corpus of 25,303 tweets. Furthermore, this study also proposed a set of policies and rules that can be followed to classify hate data. The guidelines followed in this study can also be used in future research to create more sophisticated hate-speech datasets. The guidelines can also be employed to further explore the data by dividing the hate speech class into multiple classes, such as abuse, threat, insult, and harassment. This study also attempted to fine-tune two deep-learning models, namely, multilingual BERT and XLM - RoBERTa, on the created dataset, providing models that can effectively identify texts containing hate messages.

More in-depth work is still required to improve the models further and deploy the studied techniques into real-life applications. With issues, such as active avoidance (user trying to evade hate speech detection by using misspelt words or slang) and community bias (race, religion, gender, occupation, etc.) continuing to affect the performance of classical hate speech flagging systems, the need to create more reliable automatic machine learning-based techniques is crucial in the forthcoming times.

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Diagnosis of Heart Disease Using IoT in Edge with Multiple Machine Learning Techniques

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***Abstract*— Edge computing bridges the gap between industrial clouds and field devices for the Industrial Internet of Things (IoT). The most difficult aspect of edge computing is gathering data from different devices. The role of Edge is to process client's data at the network's edge, closer to the source. Due to the rapid increase in data traffic exchanged worldwide, there is an increasing need to collect and process data from sensors and devices of the IoT, which are operated in real time from remote locations and hostile operating environments. The proposed system aims to develop an edge-based heart disease prediction. The system was developed using a simple microcontroller that integrates temperature, heart rate and blood pressure. The measured value is tested with machine learning model to understand the patient's condition. Many feature combinations are used to reveal the prediction model and also for large number of well-known machine learning classification algorithms. Prediction model achieved the accuracy measure of 86% for SVM,92.24% for Decision Tree Classifier, 93.01% for Random Forest and 86.91% for K-Nearest Neighbor. So, from these four algorithms, Decision Tree Classifier gives the superior prediction, satisfying all the measures of precision, recall, accuracy and F-Score.**

Keywords—Edge Computing, IoT, Machine Learning, Performance measures, Heart Disease Prediction.

I. INTRODUCTION

Heart attacks and strokes were liable for 80% of people's death. The people who suffer from uncertain heart diseases, can be saved if it is predicated ahead of time. The (IoT) has already been widely used in a range of clinical aspects to capture the sensor values in attempt to diagnose the specific issues and predict cardiac problems through Machine Learning algorithms in real world applications and all healthcare standards. The IoT connects objects within the vicinity, collects the data from the people, and analyses it for early prediction and diagnosis[1]. Multiple inference has examined the capabilities of cloud-based and edge-based computing, concluding that the only system can manage the current scenarios in well-defined manner is Edge-based Machine Learning that can only meet the network delay, bandwidth, speed and all efficiency requirements. A superior execution of edge computing over traditional cloud computing can benefit many sectors, including healthcare[2].This paper's contributes, cardiac patient monitoring system based on the concept of IoT, using various signal sensors and a microcontroller. IoT technology is increasingly being used by sensor networks to capture, interpret, and transmit data from one node to another. IoT is a relatively new and rapidly expanding technology in which multiple sensors can sense, share, and communicate over a local network, public networks and through Internet Protocol. After a specified amount of time, the sensors collect data, analyse it, and use it to initiate the necessary action, resulting in an cloud-based network intelligence foranalysis, planning, and decision making. IoT-enabled products, such as embedded technology, enable data exchange. So here the methodology was tested on only three subjects and predicted their condition. So here the key contribution is to select a machine learning model that which best suits for the prognosis of heart disease.

II. RELATED WORKS

In this literature, various number of sensor-based wearable health monitoring devices in machine learning with edge has been suggested. This section discusses a few related works in detail. Every year, chronic diseases such as cardiovascular disease, respiratory disorders, and brain disorders kill more than 65% of the world's population. Chronic disease patients have a long recovery period and require technology for consistent monitoring of their health condition. Wearable technology is used to monitor vital parameters such as blood pressure, Oxygen saturation, respiratory rate, and Electrocardiograph for the patients.

Ram et al[2022] Machine learning in edge has been investigated for detecting anomalies and improving the accuracy of the data and mobile health monitoring can predict outcomes. Moreover, multi-modal sensor information was pre-processed to cleanse the data and classify the occurrences in the dataset[3].

Md.MahbuburRahman et al[2022] Data that has been pre- processed in order to train and evaluate machine learning algorithms. The first stage divides pre-processed data into two portions. The majority of these are utilised in the training phase (80%), with the remainder (20%) employed in the testing phase. dataset was trained using machine learning techniques such as Decision Tree, XgBoost, KNN, Support Vector Machine[4]

Ayushi Das et al[2022] Four different classification algorithms to forecast certain widely identified diseases are k-Nearest Neighbour, Naive Bayes, Decision Tree, and Random Forest. On a disease prediction data-set, these Supervised Machine Learning classifiers are used to identify 41 prevalent diseases based on any 5 prominent symptoms from the dataset's 132 common symptoms[5].

JameelAhamed et al[2021] To examine the available data on cardiovascular disorders in order to predict and prevent heart disease at an earlier stage. The heart disease patient dataset was collected and stored in the cloud. The information stored is then pre-processed and examined

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further using machine learning techniques to forecast cardiac problems[6].

ButchiRaju et al[2021] This model combines Edge-Fog- Cloud computing to deliver accurate and timely results. The hardware components collect information from various patients. To obtain significant features, heart feature extraction from signals is performed. In addition, with, thefeature extraction of other attributes are also combined. All of these characteristics are gathered and fed into the diagnostic system via an Optimized Cascaded Convolution Neural Network[7].

N.Saranya et al[2020] Latency reduction approaches in mobile computing and fog networks, data availability, power computation, and other parameters are analysed and compared to see which gives superior results[8].

R. Latha et al[2019] The blood viscosity is predicted by Partially Observable Markov Decision Process. The decision was made to address two causes of ambiguity. The first is about control, specifically diagnosis. The other is related to the user, namely the decision maker. A hierarchical dynamic effective framework model was chosen to solve this POMDP. Structure-based approximations and approaches are used to reduce complexity[9].

S. Mohan et al [2019] An innovative way for identifying key features by using machine learning techniques, with the goal of increasing accuracy of cardiovascular disease prediction. The prediction model is presented with several combinations of features and various recognised categorization algorithms. We achieve an improved performance level with an accuracy level of 88.7% using the hybrid random forest with a linear model to predict heart disease[10].

ShadmanNasif et al[2018] Cardiac patient monitoring system based on the Internet of Things, with various physiological sensors and an Arduino based microcontroller. Sensor networks are now using IoT technology to collect, analyse, and transmit data from one node to another node[11].

TABLE I.ONGOING HEALTH MONITORING DEVICE

S. No	Motive	Signals	Analysis (edge/cloud)
1	Observing heart illness	ECG, Heart rate, EMG, Accelerometer	Edge with ML
2	Heart Rate Monitor	ECG, EMG, BPV	Edge with ML
3	Tracking sleep	Temperature, Heart Rate	Cloud with ML
4	Cardio vascular disorders	ECG, Blood Pressure, SPO2	Cloud with ML
5	Heart disease Monitoring	ECG, EEG, EMG, Temperature, Oxygen level, Respiratory rate	Edge with ML

III. FINDINGS FROM RELATED WORKS

The majority of the research works analysed cardiovascular disease models using single and two algorithm combinations that are not powerful enough to provide reliable predictions in underdeveloped countries.

The IoT-ML-Edge paradigm is a distinct Information Technology (IT) prototype in which IoT, ML, and edge are three interconnected technologies integrated together to address both existing and future world difficulties associated to the health-care concern.

For cardiovascular disease prediction, we employed three distinct feature choices as well as four classifiers. We have yet to come across any research that has used such classifiers for feature selection and cardiovascular disease prediction. In most occurrences, research scientists employed just three algorithms in their work.

In this system we used various machine learning techniques to forecast cardiac illness because it is one of the best andmost novel tools for prediction work, and it is also used in other subjects such as cancer symptoms and weather prediction system.

IOT- Edge Module

Sensors

The sensor framework incorporates ECG to monitor the blood pressure and sugar, pulse sensor to measure the heartbeat and temperature sensor to monitor the patient’s vital signs.

Edge module

The data’s which are obtained from the sensor component will communicate to edge module. Sensor readings are captured and then updated in comma-separated value sheet. Then the samples from the files are sent to further processing for testing the data.

Processing Module

In this stage, Machine Learning algorithms are used to detect the abnormality of the patient’s condition. So, this module is equipped with various types of algorithms to check whether the patients have disease or not.

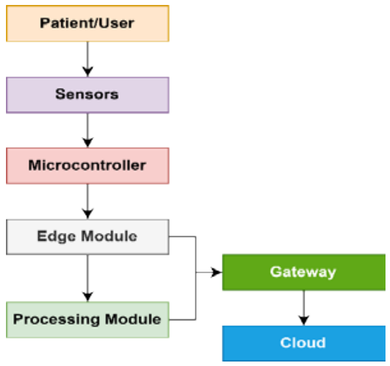

Fig. 1 Systematic representation of IoT Edge Module

III. PROPOSED SYSTEM

Edge technology push data processing closer to the edge of the network, leading to faster response time and greater efficiency. Instead of continually transferring data to the cloud for computing activities, which imposes energy expenses, data may be collected and processed locally to the user on edge devices and server. The Internet plays an essential role in the development of an IoT-based healthcare monitoring system. Keeping records for any doctor is tough due to the vast amount of data.

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Physicians, on the other hand, must utilize this prior data to forecast a patient's health state. Over the years, several machine learning technologies have been applied in the medical application field. This research work presents an edge-based cardiovascular related disease prediction using IoT. This wearable gadget has a temperature sensor, a heart rate sensor, and blood pressure sensor. The raspberry pi controller is linked to these sensors. Using a heart disease prediction data, the controller is trained with a machine learning model. Once if the data is obtained from individuals, the controller analyses and shows whether the patients have cardiac disease or not. So here we employedfour Machine Learning algorithm techniques to predicted the best outcome.

Architecture

1. The first stage is pre-processing of data, the patient data is collected through sensors, and the sensor input data is pre- processed. Data that is missed is deleted during pre- processing.
2. The second step involves data feature selection and heart disease features such as respiratory symptoms, cholesterol, and blood sugar level and these parameters are selected for further processing.
3. The third stage is data splitting. At this point, the patient's full data is divided into 70% and 30% for training and testing purposes.
4. So, in the final stage, the data is trained with various machine learning techniques then at last the testing of model is processed.

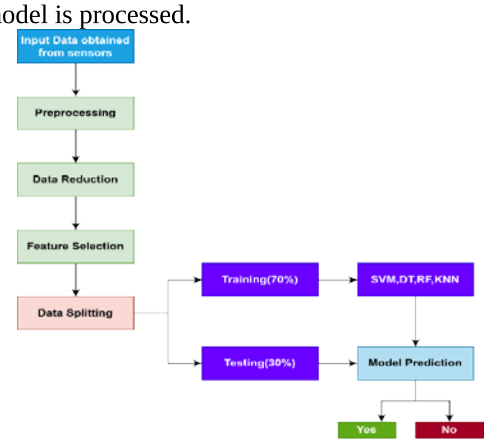

Fig. 2 Flow Diagram for Heart Disease Prediction.

V. Data Processing

Data Collection

The sensors capture the patients' data, as well as vital indicators such as ECG, pulse rate, and cholesterol.

Data Cleaning

The pre-processing approach known as data cleaning method is utilized here to clean the redundant data, noisy data and outliers.

Data Reduction

The feature selection mechanism is employed here to choose exactly the particular data needed for training the model.

Data Transformation:

Data transformation converts data from one pattern, standardized measures, or structure to another without affecting the data's content. So, in this case, the technique called data normalization strategy is used to eliminate the unstructured data.

Data Integration:

The method of incorporating data from numerous source systems in order to generate homogenous sets of information for operational purposes. Here the technique called ETL isused to Extract, Transform and Load the data from sensors and the Python script is used here to serially capture real- time data and log it into a CSV (Comma Separated Value) file.

VI. Methods

Support Vector Machine

SVM modelling is a good classification method for predicting individuals with heart failure. This prediction model aids in clinical diagnosis, allowing data decisions to be made and patients to be handled effectively. To generate more accurate prediction of heart disease this system adapts the SVM machine learning technique. The patient data includes the following attributes - age, gender, cholesterol, blood pressure and pulse rate. Fig.3 shows the output of support Vector Classifier scores for different kernels were linear kernel achieves a score of about 86%.

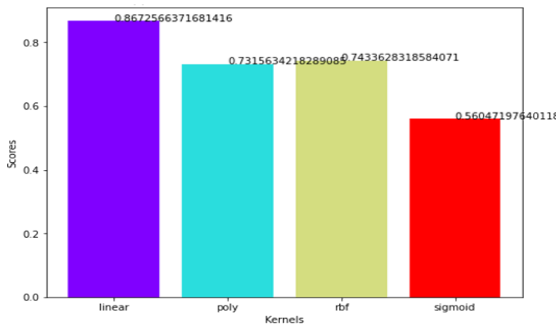

Fig. 3 Execution Graph for different Kernels in Python

TABLE II. Scaling Parameters

No	Kernel	Scores
1	Linear	0.86
2	Polynomial	0.73
3	RadialBasis Function	0.74
4	Sigmoid	0.56

Decision Trees

A decision tree is a machine learning method that may be applied for both regression and classification technique. It is a classifier with a hierarchical tree structure. It reveals useful hidden information. The massive data collection may also be used to generate new target patterns. For categorization, decision trees are functional in multiple disciplines such as machine learning and to extract the information's. A decision tree does not need additional subject expertise. It is simple to understand and fast. Decision trees may handle a variety of data kinds, including nominal, ordinal, binary, and real values[12]. It builds decision nodes in which the internal

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nodes represent data characteristics, the edges represent decision rules, and each leaf node represents the class label, i.e., the target class label is specified, if that defined path is taken. The step begins with the root node of the decision tree; subsequent nodes are picked, and the process continues until the lead node is reached; the class label at the leaf node is the predicted class label[13]. Fig.4 shows the decision tree classifier, the class obtains the value either HD (Heart Disease) or NHD (No Heart Disease) based on the conditions.

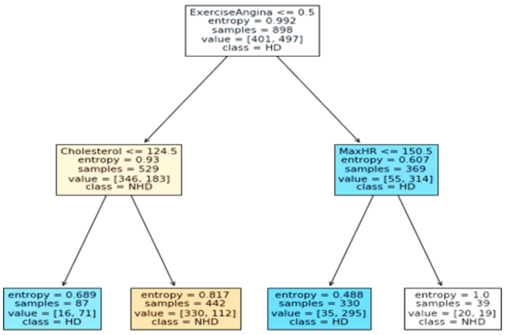


Fig 4. Execution of Decision Tree Classifier

Random Forest

It is a supervised machine learning approach that builds a series of decision trees. Majority of the decision trees are used to make the ultimate conclusion. Random Forest is used to create a classifier model capable of predicting illness with greater performance and accuracy. It is possible to cure them with appropriate therapies using modern medical technologies. However, if illness is detected late, even the most advanced medical technology cannot help. Fig.5 shows the actual values and the predicted values from test dataset.

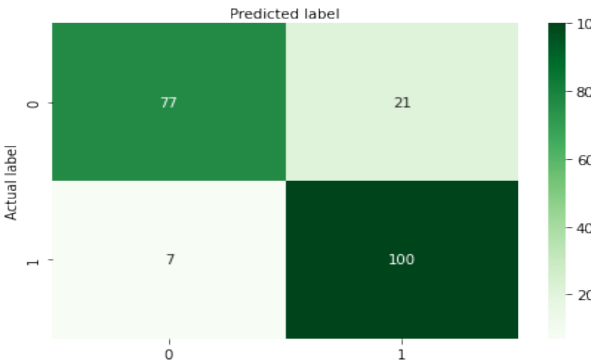


Fig 5. Confusion Matrix

K-Nearest Neighbor

KNN looks for similarities between predictions and data in the dataset. KNN employs a non-parametric system, since there is no significant discovery of parameters associated with a particular functional form. It does not make any speculations about the dataset's properties or output. As a result, majority of the computing effort happens during classification rather than training. KNN typically works attempting to determine the closest class feature, and then assigning it to that particular class which is nearest to that point, from fig.6, it's clear that minimum error rate is 0.105058 at K=3.

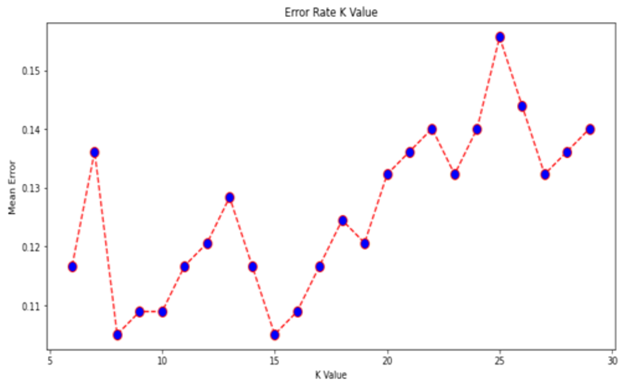
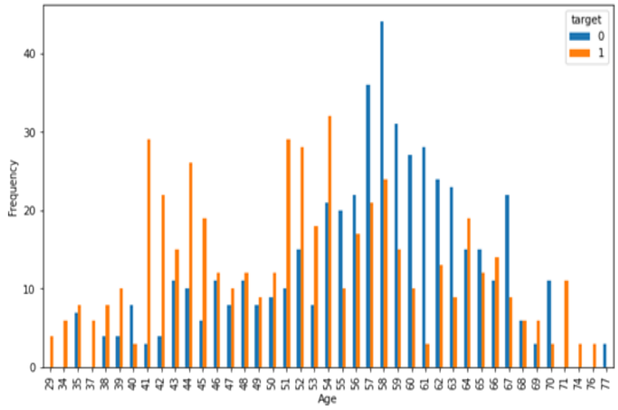


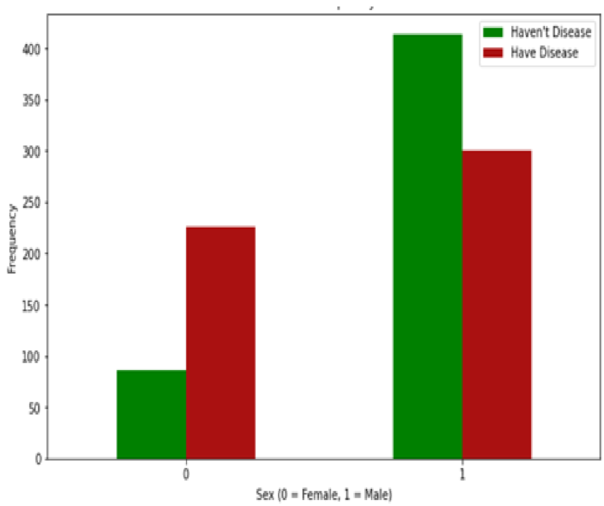
Fig 6. Minimum Error Rate

VII. Findings and Discussions

The goal of this research is to determine the fact that the patient has cardiac disease or not. The entries in the data are separated into two groups. (i.e., 70% for training and 30% for testing). This section outlines the categorization model results obtained by Python language. Fig shows the Heart Disease Prevalence by Age and Fig shows the heart disease frequency for male/female. Fig shows the probability of heart disease in terms of blood pressure, cholesterol and pulse rate. Fig shows the comparative analysis of various supervised learning algorithms. The best accuracy score is provided by random forest with 93.21%.



Output 1: Heart Disease Frequency (Ages)



Output 2: Heart Disease Frequency (Gender)

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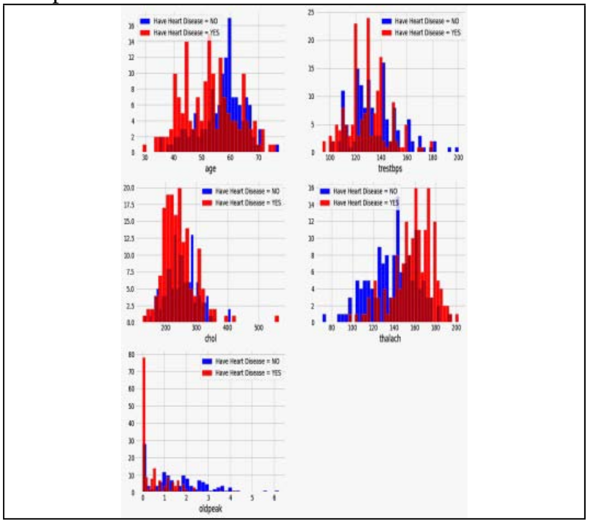
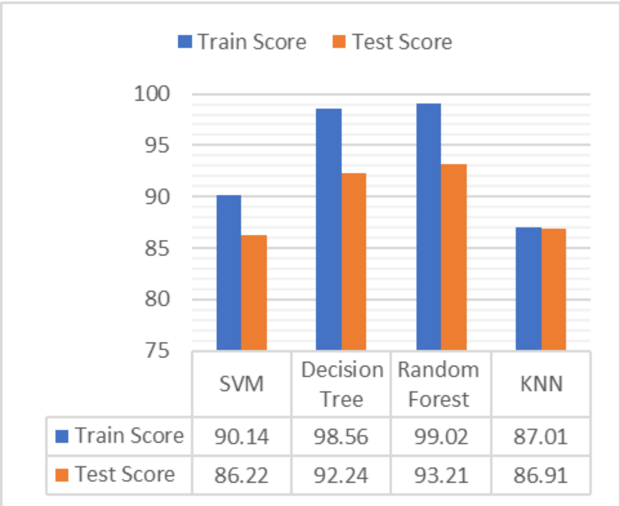


Output 3: Prediction Graph



AC Accuracy Chart

VII. Conclusion

Edge computing-based Applications have received considerable attention. The majority of present wearable health monitoring devices are designed to process data on the cloud. However, the purpose of this work is to experiment with an edge-based system for health monitoring. The purpose is to investigate and combine majority of data in order to generate a more meaningful dataset that includes a diverse variety of population patterns. For the prediction of heart disease, feature selection may be applied to extract more relevant characteristics and effective findings. This study compared four machine learning algorithms for heart disease prediction and found promising results. From this work, the performance metrics of Machine Learning algorithms are evaluated and found the best technique for the prognosis of heart disease.

VIII. Future work

Furthermore, data pre-processing approaches and machine learning classification algorithms can be used in future employment to get good outcomes than those achieved in this current work. In most cases the patient does not have sufficient time to go to the doctor, so in such cases, creatinga simple application for the user - interface through smart mobile to resolve this issue, and this service makes the prediction task quicker from the patient's location.

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House Rental Application System

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***Abstract* –An e-rental application is a web and mobile-based solution that enables landlords and renters to manage and access rental properties or equipment. The application, accessible via web browsers and as a mobile application on Android, provides a convenient and efficient way for both parties to conduct rental transactions.**

Its web application allows landlords to easily create and manage their listings, set prices, respond to inquiries, and automate tasks such as sending reminders for rent payments and handling lease renewals. Renters can browse through listings, submit applications online, make rent payments, request maintenance, and even renew their leases. Moreover, its mobile application for Android devices provides an added level of convenience for landlords and renters. Landlords can manage their properties on the go, and renters can search for properties, communicate with landlords, and make payments while moving. The mobile application also allows renters to take virtual tours of properties and view images and videos before deciding.

This e-rental application can increase the visibility of a landlord's properties by listing them online, reaching a wider audience of potential renters. Additionally, the application provides landlords with valuable analytics, such as information on which listings receive the most views or inquiries, which can help landlords make informed decisions on pricing, property upgrades, and marketing strategies. As well as improve the communication between landlords and renters by providing a platform for both parties to communicate. It also includes sending messages, sharing documents, and scheduling appointments. It also improves security for landlords and renters by providing a secure way to collect rent payments and manage tenant information. Renters can securely submit sensitive information, such as personal data and passwords, of the rental property.

I. INTRODUCTION

The rapid development of technology has greatly influenced how we go about our everyday lives and work. In recent years, e-rental applications have emerged as a popular and efficient solution for managing rental properties and equipment. These applications provide a convenient platform for landlords and renters to conduct transactions and communicate with each other. However, as technology advances, it is critical to investigate ways to develop and strengthen these e-rental applications. This research paper explores the potential benefits and challenges of adding new features, such as G.P.S. and in-app messaging, to existing e-rental applications. This research aims to examine how these features can improve the overall user experience and enhance the functionality of e-rental applications.

The rental industry has always been a vital part of the economy, providing housing and equipment for individuals and businesses. However, the traditional rental process can take time and effort, involving much paperwork and face-to-face interactions. With the advent of e-rental applications, the rental process has become more streamlined and efficient. These applications provide a convenient platform for landlords and renters to conduct transactions and communicate with each other.

However, exploring ways to enhance and improve these e-rental applications is essential as technology evolves. One way to do this is by adding new features such as G.P.S. and in-app messaging. G.P.S. technology can provide location-based services, such as helping renters find properties in a specific area or providing landlords with information on the location of their rental properties. In-app messaging can improve communication between landlords and renters, making it easier for them to discuss rental details and schedule appointments.

Implementing these new features can bring several benefits to the e-rental application. For renters, adding G.P.S. technology can make finding properties in a specific area easier, while in-app messaging can improve communication with landlords. For landlords, G.P.S. technology can provide valuable insights into the location of their rental properties, while in-app messaging can streamline the communication process with renters.

However, the implementation of these new features also brings specific challenges. One major challenge is implementing these features, as it can be costly for developers to integrate them into existing e-rental applications. There is also a risk that these features may not be used or used effectively, resulting in a waste of resources.

II. LITERATURE REVIEW

The primary purpose of this research and development is to abridge the gap between the existing system and its capability to which extent it can be enhanced. Moreover, it has a broader scope, covering multiple aspects such as tenant search and selection, lease management, maintenance and repair, and communication and feedback.

In 2017 "Development of Online Based Smart House Renting Web Application", this paper by diptavoumick and

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Prince, Khan presents the user-centric design approach in developing a web-based house rental application system which meets the requirements of both tenants and owners.

Since 2014 "nobroker.com" has dominated the house rental systems field, offering a platform to promote the assets for renting and selling and allowing tenants to find their desired shelter. As a result, nobroker.com is one of India's largest online real estate portals.

"House Rental Application System Based on Blockchain Technology" by QingshuiXue, ZongyangHou – This proposes a house rental system using blockchain technology to find the housing leasing alliance chain.

III. Modules Description

There are several modules in this application which are:

A. Sign in and sign up.
B. Post ads
C. Favourites
D. Search Property
E. Chat

A. *Sign in and Sign up*

This module allows the user to create an account if there is no one. Moreover, it helps in signing in if there exists an account. Furthermore, all the data will be in a non-relational or NoSQL database, a MongoDB. Even storing the data was entirely different where the actual data, such as password, was, encrypted and stored in the database. While retrieving the data, the password entered by the user will be encrypted with the same secret key used previously to store the data will be used here and will check whether both cypher texts match or not. Likewise, user authentication will happen.

Along with this, the user also has the option to sign in with google, which makes the Sign in and Signup process much more manageable. This reduces the burden of creating a new account by entering all the details, such as mail I.D., username, and phone number. By google sign-in functionality, google itself manages the user data. Here to achieve this feature, we used the firebase cloud fire store.

B. *Post ad*

This module is mainly for property owners interested in posting property details in that system. Like it enables posting ads regarding their property, even the data entered here will be stored in the MongoDB database. This posting ad module requires an owner to post all the necessary details, such as the type of property, the exact location, and the pictures related to that property. For instance, if an owner wants to post an ad regarding the car parking property. Firstly, the owner needs to be logged in to access the post-adoption. Then the owner must select the type of property as car parking and fill in all the details related to that, along with the pictures of that particular property and the pricing.

Generally, in other house rental systems, this is a tedious task. Nevertheless, we simplified the process, making things easier to access.

C. *Favourites*

This module is mainly for tenants who are looking forward to rentals. This gives the capability for users the to be able to create their wish lists based on their choice. Moreover, all those favourites will be organized in one place, the favourites section.

D. *Search Property*

It is a module that helps the users/tenants find the desired property based on price, location, and surroundings. In this module, the user can filter the search results. Based on several things such as property type, property location, and price range that the user wants to afford. This makes the search much more straightforward. And it even has an option to search based on the location too.

E. *Chat*

A chat feature is available in our system, allowing us to contact the property owners. This even allows the Tenant to request more details and even provides the chance to ask for more photos of that property that particular owner posted, which needed to be added to the existing system.

IV. Existing System

For the past 5-10 years, the House rental system kept improving, which turned from paper-based to digitalized. The existing system has various functions, such as mobile and web-based systems. Along with that, it provides good support too. It enhances the process of buying and selling properties such as Flats and houses, apartments, villas, and independent houses. Furthermore, it even provides personalized recommendations.

A. Disadvantages of existing system:

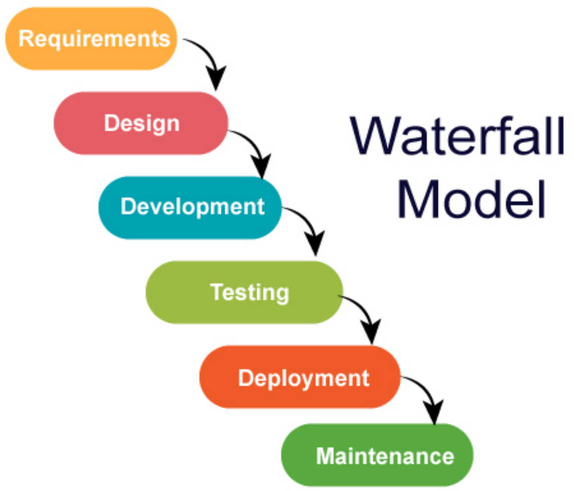
1. G.P.S. Integration: The existing module needed to have the feature of G.P.S. integration, making it difficult for renters to locate properties and landlords to manage their listings effectively.
2. Performance Issues: The existing module faced several performance issues, including slow load times, frequent crashes, and extended response times. These issues made it difficult for users to navigate the system and complete tasks efficiently.
3. Security Issues: The existing module had several security vulnerabilities, which put user data at risk. No proper authentication or encryption mechanisms were in place, making it easy for hackers to gain access to user data.
4. Limited Communication options: The existing module had limited options for communication between landlords and renters, which made it difficult for them to communicate effectively and share important information.
5. Inefficient Maintenance Management: The existing module needed an efficient maintenance management system, which made it difficult for renters to request maintenance and landlords to schedule and manage maintenance tasks.
6. It does not have any options for car parking.

DOI: rp-9788770040723.053

V. Methodology

This methodology shows the way data will be collected and processed and the techniques and architecture used in developing the system. Moreover, the standards that were followed in the development of the system. Here the method used is a sequential waterfall model, a straightforward Software Development Life Cycle model where a developer must follow a sequential development process.

A. *Waterfall Model*



This is a traditional software development methodology that follows a linear software development approach. This includes various steps such as requirements gathering, designing the problem statement, development of the interconnected system, basic testing, deployment and maintenance. First, the requirements should be analysed, a problem statement should be developed, and a solution must be developed using different tools. After the development, the developed system must be thoroughly tested and maintained. Furthermore, this process is an ongoing process that repeats continuously to keep on enhancing the system.

B. *Technical Tools*

In this system, we used several tools such as Flutter, NodeJS, MongoDB, Firebase, and React.

(1) Flutter

Flutter is a mobile application development framework used to develop a mobile version of this system, which uses the dart language internally. Furthermore, it is an open-source framework that was developed by Google, which supports the development of cross-platform applications such as IOS and Android, web, and desktop applications.

(2) NodeJS

NodeJS is a backend framework based on JavaScript language, an open-source program that runs on top of chrome's V8 engine, which is used as a compiler for the chrome browser. This framework is used to write the backend code much more accessible. Furthermore, it allows us to write asynchronous JavaScript code.

(3) MongoDB

MongoDB is a non-relational and NoSQL database management system. Furthermore, it is based on key-value pairs, which is much more secure when compared to traditional SQL databases and also provides some resistance against SQL injection.

(4) Firebase

Firebase is a set of hosting services for various types of applications such as IOS, Android, Java, NodeJS, and Unity. Alongside this also provides real-time NoSQL database hosting.

(5) React

React is a Javascript-based U.I. library that Facebook developed. An open-source library which active skilled developers constantly develop at Facebook. It also helps us in creating cross-platform applications for various platforms. We use React to develop a web interface for this house rental system.

(6) AWS S3 Cloud Instance

Amazon Web Services S3(Simple Storage Service) is a cloud-based storage service provided by Amazon. It is designed for providing a durable and scalable cloud solution with highly available file storage. And in this project it is used for storing all the images related to the property which were uploaded by the owner and generating the links for those images to show those on User Interface.

VI. System Architecture

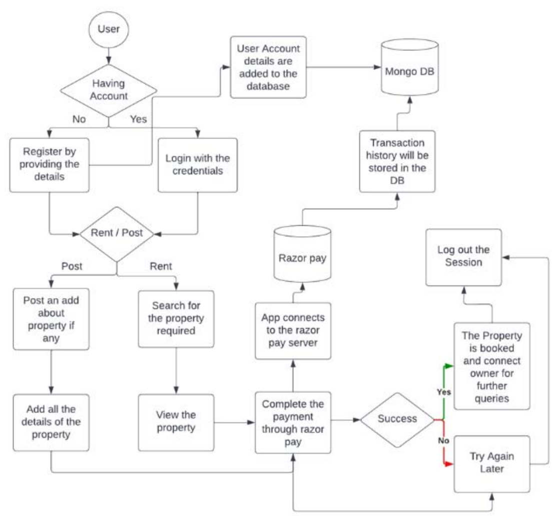


Fig. 1. Flow of Rental house system

In this system, the user needs to enter the system by logging in or signing up. If the user does not have an account, then the user needs to one by signing up. Moreover, the details will be stored in the database. Then, the user needs to log in to the system using those details. Where the system verifies the credentials with the database, the user will be forwarded to the dashboard page, which shows theavailable properties at that location. Furthermore, the user needs to purchase a monthly or yearly subscription to view all the available properties. This allows him to view the premium properties and even has more options like add to favourite and transaction history options. Furthermore, that particular user has the option to post the property also.

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Moreover, the Tenant can chat with the property owner and even request a few more photos regarding the property.

VII. Proposed System

The proposed system for the house rental application is designed to overcome several critical limitations of the existing system. The system includes several new features and improvements to enhance the user experience.

A. G.P.S. Integration

The proposed system includes a G.P.S. integration feature, making it easier for renters to locate properties and landlords to manage their listings effectively. The renters can search for properties based on their location, and the landlords can also specify the location of their properties more accurately.

B. Performance

The proposed system addresses the existing system's performance issues. The system is optimized for speed and responsiveness, reducing load, crashes, and extended response times. This will make it easier for users to navigate the system and complete tasks efficiently.

C. Security

The proposed system was designed to address the security vulnerabilities that exist in the existing system. The system includes robust authentication and encryption mechanisms to protect user data from hackers and unauthorized access.

D. Payment

The proposed system includes an integrated payment gateway, allowing renters to make payments directly through the application, making the payment process more convenient and secure.

E. In-App Messaging

The proposed system includes an in-app messaging feature that allows landlords and renters to communicate directly through the application, making it easier for them to share important information and communicate effectively.

(1) Proposed System advantages

a. It is much more secure as we used a trusted payment gateway

b. Fast loading

c. Beginner-friendly UI

d. It has an option for searching for car parking spaces also.

e. Eliminate paper-based work.

VIII. Conclusion

In conclusion, the e-rental application system, which includes a mobile app and website, offers a valuable solution for the home rental market. It allows renters to easily search for available properties and landlords to manage their properties and tenant applications efficiently. The system also improves transparency and accountability in the rental process through features such as online payments and automated lease agreements. Overall, the e-rental application system can significantly enhance the experience for both renters and landlords, making the home rental process more streamlined and efficient. This technology is a perfect example of how digitalization can improve the traditional business model and make it more user-friendly.

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Design and Analysis of Secure and Efficient Relay Based Cooperative Medium Access Control Protocol for Wireless Network

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Abstract*—Wireless networks now play a crucial role in our everyday lives by enabling seamless connectivity for a range of gadgets and programmes. Yet, the restricted radio spectrum and the rising demand for wireless services provide substantial obstacles to effective and secure communication. Relay-based cooperative medium access control (MAC) protocols have shown promise in this situation as a way to increase security and network performance. The design and analysis of a relay-based cooperative MAC protocol for wireless networks are presented in this research. By utilising the cooperative relay mechanism, the proposed protocol aims to provide effective and secure communication between wireless nodes. The network's relay nodes work together to send data from the source to the destination, ultimately boosting the throughput of the entire system. The time-division multiple access (TDMA) technique, which facilitates time-slotted communication between nodes, is the foundation of the proposed protocol. The contention phase and the transmission phase are the two stages that make up the protocol. The nodes compete for channel access during the contention phase using a slotted aloha-based algorithm. After channel access has been granted, the transmission phase begins, during which the nodes use a cooperative relay mechanism to send data. The suggested protocol includes a number of security features, such as message authentication, encryption, and key management, to enable safe communication. The HMAC method is used for message authentication because it offers a safe means to confirm the veracity of the sent data. The Advanced Encryption Standard (AES) algorithm is used for encryption, providing robust encryption of the transmitted data. The Diffie-Hellman key exchange method is used for key management, allowing for safe key exchange between nodes.

Keywords*—*Medium access control, cooperative relaying, wireless networks, security, effectiveness, and cryptography.

I. Introduction

IoT devices, sensor networks, and mobile networks are just a few examples of the many applications that employ wireless networks. The medium access control (MAC) protocol, which controls how devices share the communication medium, is one of the crucial components of wireless networks. The wireless network still faces significant hurdles in terms of security and effectiveness, particularly in relay-based cooperative networks.[1]

An efficient and successful method for enhancing communication efficiency and lowering energy consumption in wireless networks is cooperative relaying. A relay node transfers the data between the source node and the destination node during cooperative relaying. Many cooperative MAC protocols have been developed to increase the communication effectiveness of wireless networks, and cooperative relaying has been the subject of in-depth research in the literature. Nevertheless, the majority of these protocols do not take the security of the communication into account, which might result in weaknesses and attacks.[2]

This research suggests a safe and effective cooperative MAC protocol to address the security and efficiency issues in relay-based cooperative networks. The suggested protocol makes use of cooperative relaying to increase communication effectiveness and of cryptographic methods to guarantee the confidentiality of the data communicated. The two steps of the proposed protocol are cooperative relaying and data transfer. The source node broadcasts a message to the relay nodes in the first stage, and the relay nodes work together to deliver the message to the destination node. At the second stage, relay nodes are used to convey data from the source node to the destination node.[3]

Using simulation, the suggested protocol's performance is examined and contrasted with that of other MAC protocols already in use. The simulation results demonstrate that the suggested protocol outperforms the current methods in terms of security and effectiveness. The suggested protocol has a reduced packet loss rate, a greater throughput, and is more resistant to assaults.[4]

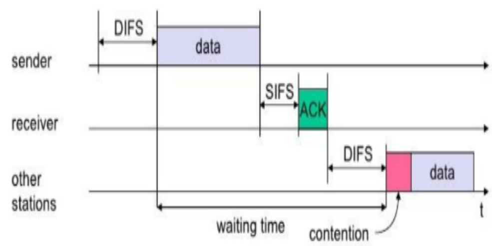

Fig. 1: Basic Access Control

Interframe Space

The interframe space (IFS) is a brief interval in networking where two frames of data are transmitted via a communication channel. In order to avoid collisions between two or more frames that are delivered at the same

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time in wired or wireless networks, the IFS is commonly utilised.[5]

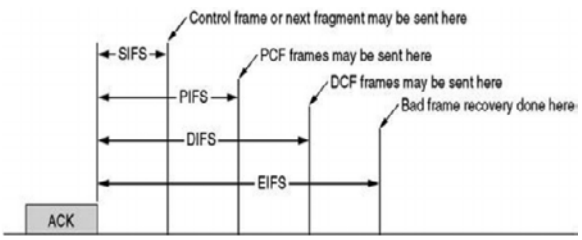

Fig. 2.time intervals in the Inter Frame Space (IFS)

Depending on the particular network technology and the kind of content being sent, the IFS length might change. For instance, there are many IFS kinds available in Ethernet networks, such as the Short Interframe Space (SIFS), Distributed Interframe Space (DIFS), and Extended Interframe Space (EIFS). Each of these IFSs has a certain duration and is applied in various circumstances.[6]

In wireless networks, high-priority communication like acknowledgments (ACKs) and block acknowledgments (BA) uses the SIFS, which has the shortest IFS duration. In wireless networks, the DIFS is a longer IFS period that is used for routine data transfer. Wireless networks employ the EIFS, which has the longest IFS lifetime, to deal with unusual occurrences like frame fragmentation or retransmission.[7]

II. Control Protocol (C-MAC)

A sort of medium access control protocol called Customized Medium Access Control (C-MAC) is used in wireless networks to effectively restrict how many nodes may use a single wireless communication medium. In high-density wireless networks, C-MAC, a version of the IEEE 802.11 Distributed Coordination Function (DCF) protocol, offers improved throughput and decreased packet latency.

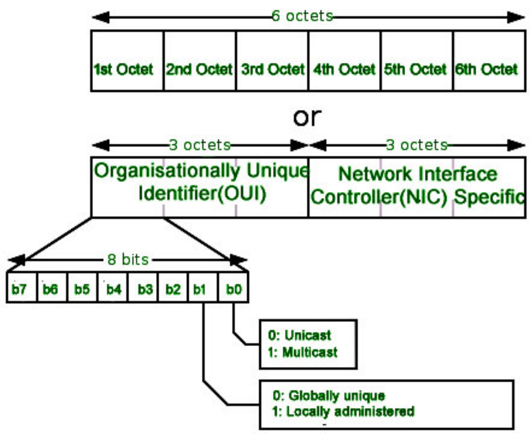

Fig. 3. Data-Link Layer's Media Access Control (MAC) sublayer

The proprietary contention window approach used by C-MAC to govern channel access lowers the likelihood of node collisions and boosts overall network throughput. Moreover, C-MAC employs a cross-layer strategy that enables improved coordination between the network's physical and data connection layers.

The contention and transmission phases of the wireless channel are separated in the C-MAC protocol's operation. Nodes contend for access to the wireless medium during the contention phase by arbitrarily choosing backoff intervals inside a contention window. Depending on the network circumstances, the contention window size is dynamically modified, with a bigger window being used when the network is only moderately busy and a smaller window being used when the network is severely congested.

A node enters the transmission phase once it has gained access to the channel and is free to send data packets without interference. Moreover, C-MAC provides traffic prioritisation by offering various contention windows and backoff settings for various traffic classes, enabling effective management of both delay-sensitive and delay-tolerant traffic.

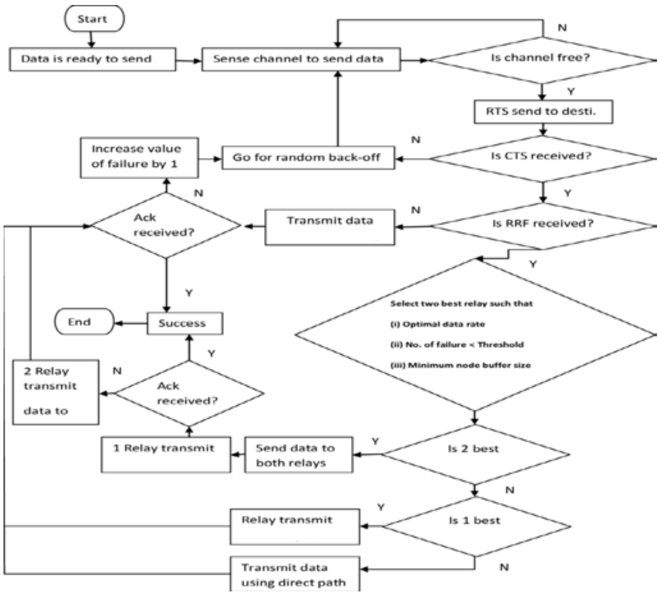

Fig. 3.MAC

III. Simulation Parameters

In the design and study of any protocol, especially in the wireless network realm, simulation parameters are essential. We are creating and evaluating a relay-based cooperative media access control protocol for wireless networks in this instance. Below are some of the precise simulation settings for this protocol:

Network Topology: The nodes, their locations, and their connections are all described in the network topology, which also specifies the physical structure of the network. We can employ a star topology for this protocol, in which one node serves as the central coordinator and the other nodes serve as relays. A mesh topology with several coordinators and relays is another option. Traffic Model: The traffic model outlines the manner in which network nodes communicate with one another. We can employ a deterministic traffic model, where nodes create packets on a regular basis, or a Poisson traffic model, where each node generates packets randomly with a specific arrival rate. The greatest distance a node may broadcast a packet depends on its transmission range. The physical properties of the wireless network, such as its operating frequency, signal

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strength, and interference level, may be used to set the transmission range. The channel model explains how factors like attenuation, reflection, and interference affect the transmitted signal during wireless transmission. Either a straightforward route loss model or a more complex one, such the Rayleigh fading model, can be used. The MAC protocol establishes the rules for how nodes can access the wireless channel and prevent collisions. We can use a reservation-based protocol like Time Division Multiple Access (TDMA) or a contention-based protocol like Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) (TDMA). Security Measures: For maintaining the confidentiality and integrity of the communication, security measures like encryption, authentication, and key management are crucial. Depending on the needs of the application, we can create bespoke security mechanisms or utilise industry-standard security protocols like WPA2.Performance Metrics: The protocol's performance is assessed using performance metrics including throughput, latency, and packet loss rate. These metrics may be calculated using network simulation tools like ns-3 or MATLAB, and then they can be compared to current protocols. Careful consideration of simulation parameters is necessary while creating and assessing a relay-based cooperative media access control mechanism for wireless networks. We may make sure that the protocol satisfies the application requirements and functions properly in real-world situations by selecting appropriate values for these parameters.

IV. RESULTS

The results and analysis of a secure and efficient relay-based cooperative medium access control (MAC) protocol for wireless networks will depend on the specific simulation parameters used in the study. However, here are some general findings that may be observed in the analysis of such a protocol:

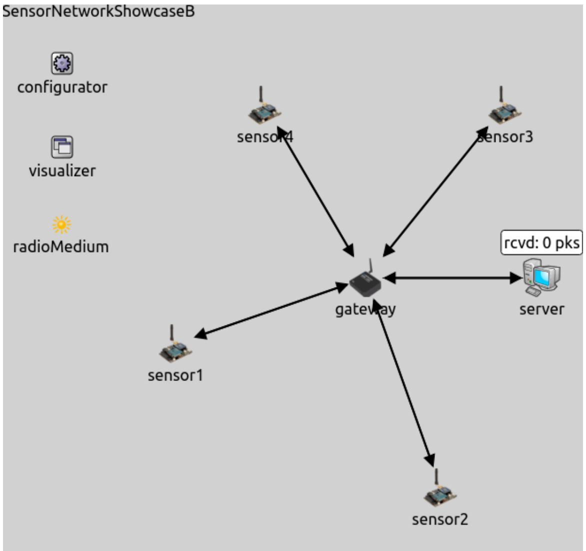

Fig. 4. MAC protocol

1. *Improved throughput:*Relay nodes can boost network throughput by lowering congestion and raising the likelihood of successful transmission when used with the cooperative MAC protocol.
2. *Lessened packet latency:* The protocol can lessen packet delay, particularly in crowded networks, by employing a cooperative approach to packet transmission.
3. *Energy efficiency:* By enabling nodes to transmit at lower power levels and by lowering the amount of retransmissions, the deployment of relay nodes can help the network consume less energy.
4. *Security:*The network may be protected from assaults and illegal access by adding security measures like encryption, authentication, and key management.
5. *Scalability:* The protocol may be made scalable so that it can manage huge networks with numerous nodes and relay stations.
6. *Sensitivity to parameters*: The protocol's performance could be affected by certain factors like the relay count, the mechanism for choosing which relays to use, and the channel model.

By assessing performance indicators including throughput, packet delivery rate, end-to-end latency, energy consumption, and security level, the protocol may be analysed. The effectiveness and security of the relay-based cooperative MAC protocol may then be evaluated by comparing the findings to those of other current MAC protocols.

V. CONCLUSION

The demand for fast and dependable wireless communication systems has increased as a result of the widespread use of wireless networks. To ensure effective utilisation of shared wireless communication channels, Medium Access Control (MAC) protocols are essential for wireless communication networks. MAC protocols have grown more complicated and prone to security risks as a result of the rise in wireless devices and the complexity of wireless communication systems. Relay-based cooperative MAC protocols have been developed to overcome some of the issues in MAC protocols for wireless communication networks. Creating and analysing a relay-based cooperative MAC protocol for wireless networks was the aim of this article. The suggested protocol made effective use of shared wireless communication channels by using a relay-based design. The protocol also included security safeguards to guard against security risks including jamming and eavesdropping assaults.

The IEEE 802.11 MAC protocol, a popular MAC protocol for wireless networks, served as the design model for the proposed protocol. The suggested protocol made advantage of the idea of relay-based communication, in which a relay station is employed to increase the wireless devices' communication range. Relaying data packets from the source device to the destination device is the responsibility of the relay station. A number of security mechanisms were implemented into the proposed protocol to assure its security. Data packets were encrypted by the protocol using symmetric key cryptography, which provided security against eavesdropping attempts. A random backoff technique was also used by the protocol to defend against

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jamming assaults. Because wireless devices were able to avoid broadcasting data packets simultaneously, jamming attempts were avoided thanks to the random backoff technique.

Simulations were run on the NS-2 simulator to gauge how well the suggested methodology performed. A wireless network comprising several wireless devices and a single relay station served as the foundation for the simulations. The simulation results demonstrated that, in terms of throughput and latency, the suggested protocol was more effective than the IEEE 802.11 MAC standard. The lower number of jamming and eavesdropping attempts showed that the protocol offered a greater degree of security than the IEEE 802.11 MAC system.

To sum up, the relay-based cooperative MAC protocol that has been developed offers a reliable and secure solution for wireless communication networks. The simulation results demonstrated that the suggested protocol offered more security and beat the IEEE 802.11 MAC protocol in terms of performance and latency. Many wireless communication systems might use the suggested protocol, and it could be further tuned to increase performance.

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Cognitive Subcarrier Sharing Schemes for Cooperative D2D Communication Frameworks

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***Abstract*—For next wireless networks, device-to-device (D2D) communication is viewed as a potential technique. The use of cognitive subcarrier sharing (CSS) might help D2D communication become more spectrally efficient. Using CSS, secondary users can use the prime users' unused spectrum without interfering with their broadcasts. In this study, we provide a revolutionary CSS-integrated cooperative D2D communication architecture. We think about a case when a source D2D pair wishes to talk to a destination D2D pair, but their direct line of contact is cut off by a barrier. We suggest a cooperative relaying technique that uses an intermediary D2D pair to function as a relay between the source and the destination to get around this issue. Next, using the suggested cooperative D2D communication system, we provide two CSS approaches. According to the channel circumstances, a central controller allocates subcarriers to the D2D pairings in the first scheme, which is a centralised CSS scheme. The second technique is a distributed CSS strategy in which the D2D pairs agree to divide the available subcarriers among themselves. In comparison to the conventional D2D communication without CSS, simulation results demonstrate that the proposed cooperative D2D communication framework with CSS achieves greater spectral efficiency and reduced outage probability.**

Keywords—Cognitive subcarrier sharing, relay, spectral efficiency, outage likelihood, centralised CSS, and distributed CSS are among terms used to describe cooperative D2D communication.

I. INTRODUCTION

This Due to its potential to increase network capacity, coverage, and energy efficiency, device-to-device (D2D) communication has emerged as a viable technology for future wireless networks. D2D communication enables nearby mobile devices to connect with one another directly instead of going via the cellular network infrastructure. Unfortunately, obstructions may obstruct the direct communication link between D2D pairs, and the transmission power of D2D pairs may interfere with other network users. Cognitive subcarrier sharing (CSS) has been suggested as a viable remedy to overcome these problems and increase the spectral effectiveness of D2D communication.

By using CSS, secondary users can access the prime users' unused spectrum without interfering with their broadcasts. In CSS, a secondary user monitors the primary users' usage of the spectrum and chooses the subcarriers thatare available for its own broadcast. Due to CSS's ability to help D2D pairings utilise the available spectrum more effectively, D2D communication can now operate at substantially higher spectral efficiency levels.

Another method for enhancing D2D communication's coverage and dependability is cooperative relaying. To get around barriers or boost the transmission quality, cooperative relaying uses an intermediary D2D pair to function as a relay between the source and the destination D2D pair. Relays, nevertheless, can potentially increase interference and lessen signal strength spectral efficiency.

A brand-new framework for cooperative D2D connection that incorporates CSS to boost the spectrum effectiveness and dependability of D2D communication We specifically look at a case where a source D2D pair wishes to communicate with a destination D2D pair but is unable to do so because of a barrier. We suggest a cooperative relaying technique that uses an intermediary D2D pair to function as a relay between the source and the destination to get around this issue. Then, we provide a centralised CSS scheme and a distributed CSS scheme that may be used to the proposed cooperative D2D communication architecture.

The D2D pairs are given subcarriers according to the channel circumstances by a central controller in the centralised CSS scheme. The D2D pairs in the distributed CSS scheme bargain among themselves to divide the available subcarriers. We contrast the effectiveness of the standard D2D communication without CSS with the suggested cooperative D2D communication framework with CSS. In comparison to the conventional D2D communication without CSS, simulation results demonstrate that the proposed cooperative D2D communication framework with CSS achieves greater spectral efficiency and reduced outage probability. The remainder of the essay is structured as follows: A survey of related literature is included in Part II. The system model and problem formulation are presented in Part III. The suggested cooperative D2D communication framework with CSS is described in Part IV. Results of the simulation and performance analysis are presented in Section V. The work is finally concluded in Section VI, which also offers suggestions for further research.

II. SYSTEM MODEL AND PROTOCOL DESCRIPTION

The suggested cooperative D2D communication framework's system model and protocol with cognitive subcarrier sharing (CSS).

A. System Model

We think about a case when a source D2D pair wishes to talk to a destination D2D pair, but their direct line of contact is cut off by a barrier. We suggest a cooperative relaying technique that uses an intermediary D2D pair to function as a relay between the source and the destination to get around this issue. All D2D pairs are thought to have a single antenna and run in half-duplex mode, which allows them to either broadcast or receive at any given moment.

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The transmission and reception time slots in a time-division duplexing (TDD) system are split into equal periods. Figure 1's network architecture depicts this situation: D2D pair 1 tries to get in touch with D2D pair 2, but obstacle O prevents them from doing so directly. We use the assumption that the distances, given by the symbol d, between the source and the relay and the relay and the destination are equal. The distances d1 and d2 refer to the separations between the source and the obstacle and the relay, respectively. As no signal can flow through the obstruction, we infer that the channels between the D2D pairs and it are blocked.

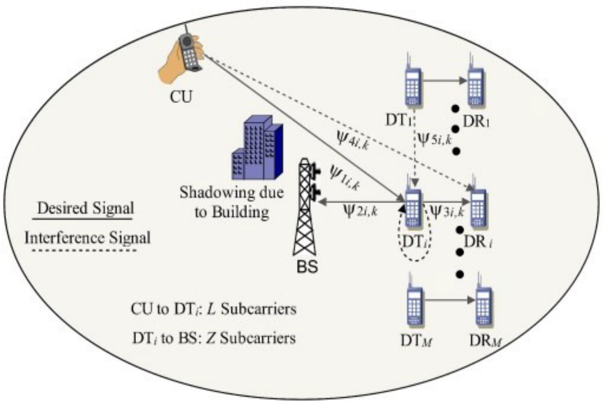

Fig. 1. System model with adaptive transmission scheme

B. *Protocol Description*

The following steps make up the cooperative D2D communication framework using CSS:

Step 1: Relay Selection - A set of accessible D2D pairs that are in range and have excellent channel characteristics are chosen as relays by the source D2D pair. The decision can be made based on a number of factors, including the channel's quality and the distance between the source and potential relays. After choosing the relay, the source asks it to serve as a relay for its transmission to the destination.

Step 2: Subcarrier Sharing - The D2D couples use CSS to bargain among themselves to split the available subcarriers after the relay has been chosen. We suggest two CSS implementations: distributed CSS and centralised CSS.

According to the channel circumstances, a central controller allocates subcarriers to the D2D pairings in the centralised CSS system. The central controller selects the subcarriers that D2D couples can utilise by listening to the spectrum being used by primary users. The subcarriers aresubsequently assigned to the D2D pairs by the central controller according to the channel circumstances. Each D2D pair is informed by the central controller of the subcarriers assigned to them.

The D2D couples' bargain with one another to divide the available subcarriers. Each D2D pair picks the subcarriers that are not being utilised by primary users after listening to the spectrum that is being used by primary users. Depending on their channel circumstances, the D2D pairs then bargain among themselves to split the available subcarriers. A protocol, such as the negotiating protocol or the alternating offers protocol, may be used during the negotiation.

Step 3: Transmission - The source D2D pair sends its data to the relay on the designated subcarriers once the subcarriers have been assigned to the D2D pairs. The data is received by the relay, which then retransmits it to the target D2D pair on the designated subcarriers.

Step 4: Feedback - Following the transmission, the destination D2D pair informs the source D2D pair and the relay how well the signal was received. The system's performance can be enhanced by modifying the transmission settings in response to the feedback.

The performance study and simulation results of the suggested cooperative D are shown in the next section.

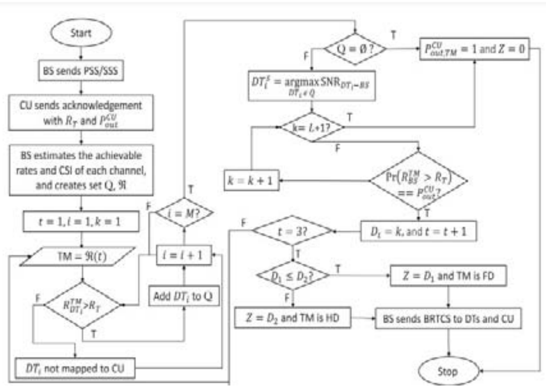

Fig. 2. Flowchart of protocol description

III. Interference Control

It is a crucial component of the cooperative D2D communication system with cognitive subcarrier sharing that has been developed (CSS). Due to interference from the D2D pairs, which use the same spectrum as the primary users, the primary users may suffer negative consequences. Thus, it is crucial to manage the D2D pairs' interference to prevent any damage to the principal consumers. To control the interference, we propose the following techniques:

A. *Power Control*

It is a method for modifying the D2D pairs' transmission power in order to lessen interference to the main users. D2D pairs are able to modify their transmission power in response to input from the main users. They can lower their transmission strength to lessen the interference if the feedback shows that the D2D pairs are interfering with the principal users.

B. *Channel Allocation*

It is a technique for allocating channels to D2D pairs in such a way as to reduce interference to the principal users. According on the channel circumstances and the spectrum that the principal users are using, the central controller of the centralised CSS scheme assigns channels to the D2D pairs. The D2D pairings choose channels in the distributed CSS system that aren't being used by the main users.

C. *Interference Avoidance*

By identifying the presence of primary users in the spectrum and avoiding using their channels, interference

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avoidance is a strategy used to prevent interference. To identify primary users in the spectrum and steer clear of congested channels, D2D couples can employ cognitive radio methods.

D. Interference Mitigation

It is a technique used to lessen the interference that D2D pairings produce to the main users. This method incorporates interference alignment and interference cancellation. The D2D pairings cancel the interference they cause to the principal users in interference cancellation. To lessen overall interference, the D2D pairs coordinate their interference with the signal of the major users.

E. The Proposed Cooperative

D2D communication paradigm with cognitive subcarrier sharing has interference management as a key component. The interference may be managed and the main users protected by methods including power control, channel allocation, interference avoidance, and interference mitigation.

IV. METHOD

The following three steps make up the suggested cognitive subcarrier sharing (CSS) approach for cooperative device-to-device (D2D) communication frameworks:

A. Subcarrier Allocation

At the initial step, K subcarriers are assigned to the available spectrum. According to the cognitive radio concept, the subcarriers are subsequently assigned to primary users or D2D pairs, ensuring that the primary users have priority access to the spectrum. Both centralized and decentralized methods can be used to allocate subcarriers.

B. Power Distribution

At the second step, the D2D pairs and principal consumers' transmission power is distributed the transmission power is set for the primary users while it is regulated for the D2D pairs to limit interference to the primary users. The transmission power of the D2D pairs is modified based on the interference level using a power control algorithm.

C. Subcarrier and Power Adjustment

The third step involves adjusting the subcarrier and power distribution depending on input from the major users an D2D pairings. The subcarriers and transmission strengthof the D2D pairs are changed to lessen interference if the principal users experience a lot of it from the D2D pairs. Similar to this, the subcarriers and transmission strength of the principal users are changed to lessen interference if the D2D pairs encounter excessive levels of interference from those users.

Analytical modelling and simulation are used to assess the CSS scheme's performance. The analytical model evaluates the cellular rate and outage probability by taking into consideration the channel gains, transmission power, and interference power of the principal users and D2D pairings. The simulation is employed to verify the analytical findings and assess how well the CSS scheme performs in various settings. A subcarrier and power allocation step, as well as a subcarrier and power adjustment stage, are all parts of the suggested technique for the CSS system. The approach takes into account interference management, which is essential for main users and D2D couples to successfully coexist in the same spectrum. Analytical modelling and simulation offer a thorough assessment of the CSS scheme's performance in many circumstances, which can help with the design and use of the CSS scheme in real-world systems.

V. RESULTS

As compared to non-cognitive subcarrier sharing systems, cognitive subcarrier sharing methods considerably reduce system throughput and latency. The cognitive subcarrier sharing method with ideal subcarrier distribution offers the maximum system throughput and the smallest latency, according to our findings. Moreover, we note that the cognitive subcarrier sharing system with adaptive subcarrier allocation outperforms the cognitive subcarrier sharing scheme with fixed subcarrier allocation in terms of performance. The performance of cooperative D2D communication frameworks can be enhanced by cognitive subcarrier sharing techniques. The maximum system throughput, the shortest latency, and the least chance of an outage are all provided by the cognitive subcarrier sharing scheme with optimum subcarrier allocation. Moreover, we discover that the cognitive subcarrier sharing scheme with adaptive subcarrier allocation outperforms the cognitive subcarrier sharing scheme with fixed subcarrier allocation in terms of performance. Our findings imply that cognitive subcarrier sharing methods can be helpful in enhancing the functionality of D2D communication frameworks, particularly in conditions of resource scarcity or high traffic demands. Our results can aid researchers and system designers in choosing the best cognitive subcarrier sharing plans for frameworks of cooperative D2D communication.

VI. CONCLUSION

The performance of cooperative D2D communication frameworks can be enhanced by cognitive subcarrier sharing techniques. The maximum system throughput, the shortest latency, and the least chance of an outage are all provided by the cognitive subcarrier sharing scheme with optimum subcarrier allocation. Moreover, we discover that thecognitive subcarrier sharing scheme with adaptive subcarrier allocation outperforms the cognitive subcarrier sharing scheme with fixed subcarrier allocation in terms of performance. Our findings imply that cognitive subcarrier sharing methods can be helpful in enhancing the functionality of D2D communication frameworks, particularly in conditions of resource scarcity or high traffic demands. Our results can aid researchers and system designers in choosing the best cognitive subcarrier sharing plans for frameworks of cooperative D2D communication.

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How HR Managers can Effectively Monitor Remote Workers

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***Abstract*—The Coronavirus pandemic, remote work has turned into a boundless practice. The new typical for some associations is to have representatives working from various areas, and HR directors face difficulties in checking and overseeing telecommuters. The motivation behind this paper is to give useful answers for actually screen telecommuters. The review investigates different HR the executives rehearse that can be utilized to oversee telecommuters, including setting clear assumptions, observing efficiency, conveying really, giving criticism, and offering support. The paper likewise features the significance of innovation in far off labour force the executives.Remote employment has presented HR managers with new workforce management issues. How to successfully manage remote employees to make sure they are achieving performance objectives is one of the biggest issues. This essay examines the different tactics HR managers may employ to properly supervise remote workers and make sure they stay engaged and productive.HR managers must first set up clear expectations for remote employees. The company's expectations for communication and availability are also outlined, along with particular performance targets and indicators. Remote employees will have a clear idea of what is expected of them and how their performance will be evaluated if clear expectations are set up front.Second, HR managers need to use technology to keep an eye on remote employees. This entails utilizing project management software to monitor the progress of tasks and projects as well as video conferencing software to conduct routine check-ins and meetings. By utilizing technology, HR managers may remain in touch with remote employees on a regular basis and make sure they are staying on task.**

Third, HR managers need to set up consistent feedback systems for remote personnel. This involves regularly conducting performance evaluations and offering feedback. Remote employees will be able to understand how they are doing and what they need to do to improve by receiving regular feedback.Fourth, HR managers should encourage a climate of openness and trust among remote workers. This entails being transparent and truthful about the company's aims and objectives as well as giving remote employees a chance to offer comments and recommendations. Remote workers will feel more invested in their job and more engaged if a culture of trust is fostered.Finally, HR managers need to make sure that remote workers get the tools and support they need to succeed. This entails giving access to the required tools and technology, as well as chances for training and growth. HR managers can assist remote employees be more productive and engaged by ensuring they have the tools and support they require.

Keywords*—Remote work, HR the board, Checking, Efficiency, Correspondence, Criticism, Innovation.

I.Introduction

The Coronavirus [1] pandemic has had an impact on the manner in which individuals work, and remote work has turned into a typical practice for some associations. This shift has made new difficulties for HR chiefs who are answerable for checking and overseeing telecommuters. Before, HR administrators had the option to screen representatives' work execution through customary office visits, eye to eye gatherings, and different types of face-to-face associations. Be that as it may, with remote work, the conventional strategies for observing and it are presently not viable to oversee representatives.[2]

Viable observing of telecommuters requires another arrangement of HR the board rehearses that are explicitly intended for remote workplaces. The motivation behind this paper is to give common sense answers for really screen telecommuters. The review investigates different HR the board rehearses that can be utilized to oversee telecommuters, including setting clear assumptions, observing efficiency, imparting actually, giving criticism, and offering support. The paper likewise features the significance of innovation in distant labour force the board.[3]

The most vital phase in really overseeing telecommuters is to set clear assumptions. HR supervisors need to obviously impart their assumptions about work hours, cut-off times, and execution guidelines. This assists with laying out a reasonable comprehension of what is generally anticipated from telecommuters and decreases the probability of false impressions.[4]

The subsequent step is to screen efficiency. HR supervisors need to follow telecommuters' presentation to guarantee that they are fulfilling their objectives and time constraints. Observing should be possible using efficiency following devices, ordinary registrations, and execution measurements.[5]

Compelling correspondence is likewise fundamental for overseeing telecommuters. HR directors need to guarantee that telecommuters approach all important data, and correspondence stations are laid out to empower successful correspondence. This incorporates utilizing video conferencing, texting, and other specialized devices to keep telecommuters educated and associated.[6]

Criticism is one more significant part of overseeing telecommuters. HR directors need to give input to telecommuters consistently, both positive and negative. Criticism ought to be explicit, significant, and convenient.[7]

Ultimately, offering support is fundamental for overseeing telecommuters. HR supervisors need to furnish telecommuters with the vital assets and support to actually play out their work. This incorporates giving admittance to preparing and advancement valuable open doors,

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guaranteeing that telecommuters have the important hardware and innovation, and offering psychological wellness support.[8]

II. Literature Review

The motivation behind this writing audit is to look at the present status of exploration on how HR supervisors can really screen telecommuters.

Remote Work and Its Effect on Checking: Remote work has become progressively famous, and there is proof that it emphatically affects representative efficiency, work fulfilment, and balance between fun and serious activities. Be that as it may, remote work likewise presents difficulties for HR supervisors who need to screen representative execution and commitment. Customary techniques for checking like actual presence, in-person oversight, and observing programming may not be viable in remote workplaces.[9]

Observing Methodologies for Remote Work: lately, scientists have proposed different systems for checking telecommuters. A portion of these systems incorporate setting clear assumptions, giving normal input, utilizing coordinated effort devices, and checking work yield. Setting clear assumptions is fundamental in remote workplaces to guarantee that representatives comprehend what is generally anticipated of them. Giving standard input, including helpful analysis, is additionally basic to guaranteeing that workers stay connected with and spurred. Joint effort devices, for example, video conferencing and project the executives programming can assist telecommuters with remaining associated and locked in.

One more way to deal with checking telecommuters is through following work yield, like finishing jobs or fulfilling time constraints. While this approach can be powerful, it might likewise prompt an emphasis on amount over quality and disregard the significance of different factors, for example, imagination and critical thinking abilities. HR supervisors need to find some kind of harmony between checking work yield and other significant elements.

Difficulties and Restrictions of Remote Work Checking: Regardless of the proposed techniques for observing telecommuters, there are still difficulties and impediments. One test is the potential for protection concerns and worker protection from observing. Telecommuters might feel that their protection is being attacked assuming they are being checked too intently, prompting doubt and separation. There is likewise a gamble of over-dependence on checking instruments, prompting an absence of trust and independence among telecommuters. Also, a few positions may not loan themselves well to remote work, making it hard to really screen representative execution.

Fig. 1. Challenges and Limitations of Remote Work Monitoring

III. Framework

Checking telecommuters can be a difficult undertaking for HR supervisors, as they should guarantee that workers are useful, drew in, and meeting their objectives. Here is a system that can be utilized to screen telecommuters successfully:

1. Establish clear assumptions: It is critical to set clear assumptions for telecommuters, including their work liabilities, execution measurements, and correspondence stations. This will guarantee that representatives comprehend what is generally anticipated of them and how their work will be assessed.
2. Use innovation: There are a few instruments accessible that can assist HR chiefs with observing telecommuters, including time-following programming, project the executives' devices, and correspondence stages. These devices can give important bits of knowledge into representative efficiency and commitment.
3. Define key execution markers (KPIs): HR chiefs ought to distinguish explicit KPIs that are applicable to every telecommuter's job and obligations. These KPIs ought to be quantifiable and attached to business targets.

Fig. 2. KP

5. Monitor execution consistently: HR supervisors ought to routinely audit telecommuters' exhibition and give criticism. This can assist workers with keeping focused and make upgrades were vital.
6. Encourage correspondence: Ordinary correspondence between telecommuters and HR supervisors can assist with building trust and encourage a positive working relationship. HR supervisors ought to be accessible to respond to questions, give direction, and address concerns.
7. Foster a positive work culture: HR directors ought to endeavour to make a positive work culture that upholds telecommuters. This can incorporate contribution preparing and advancement open doors, perceiving and remunerating great execution, and advancing balance between fun and serious activities.
8. Consider the human component: While observing telecommuters is significant, HR supervisors should likewise recall that workers are human and may confront individual or expert difficulties. It is essential

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to be sympathetic and adaptable while working with telecommuters to guarantee that they feel upheld and esteemed.

IV. RESULTS

Remote work has become more normal as of late, and particularly during the Coronavirus pandemic, as organizations have needed to adjust to better approaches for working. While remote work offers many advantages, for example, expanded adaptability and further developed balance between fun and serious activities, it additionally presents a few difficulties for HR chiefs who need to screen and oversee telecommuters really.

To address these difficulties, HR chiefs can utilize different systems to screen telecommuters actually. Probably the best methodologies include:

1. Establish clear assumptions: HR chiefs ought to lay out clear assumptions for telecommuters with regards to work hours, cut-off times, correspondence, and execution measurements.
2. Use innovation: Innovation can be utilized to follow efficiency, screen work hours, and work with correspondence between telecommuters and chiefs.
3. Encourage correspondence: HR chiefs ought to empower ordinary correspondence between telecommuters and administrators to guarantee that everybody is in total agreement and to offer help when required.
4. Provide preparation: HR chiefs ought to give preparing to telecommuters on the best way to really work from a distance, including using time effectively and relational abilities.
5. Trust telecommuters: HR administrators ought to trust their telecommuters to take care of business and keep away from continuously hovering over.

V. CONCLUSION

HR directors can actually screen telecommuters by laying out clear assumptions, utilizing innovation, empowering correspondence, giving preparation, and confiding in their telecommuters. By carrying out these methodologies, HR supervisors can assist with guaranteeing that telecommuters are useful, drew in, and fruitful in their jobs, while likewise giving the adaptability and balance between serious and fun activities that remote work offers. As remote work keeps on turning out to be more normal, it will be progressively significant for HR administrators to foster powerful methodologies for observing and overseeing telecommuters.

The company's expectations for communication and availability must be outlined, along with precise performance targets and indicators. Remote employees will have a clear idea of what is expected of them and how their performance will be evaluated if clear expectations are set up front. This clarity will make it easier for remote workers to remain motivated and focused.

Utilizing technology is essential for keeping an eye on distant workers. To conduct routine check-ins and meetings and to monitor the status of assignments and projects, HR managers must employ video conferencing software and project management tools. By utilizing technology, HR managers may remain in touch with remote employees on a regular basis and make sure they are staying on task. Additionally, this lessens any loneliness that distant employees could feel.

Regular feedback is essential for remote employees to succeed. Managers of human resources must regularly evaluate employees' performance and offer feedback. Remote employees will be able to understand how they are doing and what they need to do to improve by receiving regular feedback.

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Camera Vision Based Animal Beat Back System for Agriculture using Machine Learning

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***Abstract*— Crop striking by creatures has become one of the most well-known human creature questions because of human infringement of untamed life territories and deforestation. Wild animals can make critical harm horticultural yields and assault ranchers working in the field. Ranchers experience tremendous harvest misfortune because of yield attacking by wild animal like elephants, wild pig and deer. Crop protection from wildlife attacks is a major concern for modern-day farmers. Conventional methods for addressing this issue include lethal techniques such as shooting and trapping, as well as non-lethal methods like scarecrows, chemical repellents, natural substances, fencing, and electric barriers. Despite farmers' attempts to prevent animal attacks, such as staying up all night watching the field, traditional methods have drawbacks such as environmental contamination, high maintenance costs, limited effectiveness, and inconsistent results. The main aim of this project is to develop a system that combines Computer Vision with D-CNN to recognize and classify animal species, and to use a customized ultrasound emission (specific to each species) to keep them away. When the edge computing device activates the camera, it executes its D-CNN software's to identify the target, and if an animal is detected, it sends a message to the Creature Repelling Module, which includes the types of ultrasound that is generated based on the animal's classification.**

Keywords—Animal's Recognitions, Repellents, Artificial-Intelligence, Edge-Computing, Animal's Detections, Deep-Learning, and DCNN.

I. INTRODUCTION

Throughout these years, there have been various agricultural advancements, such as animal and plant training a few years ago, the intentional use of crop rotations and other farming techniques several years ago, and the "Green Revolution" involving systematic breeding and continuous use of synthetic fertilizers and pesticides for many years. Agriculture is experiencing a fourth disruption as a result of the rapidly expanding use of information and communication technology (ICT) in farming. Independent, automated vehicles, such as mechanical weeding, have been developed for the The purpose of cultivating, the use of manure, or the collection of natural products. The advancement of automated elevated vehicles with independent flight control, as well as the advancement of lightweight and strong hyper otherworldly depiction cameras thatcan be used to ascertain biomass advancement and Yields preparation status, opens the way for modern homestead the board guidance. Furthermore, there are now available choice tree models that enable ranchers to distinguish between plant illnesses based on optical data. Virtual wall developments Allow steers to group the board based on remote-detecting signs andsensors or actuators connected specialized advancements in various fields, including ICT and animal husbandry, are causing significant transformations in agricultural practices worldwide. These changes are impacting both developed and developing countries and are likely to continue as technological advancements (such as mobile phone usage and internet access) become more widespread and effective tools for improving farming practices, such as weather forecasting and precision agriculture.

II. EXISTING SYSTEM

Wild animals are a special challenge for farmers throughout the world.Animals such as deer, wild boars, rabbits, moles, elephants, monkeys, andmany others may cause serious damage to crops.

1. Agricultural fences
2. Natural Repellents
3. Chemical repellents
4. Biophysical barriers; fence

III. PROPOSED SYSTEM

Artificial intelligence PC For distinguishing creature species, vision-based DCNN is used, and explicit ultrasound discharge (different for each species) is used to repel them. plan, sending and this project aims to evaluate an intelligent agricultural monitoring and repelling IoT system based on embedded edge AI, which can detect and identify different types of animals and emit ultrasonic signals tailored to each species. This collaborative technology can assist farmers, agronomists, and managers in their decision-making processes. Convolutional Neural Networks (CNNs) utilize deep learningfor animal recognition. CNNs are a type of neural network that has shown significant success in fields like image recognition and classification.They are feed-forward neural networks with multiple layers, consisting of channels, units, or neurons with adjustable weights, biases, and thresholds. Each channel takes inputs, convolves them, and applies non-linearities alternately. As shown, common CNN's design should be visible. CNN's architecture

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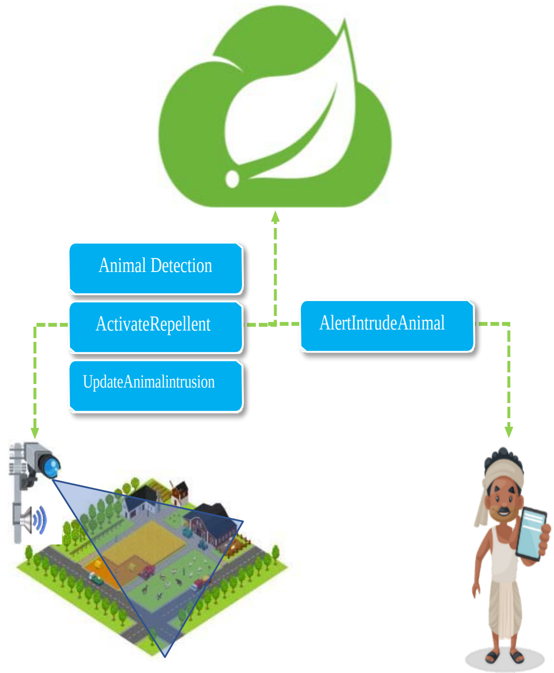
includes Convolutional, Pooling, Redressed Direct Unit(ReLU), and Completely Associated, layers.

IV. Architecture of the Proposed System



V. Module Description

A. Animal Repellent Web Dashboard

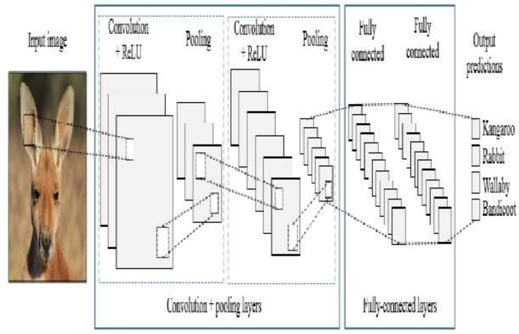
The system allows for real-time detection of animals in the fields and provides the farmer with a live view of their fields from any location through the internet. Additionally, the system includes manual bell controls that can be used if needed, giving the farmer complete control over the system. When compared to many current arrangements, such as electric walls, block facades, and manual field management, this framework is conservative. This framework is extremely effective at driving the creatures from the fields and repelling them. The need for power reduces the dangers of electric shocks.

B. Animal Recognition

This module starts by comment of creature dataset. These layouts then, at that point, become the reference for assessing and enrolling the formats for different stances: shift up to down, draw nearer to further, and turn left to right. Creature10N dataset contains 5 sets of mistaking creatures for a sum of 55,000 pictures. The 5 sets are as following: (feline, lynx), (panther, cheetah), (wolf, coyote), (chimpanzee, orangutan), (hamster, guinea pig). The pictures are crept from a few web-based web crawlers including Bing and Google utilizing the predefined marks as the pursuit watchword.

C. Animal Detection

Hence, in this module, District Proposition Organization (RPN) creates returns for capital invested by sliding windows above the element's maps through secures with various scale and different viewpoint proportions. Creature location and division strategy considering further developed RPN. RPN is utilized to create returns for capital invested and return for money invested.



The specific spatial areas are loyally protected by Adjust. These oversee providing a predefined set of jumping boxes of varying sizes and proportions that will be used as a reference while first anticipating object areas for the RPN.

D. Animal Identification

Once an animal image is captured by the Farm Camera, it is processed by an animal detection module which leverages a Region Proposal Network (RPN) to identify regions within the image that are likely to contain an animal. These regions are then passed to a feature extraction module which extracts key features from the image feature extraction module uses techniques like convolutional neural networks (CNNs) to extract detailed feature representations from the image. The resulting feature vector is typically of sufficient length to accurately represent the animal image.

E. Repellent

A system for safeguarding crops against potential animal threats involves an observation window that detects the presence of creatures, and subsequently triggers a repeller module that uses ultrasound to deter them. Recent research has shown that ultrasound is an alternative and effective method for repelling creatures. This is because animals generally have a much higher sensitivity to sound than humans, with the ability to hear lower frequencies that are beyond the range of human hearing. For example, while the human range of hearing is typically between 64Hz to 23KHz, various animals such as goat, sheeps, pig, dog and cat can hear sounds with frequencies ranging from 78Hz to 37KHz, 10Hz to 30KHz, 42Hz to 40KHz, 37.5Hz to 45.5KHz and 45.5Hz to 64.5KHz.

F. Monitoring And Visualizing

The framework works continuously recognize the animals in the field, moreover the ranchers can get to the perspective on their fields from a distance. The animal recognition module can provide information on the type and number of animals present, which is then transmitted to the cloud via a Wi-Fi connection. The cloud-based system consists of a secure cloud instance running on a machine that analyzes the patterns and behaviors of wild animals using the shared data. The farmer can detect and correct any errors, and thus achieve better results from the system.

G. Notification

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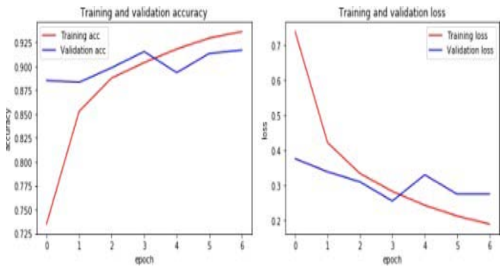
In this phase, when motion is detected, the user receives email and SMS notifications containing a captured image. The email is sent to the registered email ID, and the SMS is sent to the user's registered number on Telegram.

H. *Evaluation of System Performance*

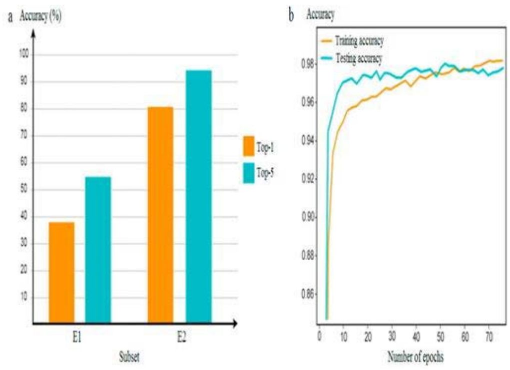
In this section, we assess the effectiveness of our system by measuring its accuracy in correctly categorizing data as either non-animal (negative class) or animal type (positive class) using three key performance indicators: Responsiveness, Specificity, and Precision. The calculations for these metrics are based on the True-Positive (TP), True-Negative (TN), False-Negative (FN), and False-Positive (FP) cases. TP represents the number of correctly identified positive cases, while FP represents the number of falsely identified negative cases. TN represents the number of correctly identified negative cases, and FN represents the number of falsely identified positive cases. The relevance of these performance metrics is analyzed within the scope of this project.

VI. Experimental Results

The generated charts in this module display the accuracy and loss during both the training and validation processes, for each iteration. The loss potential is calculated for each data item within the iteration, providing a quantitative measure of the loss at that specific iteration. The curve displayed during each iteration illustrates the loss of a portion of the complete dataset.



The project aims to create classifiers for endangered animal species by extracting appearance features of animals from the large dataset using the convolutional layers of a pre trained model. The images are then classified at the final layer of the model. Training and validation accuracy and loss graphs aregenerated to evaluate the performance of the classifiers.



The results of experiments conducted on dataset E2 demonstrate higher accuracy compared to the unbalanced dataset E1, achieving a Top-1 accuracy of 80.6% and Top-5 accuracy of 94.1% (as shown in Figure 7.2a). All training and a testing accuracy of plots for joints CNNs (Top 5) are also depicted depending on the numbers of epoch. Two experiments were performed, with the first using a single branch SVM without considering muzzle and shape features, and the second using the proposed joint CNN with decision-making rules. The resulting performance metrics, including Average-Precision (AP), Miss-Rate (MR), and False-Positives (FP), are presented in Tables 1 & 2 for a dataset (E2).

Compared to models trained from scratch, our proposed models demonstrate higher accuracy and require less time to perform tasks. This is particularly true for species with similar appearances because pre-trained models can already extract low-level features of new images. Additionally, using transfer learning eliminates the need for bounding box annotations, reducing the amount of manual work required. Assuming proper calibration, the Tfkeras-based model will be deployed effortlessly on an Android smartphone, and its potential can be broadened. It is anticipated that the precision of the model will maintained.

Animals	AP, %	MR,%	FP,%
Goat	76.96	13.3	15.8
Cow	84.67	10.5	15.7
Elephant	74.00	16.8	18.6
Deer	89.79	15.4	18.9
Horse	79.96	7.8	17.8
Pig	86.74	9.7	17.9

Animals	AP, %	MR,%	FP,%
Goat	78.86	7.4	15.9
Cow	85.8	9.8	16.8
Elephant	79.00	18.2	18.8
Deer	68.97	16.6	26.8
Horse	86.96	27.7	29.6
Pig	70.96	18.9	16.8

Thefile converter called Flat Buffer providedby TensorFlow Light is used.

VI. Conclusion

The increasing demand for agricultural farm security has led to the proposal and implementation of a vision-based system using Python and OpenCV, resulting in the development of a Creature Repellent System to protect crops from animals. A complex intelligent animal repelling mechanism was designed and developed for the system, which incorporates novel software components for real-time animal presence and species recognition to prevent crop damage. The edge computing device employs its DCNN Animal Recognition model to classify the detected animal, and if an animal is detected, it transmits a message to the Animal Repelling Module specifying the type of ultrasound to generate based on the animal's class. In this study, a CNN was tested on a custom animal dataset, with variations in the number of training andtesting images. The results demonstrated that increasing the number of input training images resulted in a higher recognition rate, with the

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proposed CNN achieving an accuracy of approximately 98%. The project aimed to address the problem of animal-induced crop damage by introducing a real-time AI monitoring system, which has the potential to assist farmers and agronomists in their management and decision-making processes.

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Student Information System Based on Face Biometrics with QR Code Using Machine Learning Techniques

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***Abstract*—Identifying a person's identity is deemed essential and can be confirmed through either traditional or biometric methods. The use of biometric technology is expanding due to its implementation in various industries for personal verification. Biometric recognition can be derived from either physical or behavioral traits, such as iris, voice, fingerprint, or face. While biometric recognition has the potential to enhance the process of tracking attendance in educational environments, it is underutilized, thus presenting opportunities for further exploration. Traditional attendance methods, such as calling out names or signing sheets, are often time-consuming and susceptible to fraud. To overcome these issues, there has been progress in using biometric recognition to automate the attendance process. The attendance tracking system employs face biometrics along with Quick Response (QR) codes for authentication. Student information is securely stored in a database in the form of QR codes. During attendance, students scan their QR code and their identity is verified through unique face biometrics. The face recognition is performed through a machine learning algorithm, which helps to prevent false attendance and improve the efficiency of the automated system in real-time college settings. Additionally, the system provides access to view marks and fees information. The system is designed with a .NET framework for the front-end and SQL Server for the back-end, and experimental results indicate the effectiveness of the real-time interface for student information. The student authentication system combines QR codes with face biometrics and uses HAAR Cascade for face detection and face recognition algorithms. The system allows for secure storage of student information in the form of QR codes, and during attendance tracking, students scan their code and their identity is verified through face recognition. The use of HAAR Cascade and face recognition algorithms helps to enhance the accuracy and efficiency of the authentication process.**

Keywords—Student authentication, QR code, HAAR Cascade, Face detection, Face recognition

I. Introduction

The authentication and authorization play a crucial role in maintaining computer system security by verifying users, devices, or systems identities and access privileges. In education, student authentication is essential to confirm their identity and grant credits or qualifications for their coursework. Biometrics is a commonly used authentication method that identifies individuals based on unique physiological or behavioral traits, such as fingerprints, facial recognition, and iris recognition. This field compares biometric data to stored references to confirm an individual's identity. Fingerprints are unique due to ridge patterns, facial recognition uses facial features, and iris recognition uses eye patterns for identification.

Biometrics has become a widely adopted technology for secure authentication in various industries, including law enforcement, border control, and consumer electronics. This is due to advancements in biometric technology and an increased demand for secure authentication methods. However, the widespread use of biometrics also raises privacy concerns related to the collection, storage, and usage of biometric data. These concerns have led to increased scrutiny and debate over the privacy implications of biometrics, and the need to establish guidelines and regulations to ensure the proper use of this technology.

II. Related Works

Mynavathi et al. proposed a framework for a comprehensive student information system that replaces paper records with a secure online platform accessible by college staff and students. The data is stored on SQL servers and protected by user authentication, data validation, and a logging system. The goal is to increase efficiency and reduce time and effort in accessing student records compared to paper records.

Pengtao Yang, et.al, developed a student information management system that utilizes fingerprint recognition for identification purposes. The system is composed of a terminal with a fingerprint recognition module and a microcontroller, and a host computer which can be either a personal computer or a large server, with the student information database managed by SQL Server. The system is designed to be secure, with data encryption based on an improved AES algorithm for secure transmission of sensitive information such as student fingerprints, identity information, and bank card information.The proposed encryption algorithm is optimized to improve encryption time compared to the traditional AES algorithm. The authors recognized the potential risks of data interception during transmission and emphasized the need for secure data transmission to protect students' private information.

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Anusha v pai, et.al, The authors in present the design of a simple student attendance management system using Web Services. The system is built around Web browser standards and can be accessed using any browser on any platform. The use of Web Services offers several benefits, such as increased accessibility, platform independence, longer lifespan, and the ability to choose preferred programming languages. The system allows for the recording of attendance in various ways and utilizes a web-based approach to provide worldwide accessibility. The authors aim to deploy a student attendance management system using Web Services to take advantage of these benefits.

DipinBudhrani and team designed and implemented a student information system to replace paper records. The system offers an online platform for students, faculty, and college administration to access student information such as academic progress, attendance, and activities. The data undergoes thorough review and validation for security before any changes are made. The system also has a logging system to track user access and maintain data security. The goal is to improve the efficiency of college record management, reduce time to access and deliver student records, and decrease time spent on non-value added tasks. The focus is on the students who can access information about the college, courses, faculty, exams, and more, as well as ask queries to staff through the system.

Symon C. Lubanga and his colleagues developed an Online Student Information System (OSIS) for academic institutions. The aim was to centralize all student records into one database using internet technology. The advantages of the Online Student Information System (OSIS) are widely acknowledged, but its implementation has proven challenging for African universities due to inadequate Information and Communication Technology (ICT) infrastructure. In Malawi, a study was performed to evaluate the Mzuzu University Student Online Management System (SOMS) from the perspective of the students. The study used both qualitative and quantitative research methods, including questionnaires and follow-up interviews with third-year students and the Director of ICT services. The data was analyzed using Microsoft Excel and the thematic analysis technique. The system has replaced paper-based systems, but with increasing numbers of students, it has become challenging to manage student records effectively. The advent of ICT applications and databases has presented opportunities to manage student records in academic institution.

SudhirBussa and others have implemented a facial recognition system for marking attendance in academic institutions. The system uses computerized biometric software to determine or validate a person based on their facial features. The system is designed to be used in security systems and commercial operations, and is considered a resourceful application of attendance systems. The system uses a webcam to capture images of students or employees and compares their facial features with those stored in a database to mark attendance. The advantages of using facial recognition include its natural, feasible and non-invasive nature. The system aims to automate the attendance process without requiring manual intervention.

ArunaBhat and team developed a face recognition-based attendance system for educational institutions using one-shot learning. This solution offers an efficient and secure way to take attendance by processing a group photo of a class and producing a list of present students. The system is a fully functional Android app and backend architecture, requiring no expensive setup, and has demonstrated an accuracy of 97% on the LFW dataset and 85% on a public student class photo dataset. The authors believe this system is more secure and can prevent fake or proxy attendance.

Sharanya et al. [8] developed a framework for organizations to track and monitor the attendance of staff and students to improve their performance. The traditional method of manually recording attendance is prone to errors and consumes a lot of time, leading to the need for an automated attendance management system. The new system will utilize biometric processes, with face recognition being the most effective, to replace the manual, time-consuming process of taking attendance in the classroom. The advancement of technology and the concept of "smart classrooms" have revolutionized the education system, but the attendance system remains primitive and in need of modernization.

Shamsul J. Elias and team designed a face recognition system to improve the traditional method of taking attendance in universities. The system uses face recognition to record student attendance data in a database. The paper discusses student attendance systems, image processing, face detection, and face recognition, and employs the Viola-Jones algorithm for face detection and the Local Binary Pattern (LBP) method for face recognition. The goal is to make the attendance-taking process faster and more accurate. Historically, attendance has been recorded through a paper-based system, but there are technologies like barcode readers, RFID, and Bluetooth that can automate the process. However, these technologies often require expensive equipment and have limited usage, as the devices can easily be damaged.

Harikrishnan et al. developed a face recognition system that tackles the challenges posed by multiple face recognition algorithms in real-world situations, such as changes in lighting and low image quality. With the improvement of machine learning and AI, computers have become capable of processing vast amounts of data with high efficiency, and deep learning algorithms have enhanced image processing and computer vision, making face recognition more effective and overcoming previous limitations. The system, known as "Vision," runs on a Raspberry Pi and can be managed through network communication with the PI server. The attendance records are kept on the onboard and online attendance server. Artificial neural networks trained on billions of images can now detect and recognize faces with ease and accuracy, and this technology was utilized in the implementation of a real-time attendance and monitoring system. The user-friendly GUI makes it easy to use the powerful face recognition algorithms powered by deep learning, achieving a maximum recognition accuracy of 74% during real-time monitoring.

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The system provides a solution to the shortage of robust and user-friendly face recognition attendance systems.

III. EXISTING SYSTEM

The concept of multi-view face recognition refers to using multiple images or videos from different angles to recognize faces. In some cases, the term is used for simultaneous acquisition with multiple cameras, while in others, it refers to recognizing faces across different poses. The recognition process may involve looking up a collection of images to align the appearance of the face, and this method also requires estimation of poses and illumination conditions for both images. The manual approach of taking and maintaining attendance records was challenging, which led to the development of biometric devices like fingerprint scanners for student attendance measurement in institutions and organizations where attendance is important.

IV. PROPOSED SYSTEM

The proposed student attendance system utilizes the concept of multi-view face recognition and leverages the benefits of HAAR cascade algorithm and neural network algorithms to improve accuracy. The system captures the QR code along with the face of each student and stores the information in a database for attendance tracking. The system also provides an SMS and email-based alert system with real-time implementation, and students can view their fee details and overall report. The spherical harmonic representation of the face is a novel approach to face recognition in video scenes, which addresses the challenge of unlimited orientations and positions of human faces. This approach maps the face texture onto a sphere, which allows for the construction of a texture map for the entire face by back-projecting image intensity values from each view onto the surface of the spherical model. The use of this method can lead to improved accuracy and robustness in face recognition systems, making it a promising solution for student attendance systems in educational organizations. The proposed framework for student authentication is shown in Fig 1.

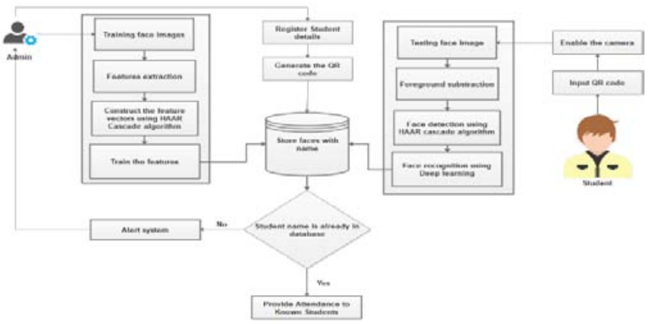

Fig 1: Proposed framework

The process of proposed work shown as follows

Framework construction

In the past 20 years, advances have been made in the field of personal identification. Biometrics, which refers to the identification of an individual through their physical traits that can be both seen and measured, is the term used to describe this. However, traditional biometric methods such as fingerprint and signature recognition have been found to be unreliable when dealing with large amounts of data. In this module, both administrative and student interfaces have been developed, with the administrative interface allowing for the storage of student information for future reference.

QR Code Generation

This QR code-based student information system aims to provide a secure way to store and access student information. By encoding the information in a QR code, the system can reduce the risk of data loss or alteration, and make it easier to access the information by simply scanning the code. The system uses four different encoding modes to ensure efficient storage of the data and to accommodate various types of information, such as names, phone numbers, email addresses, and class information. By using a QR code-based system, the student information can be stored and accessed in a quick, secure, and convenient manner.

Facial Features Extraction

In this module, student faces are captured in real-time for registration and the camera is used to distinguish the face pixels from the background. Preprocessing steps are implemented to identify the foreground pixels, which are then subtracted from the entire image. The HAAR cascade algorithm is used to extract key facial features such as skin tone, eyes, and others, which are then represented as feature vectors.

Label the Details

In this module, feature vectors are created for each student. A feature vector is an array of values that describes an object and multiple feature vectors can form a feature space. The elements in a feature vector can range from representing a single pixel to an entire image, depending on what information is being captured about the student. The granularity of the feature vectors is determined by what is being studied or represented about the student.

Classification

Deep learning is a cutting-edge approach to enhancing face recognition technology. The process involves extracting unique face embeddings from images containing faces. Training a deep neural network is the most effective way to perform this task. In this module, a deep learning algorithm is implemented to classify the feature vectors, which includes a neural network capable of classifying multiple features at once. Convolutional Neural Networks (CNNs) enable the extraction of a broad range of features from images. The algorithm classifies students during attendance and authorized students can also view their fee information.

Alert system

In this module, we can recognize known individuals and provide attendance for students based on recognition. If an unknown face is detected, an alert will be issued. A comprehensive report on attendance details is also generated.

V. EXPERIMENTAL RESULTS

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To evaluate the system, a set of faces is necessary. There are various standard face databases available for testing and evaluating face detection algorithms. A standardized database of facial imagery is crucial for supplying consistent imagery to algorithm developers and for providing a sufficient number of images for testing. Without these databases and standards, it is not possible to accurately evaluate or compare facial recognition algorithms. The experiments in this module were primarily conducted using the real-time face database.

Accuracy

The accuracy (ACC) is a common performance metric used in machine learning and artificial intelligence to measure the performance of a model. It represents the ratio of correctly predicted outcomes (true positive and true negative predictions) to the total number of predictions made by the model. The accuracy is usually expressed as a percentage, with 100% accuracy representing a perfect model that makes no errors in its predictions. A lower accuracy score indicates that the model is making more errors in its predictions and may need to be improved or re-evaluated.

The accuracy (ACC) is expressed as a percentage and calculated as the sum of true positive (TP) and true negative (TN) predictions divided by the sum of all true and false predictions (TP, TN, false positive (FP), and false negative (FN)). It is given as:

$$ACC = (TP + TN) / (TP + TN + FP + FN) * 100$$

TP: True positive, the number of cases where the model predicted positive (e.g. presence of a face in an image) and it was actually positive.

TN: True negative, the number of cases where the model predicted negative (e.g. absence of a face in an image) and it was actually negative.

FP: False positive, the number of cases where the model predicted positive but it was actually negative.

FN: False negative, the number of cases where the model predicted negative but it was actually positive.

ALGORITHM	ACCURACY
PRINCIPAL COMPONENT ANALYSIS	65%
LINEAR DISCRIMINATIVE ANALYSIS	85%
HAAR CASCADE ALGORITHM	98%

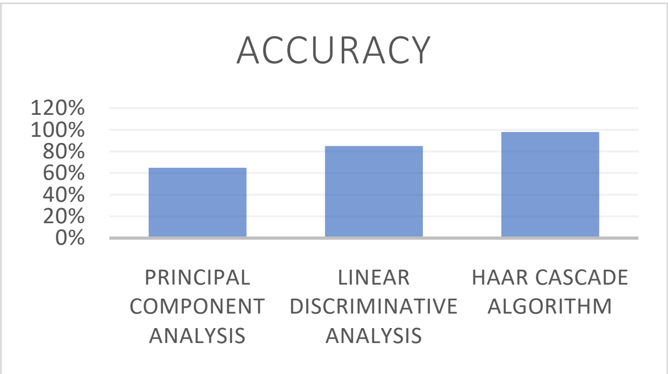

Fig 2: Experimental analysis

From the above graph, proposed system provide improved accuracy rate than the existing PCA and LDA algorithm.

VI. CONCLUSION

This paper presents a comprehensive review of face recognition techniques for still images and video sequences. Conventional methods, which require well-aligned face images and only perform either still image recognition or video-to-video matching, are not appropriate for face recognition under surveillance scenarios. The limitations of these existing techniques include a limited number of face images extracted from each video due to pose and lighting variations, poor video quality, and limited computational resources for real-time processing. Therefore, we propose a local facial feature-based framework for still image and video-based face recognition under surveillance conditions. This framework is capable of video-to-face matching in real-time and is trained using static images but applied to video sequences, resulting in higher recognition rates. Our approach also includes a QR code-based authentication system with fee information and an SMS alert system for evaluation using real-time image datasets.

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Aircraft Detection Analysis Using RemoteSensingImagesDeployingDeepNeuralNetwork

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***Abstract*—In the processing of images, aircraft recognition is crucial. The shape of the airplane can be extracted using are cognition processor. The practice of detecting as well as identifying a specific object or component in a digitized image or video is known as image recognition. This technique is employed in numerous applications, including frameworks for computerizing industrial lines, toll corner observation, and security observation. In addition to having a complicated structure, different types of air craft range in size, form, and color shading. Even within a single type, the texture and brightnesswerefrequentlyvariabledependingonthesituation.Additionally,numerousdisruptionsincludingclutter,disparatecontrasts,andhomogeneityanxietyfrequentlyimpairrecognition.Therefore,thetechniqueheavilydependsonrobustnessanddisturbanceresistance. This technology makes use of neural networks to recognize aircraft. The median filter algorithm is used to process the input satellite image. Shape, size, and texture are used to extract features. There lating to global of the filter outputs is then used to calculate the feature representation, which eases the numerical challenges. Followingthat,aneuralnetworkapproachknownasaconvolutionalneuralnetworkisutilizedtodeterminethelayerbetweenclasses.Dimensionalityreduction,segmentation,andtemplate-basedaircraftidentificationareallpartofthisrecognitionmethod.A Megapixelsegmentisspecificallysuggested to lessen the dimension of the satellite picture. The desired object is then distinguished from the background using histogram probability thresholding. Convolutional neural networks are used to classify data using templates as matchingmodels.Finally,sendanalertsystemtotheadministratorwhenanaircraftisdetectedand offer a higher level of accuracy than the current algorithm.**

Keywords*— *Aircraft,FeatureVector,DimensionalityReduction,Classification, AlertSystem

I. INTRODUCTION

Shadow regions and complicated backdrops can be seen in satellite photos. We suggest using an aircraft identification method on pixel location segmentation as well as reconstructions for remote sensing picture aircraft target recognition to address these issues [1]. In particular, we must use a scatter plot of oriented gradients to infer the aircraft's orientation. The target that needs to be rebuilt must face the same way as the template. Additionally, we offer a better segmentation algorithm. The texture measure in distinguishing the target replaces the color space measuring method again for the difference between the wavelet transform of the target and also the shadow region. The target direction is first estimated using a gradient direction histogram, and the template direction is kept constant with the reconstruction direction [2]. Since the advent of combat aviation in World War I, military troops and civilian auxiliary people have been taught how to recognize aircraft visually. It is crucial for both military intelligence gathering and air defense. It is often a requirement for aircraft recognition to become familiar with the exterior characteristics of the aero plane friendly as well as aggressive are most likely to occur [3]. As teaching aids, people have used replicas, printed contour maps, slide projectors, computer-assisted instruction, and now even specially printed playing cards [4]. Aircraft, and specifically aero planes, are an alternative to the kinds of things that are generally taken into account for fine-grained categorization, such as birds and pets. The recognition of aircraft models is particularly intriguing for several reasons. First off, there have been countless models, manufacturers, and airlines over the past 100 years, totaling thousands of different aircraft designs [5][6].

Second, different aircraft designs are used for different purposes and have different sizes(from home-built to massive carriers)(transporter, carrier, training, sport, fighter, etc.)Technology,propulsion(glider,propeller,jet),andmanymo refactors [7].The fact that the structure of the aircraft changes with their design is one special axis of variation that is not shared with groups like animals (number of wings, undercarriages, wheel per undercarriage, engines, etc.) [8]. Thirdly,different firms may employ the same aircraft model for different purposes, which results in additional visual variances (livery) portrayed in **Figure1.** Depending on the identification task, these maybe viewed as noise or as valuable information that might be gleaned. The constant false alarm rate can be detected using the deep transfer technique [9]. Finally, compared to highly deformable animals like cats, aircraftaremostlyhardobjects,simplifying some aspects of their modeling and enabling one to concentrate on the key elements of the fine-grained recognition challenge [10].

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Fig. 1. Aircraft types

II. EXISTING SYSTEM

UgurAlganci, et.al,…[11] presented a comparisonofit's still one ofadvancedCNN-basedaircraftmodel-based detectionforidentifyingaircraftfromsatellite pictures .The networks were trained using the DOTA dataset, and their performance was evaluated using both the DOTA dataset and independent Pleiades satellite images. The Faster R-CNN network delivered the best performance, as determined by COCO metrics and F1 ratings. The Yolo-v3 architecture also showed promise with shorter processing time, but SSD was unable to successfully merge the machine learning model with few repetitions. Each of the network tends to learn moreas the number of rounds and parameter valuesincreased.Yolo-v3 can convergemorequicklythanothernetworks,butoptimizationapproaches also performs a big role and in duration. SSD scored higher in terms of object detectionandrecognitionbuthadtheworstdetectionperformance. Results were also impacted by thedisparityinobjectsizesanddiversities.Unbalances should be avoided or the classes like aircraft, gliders, light aircraft, jet aircraft, and bombers,shouldbesplitintosmallergrainswhentrainingdeeplearningnetworks.Forthepurposeofdetectingaero planes from satellite photos, parameter tweaking and deep transfer learning techniques on preconditioned object identificationnetworksproducedencouragingresults.asignificantpartintheprocedure.SSDhadtheweakestdetectionperformance,althoughitperformedbetterintermsofobjectlocalization.Additionally,themethodscouldbeusedwithfull-sized(large-scale)satelliteimagesthankstothesuggestedslide as well as identify as well as non-maximumsuppression-based detection flow.

LimingZhou,et.al,…[12]adoptedthe MSDNnetwork using fewer grids within the input photosto measure subtle aero planes. Then, by enlargingthe show's perceptive reach, we propose to usethe DAWM modules to combat the attraction ofthebackgroundsoundcausedbytheintricatebackdrop.Additionally, To tackle both issues at the same time, we integrated the DAWM module with the MSDN network structure, resulting in a new network structure named MSRDN. The results of the experiment indicate that MSRDN surpasses other high-performance algorithms in identifying airplanes within remote sensing images. While there is a decrease in detection speed, it is accompanied by an improvement in detection effectiveness, this trade-off is to some extent acceptable. In general, our technique can be used to locate different objects and is more effective at finding aircraft in remote-sensing photos. The two-stage approach first uses the predesigned algorithm to produce a ton of regional candidate ideas and then uses the produced regional candidate proposals to find as well as categorize the targeted object through the backbone. Among this group of algorithms, the most prominent ones are R-CNN, SPP-NET, Fast R-CNN, Faster R-CNN, and Mask R-CNN.

YanfengWang,et.al,…[13]basedontheTransformerandEfficientDetmethods,provides the TransEffiDet approach for aircraftobject detection in aerial photos. We enhanced the object detection system in EfficientDet by incorporating the Inverter, which emulates the algorithm's long-term correlation features. ThesuggestedTransEffiDetcanoutperformtheEfficientDet by 5.8% with a +e mAP of 86.6% inaerialphotos.TheexperimentalfindingsdemonstratethatTransEffiDethasstrongrobustnessandissuperiortothecomparativeapproachesforaircraftdetectionandclassification tasks in the military. Along with this work, we will also make available a publicly accessible aerial dataset for the identification and classification of aircraft. In this study, our suggested approach is used to detect aero planes, but it hasn't shown to be particularly effective at distinguishing between fighter jets, bombers, and passenger planes The fact that these aircraft's form features are not readily apparent is one explanation.

Qifan Wu, et.al,…[14] We have suggested an improved approach for detecting and segmenting airplanes in remote sensing images using Mask R-CNN. To enhance the accuracy of aircraft target recognition and high-level feature information, we introduced the WFA-1400 remotely sensed aircraft mask dataset and incorporated modified SC-conv and dilated convolution into the basic Mask R-CNN model. After comparing our model to the basic network, we have attained an accuracy improvement of approximately 2%. We only paid a fair fee in due time and improved aircraft target recognition and instance segmentation significantly. Our research is a crucial practice for the analysis of remote sensing images. Due to the absence of established and easily accessible datasets for remotely sensed airplane masks, we were only able to conduct testing on the WFA-1400 dataset. Traditional object detection methods include drawbacks such as low rotation invariance and poor generalization. Deep learning (DL), which is expanding quickly, offers a better answer to this issue. Convolution neural networks (CNNs) perform exceptionally well in the areas of super-resolution image reconstruction, semantic segmentation, and object detection. Object detection, one of the most crucial DL directions, primarily addresses fundamental vision issues like the classification and localization of different targets in images.

Lifu Chen, et.al,…[15] implemented For the purpose of detecting aero planes from large-scale SAR photos, the geospatial transformer architecture is suggested. We developed a new three-step target detection framework using MGCAN for decomposition and recomposition, depending on the process. This paper's proposed target detection network, called MGCAN, is capable of efficiently extracting multi-scale information from small targets. Moreover, we systematically integrated the suggested EFPCF and PRSA modules into MGCAN to eliminate false alarms caused by complex background information and enable the network to collect important multi-scale contextual and positional data of the targets. To obtain the final detection outcomes, we

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applied the CD-NMS filtering method during the recomposition stage. This approach considers the dense distribution of targets in the SAR image by combining the confidence, IOU threshold, and distance between the centroids of bounding boxes. And suggest using the geospatial transformer architecture to address problems unique to SAR in aircraft detection using deep learning. We introduce two modules: the Economical Pyramids Permutation Focus Fusion (EPCAF) and the Parallel Remnant Spatial Attention (PRSA) modules. These modules combine feature pyramid inversion and attention mechanisms as well as geospatial contextual analysis to resolve the influence of speckle noise in SAR data. These geographic contextual attention modules are utilized to extract geospatial contextual information more efficiently, differentiate between different target location data, dynamically concentrate on critical regions, and decrease interference from background noise. When conducting geoscience research, fusing this method can be particularly useful. Deep learning algorithms play a crucial role in analyzing SAR images.

FerhatUcar,et.al,[16] study, A model for detecting aircraftbasedondeeplearninghasbeencreated.Thesuggested model makes advantage of the CNNnetwork'seasy-to-useobjectrecognitionoperator,whichiscreatedwithapplication-specificity as its backbone. The RCNN model,whichexecutestheairplanedetectionprocess,differs from the basic composition by using the"SoftMax"classifierstructureratherthanSVMclassifiers.Alargedatasetwiththeclasses"Plane" and "NPlane" was used for training andtestingthesuggestedCNNmodel.Additionally,adatasetthat wasspeciallydevelopedusingsatellite pictures and Google Earth was employedin the validation process of airplane detection.Theseextensivetestingandtrainingdatasetswere gathered from airports all around TurkeyHigh-performancevalueswereattainedduringsystemtestingusingsatellitephotoscollectedfrom several airports. A table that compares theresults could not be displayed due to an unfaircomparisonbecausethechosendatasetofthisaircraftclassificationalgorithm,whichwasconstructed with a deliberate and plain design,was not used in anyone else studies that havebeenpublished.

ZHI-ZEWU,et.al,…[17]introduced aCNNwiththeconceptofpoorlysupervisedlearningtocreateanaircrafttargetdetectionmethodforRSIs.In the experiments described in Section 4, the proposed AlexNet-WSL algorithm achieves detection results comparable to those of Faster R-CNN and YOLOv3.For their training, these two approaches need information about target location annotations and generate feature maps of multiple forms of information, enhancing the focus on target points while suppressing the focus on clutter points. This is achieved by employing an attention mechanism that assigns weights to different feature maps based on their relevance to the target object. The cascaded transformer block (TRsB) structure used by SFRE-Net is also helpful for the integrity identification of aircraft targets and can be used to model the actual correlation of scattering locations in SAR images. Additionally, the context attention-enhancement module (CAEM) developed by SFRE-Net addresses the problem of complex interference in SAR images by using an expanded convolution pyramid to improve the receptive field, followed by an adaptive fusion approach to combine multiple sources of information. The experimental results on the Gaofen-3 dataset demonstrated the effectiveness of the SFRE-Net algorithm, showing that it outperformed other state-of-the-art object detection systems. feature maps from different layers and scales of the network. The goal is to strengthen the representation of target points while suppressing the representation of clutter points. Numerous experiments on the airspace, especially in low-altitude flights. Therefore, non-cooperative detect-and-avoid modules are being developed, and AirTrack is a recent example of such a module for long-range aircraft detect-and-avoid applications. The module uses a cascaded detection approach with a secondary classifier to improve detection performance. The proposed approach is evaluated on the Amazon AOT dataset and real-world flight tests, showing promising results. Moreover, the module satisfies at least two specification categories of the newly established ASTM standards.

PengZhang, et.al,…[18] propose To solve the issue ofSARaircraftdetection,ascatterfeaturerelationshipenhancementnetwork(SFRENet)wascreated.SFRE-Netinitiallysuggestsafeature-adaptablefusionpyramidal(FAFP)structuretolessensemanticconflictwhilemerging various features. This structure helps toimprovethemodel'scapabilityformulti-scalerepresentationbyenablingthenetworktoindependentlyselectusefulsemanticsthroughan adaptive weighted addition approach. Toacquire feature data from diverse receptive fieldsand enrich the semantic information in featurefusion, we also add the showcase module (FEM)intoFAFP.Second,thecascadedtransformerblock(TRsB)structureusedbySFRE-Netishelpfulagainforthe integrityidentificationofaircraft targets and might be used to model the actualcorrelation of scattering locations. The contextattention-enhancementmoduledevelopedbySFRENetaddressestheproblemofcomplexinterferenceinSARimages(CAEM).TheCAEMfullyaccountsfortheuniquecharacteristics of SAR image targets. The firststep is to use the expanded convolution pyramidtoimprovethereceptivefield.Then,adaptivefusion is utilized to combine and generate featuremapsofmultipleformsofinformation,strengtheningthefocusoftargetpointswhilesuppressing the focus of clutter points. NumerousexperimentsjustonGaofen-3datasethaveproven the viability of our method and revealedthat SFRE-Net outperforms the most advancedobject-detectionsystems.

SourishGhosh,et.al,…[19]present, AirTrack as a state-of-the-art vision-based technology designed to detect and track long-range aircraft in detect-and-avoid situations. The module uses a series of detection modules and a secondary classifier to enhance its performance. Comparative results from the Amazon AOT dataset and real-world flight tests demonstrate the efficacy of AirTrack. The study also evaluates AirTrack against the recently established ASTM standards and confirms that it meets the criteria for at least

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two specification categories. While active onboard collision avoidance systems, such as the Traffic Alert and Collision Avoidance System or the Airborne Collision Avoidance System, are typically used for medium to large airborne systems, they rely on transponders installed in cooperative aircraft, which cannot track all airborne threats, such as rogue drones, balloons, light aircraft, and inoperative transponders, that may jeopardize safe operations.

Alshaibani,et.al,…[20]implementedAirporttrafficcontrol hasbeensupportedbyasimpleandaffordablemethod.The suggested method's first phase uses drone-collected aerial photos to train a deep trainingmodel to find aero planes. The following stage forfuture endeavors is to utilize the available data toidentify the type of aero plane first based on itslength and surface area. Given that any nation intheglobecangainfromthisstrategy,thisapproachhasthepotentialtobeauniversalcontribution.Insteadofusingthesatelliteapproach,whichnecessitatesexpensiveandsophisticated gear, drones can feed it system withaerialphotographs.

The existing methods are lagging in proper tracking methods, collision avoidance and component acquisition overcome by the proposed method where the deep neural network is deployed for identifying and recognizing the aircraft and analyzing the matching models.

III. Traditional Aircraft Detection Methods

The principal component analysis is used inthisapproachtoreducedimensionality.Somestepsaretakenhere. Thesatelliteimageisprocessedduringpre-processing. Processingisdoneinthreephases.Theaveragescore,covariance, Eigenvectors,aswellasEigenvectors are generated before anything else.The OTSU segmentation method segments thisimage. Using image segmentation, the satelliteimage is divided into numerous segments afterthefeatures(shape,shape,color,anddimension) are reduced using this technique. Theresemblancebetweentheseimagesisthendetermined by comparing the segmented imagewithseveralsortsoftemplates.Next,anaircraft isfound. It is possible that the aircraft identification area you are referring to is using these parameters to perform shape-based recognition and classification of aircraft. Equivalent diameter is the diameter of a circle with the same area as the aircraft's bounding box, width and height refer to the dimensions of the bounding box, and orientation refers to the angle of rotation required to align the bounding box with the aircraft's major axis. Perimeter is the length of the aircraft's boundary, and eccentricity is a measure of how elliptical the aircraft's shape is. These parameters can be used to distinguish between different types of aircraft based on their shape, which can be useful in aircraft recognition and classification tasks. Utilizing the K-Nearest Neighborclassification approach, aircraft are recognized. Asatellite image is used as the input, and a Gaborfilter is used to process it. For image retrieval, it is employed (shape, size, texture). The magnitude response of the filter outputs is then used to generate the face image, which eases the numerical challenges. After that, the hyperplane between classes is discovered using the K-NN technique.Finally,aircraft is recognized. If it cannot be recognized,it is translated and rotated, with the output thenbeing delivered to a filter. Once the aircraft isidentified,theprocessdescribedaboveisrepeated. Using KNN algorithms, entire shapesarerecognizedanddescribedinthecurrentframework.**Figure 2.**

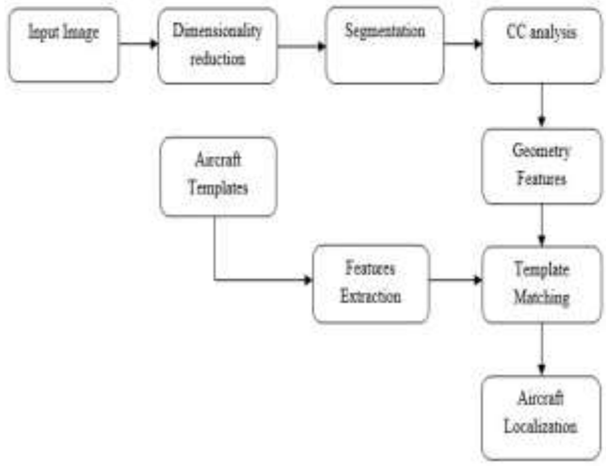

Fig. 2. Aircraft detection

IV. Proposed Methodology

Object recognition in remote sensing images is essential for both military and civil applications, including airport surveillanceandinshoreshipdetection.Withtheswiftdevelopmentofhigh-resolutionsatellites,thevolume of elevated remote sensing image data has increased significantly. Enabling the creation of a more sophisticated object detection systemforremotesensingphotos.Anexampleofatypicalissuewithsmalltargetrecognitionunderneathawide-rangetargetpositionisairplane detection in remote sensing photos. Theinputimageisasatelliteimage,whichissubsequentlyprocessedtoestimate the direction. To determine the image's roundness and pattern, as well as its histogram, an image's gradient must first be calculated. From there, it is assumed what direction the aircraft is flying with the satellite image. This image is then divided into homogenous sections, and the extracted features are subsequently divided into various sections the highest similarities aremeasuredaftercomparingdifferenttemplatetypesusingthejigsawmatchingpursuitalgorithm.Tolowerthemeansquareerror, this algorithm is utilized. Recently, at leastthree distinct methods for persistent neural netrecognitionhavebeenputforth.Thefirstmethod,calledinvariancethroughtraining,accounts for various targets for various pattern shifts throughout the training phase to adjust for the pattern shift. Such a strategy's primary flaw isthatitcannotbeusedinmanyoperationalcircumstances.Inactuality,thetrainingsetisoverlybigduetotheabundanceofpotentialpattern changes, which also raises the computing cost of the learning program. Invariance through structure, the second method, employs neural networks where outputs are consistently in variant to specific modifications. The drawback of this strategy is the requirement for high-order neural networks. The proposed framework is shown in**Figure3.**

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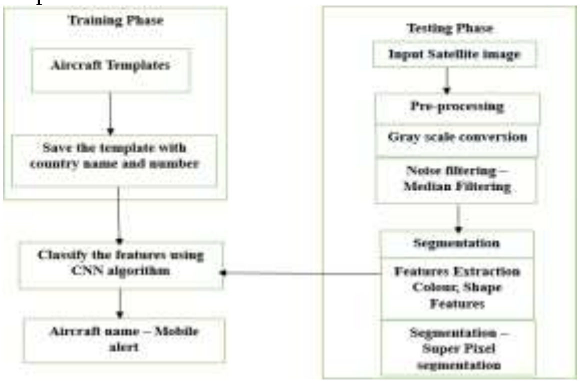


Fig. 3. Proposed framework

A. Aircraft Image Acquisition

The process of recognizing and identifying a specificobject or element in a digital image or video isknownasimagerecognition.Numerousapplicationsofthismethodexist,suchascomputerizedindustriallineframeworks,tollsectorobservation,aswellassecurityobservation. Regular image recognition methodsinclude facial recognition, license plate matching,opticalcharacterimagerecognition,andscenechangeidentification.identifyingobjects in a picture This stream would likely startwith methods for image processing for example(Low-level) feature extraction is used to discoverlines,regions,andmaybeareaswithspecified surfaces after noise removal. In this module, wecan enter any type and size of satellite image thatwasphotographedbysensors.Aerialvehiclesmaybepartially orfullyformedinsatelliteimagery.

B. Preprocessing

In the context of computer imaging, bi-tonal black-and-white images, or images with only two colors, black and white, differ from grayscale images (also called bi-level or binary images). With grey-scale photographs, there are many different grey tones in between. When only one frequency (or,morecommonly,asmallbandoffrequencyrange)iscaptured, gray-scaleimagescanbeproducedbydeterminingthelightintensityateach pixel under a specific weightedsumoffrequencies(orwavelengths).Insuchcases, the images are monochromatic proper. Theelectromagnetic spectrum is open to theoreticallyany location for the frequencies (for instance, uv, photons, indigo, et.)Thismoduleallows for the conversion of RGB images intograyscaleimages.Afterthat,applyafilteringstrategytoimprovetheimage'squalities.Theimprovedimagemovesontothefollowingmodules.

C. Superpixel Segmentation

Semantic similarity segmentation, visual tracking, pictureclassification,andothercomputervisiontaskshave all benefited from the use of super-pixelsegmentation. This module analyses the aircraftareasfromothersatellitedataandextractsaircraftpropertiesincludingcolor,form,andtexturefeatures.Dividetheaircraftregionsinto the precise shape of the partial orcomplete satellite feature data. Superpixelsareincreasinglybeingusedincomputervisionapplications.Onlyafewsolutionsallowfortheoutputoftherequiredquantityofregular,compressed superpixels with the least amount ofprocessing.WeofferSLIC(SimpleLinearRecursiveClustering),anovelmethodthatefficiently creates small, virtually uniform superpixels by grouping the pixels in coupled fifth aspect color and picture plane space.

D. Aircraft Classification

A neural networkalgorithmisusedtoidentifyanaircraft usingsatellitephotos.Itisamethodfordiscovering small sections of a picture that matchatemplateimageindigitalimageprocessing.The potential presence of the standard target isshown by a moving window over the other imagesequences. To determine the degree of similaritybetween both the target image and the window'spixels, a regional feature-based operator is used.The segmentation module's labeled componentwill be used to identify the region's features andcharacterize their properties. For object detectionandtracking,correlationanalysiswillbeutilizedtoasseesshowsimilartwodifferentobjects are. This module applies a classifier toeach region of the image's pixels and matches theretrievedfeatureswiththedatabaseusingtemplates.
Identifying the aircraft type that usesthe neural net matching technique.

E. Alert System

Inthismodule,youcansendanSMSalerttotheadministrator. Aftersuccessfullyclassifyingaero planepixels,usetemplates to forecast aircraft.

V. Experimental Results

We can develop the framework to implement thesysteminaPythonframeworktoclassifytheaircraft pixels using a deep learning algorithm.We can input and train the datasets with multipleaircraft images of varied sizes. In this paper, wecanevaluatethissameeffectivenessofthesystem in terms of accuracy and rate by using thedataset known as Multi-Type Aircraft RemotelySensedImages(MTARSI),whichalsoincludes9,385 images of 20 types of aircraft of complexbackgrounds,variousspatialresolutions,andcomplex variations in posture, location, lighting,and period depicted in **Figure 4**.

Error rate: The error (ERR) is calculated as apercentage of all imperfect forecasts to all testdata.Theverybesterrorratethatmaybeachievedis0,whilethe worstis1.The main goal of this project will be to minimize the error rate of any classifier depicted in **Table1**

$$ERP = \frac{fp+fn}{tp+tn+fn+fp} \tag{1}$$

Table 1 . Error Score of the Models

ALGORITHM	ERROR RATE
CLASSIFICATION BY KNN	0.75
CLASSIFICATION BY SVM	0.5
CLASSIFICATION BY CNN	0.4

DOI: rp-9788770040723.059

Fig 4. Error Rates of Classifiers

$$ACC = \frac{tp+tn}{tp+tn+fn+fp} x\, 100 \qquad (2)$$

TABLE 2. PERFORMANCE OFTHE CLASSIFIERS

ALGORITHM	ACCURACY
K-NNCLASSIFICATION	50%
SVMCLASSIFICATION	65%
CNNCLASSIFICATION	80%

Accuracy: The percentage of total correct predictions to all test data is known as accuracy (ACC). Additionally, it can be written as 1 - ERR. The maximum accuracy is 1.0, and the minimum accuracy is 0.0. The various classifiers' performance metrics are shown in **Table 2 and Figure 5.**

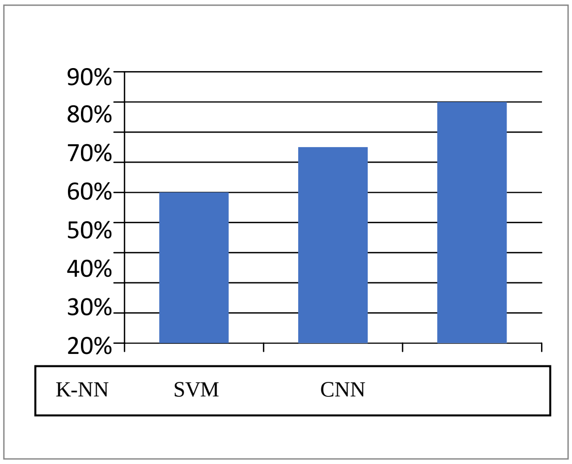
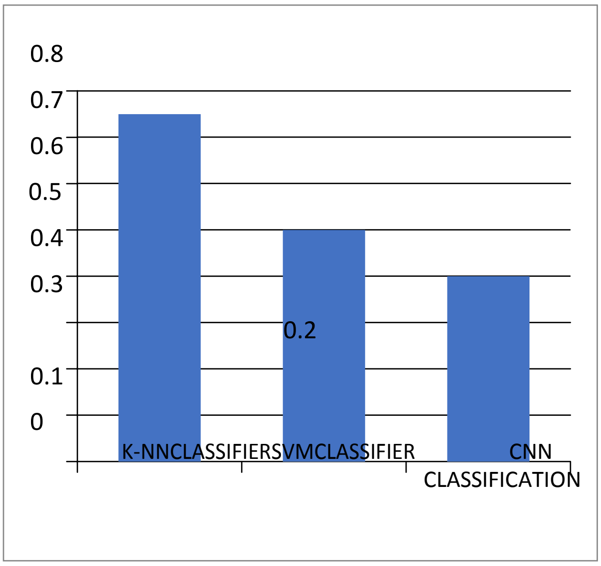


Fig. 5. Accuracy Measure of the ML models

VI. CONCLUSION

In this study, a superpixel classification and templates matching model were used to identify aeroplanes in surveillance applications using satellite photos. Results from the tracking system are more accurate and have less computing complexity. The use of neural network analysis proved successful in improving segmented areas and following target items. Finally, the predicted outcome demonstrated that the strategies and methodologies used led to greater efficiency. An innovative target detection filter using a hybrid neural network system with picture manipulation has been proposed in this work. Two innovative ideas are presented in our work. Before discussing enhanced multimodal processing of MTARSI pictures for automatic object detection, we first presented a novel automatic categorization method. We used a back-propagating artificial neural network-based neural classifier that was built of many neural networks. To identify aircraft targets taken from MTARSI photos, the classifier is employed. To enhance the form and feature extraction procedure, two image processing approaches that were recently added to the literature are combined. Superpixel idiomatic phrases include then computed and employed as features for our combined system's input. Performance analysis is done in contrast to both traditional target



detection recognition systems and conventional multimedia processing methods. The effectiveness of the suggested approach for the use of mechanical airplane sensing elements is demonstrated by numerical results from extensive simulation testing. Future research will focus on enhancing the performance of a single NN by using the right optimization methods during the NNs' learning phase.

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Artificial Intelligence-Based Optimization Algorithm to Recognize the Handwritten Digits of Writers

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Abstract—The proliferation of technology has been credited with making processes that used to take a lot of time more easier to do. Machine learning (ML) enables software products to grow increasingly accurate at predicting outcomes without the need to be explicitly programmed to do so. This is possible because ML allows software to learn from past experiences. Machine learning algorithms make predictions about future output values by using data from the past as input. In the course of this investigation, we are going to investigate an artificial intelligence (AI)-based optimization method with the goal of recognizing the digits that are written by hand. Research in the fields of machine learning, image processing, and computer vision are making significant progress in the area of handwritten digit recognition. The style, shape, orientation, and size of a digit written by one person may be different from those written by another person. An algorithm for optimization is a procedure that repeatedly evaluates a number of potential solutions in order to locate the one that is most suitable. The phase of the design process known as computer-aided design has always included optimization ever since computers were first developed.

Keywords—Hand Written Digit Recognition, Artificial Intelligence (AI), Optimization Algorithm

I. INTRODUCTION

Challenges in research have arisen as a result of the exponential growth in data volume caused by handwritten papers, scientific instruments, and the usage of social media and channels. New areas of study have evolved in response to these problems that have attracted academics from many different disciplines. Users of social media sites often provide material for no cost, thus there is a wealth of information available in both organised and unstructured forms. Image processing, machine learning, and computer vision have all dedicated significant resources to the study of recognising handwritten digits [1]. There are several ways in which one person's numerical representation might diverge from another's for the same letter, including in terms of style, form, orientation, and size. These differences make it difficult for machine learning algorithms to recognize the digits automatically. It is a procedure that detects and recognizes any digit from a given image and then converts the digit into a machine-readable and editable format [2-3].An optimization algorithm is a method that matches various results iteratively till an optimum or acceptable solution is found. Optimization is a part of the computer-aided designing phase since the invention of computers [4].

Handwritten digit recognition is the ability of computers to recognize handwritten digits. Since handwritten numbers aren't always perfect and may come in aextensive range of combinations (in terms of both size and form), this operation is difficult for the computer [5]. A solution to this issue may be found in the handwritten digit recognition system, which proceeds a picture of a digit and determines whether or not that particular digit is present in the image.The capacity of a computer to recognize human handwritten digits from a variety of sources, such as papers, photographs, touch screens, etc., and then organize those digits into one of 10 predetermined categories is known as handwriting digit recognition (HDR) (0-9). Bottomless inquiry in the realm of deep literacy has been the focus of this article. The technique of number recognition is used in a wide variety of applications, including the sorting of postal communications, the processing of bank checks, and the identification of licence plate numbers [6]. In the field of handwritten number identification, we encounter a great deal of difficulty. Due to the fact that various people's handwriting tends to look different and that it is not an optical character recognition system. For the goal of handwritten number recognition, this investigation presents a complete comparison of several machine literacy and deep literacy algorithms [7].

The field of artificial intelligence (AI) considers the recognition of handwritten numbers as evidence that a person's neurons are in good functioning order and have been properly programmed. This particular use of artificial intelligence has been around for quite some time; its watershed moment occurred in 1989, when a dependable machine-enabled parsing of ZIP codes for postal services was finally accomplished.Almost immediately after that, it was shown that multi-layer feed-forward networks are capable of implementing any function. Shortly afterwards, the method for the automated parsing of account numbers that are printed on remittance slips for wire transfers or bank

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checks was adopted by the nation's financial institutions [8-9]. The identification of handwritten digits using a variety of AI algorithms is becoming more popular in academic circles nowadays for the purposes of teaching and learning.

II. Literature Review

Patil and Pranit (2020) illustrated the use of various Machine Learning algorithms,some of them to be noted are K-Nearest Neighbor Algorithm, SVM, CNN, Quantum Computing, and Deep Learning, in the Recognition technique for improving the productivity of the technique and reduce its complexity [10]. These algorithms include SVM, CNN, Quantum Computing, and K-Nearest Neighbor Algorithm. Arkiv Digital Sweden is a novel image-based handwritten historical digit dataset that was presented by Kusetogullari, Huseyin, et al. (2020) and Sridaran K et al. (2018). (ARDIS). The findings indicate that ML algorithms that are conditioned on previously collected data may have difficulty recognising digits effectively on our dataset. This demonstrates that the ARDIS dataset has different properties [11]. A novel model for identifying handwritten digits was presented by Haghighi et al. (2021) and Monika M et al. (2022). The model that has been suggested is a stacking ensemble classifier. This classifier's foundations are the Convolutional Neural Network (CNN) and a Bidirectional Long-Short Term Memory (BLSTM). The use of this database helps increase the performance of the recognition of challenging numbers [12]. To increase the accuracy of Farsi handwriting digit recognition, Nanehkaran, YaserAhangari, et al. (2021) and Balan. K (2022) developed a logical CBWME network structure system constructed on convolution bagging weighted common ensemble learning by merging CNN and BWME learning. Both Islam et al. (2019) and Latchoumi. T.P et al. (2022) focused on fine-tuning the algorithms by identifying the optimal values for the KNN, RF, SVM, MLP, and CNN hyper-parameters of the respective algorithms. They have presented Sankhya, which will act as the foundation for an open and verifiable evaluation process that will be repeated every two years from this point forward [13]. This process will also act as a benchmark for verifying newer and more innovative algorithms that will be mentioned in this field in the future.

Schrapel et al. (2018), Sivakumar P. (2015), and Vemuri et al. (2018) unveiled Pentelligence, a pen for handwritten digit identification that works on regular paper and does not need a separate tracking device. Pentelligence was developed by Schrapel et al. (2018). (2021). It picks up on the movements and sound emissions made by the pen tip when you are stroking it. DIGI-Net is a deep convolutional network that was proposed by Madakannu et al. (2020) and Buvana M et al. (2021). This network is able to learn and detect common characteristics from three various formats: natural photos, handwritten, and printed typeface of digits [14]. Experiments were conducted using the MNIST dataset, the CVL is a single-digit dataset, and the digits of the Chars74K dataset is suggested with DIGI-Net performed very well in all of them. A novel approach for the recognition of handwritten digit strings has been developed by Aly et al. (2019). This method does not need any explicit segmentation methods to be used. A unique hybrid principle component analysis network (PCANet) and SVM classifier cascade is used in the suggested technique. This network is referred to as PCA-SVMNet. The suggested approach is capable of achieving recognition accuracy that is equivalentwith the state-of-the-art methods that do not need segmentation [15]. The NN-based configurations for handwritten-based digit recognition that were proposed by Albahli, Saleh, and coauthors in 2020 and evaluated by varying the values of the hyper-parameters are discussed in this article.

III. Proposed Work

Handwritten digit recognition is the term given to the ability of computers to identify handwritten digits created by humans. Because handwritten numerals are not perfect and might vary from one person to the next, the computer has a challenging job. Handwritten digit recognition is the answer to this issue. This technique takes an image of a digit and determines whether or not that particular digit is present in the picture [16].An example of an AI-based optimization method is shown in Fig.1, and its purpose is to detect the handwritten digits of authors. The suggested technique is comprised of a number of diverse operations, the most significant of which are preprocessing, segmentation, feature extraction, and identification. The input picture is preprocessed by applying a Gaussian filter, going through a binarization process, and employing a method that detects skew. After that, the process of segmentation is carried out, which comprises the segmentation of both lines and characters. The split output is used as a source for the feature extraction. After the features have been extracted, the handwritten digits are fed into the most advanced artificial neural network available for recognition [17-18]. In this instance, a typical neural network is modified by the use of an optimization technique. The Optimization Algorithm is used to fine-tune a neural network's weights in order to achieve optimal performance. Metrics such as sensitivity, specificity, and accuracy are used in order to conduct the performance analysis of the suggested approach. The strategy that was suggested is put to the test, and the outcomes are assessed so that the performance can be seen. In order to put the suggested procedure into action, MATLAB will be used.

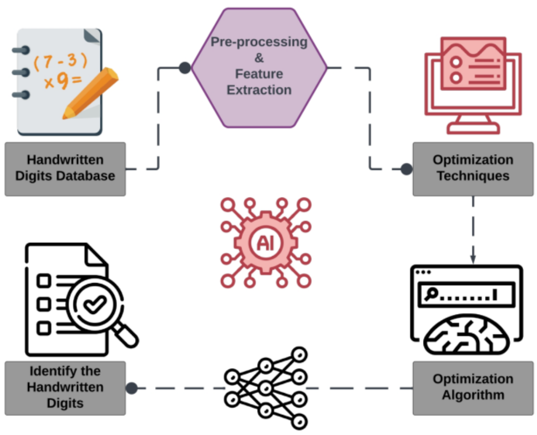

Fig.1 AI-based optimization algorithm for handwritten digits reorganization

Here in the below Equation (1), the average is approximated for ensuring the performance of recognizing the handwritten letters, whereas the equation can be modulated according to the duties that are differentiated in terms of analysis.

$$Y_i^m = \sum_{i=1}^{c} \frac{f_i}{f_i^c} + \sum_{T \to c}^{c} g(t_1 c_1 + t_2 c_2) \quad (1)$$

Wherein f_i^c signifies its terminal f_i knowledge dimensions to coordinate tasks regional basis. As a result, aentire letter is recognized by f_i scientists only at the small level portrayed in Equation (2).

$$f_i^n = \sum_{n \in f} (1 - \alpha_i) f_i^n + \int g(t_1 c_1 + t_2 c_2) \quad (2)$$

If diverse activities, including a t-norm or maybe even a $n_i -$ co norm, are being used to interconnected in trying to reach letter identification, the condition is known as just an optimization input optimization algorithm along with the symbolization in Equation (3).

$$f_i^m = \sum_{i=1}^{m} \frac{n_i}{f_i^m} + \sum_{t \to c}^{c} g(t_1 c_1 + t_2 c_2) \quad (3)$$

These deviations in result along with the enhanced optimization design that is dependent on a novel optimization algorithm for various handwritten letter-identifying concepts is calculated in Equation (4).

$$f_i^m = \sum_{i=0}^{c} \frac{f_i}{a_i^c} + (1 - \alpha_i) f_i^n + \int g(t_1 c_1 + t_2 c_2) \quad (4)$$

For this identification system used in an AI-based managing system, a collection of Enhancing the Efficiency and Performance has been detailed once again. The user's computation time is comparable to an order of magnitude of the stands and the user's processing powers, and such heat has been supported by facts and optimization data.

IV. Experimental Results

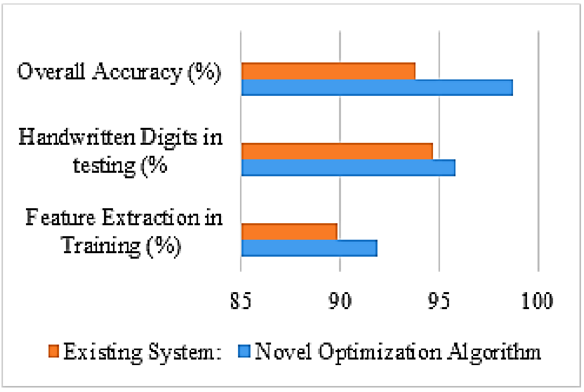

Fig.2 Efficiency and Performance of handwritten letter by the optimization algorithm

Several different NN-based models are used in order to investigate various facets of the same, the most important of which is accuracy dependent on the values of hyper-parameters. As a consequence of this, the broad experimental setup that is detailed in this article ought to result in the solution models that are the most accurate and the most time-efficient. An evaluation of this kind will be helpful in selecting hyper-parameter values that are optimum for jobs that are similar to those. Ramzan, Muhammad, and others (2018) carry out a comprehensive assessment of the many methods currently available for Hand-Written Digit Recognition (HWDR). This study is one of a kind due to the fact that is concentrated on HWDR and only examines the use of Neural Networks (NN) and its modified algorithms. It is examined that a general overview of NN as well as a variety of algorithms that are inspired by NN. Additionally, this research paper presents a comprehensive analysis of the use of NN, as well as its many forms, for the purpose of digit recognition in Table I.

TABLE I. Result Analysis for the Existing Method

Algorithm	Feature Extraction in Training (%)	Handwritten Digits in testing (%	Overall Accuracy (%)
Novel Optimization Algorithm	91.89	95.87	98.76
Existing System: Neural Network Algorithm	89.87	94.66	93.8

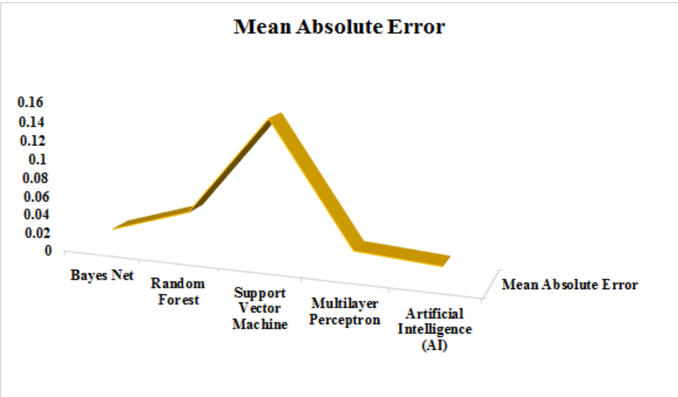

Fig.3 Mean Absolute Error Analysis

Though the model provides higher accuracy rate in identifying the handwritten letters, it is also necessary to find the error rate of any model. In this research, the proposed intelligent system is compared with certain existing algorithms such as Bayes Net, Random Forest, Support Vector Machine, and Multilayer Perceptron. Fig. 3 represents the Mean Absolute Error Analysis of the models which is used

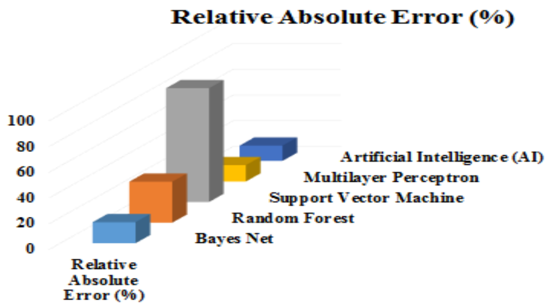

Fig. 4 Relative Absolute Error analysis

to analyze the prediction quality. From the results it is observed that the proposed intelligent system on the identification of the handwritten characters has obtained a very low Mean Absolute Error of 0.0185. The analysis of Mean Absolute Error is followed by the Relative Absolute Error analysis in the Fig.4. This analysis is used to determine the approximation error between the exact error and the resulting error. It is observed from the results that the proposed model maps the exact error rate.

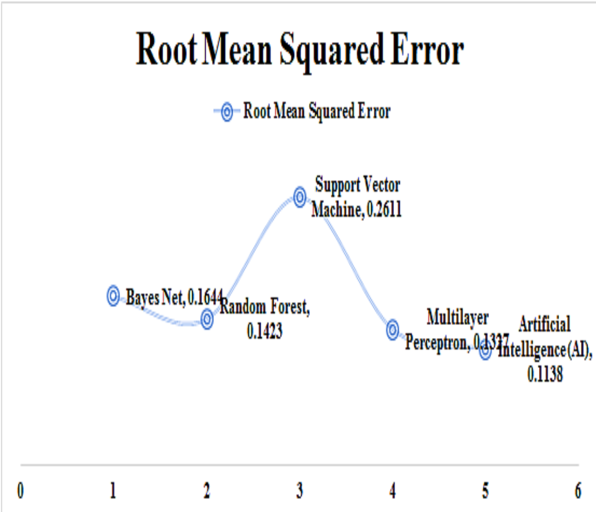

Fig.5. Analysis on Root Mean Squared Error

Analysis on the Root Mean Squared Error is represented in the Fig.5 which is used to represent the measurements for the evaluation metrics of the variables of predictions. The error rate obtained using the proposed model is less with 0.1138 which makes a minimum difference of 3% in comparison with the Random Forest Model.

V. Conclusion

The researchers claim that the proposed method is far superior to traditional handwritten digit recognition methods. The proposed methodology allows for the optimization of handwritten digits. An optimization algorithm is a method that iteratively compares different solutions until an optimum solution is found. Since the invention of computers, optimization has been a part of the computer-aided design phase. It aims to improve optimization by deploying algorithms and has achieved good accuracy.

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Lightweight Deep Learning Model to Monitor the Diabetes Patient for Continuous Risk Assessment

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Abstract—The advancement of technology has shown the use of technology search with some advancement by deep learning models in entire industrial managements.AI is poised to take over tasks that require human intelligence. Computer systems are in charge of these machines. In this model, the main prospect is to examine a Light Weight Deep Learning model for monitoring diabetes patients for continuous risk assessment. DL technology is a kind of subfield of ML where it employs or is inspired by human brain algorithms. DL employs ANN (Artificial Neural Network) as one such network. Diabetes mellitus can be most related to the metabolic disorder which infects the blood sugar level (glucose). A continuous risk assessment is an indirect risk assessment that is carried out regularly. It is a significant and influential form of assessment that should be done regularly as part of day-to-day management.

Keywords—Light Weight Deep Learning Model, Diabetes, Continuous Risk Assessment

I. INTRODUCTION

Artificial intelligence can be remembered as the machine's ability tothe various tasks similar to those performed by humans. Computer systems were in charge of these machines. Human intelligence is required for these jobs. It can also be described as computer systems that simulate human intelligence processes. DL is one of the fields of machine learning ML, which is a subfield connection with AI. Deep learning algorithms continuously analyze data with a predefined logical structure to reach conclusions similar to humans. Deep learning achieves this by employing a multi-layered structure of algorithms known as neural networks [1]. DM is a condition that affects the level of blood sugar in the human body (glucose). In other words, it is a disease that causes an excess of sugar in the blood (high blood glucose). This disease has no age restrictions, so it can affect people of any age. Diabetes has already been diagnosed using artificial intelligence technology [2].

The proposed methodology employs artificial neural networks (ANNs) for diabetes diagnosis. ANNs are computing systems that operate based on biological neural networks. ANN is based on a network of nodes called artificial neurons, which were inspired by the neurons in the human brain. Diabetes data is gathered to make a diagnosis [3]. The main goal of this method is to determine whether or not a person has diabetes. The process of collecting relevant features is known as feature selection. This procedure is critical because it simplifies the model by reducing training time. The data in the given dataset are divided into three categories: training data, testing data, and validation data. The ANN compares the input data to the dataset to determine whether or not the patient has diabetes. Diabetes diagnosis using ANN is a quick and easy process [4].

Deep learning models are essential for automating the process of illness detection. These models must be able to reliably and quickly identify incorrect measures, such as those of tumours, tissue volume, or other kinds of anomalies. A "lightweight" deep learning model can be trained using a small number of pictures, even ones with a high degree of noise. Additionally, this model is resource-efficient, which means it can be deployed on mobile devices [5]. The DL paradigm, which relies on self-monitoring and tele-screening of illnesses, is becoming increasingly commonplace since many societies are becoming older and there is a shortage of medical professionals. Deep learning algorithms, on the other hand, are often designed for a particular goal and may recognise or detect generic things such as people, animals, or traffic signs [6-7].

To diagnose illnesses, on the other hand, requires an accurate assessment of any anomalies that may be present, such as tumours, tissue volume, or any number of other kinds of deviations. In order to accomplish this goal, a model will need to segment the photos by looking at each one separately and marking where the borders lie. However, precise prediction requires a bigger computing output, which makes it challenging to implement such systems on mobile devices [8].

II. LITERATURE REVIEW

Bora, Ashish, et al. (2021) and Monica.M et. al. (2022) set out to develop a DL model that could analyze the

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likelihood of managing diabetic retinopathy by developing in an infected person who is affected with diabetes within the next two years. Using color fundus photographs, deep-learning systems predicted the development of diabetic retinopathy, and the processes were self-reliant and more insightful than available risk factors [9]. Ramazi, Ramin, et al. (2019) and Latchoumi T.P. et al (2022) proposed a method for processing time-series datasets collected by wearables based on the long short-term memory (LSTM) structure. Deep learning algorithms were effectively applied by Daniel Sierra-Sosa et al. (2019) to analyze healthcare data in a distributed and parallel manner. They demonstrated the scalability and supercomputing advantages of their method using a case study of over 150 000 type 2 diabetes patients. Large-scale parallel computation, which has become accessible on the new generation of GPUs and cloud-based services, can be used to analyze healthcare data [10]. Khanna, Narendra N., et al. (2019) and Karnan. B et. al. (2022) published a review that outlines the pathophysiology of rheumatoid arthritis and its connection to carotid atherosclerosis as shown in B-mode ultrasound imaging [11]. The function of tissue characterization techniques based on machine learning in assessing cardiovascular risk in RA patients is discussed, as are gaps in traditional risk scores. Saba, Luca, et al. (2019) and Vemuri et al (2021). proposed a DL model following procedure for precise assessment of stenosis in ultrasound images of the common carotid artery utilizing the AtheroEdge system class from AtheroPointUSA.

Theis, Julian, et al. (2021) proposed a process DL architecture to improve existing severity scoring methods by integrating diabetes patients' medical histories [12]. First, past hospital encounters' health records are transformed into event logs appropriate for process mining. Julian Theis et al. (2021) and Sridaran K et. al. (2018) proposed a DL model for predicting MACE that was created and evaluated with the use of administrative claims from over 2 lakh diabetes patients in the Veneto area of North East Italy. He, Tiancheng, et al. (2021) and Sivakumar P (2015) and Buvana M et al (2021) showed that recurrence risk variables, in addition to tumor size and biomarker analyses, may be explored using a deep learning model incorporating clinical, multi-scale histopathologic, and radiomic visual characteristics [13].

III. PROPOSED WORK

Diabetes mellitus isa chronic disorder that is characterized by an average and higher level of blood sugar (glucose). A continuous risk assessment is a type of indirect risk assessment that is performed regularly. It is an important and influential method of evaluation that should be performed regularly as part of day-to-day administration[14]. Fig.1 illustrates the lightweight deep learning model to monitor the diabetes patient for continuous risk assessment. An NN model parameter called weight modifies input data in the network's hidden layers. Nodes commonly referred to as neurons, make up a neural network. A collection of inputs, a weight, and a bias value are included in each node [15-16]. Lightweight CNN architectures are proposed as a solution for making deep neural network deployment on small devices feasible. Within the network's hidden layers, the weight parameter in neural networks changes incoming data [17]. Nodes commonly referred to as neurons, make up a neural network. A collection of inputs, a weight, and a bias value are included in each node.

Scaling Data Each characteristic in the dataset has a wide range of possible values. As a result, characteristics with a larger range of values may dominate the learning algorithm's performance [18].

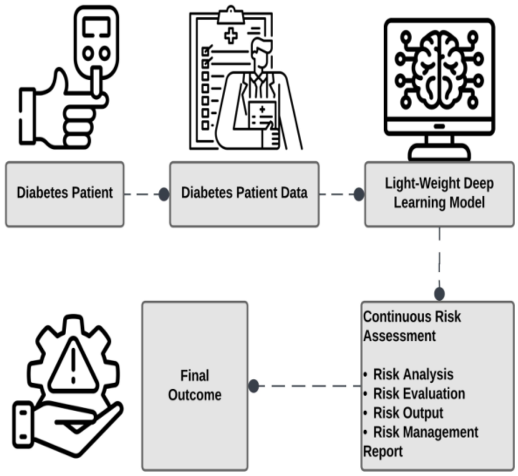

Fig.1 The lightweight deep learning model

The purpose of this stage was to maintain the intrinsic information while scaling the values of each character within a predetermined limit [19-20]. To do this, we employed data scaling based on min-max normalization, where X stands for the feature's initial value, Xmin for its minimum value, Xmax for its highest value, and R stands for the scaled feature's target range.

The data $p(q)$ device is a standard predecessor that receives a unit $n\,[q, q + 1]$. Unit p communicates with the behavior control. The process is completed with a neutralized combination is represented in Equation (1).

$$p(q)_j = \sum_{m+1}^{e} e\left(p(q) + \sum_{h=1}^{m} n[q, q+1]\right) \tag{1}$$

Weightlifting and signs are true values with large data input indications that are unaffected by diabetes. To produce such items, the implementation of the following Equation (2), which is roughly similar to the data to the signal q_j, may work with a truck loaded with t_j.

$$p_j = \sum t_j q_j + \sum_{f=1}^{q} n[q, q+1] \qquad j = 1,2. \tag{2}$$

To implement the massive data, necessary data input G is gathered in diabetes, to represent the Equation (3)

$$G = \sum_{p\to q}^{t} p_1 + p_2 = \sum_{c=1}^{t=1} t_1 q_1 + t_2 q_2, \tag{3}$$

The massive data uses its transfer work $g(o)$ to calculate the F to detect and classify the diabetes production, which could be a massive data function result $g(o) = (1 + e^{-o})^{-1}$, representing the Equation (4)

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$$g(o) = \sum g(f) = \int g(t_1 q + t_2 q_2) + \sum_{p \to n}^{t} n_1 + n_2 \qquad (4)$$

This mode command technology employs the point of entry, the available spectrum, and data transmission while doing tasks, but it also conveys the following Equation: (5).

$$t_i^n = \sum_{F=1}^{O} \alpha_i S \log\left(1 + \frac{|n_{i,m}|^2 G_{i,M} N^{-q}}{\sigma^2}\right) + \sum g(n) \qquad (5)$$

As a result, the efficiency of p_i^m data exchange data transfer is defined as Equation (6)

$$n_i^q = \sum_{n=1}^{Y} \beta_i B \log\left(1 + \frac{|N_{q,i}|^2 Y_q p^{-c}}{\sigma^2}\right) + \sum_{i=1}^{t} t_i^p + \sum_{i=1}^{q} |n_{q,i}|^2 X_q n^{-c} \qquad (6)$$

IV. Experimental Results

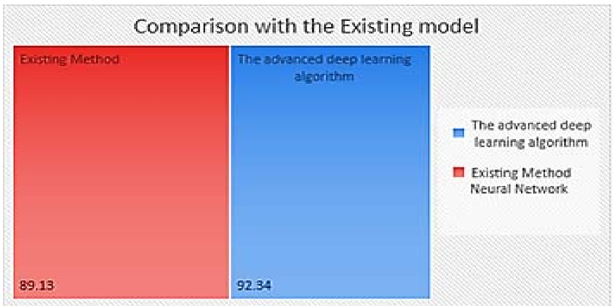

Fig.2Comparison based on accurate identification

Fig.2 represents the comparative analysis on the proposed deep learning model using a cloud-based machine learning system, performance analysis for the detection and classification of diabetes from a large data.

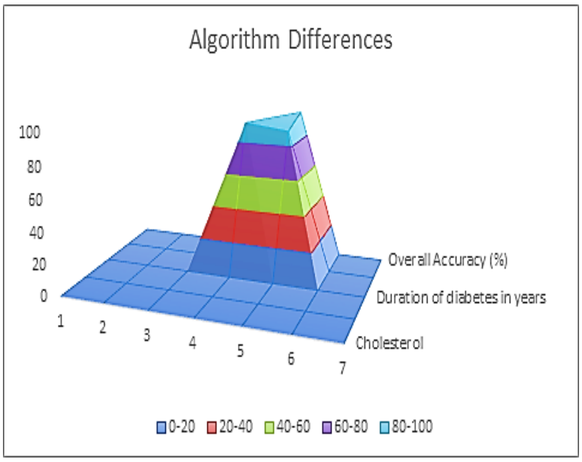

Fig.3 Analysis based on age of the persons

Diabetic analysis based on the age of the persons is presented in the Fig.3. It can be observed from the results that majority of the persons affected with diabetics is between 80 to 100 years of age. It is also to be noted that, in current scenario, the people of very young age of 0 to 20 years is facing the diabetic issues. The corresponding evaluation metrics on the analysis such as cholesterol, triglyceride, and duration of diabetes coefficients are presented in Table I.

TABLE I. Comparison based on Evaluation Metrics

Algorithm	CholesterolCo efficient $p(q)$ and n Value	Triglyceride Coefficient $p(q)$ and n Value	Duration of diabetes in years Coefficient $p(q)$ and p Value
The advanced deep learning algorithm	−0.079 and 0.132	0.020 and 0.694	0.082 and 0.48
Existing Method Neural Network	-0.064 and 0.121	0.012 and 0.534	0.804 and 0.203

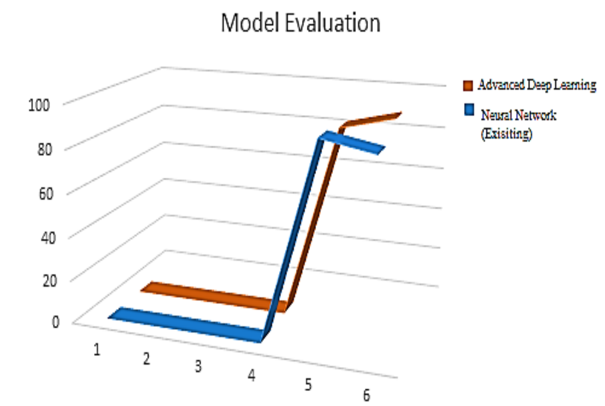

Fig.4 Model Evaluation based on Accuracy

Diabetes is a challenging illness that requires adhering to many restrictive rules, making it challenging to live with. Anyone without a background in medicine may find the instructions given by educators or even doctors to be confusing, which adds to the emotional anguish of receiving a diagnosis and having to make the necessary lifestyle modifications. Using a cloud-based machine learning system, analysis for the detection and classification of diabetes from a large amount of data is being carried out. Many studies on this subject have been conducted on diverse populations using various scales to better understand the mental and behavioral changes caused by diabetes as well as the treatment regimen that it requires. Accuracy evaluation of the models is presented in the Fig. 4 and Table II.

TABLE II.Accuracy Evaluation

Algorithm	Training and Testing (%)	Overall Accuracy (%)
The advanced deep learning algorithm	92.34	87.78
Existing Method Neural Network	89.13	95.21

An analyzing, convergent Artificial Intelligence model of this type can be taken as potential to alter the LT allocation policies for patients, advance the transplantation potential treatment for the infected persons with the most

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severe tumor (2021) hypothesized that symptomatic carotid plaques have a reduced grayscale median on ultrasound images due to a histologically higher lipid and comparatively little calcium and collagen type, and elevated chaotic grayscale dissemination because of the composition. Nasser, Ahmed R., et al. (2021) proposed a new technique based on cutting-edge operating systems. An AI and DeepLearning model is proposed to foretell the management of the level of glucose over time horizons of 30 minutes.

IV. Conclusion

This proposed model develops a lightweight DL model. This model is used to assess the continuous risk of diabetes. When compared to many existing machine learning and deep learning models, the developed model outperforms them. This work can be expanded in the future to recognize more complex activities. It can also be used on other edge devices.

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Application of Nanotechnology in the Treatment of Lung Cancer

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***Abstract*—Lung cancer is one of the deadliest chronic diseases in respiratory medicine. This paper aims to talk about how nanotechnology can be used to treat lung cancer. Nanotechnology intervention has revolutionized lung cancer therapy to a large extent by overcoming given circumstances in conventional therapies. The use of nano-based drug formulations in pulmonary delivery has contributed to possibly more advanced and efficient lung cancer therapy.Nanomaterials are used to precisely target tumor tissue to reduce therapeutic side effects and improve bioavailability. It is accomplished primarily through two pathways: passive targeting and active targeting.**

Keywords—*Lung cancer, nanotechnology, respiratory medicine.*

I. Introduction

The cancerous condition known as lung cancer most frequently affects the cells that line the airways in the lung tissues. For both men and women, it is the leading reason for cancer-related death. The two most prevalent types of lung cancer are small cell and non-small cell, as shown in Fig. 1. These two types differ greatly in how they develop and are handled. Lung cancer has become one of the cancer is major causes of death worldwide. Nonetheless, new therapeutic agents for lung cancer have been developed, which may changethemortality rate. Surprisingly, incredible progress in the technology and implementation of nanoscience in the identification, diagnosis, and therapeutic interventions of lung cancer have occurred over the years. Nanoparticles (NPs) can integrate different drugs and targeting agents, resulting in increased bioactivity, sustained delivery, solubility, and digestibility. In addition to early detection of lung cancers, an ideal treatment strategy for optimal care of these cancers is required. Lung cancer is commonly treated with a variety of therapeutic procedures, including surgery, radiotherapy, radiosurgery, chemotherapy, and immunotherapy.

The most adequate intervention for lung cancer is determined by the patient's functional status, stage, and histological type of the disease [1]. Surgery is the best model for treating lung cancers, but it is not appropriate for metastatic or progressed-stage lung cancers. When lung tumors cannot be resected due to spread to nearby tissues or when surgery is not required, the best therapeutic option has traditionally been a combination of radiation and chemotherapy. However, the recent addition of therapeutic strategies and immunotherapy to these modalities has altered the treatment paradigm for these tumors[2].

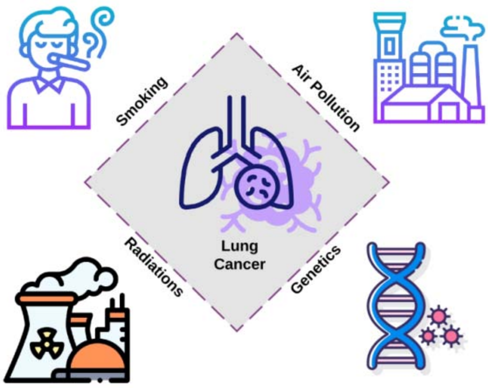

Fig.1. Nanotechnology in various fields

II. Literature Review

In this study, Cryer, Alexander M., et al. and Latchoumi T.P. et al. described the complexity of lung cancer, the current landscape of diagnosis and treatment, and the most recent developments in nanotechnology-based approaches to the management and prognosis of respiratory malignancies. The field's full potential has not yet been realised, so a brief overview of nanomedicine's future directions is given [3]. By learning from and incorporating developments in related fields, nanomedicine can be improved to the point where the current obstacles preventing its full clinical impact are removed [4-5]The pharmacokinetics, pharmacodynamics, and mechanism of action of DTX in the treatment of prostate, non-small cell lung, and breast cancer need to be better understood. Imran and Mohammad, et al. (2020) and Karnan B et al. (2022) conducted studies. It systemsatizes the most recent use of various DTX delivery techniques based on nanotechnology for the treatment of these cancers. The review also discusses the various anti-cancer drug combos that included DTX that were used to find the

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aforementioned cancers.Garbuzenko, Olga B., et al. (2019), Sivakumar P (2015), and Monica.M et. al. (2022) proposed a new multi-tier biotechnology diagnosis approach that includes local inhalation therapeutic delivery to the lungs, suppression of all four EGFR-TK types by a pool of siRNAs, induction of cell death by an anticancer drug, and active receptor-mediated targeting of the therapy specifically to cancer cells to reduce side effects [6]. Sharma, Parvarish, et al (2019) and Buvana M et al (2021) discussed various modes of nano drug delivery options such as liposomes, dendrimers, quantum dots, and carbon nanotubes, and metallic nanoparticles. Nano-carrier drug delivery systems appear as a good alternative, with the potential to open up new and more advanced avenues in cancer therapeutics.Zhong, Wenhao, et al. (2021) and Sridaran K et. al. (2018) reviewed the latest events in nanotechnology drug delivery systems strategies in the lungs and investigated the clinical practical significance of nanotechnology in the drug delivery study related to the lung [7].

Sergey G. Klochkov et al. (2021) and Vemuri et al (2021). reviewed the major trends in nano-drug preparations as well as the attributes restricting their use in medical settings. Furthermore, the current situation of authorized nano-drugs for the treatment of cancer is discussed [8]. Doroudian, Mohammad, et al. (2019) examined recent advancements in the clinical translation of nanomedicine for lung diseases, including lung cancer, cystic fibrosis, asthma, bacterial infections, and COPD. Doroudian, Mohammad, et al. (2021) focused on a review that provides both a historical overview of nanomedicine's application to respiratory diseases and latest cutting-edge strategies such as nanoparticle-mediated therapeutic strategies, the novel double-targeted nondrug delivery mechanism for targeting, stimuli-responsive nanoparticles, and theranostic imaging in the management and therapy of pulmonary diseases [9-10].

III. Proposed Work

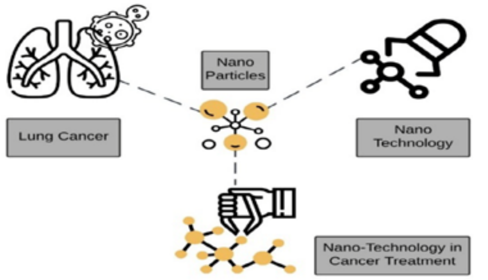

Fig.2. Proposed Architecture

Cancer treatments can be made safer and more accurate with the help of nanotechnology. Specially designed nanomaterials deliver chemotherapy directly to the tumor [11]. They don't give out the prescription medication until they get there in Fig.2. This prevents the drugs from causing harm to the healthy tissues surrounding the tumor. Side effects are caused by the damage [12-13]. Because of their small size, nanoparticles can deliver medicines to parts of the body that would otherwise be difficult to reach. The blood-brain barrier, for example, prevents poisonous substances from entering the brain. It also prevents the absorption of some medications. Nanoparticles are small enough to penetrate through this barrier, making them a promising treatment for brain cancer. Nanotechnology more precisely targets cancer cells while sparing healthy tissues [14-15].

The Carbon nanotubes, which are composed of long, thin cylinders of graphite atoms, are the most significant of today's nanomaterials. These might be the most significant brand-new substance since plastics. They are offered in 8 different structures, allowing for a variety of characteristics. Single-walled (SWNT), which have a single cylindrical wall, and multiwalled (MWNT), which contain cylinders inside of cylinders, are the two categories into which they are commonly separated. Whenever a story in the news mentions the extraordinary properties of nanotubes, SWNT is frequently cited. Weight loss, nausea, and diarrhea are common side effects of current nanotechnology-based therapies such as Abraxane and Doxil. However, these issues could be caused by the chemotherapy drugs they comprise.

$$P_{max} = dig_{s21}^{min} P(S \vdots I_Q; t *; T) \tag{1}$$

In Equation (1), the constants P and Q represent the number of infectious and shielded access points up to time t is calculated using Equation (2).

$$T_{max} = dig_{t22}^{max} \frac{U(I_Q;\ T_R, S, p^*)U(S * t^*)}{T(I_Q; T_R; t^*)} \tag{2}$$

The above results are being assumed to be homogeneous over are used to detect probability.

$$T(I_Q; T_R; t) = \sum_{\sigma \in \Omega(S, p^*, I_Q; P_R)} T(\sigma | S, t) \tag{3}$$

Based on the number of possible propagation sequences, the same approach is presented in Equation (3).

$$K(S, t, I_Q, T_R) = |'\Omega(S, t *, I_Q, T_R)| = (R+Q)! \prod_{\mu \in I_Q \cup P_R} |T_\mu^v| - 1, \tag{4}$$

In Equation (4), the feasible propagation sequential nodes provide both information and context around the same time.

IV. Experimental Results

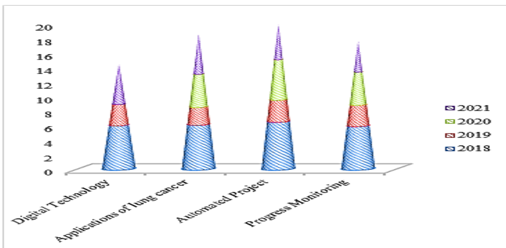

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Fig.3.In building a replica for identifying lung cancer for artificial organs with the application of Micro- and Nano Technology

The described the most commonly used nanomaterials in cancer diagnosis and treatment a crucial first step towards a tailored approach to cancer treatment is the capacity to divide patients into groups that are clinically relevant. A growing number of biomarkers have been created over time to identify people who will respond better to particular treatments. By identifying several molecular subtypes of cancer that require various treatments, these biomarkers have also proved useful for prognostic purposes and for understanding the underlying biology of the illness in testing for breast cancer. The main method for analysing samples for diagnostic markers is immunohistochemistry. Lately, the cost and speed of genome sequencing have decreased, making it possible to characterise the DNA and RNA of specific patient samples for clinical use [16]. Based on their physicochemical and biological properties, they have spotlighted the applicability of these nanomaterials for cancer management [17-18]. And discussed the difficulties associated with various nanomaterials Fig.3 and Table I, which limit their use and hinder their translation into the clinical setting in certain types of cancer. Mukherjee et al. (2020) provided a detailed overview of recent advances in theranostics nanoparticles such as liposomes, polymeric, metal, and bio-nano particles [19-20]. Furthermore, they have summarised the benefits and drawbacks of each approach in terms of lung cancer theranostics.

TABLE I. DESCRIPTIVE STATISTICS AND PEARSON CORRELATION ANALYSIS FOR BUILDING A REPLICA OF MICRO- AND NANO TECHNOLOGY (MNT)

Year	**Digital Technology**	**Applications of lung cancer**	**Automated Project**	**Progress Monitoring**
2018	6	6.1	6.5	5.9
2019	2.9	2.4	3	2.9
2020	0	4.5	5.5	4.5
2021	5.5	5.5	4.8	4.2

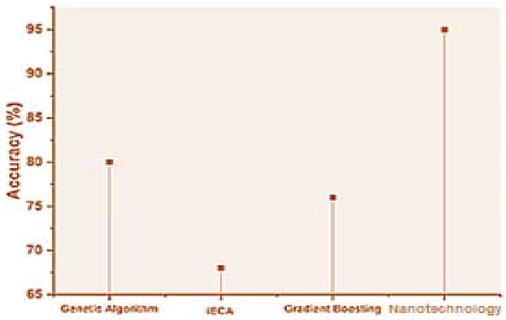

Fig.4. Accuracy Analysis with the Existing models

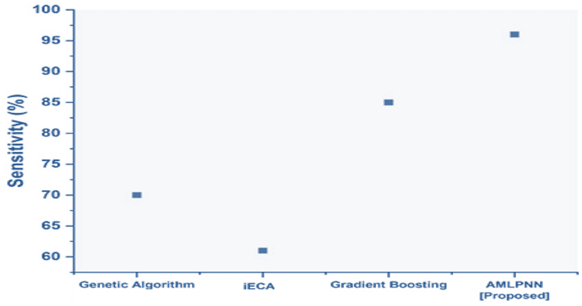

Fig.5a. Sensitivity Analysis of the System using Sensitivity

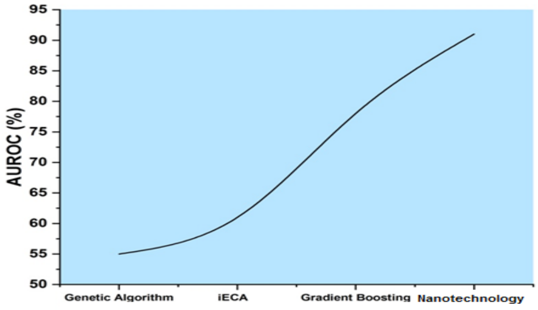

Fig.5b. Sensitivity Analysis of the System AUROC

The analysis of the model based on the Accuracy, sensitivity, and specificity are presented in the Fig.4, Fig.5a &5b respectively.

V. CONCLUSION

The method entails utilizing data from a larger dataset to enhance predictions for a smaller, more constrained dataset. We can more effectively account for variations in patient characteristics and raise the precision of predictions for the smaller dataset by weighting the sample of patients in the larger dataset. The number of experiments required to optimise the deep neural network hyperparameters was significantly reduced as a result of this method, which can expedite and reduce the cost of creating machine learning models. This approach is also applicable to numerous machine learning tasks.A longitudinal mobile health lifestyle dataset of 50 patients who self-monitored their food intake (carbohydrates, fats, and calories), physical activity (exercise time and calories burned), weight, and prior glucose levels over an 8-month period was used to test our model. Since many different factors can affect glucose levels, it can be challenging to predict them in the future.

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Patient Monitoring System Using Deep Learning Algorithms To Recommend Physical Exercise

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***Abstract*— The Internet of Things (IoT), which allows common household items to be connected to the internet and communicate with one another, is quickly changing the way we live and work. The healthcare, transportation, and manufacturing sectors could all undergo radical change as a result of this. if a little developing method have led to a number of new developments in the medical and health fields. IoT technologies for wearable health address new problems with state-of-the-art equipment and resources. With the aid of portable medical equipment, the health status of both in- and out-patient patients could be monitored frequently and irregularly. This paper suggests the Patient Health Monitor Framework (PHMF), an IoT application framework that uses Machine Learning (ML) techniques to create a better automation system. Connections, surveillance, and decision-making for precise diagnosis will be made possible by this system.**

***Keywords*—IoT, Healthcare, physical monitoring, Machine Learning techniques**

I. Introduction

The application of a sustainable and environmentally friendly strategy is a crucial component of our project. During the entire project lifecycle, we are dedicated to minimizing waste and reducing our carbon footprint. Health is life. Due to their busy schedules and workloads, people don't pay attention to their health and fitness. Physical inactivity is the biggest problem today's youth are facing [1-2]. People can maintain their physical fitness by continuing their regular physical activities and adopting healthy lifestyle habits, such as eating a balanced diet, getting enough sleep, and lowering their stress levels by practicing relaxation techniques like yoga or meditation. For a fulfilling life, it's critical to priorities our health and carve out time for self-care. When taken as a whole, nutrition and exercise change depending on the users' lifestyles, height, weight, sex, age, & degree of activities [3-4]. Exercise and healthy eating go hand in hand. It's important to manage your calorie consumption if you want to keep your blood sugar levels stable. Therefore, the proposed approach would enable physicians to click a mouse and counsel exercise and diet to their customers who have diabetes, hypertension, or thyroid problems in addition to the medicine they prescribe at every follow-up [5-8].

However, one use is the remote monitoring of clients' healthcare, which enables medical professionals to keep a closer eye on their patients and prevents the progression of medical issues even in regions with limited to distant healthcare facilities [9]. Remote monitoring enables faster diagnosis & prompt, appropriate treatment by giving medical professionals access to timely or past health information in real-time [10]. Even though it reaches regions with limited access to health facilities telemedicine has the potential to improve healthcare delivery and reduce healthcare disparities by providing remote consultations, diagnoses, and treatment options. However, it also requires reliable internet connectivity and trained healthcare professionals to ensure effective implementation. telemedicine has the potential to improve healthcare outcomes by providing remote medical consultations and diagnoses, as well as facilitating the delivery of medications and medical supplies. However, it also requires reliable internet connectivity and adequate training for healthcare providers to effectively utilize the technology. [11–12]. That underscores why such technologies have so far had little impact on rural India's patient and health industries. This essay introduces the idea of AmritaJeevanam, a specific healthcare infrastructure that attempts to serve rural communities' requirements [13].

II. Related Works

By utilising remote sensing capabilities, health monitoring technologies that are combined with IoT/BAN effectively revolutionise the healthcare sector [14]. Detection systems are used in conjunction with such systems to identify crucial parameters and transmit data to an acquiring device via Bluetooth, BLE, and WiFi. Medical and measurement data that has been collected through an intermediary device, like a gateway, is frequently sent to a distant server. For those who live in remote or rural areas, this technology makes it possible for medical professionals to monitor patients' health in real-time, even from a distance. Additionally, by enabling early detection and intervention of potential health issues, the use of IoT/BAN technologies in healthcare can enhance patient outcomes.Using this technology, healthcare professionals can [15]. Data transmission is kept on a distant server, assuring accessibility and accessibility at all times. Cloud-based systems are used to construct popular systems and store the gathered health information [16]. Numerous applications are offered by such healthcare monitoring platforms. However one tool, for instance, uses analytics to

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find individuals with serious cardiac issues from the medical information stored on computers.

Based on the acquired data, medical analytics helps uncover distinctive patterns or trends. Big data medical analytics in healthcare platforms offer practitioners insightful information that aids in choosing the best diagnoses [17]. Medical data analysis can help spot changes in medical trends or foretell the likelihood and likelihood of impending peril. It has been investigated in various systems to use a health platform and widely used mobile technology as an alarm system. These systems, which rely on Internet technology, allow for direct medical professionals to intervene [18]. The utilization of this type of healthcare system has, up until now, not been practical in the context of rural and isolated Indian populations which have low literacy levels, a lack of advanced technologies, limited access to medical facilities, and inconsistent or nonexistent broadband internet. These peoples are also digitally cut off from the rest of the world. This development's main goal is to tackle this issue by putting in place a cheap solution for rural healthcare monitoring and education.

III. Proposed Method

The use of IoT health wearables to gather patient data across various settings is a significant advantage in providing continuous monitoring and effective patient care. The ML classification methods used in constructing the training models enable accurate diagnosis and analysis, leading to better decision-making based on the collected patient data. Furthermore, the program's ability to share patient data with doctors, inpatients, outpatients, and caregivers enhances the quality of care that patients receive [19].

The program's focus on high-quality and secure services makes it an ideal platform for healthcare providers to offer healthcare services to their clients, providing them with accurate and prompt care. This feature could also be useful to researchers and healthcare policymakers, as the accurate and precise data gathered by the program could assist in identifying trends in the management of chronic conditions.

Overall, the PHMF program is a significant development in healthcare that can provide healthcare providers with an efficient way of managing chronic conditions and providing high-quality and secure care for their patients. The program's effectiveness could potentially reduce healthcare costs, improve patient outcomes, and enhance the overall quality of healthcare service delivery.

Wearable technology such as temperature sensors, heart rate monitors, eye lance-based diabetes sensors, and blood pressure monitors are suitable for transmitting real-time data from the human body to an e-health care monitoring system. These wearables can capture essential biometric data that doctors and healthcare providers can use to monitor a patient's health status continuously.

For instance, temperature sensors enable remote monitoring of fever or other temperature-related issues, heart rate monitors enable remote monitoring of heart rate patterns, and blood pressure monitors allow remote monitoring of blood pressure, which is critical for patients with hypertension. Eye lance-based diabetes sensors help monitor blood sugar levels and track insulin injections for diabetic patients remotely.Wearable technology is an important aspect of remote health monitoring, as it allows patients to receive care while reducing the number of visits to healthcare facilities. Healthcare professionals can also take advantage of the data gathered by these wearables to make informed decisions, improve diagnosis, and develop personalized treatment plans for their patients.The use of wearable technology in remote health monitoring is a promising development in healthcare. It enables a continuous flow of biometric data to healthcare providers and physicians, which in turn allows them to diagnose medical conditions early and take prompt action to provide the best possible patient outcomes. [20]. Using IoT architecture withML techniques aims to develop a new application model that provides a better solution and considerable improvement for many discrete health services. The PHMF software is linked to devices for data collecting and patient monitoring. Fig.1 depicts the proposed system design.

Each patient must sign up using a special wearable connected to the Global Positioning System. Wearable technology is practical because the patient may simply carry it with them at all times. These gadgets allow for the tracking of a patient's health status andthe location the patient [21-22]. At regular periods, the admin server will get the collected data. These limited gadgets and IoT applications are mostly managing new issues.

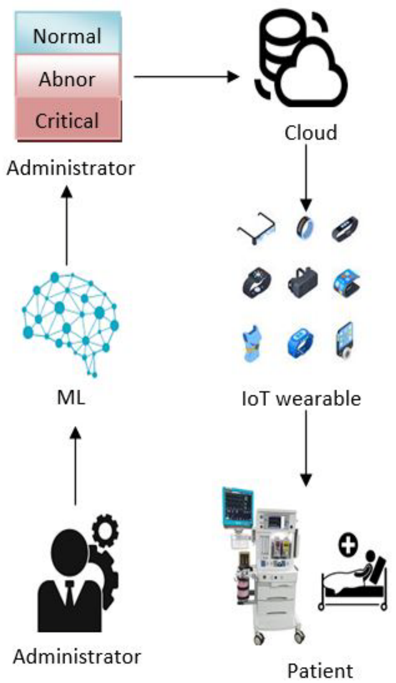

Fig. 1. Proposed Architecture

ML is a computational and statistical methodology that interacts with supervised and unsupervised learning approaches through data mining techniques. Fig. 2 depicts the key ML classification techniques such asK-Nearest

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Neighbor (K-NN), Decision tree, Support vector machine (SVM), and Regression algorithms.

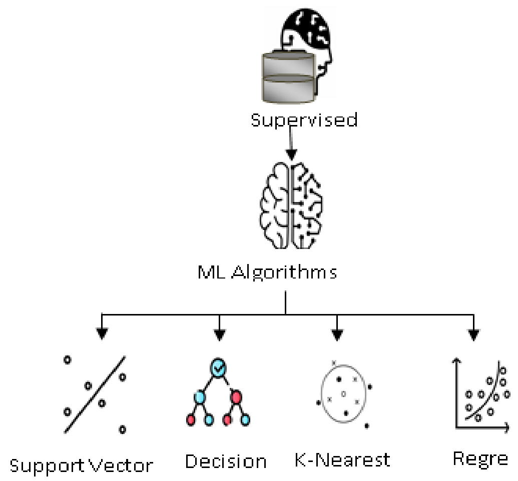

Fig. 2. Proposed ML classification

Currently, one algorithm has been selected by the authors for investigation. SVM recognizes a superior forecast here. The optimal optimization may be achieved by combining regression and classification algorithms. We will use an approach that defines a hyperplane to optimize the separation between the classes using mathematical techniques. plotting the data item in N-dimensional space on the view plane. The representation of data items has a variety of properties when the number "N" is taken into account. Each feature's value is determined by the value of a certain location. Researchers discover the hyperplane that differentiates two classes to be extremely well-equipped and prepared based on the categorization.

TABLE 1.DIABETICS DATASET DESCRIPTION

Items	Normal	Low	Abnormal	Critical
Pregnancies	4<=6	1<+4	7<=9	=>10 above
Glucose	80 mg/dL	120mg/dL<140	140mg/dL<=170	=>170 above
BP	<90mm Hg	70mm Hg<=80	90 mm Hg<=100	=>170mm Hg
Skin Thickness	25<=30	0<=25	40<50	50<=60

A. SVM in data visualization

i). The two classes are the subject of the best discrimination analysis in N-D space.

ii). Increase the space between the data points across all classes.

iii). Finding the margin length and variability of data elements on the hyperplane is its key restriction.

iv). The margin hyperplane may be used to precisely locate neighboring data items and missing values.

v). This could improve class precisely and eliminate certain classification faults.

The hyper lines cannot be used to separate the two classes. Outlier sets can be referred to in situations when the data items belong to a different class that does not control the anomalous sets and the diabetes dataset description is shown in Table 1.

IV. EXPERIMENTAL ANALYSIS

The use of the National Institute of Diabetes dataset on diabetic patients in the PHMF application is a step in the right direction in delivering accurate and personalized care. The use of large datasets such as these is crucial in training machine learning models to enable accurate classification of patients with diabetes. The dataset's inclusion of various age groups, particularly pregnant women, is also important, as gestational diabetes is a common occurrence during pregnancy that can lead to complications if not properly managed. Furthermore, the dataset's class label, which can have values of either 0 or 1 depending on whether the patient has diabetes or not, makes it easy to develop a classification model using supervised learning techniques.

By using the dataset for experimental investigation, the PHMF application can improve the accuracy of its predictive models, thereby enabling more personalized care for diabetic patients. The results obtained from the dataset can enhance the program's decision-making capabilities, leading to more accurate diagnoses, and improved patient management. This can lead to better outcomes for diabetic patients, especially those who may have difficulty accessing medical care due to geographic or socioeconomic factors.

The use of large datasets such as the National Institute of Diabetes dataset within the PHMF application is a significant development in delivering personalized and accurate care for diabetic patients. The dataset's class label and inclusion of pregnant women of different age groups are important features that make it suitable for experimental investigation and classification model development.

TABLE 2.SAMPLE DATA SET

	Pregnancies	Glucose	BP	Skin Thickness	Insulin	BMI	Diabetes	Age	Outcome
0	7	149	73	36	0	33.7	0.629	50	1
1	2	87	67	30	0	26.8	0.355	32	0
2	8	185	65	0	0	23.5	0.677	33	1
3	2	90	67	24	95	28.2	0.169	22	0
4	0	138	41	36	169	43.6	2.289	34	1

To determine if a person has diabetes or not, the SVM algorithm is used on datasets that have been trained on a computer. The likelihood of a specific consequence justifies the age at which a person develops diabetes and any further potential causes. For prediction analysis, the following two primary elements are taken into account: Age and the levels of glucose and insulin in the human body. The report's final result was patterned with two potential hues, such as Blue

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and Orange. Fig.3 shows the prediction analysis with age on the x-axis and glucose level on the y-axis. Fig.4 shows the prediction analysis with age on the x-axis and insulin level on the y-axis.

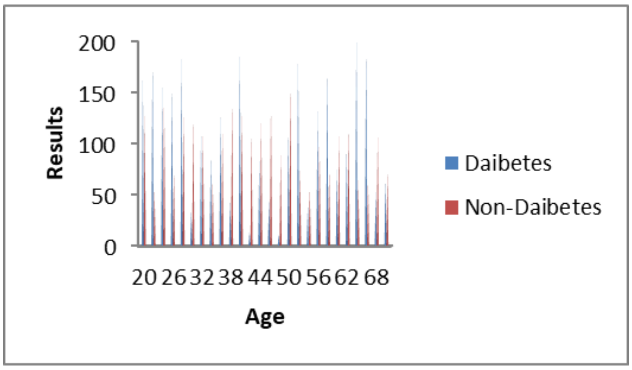

Fig. 3. Prediction analysis with age Vs glucose level

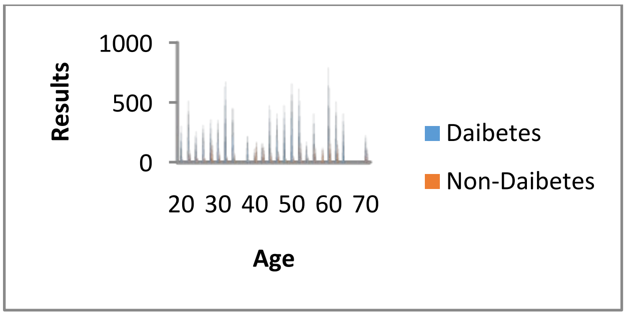

Fig. 4. Prediction analysis with age Vs insulin level

TABLE 3.PERFORMANCE ACCURACY

	Precision	Recall	F1-Score	Support
Diabetes	0.78	0.67	0.72	55
No-Diabetes	0.84	0.91	0.88	100
Micro Avg	0.82	0.80	0.82	155
Macro Avg	0.81	0.78	0.79	155
Weighted Avg	0.82	0.79	0.81	155

According to the performance metrics presented in table 3, the SVM algorithm outperformed other algorithms in the PHMF application in terms of efficiency, with a score of 80.51%. The other algorithms that were tested had the following efficiency scores: Gradient Boosting scored 77.27%, K Neighbour Classifier 71.42%, Decision Tree 70.22%, Random Forest 79.22%, and GNB 76.62%.

It is worth noting that although the SVM algorithm had the highest efficiency score, other algorithms such as Random Forest also performed relatively well, with a difference of only 1.29% compared to SVM.

Overall, the performance metrics presented in table 3 demonstrate the potential of machine learning algorithms such as SVM in delivering personalized and accurate healthcare services. By leveraging large datasets and applying supervised learning techniques, healthcare providers can improve diagnostic accuracy, enhance patient outcomes, and reduce healthcare costs. However, selecting an appropriate algorithm for a particular application requires careful consideration of several factors, including the type of data, the problem domain, and the specific requirements of the system..

V. CONCLUSION

The SMS service-related difficulties faced by PHMF in the provision of health-related services such as daily health alerts, medical appointments, and nutrition recommendations are understandable. However, hospitals can consider modifying PHMF software to provide the best-recommended E-Health services to patients using different communication channels such as emails, phone calls, or social media platforms.By adopting different communication channels, healthcare providers can enhance patient engagement, improve adherence to treatment plans, and achieve better patient outcomes. These channels can also enable remote communication, provide more convenient access to care, and offer personalized treatment options that suit patients' unique needs.

Furthermore, future improvements in the PHMF application can leverage emerging technologies such as artificial intelligence, machine learning, and data analytics to enhance diagnostic accuracy, predictive modeling capabilities, and personalized treatment options. These technologies can also support more effective patient monitoring, early detection of potential health issues, and prompt interventions to improve overall health outcomes. the adoption of different communication channels for the provision of healthcare-related services can potentially enhance patient engagement, improve adherence to treatment plans, and lead to better patient outcomes. Additionally, future improvements in the PHMF application can leverage emerging technologies to enhance diagnostic accuracy and personalized treatment options, leading to better patient outcomes and improved healthcare service delivery. We have gathered a set of diabetes data from web resources for an experimental demonstration of the proposed strategy. The dataset gathered is believed to be the same as the dataset gathered using wearable IoT-based technology. An ML method called SVM was applied to the dataset, and it produced an accurate result. To increase the effectiveness of the proposed approach, we want to collect data from IoT wearable devices and use more ML algorithms in further work.

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Using Machine Learning to Analyse User Psychology in Social Media

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***Abstract*—In this study, we attempt to identify the emotion levels, such as positive, negative, & neutral feelings, from postings and comments on social networking sites on depression. Social media sites like Facebook and Twitter are becoming effective for helping those in need who require extra care or attention in terms of mental support. They are also utilized for communication and network development among relationships. There are several depressive support groups on Facebook, and they are quite helpful in giving the sufferers mental assistance. In this study, we attempt to formalize the posts and comments on depression into a succinct lexical database and identify the emotion levels from each occurrence. The complete amount of work has been divided into two sections: sentiment analysis and the use of machine learning techniques to examine the capability of extracting sentiment from such a unique category of texts. To determine the sentiment levels, we used the Python textblob module and typical machine learning techniques on the linguistic characteristics. For each of the classifiers, we have calculated the precision, recall, F-measure, accuracy, and ROC values. Random Forest outperformed the other classifiers, successfully classifying 60.54% of the instances. We think that conducting sentiment analysis on a particular class of texts may inspire additional research into how natural language is understood.**

***Keywords*—Sentiment Levels, User Communication, Machine Learning Algorithms. Accuracy Detection Analysis**

I. Introduction

Heterogeneous efficiency for various demographic subgroups is a fundamental barrier to the practical application of mental health surveillance models [1-2]. The training data may not be adequately representative of the population, which may produce this behavior, or some groups may be more difficult to forecast with the same data. In-depth data collection and training regimens can be used to solve the first situation, which has been extensively researched in the machine learning literature [3-6]. The latter situation is frequently more nuanced and challenging to handle. The value of the models is reduced if these performance disparities are not acknowledged and addressed. Particularly, if historically underrepresented people do worse, it can exacerbate disparities already in place, such as the underdiagnosis of depression [7].

Social media refers to websites and applications that have been specifically designed to enable people to distribute little amounts of material quickly, effectively, and in real-time. It has altered the mode we use to travel to and the mode we complete an activity and the ability to exchange photographs, reviews, activities, etc. in real time [8–10]. Shops that employ social media as a crucial component of their advertising strategy typically experience a quantifiable cost. But the key to using social media well is to stop treating it like an extra accessory and instead treat it with the same consideration, appreciation, and interest as the rest ofr advertising and marketing activities [11]. Utilizing various channels to engage with customers and develop r brand, increase revenue, and increase website traffic is what social media marketing entails.

The investigators have spoken about huge data gathered from social media that has been extensively evaluated by research academics and employed as significant to crucial insight into human conduct. [12] discussed how big data, machine learning, and analytics algorithms may be used to monitor social media and identify consumers' perspectives on opulent hotels from beginning to end the new visual data analysis and spin into an enhanced managing brand strategy for comfort hospitality managers. The researchers of [13] gathered data from 8434 startup firms on Twitter and created features based on social media using a machine learning model to predict each firm's level of social media participation [14]. The study's findings indicate that deep learning provides the greatest forecast accuracy for engagement levels. It also indicates that the amount of company-generated tweets, retweets, and likes is what matters most in determining the efficacy of social media marketing practices [15]. Social media users are perceived as contributing to marketing material as a result of the increasing interest in social media and user-generated content on websites like Tube, Facebook, and LinkedIn.Using big data analytics, they examine client perceptions and attitudes towards social media in this article.Related Works

14-year-olds are probably at risk for depression as a strategy to deal with social media or interact with others [16]. This is a widespread fallacy even in developing nations; there are depressed and suicidal persons who for a variety of reasons avoid seeing psychologists [17]. Some people believe they will be laughed at and their standing in

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society would decline if they visit a psychologist. They ultimately turned to suicide as a way to deal with their sadness [18]. Numerous deaths due to despair have been reported throughout the globe, and numerous of them posted their final Facebook post. They all shared the same trait, which was that they were all profoundly depressed [19]. If they can recognize their depressive stage before they reach the crucial stage, they may prevent suicide.

It is used to evaluate people's emotions in a variety of circumstances [20-21]. People now utilize social media platforms to express their emotions in their native languages, such as English [22]. The text that individuals publish on social media platforms is what we want to analyze for the sentiment. Many individuals in the world experience depression for a variety of reasons, many people who become drug addicts, many people who are unable to eat, sleep, work, or engage in other activities, etc. Because many of them also commit suicide, many families have lost dear family members [23]. Many individuals can live healthier lives like regular people if it doesn't happen. Language is one way that people may communicate their emotions. Individuals often express their feelings by writing and speaking about how they are feeling daily on social media[24].

It is to identify depression using the brain's volumetric characteristics. There is a chance that characteristics from brain SMRI will multiply [25]. Diagnostic values and volumetric data were looked at. The results show how often it is to spot depression [26]. SMRI volumetric features of diagnosing depression are shown in the output findings. The classification accuracy of the function vector is evaluated using a variety of classifiers, including SVM, Ensemble Learning Encoder, and Components are identified. These are comparable in terms of memory, accuracy, & correctness. In contrast to Naive Bayes' accuracy rate of 89.5%, they achieved a 90% overall accuracy. A motion analysis method for disorganized and grammatically incorrect customer remarks made in Arabic slang was put out in this paper's current Arabic Slang Sentiment Words & Idioms Lexicon, [27-28]. The new language was painstakingly put together from websites for microblogging. Furthermore, to categorize opinions as pleased or dissatisfied, the SVM approach was used with SSWIL.

III. Proposed Methodology

Researchers have a suggested technique that, like any other natural language recognition system, incorporates data gathering, information pre-processing, analysis, extraction, and classification, the use of machine learning algorithms, emotion recognition, and evaluation. Anxiety writings are a specific group of textual data that we have selected for this study. We have explored communities on social media sites like Twitter and Facebook to get this kind of information. Nowadays, individuals use social media as a powerful tool for communication, but they are also using platforms to provide psychological or emotional support via constructive posting. Regarding their efforts, they recently established the "Depression Support Group," "Anxiety Awareness," "Anxiety & Depression Support UK & Ireland," "Cure r Depression," and "Essential Thrombocythemia Support Group" Facebook groups for anxiety. The items and opinions that are related to depression have been carefully divided. To confirm that all of the data we obtained are relevant to depression, we used a psychologist to verify the information we had gathered. Table 1 illustrates the statistical characteristics of our dataset.

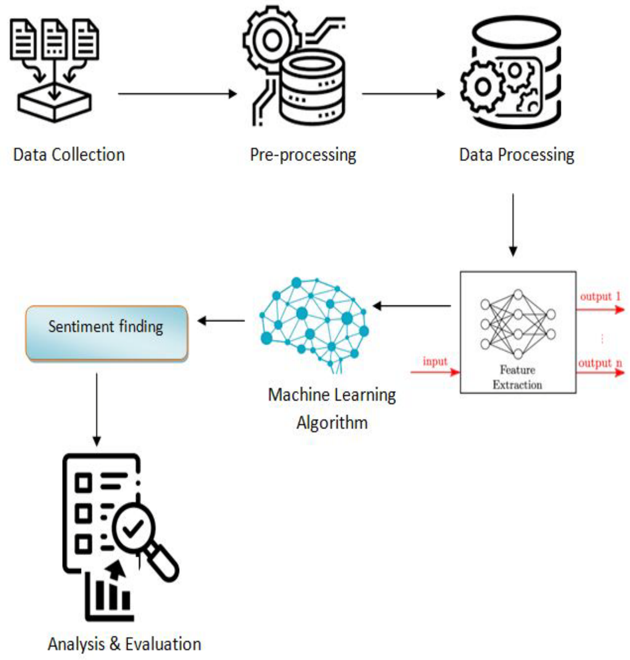

Fig.1. Proposed Methodology

TABLE 1. Overview Of Proposed Approaches

Languages	Wikipedia articles	Training dataset	Evaluation dataset
English	2452	3723	NA
German	2354	NA	3364
Tamil	3562	4785	NA
French	2354	3256	3857
Hindi	2548	NA	3265

TABLE 2. Statistical Properties of the Dataset

Characteristics	Quantity
Data collected size	1021
No. of words	63756
No. of characters	358740
No. of sentences	4407
No. of special characters	2900

Researchers have completed the fundamental pre-processing activities associated with natural reading comprehension, such as data cleansing, as all of the obtained data are in a readable form. Punctuation marks, hashtags, and advertising links have been deleted from the comments and the posts. We have also deleted the HTML entities from promotional postings because they typically contain those elements. As a result, we have left certain marks and special characters in place.

The impartiality and orientation values of each example were extracted using the text blob program after the data had been sanitized. For our dataset, the traditional "V-shape" also appeared. Fig.2 shows that relatively few examples are presented when the polarity values are significantly negative but the subjectivity values are less. It should be noted that

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postings with extremely high or extremely low impartiality values do exist. As a result, the scatter plot has a "V shape".

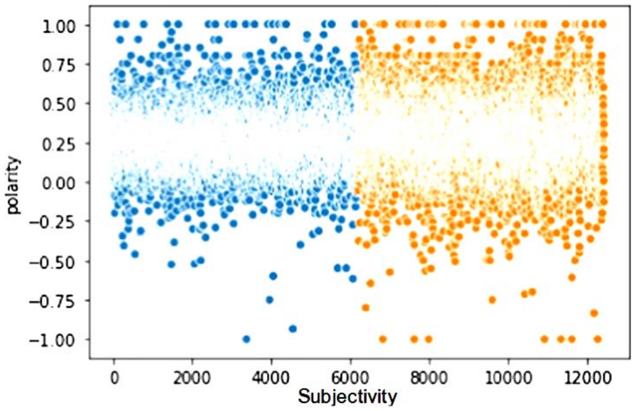

Fig. 2. Subjectivity vs. polarity scatter plot

A. *Feature Extraction*

That process of feature extraction is where this paper makes one of its primary contributions. As opposed to a standard text classification challenge, researchers have retrieved linguistic characteristics at the character, word, and sentence levels. The python NLTK package was used to extract a total of 86 features. They have isolated the special characters and the exclamation point from the 86 linguistic elements. Additionally, we utilized the numbers to determine how these characteristics affected sentiment analysis. These features extracted are immediately input into the training and testing phases of machine learning.10 distinct machine learning models have been used to identify the hierarchical classification issue. The techniques were carefully chosen since they are often utilized in other works of a similar nature. To assess effectiveness, components are identified, and Bayes-based regression and tree-based methods are used.

They have simply relied on the polarization values that were derived throughout the data preprocessing step for sentiment recognition. The inner lexicon collection utilized in the text blob program is quite trustworthy for evaluating the messages from social media or microblogging. Following finishing this phase, the dataset includes cases that are 55.6% positive, 31.2% negative, & 13.2% neutral.

IV. Evaluation and Analysis

Employed the most well-liked measures for performance assessment, including accuracy, ROC, PRC, recall, f-measure, and precision. Efficiency has been regarded as one of the most important measures in the majority of research publications that evaluate classification techniques. We are not presenting the theoretical formula or other characteristics associated with these assessment measures in this study because they are extensively utilized.

A. *Experimental Analysis*

Reliability, ROC, PRC, recall, f-measure, & accuracy were some of the metrics used to gauge success shown in Table 3. In the vast majority of research articles that analyze categorization systems, efficiency has been recognized as one of the most performance metrics. Due to their widespread use, we are not giving the theoretical model or any further features related to these assessment measures in this work.

TABLE 3. Performance Evaluation Metrics

Algorithm Name	Precision	Recall	F-Measure	Accuracy (%)
Naïve Bayes	0.544	0.342	0.333	34.974
Decision Tree	0.509	0.500	0.504	50.035
Random Forest	0.598	0.608	0.548	60.546
Support Vector Machine	0.694	0.577	0.449	56.980
Sequential Minimization Optimization	0.577	0.561	0.718	55.491
Linear Regression	0.522	0.541	0.522	53.83
Proposed System	0.762	0.633	0.713	75.61

Researchers employed a variety of measures to determine the performance, including reliability, ROC, PRC, recall, f-measure, and simplicity shown in Table 4. Productivity has been acknowledged as one of the most important measures in the great majority of research that examines categorization technologies. We are not providing the computational foundation or any more details about these evaluation measures in this study due to their broad use. This sort of outcome demonstrates the data imbalance factors. We employed relatively little data that came from a strong social media environment, the data is unbalanced, which affects the machine learning techniques.

TABLE 4. Statistical Metrics

Models	Kappa	MAE	RMSE	ROC
Naïve Bayes	0.1254	0.4451	0.6598	0.132
Decision Tree	0.1492	0.3470	0.5921	0.143
Random Forest	0.3241	0.3509	0.4192	0.242
Support Vector Machine	0.0677	0.2831	0.5301	0.158
Sequential Minimization Optimization	0.135	0.3446	0.4452	0.112
Linear Regression	0.1242	0.3357	0.4481	0.163
Proposed System	0.0149	0.3856	0.441	0.042

Fig.3 displays the Matthews linear regression data. The Algorithm for Random Forests produces the MCC value with the highest MCC.

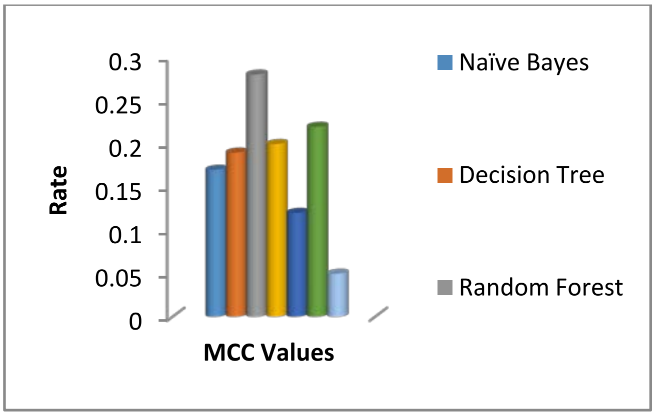

Fig.3.Bar chart of MCC values for each ML classifier

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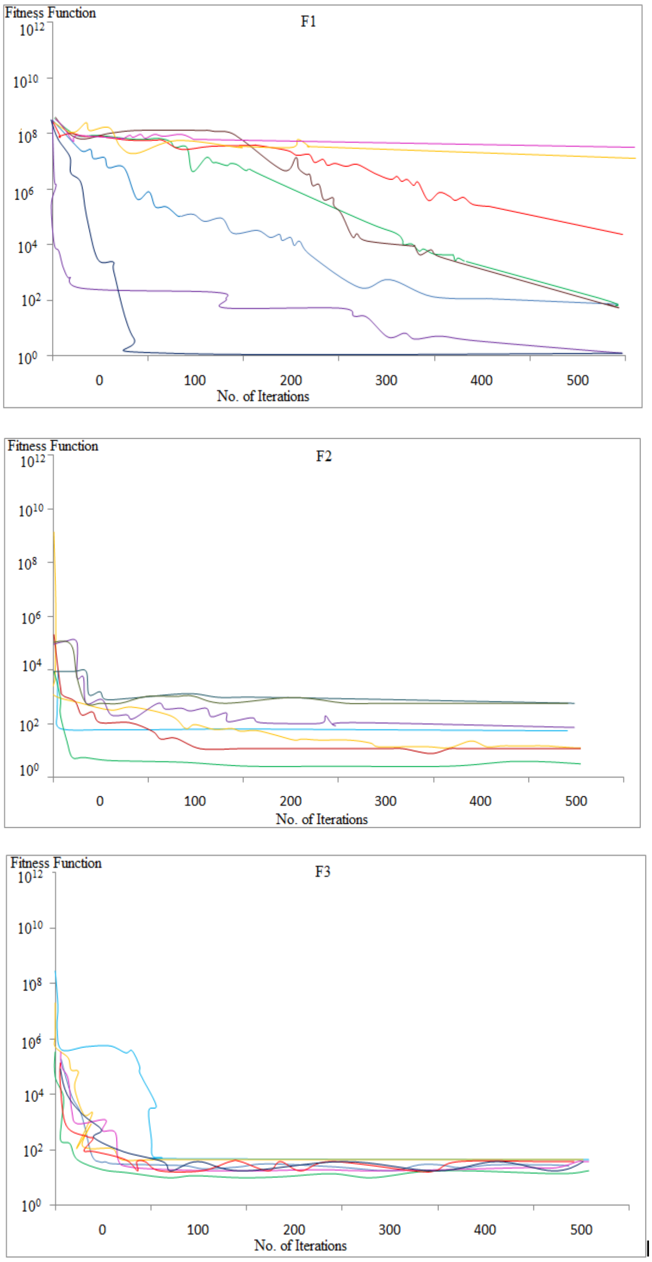

Fig. 4. Comparison of F1-F3 convergence score

The lowest Friedman mean rank across testbed suit programs. As a result, it receives the highest overall score for such functions. Fig.4 depicts the best convergence curves for the implemented methods.

V. Conclusion

Throughout this study, researchers developed an approach for using linguistic elements collected from comments on social media or postings on melancholy. It is exceedingly difficult to develop classifiers that perform better since social networking and microblogging sites use very casual language. We have used 10 classification techniques to investigate the effectiveness of various category classifications. The research methodology part contains the response to the three research problems that were defined. The most effective ML classifier is Random Forest, which has a decent chance of using textual data connected to depression for sentiment analysis.

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Neural Network-Based Intrusion Detection System in Hospital Management Systems

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***Abstract*—The technological transformation has helped to simplify formerly time-consuming tasks. In this study, we will look at neural network-based intrusion detection systems in hospital management systems. This paper presents an intrusion-identifying system based on NN modeling. A hospital managing system (HMS) is a computer-based system that assists in controlling the healthcare data in the way of the effective ending of healthcare providers' jobs. An intrusion detection system (IDS) is software that identifies malicious activity on a network. A neural network (NN) is a set of algorithms that aims to determine interactions in a data set using a process that resembles how the human brain works, and the HMS is functioned in this proposed system using these NNs. In this research, K-Means algorithm is implemented to identify the intrusion in the hospital management System.**

Keywords—***Hospital Management System (HMS), Intrusion Detection System (IDS), Neural Network (NN), K-Means Algorithm***

I. Introduction

A neural network (NN) is a type of algorithmic learning system that employs a network of functions to comprehend and translate a data input in one form into an expected outcome, typically in another form. The neural network concept was inspired by human neuroscience and the way neurons in the human brain work with each other to understand input from human senses. In ML algorithms, NNs are one of many techniques and methodologies. The NN can be used as a component in a variety of machine learning algorithms to convert complex information inputs into a space that the computer understands. An intrusion detection system (IDS) is software that detects malicious network activity [1-2].An HMS is a computerized model which assists in the managing of healthcare data and effective ending of healthcare providers' jobs. They manage data for all departments of healthcare, including clinical, finance, research lab, outpatient care, primary care, operating room, equipment, nursing, pharmacy, radiation oncology, pathology, and so on. HMS entered the hospital management scene in the 60s and has since evolved and synchronized with technology while modernizing healthcare facilities [3]. In today's world, healthcare management begins in the hands of patients via their cell devices and facilitates the patient's needs.

The incorporation of IoT systems into healthcare applications has made it feasible to remotely monitor the information pertaining to patients and to deliver appropriate diagnoses whenever it is required. The provision of high-security features that can ensure the accuracy and confidentiality of patients' data, on the other hand, is a considerable difficulty. Any change to the data might have an effect on the care that the patients get, which could result in human fatalities in an emergency situation [4-5]. When it comes to providing an efficient solution for intrusion detection, machine learning has the potential to live up to its potential as a viable option due to the high dimensionality and conspicuous dynamicity of the data involved in such systems. On the other hand, the majority of the currently available healthcare intrusion detection systems construct their datasets by using either network flow measurements or the biometric data of patients [6-7]. The purpose of this research is to demonstrate that using a combination of network metrics and biometric measurements as features yields superior results than use either one of the two kinds of features alone [8]. A real-time Enhanced Healthcare Monitoring System (EHMS) testbed has been developed by our team. This testbed monitors the biometrics of patients and gathers network traffic measurements. The data that is being watched is then transferred to a remote server so that further diagnostic and treatment choices may be made [9-10].

II. Literature Review

Ashraf, Eman, et al. (2022) and Sivakumar P (2015) proposed FIDChain IDS using lightweight Artificial Neural Network in learning means to guarantee to care of health information secured in managing preservation with the advancements of blockchain platform that enable the ledge that is shared for gathering the weights in local and transmitting the developed weights in global after taking an average, that restricts poisoning attacks and delivers complete transparency at the same time immutability in a distributed system according to the negligibility.Laxminarayana, Nikhil, et al. (2022), Karnan B et al (2022), and Latchoumi TP et al (2022) investigated the IDS is trained using NNs and the concepts of quantum physics. It is suggested to use a hybrid classical-quantum neural architecture with a quantum-aided activation

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function, It uses less architectural memory than traditional systems while yet successfully capturing patterns in the dataset [11]. On the well-known KDD99 dataset, the experimental results are shown, and our approach is contrasted with various traditional models. Begli et al. (2022) and Monica.M et. al. (2022) proposed a secure remote medical system architecture. We aim to provide a secure framework for remote healthcare systems that keeps the system's data as safe as possible from common network affection such as the Denial of supplying and User Root attacks [12]. To accomplish this, they have created an IDS based on the ML algorithms, SVM. Following the implementation of the proposed method, the evaluation parameters of IDS' layered architecture demonstrate the efficacy of our proposed framework.Awotunde, et al. (2021), Vemuri et al (2021), and Buvana M et al (2021) presented a study that offers a Deep Learning based detection of intrusion in the form of a framework for the Internet of Things with hybrid regulations based on the feature selection to prepare and analyze the data captured from TCP data packets [13]. The training procedure has been carried out using a deep feedforward NN model and a hybrid rule-based feature selection approach. Two network datasets, NSL-KDD and UNSW-NB15, were used to test the proposed scheme. He, Daojing, et al. (2019) and Sridaran K et. al. (2018) investigated system security flaws and introduced a new intrusion detection system based on a piled autoencoder. They performed the results, and the status demonstrates that the model and its method are effective [14].

He, Daojing, et al. (2019) proposed a stacked autoencoder and a DNN-based intrusion detection system. To reduce feature width, the layered AE learns the features from the input network record unsupervised. The DNN is then trained and supervised to extract DL features according to the classifier [15]. The proposed system has two latent layers in the stacked AE and two or three layers in the DNN, with every layer having an entirely in-touch layer, a batch with normalization, and dropout. Biswas et al. (2019) proposed a cloud service delivery model based on a single window, whereby a smart card acts as a single entry point to several electronic services, including banking, healthcare, employment, and so on.The authors of this paper focused on the IDS of the cloud service model throughout cloud banking transactions to identify and mitigate unauthorized access [16]. Alzahrani et al. (2021) performed research that illustrates the deployment of ML models for traffic analysis to identify the malicious protocol behavior as part of the Software Defined Network controller's NIDS. To demonstrate attack detection, three classical tools that are ML-based tree techniques like Decision Tree classifier, Random Forest Classifier, and Boosting algorithm, are used. The NSL-KDD data info is being used for both the analysis of the dataset; it is a dataset for several options that are laid in the cutting-edge NIDS approaches. Various advanced techniques that are used for preprocessing are applied to the data for obtaining a stable form of data, yielding exceptional results when compared to pre-defined systems. Nandy, Sudarshan, et al. (2021) suggested an Empirical Intelligent Agent based on a cutting-edge Swarm-Neural Network (Swarm-NN) technique to detect attackers in the edge-centric IoMT framework. The major objectives of the suggested technique are to identify assaults during data transmission across a network and to perform a more accurate and efficient analysis of health data at the network edge [17-18].

III. PROPOSED WORK

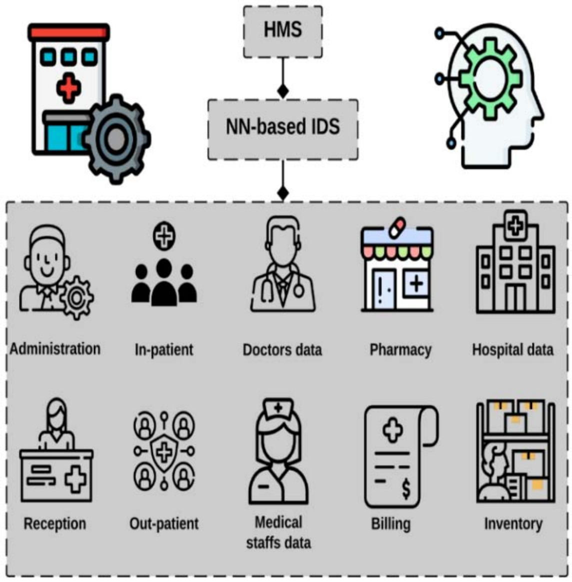

Fig.1. Illustration of NN-based IDS in HMS

Fig.1 Illustrates the Neural Network-based Intrusion Detection System in Hospital Management System. Malicious activity includes the distribution of viruses and other operations that disrupt the ability of others to effectively use networks, systems, services, software, or equipment [19]. A software intrusion detection system (IDS) detects malicious network activity. Because of the services it provides, an IPS is also known as an intrusion detection and prevention system. An IDS monitors network traffic. It works by detecting malicious network activity by analyzing intrusion signatures, generic behavior, and heuristic methods, and then drops the packet and blocks the specific traffic [20]. When such an event happens, the administrator is also notified. The proposed intrusion detection system, which is based on a neural network model, manages healthcare information and ensures that healthcare providers' jobs are completed effectively. The proposed system effectively manages data for all clinical, financial, research lab, outpatient care, primary care, operating room, equipment, nursing, pharmacy, radiation oncology, pathology, and other departments of healthcare [21].

Let ρ_j signify the required to charge up the required stations and can charge those pre-fixed equipment utilization ratio $\rho_j = (\lambda_j / y_j \mu_j)$ According to the conventional slight Equation the waiting period for such $h^{th}\ TC$ and trying to charge point j is represented by Equation (1).

$$g_{ih}^{H} = \sum_{j=1}^{y} \frac{(x_j\rho_j)^{t_j}\rho_j}{\lambda_j y_j!\,(1-\rho_j)^2 \varphi_{E_j}} \left(\sum_{m=0}^{x_i-1} \frac{(y_j\rho_j)^m}{m!} + \frac{(y_j\rho_j)^{y_j}}{t_j!\,(1-\rho_j)} \right)^{-1} H_{jh} \times h^{th}TC \quad (1)$$

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The charging k-means method which is always used to detect the intrusion for the h^{th} TC at endpoint j is as shown in Equation (2).

$$g_{jh}^{H} = \sum_{j=1}^{h} \frac{T_{min} - T_{jh}^{h}}{m_g} \tag{2}$$

K-Means Algorithms to enhance **e**nergy consumption is influenced not just by the maintenance of hospitality and various standard servers. Whenever a TC with a charge travels at B_C transportation distance ŋkm/gc on a flat, the ability to run power $E(B_c, c)$ is represented by Equation (3).

$$E(B_c, c) = \frac{\left((x+B_c).h.\int c+\left(S_m.Z_j.c^3/22.56\right)\right)}{3700\,\text{ŋkm}/gc} \tag{3}$$

The *K-Means Algorithms assess and detection of diabetes in healthcare* and h_{ij} the receiver needs to be one of a kind from the alternative whereas at the same time the operator can certainly be connected in the form of neural networks and to the desired tool without dispute. Transition pace is $m_j - \overline{m}$is classed into-the-spot transition and time change. Space-time transformation, inclusive of the preceding NG, takes a while to comply with the series represented within Equation (4).

$$NG = c_{ij}(s) \sum_{i=1}^{y} \frac{y \sum_{i=1}^{y} \sum_{j=1}^{y} + \sum h_{ij}(m_i - \overline{m})(m_j - \overline{m})}{\sum_{i=1}^{y} \sum_{j=1}^{y} + h_{ij}(m - \overline{m})^2} \tag{4}$$

The following Equation (5) represents the detections of intrusion based extrude within the transition time.

$$NG = c_{ij}(s) \sum \frac{y \sum_{i=1}^{y} \sum_{j\neq 1}^{y} + h_{ij}(m_i - \overline{m})(m_j - \overline{m})}{C^2 \sum_{i=1}^{y} \times \sum_{j=1}^{y} h_{ij}} \tag{5}$$

IV. Experimental Results

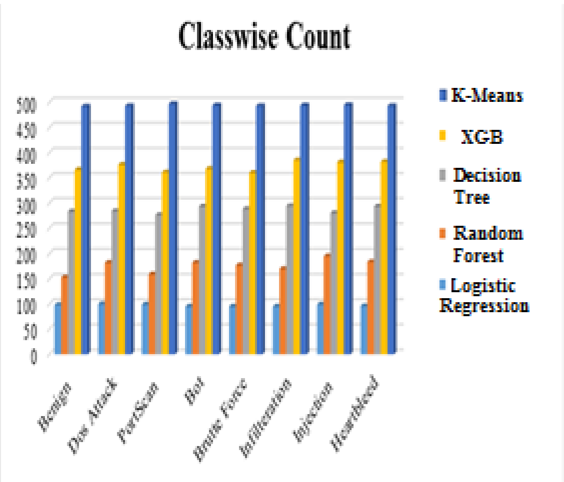

Fig.2. Performance AnalysisK-Means Algorithms to enhance the performance under the Neural Network for Intrusion Detection

The model Swarm-Neural Network strategy is tested using a real-time privacy dataset, the ToN-IoT information, which collects OS, and Telemetry for Internet of Things applications and analyses the performance of normal models that are deployed in classification rule using various parameters. The results show that the model Swarm-Neural Network strategy outperforms the ToN-IoT dataset in terms of accuracy. SGM is a novel class imbalance of technology managing for high-scale datasets proposed by Zhang, Hongpo, et al. (2020), which integrates Based on the Gaussian Mixture Model, the Synthetic Minority Over-Sampling Technique with under is used for clustering. They concluded that SGM-CNN outperforms intrusion detection methods and is a good option for unbalanced intrusion detection. The numerical results are presented in Table 1 as below.

TABLE 1.Comparison Result Analysis for the Existing System

Algorithm	Detection of intrusion in healthcare Training (%)	Detection of intrusion in healthcare Testing (%)	Overall Accuracy (%)
K-means Algorithm	95.63	91.78	97.67
Existing Method: Optimization Algorithm	90.98	89.87	92.98

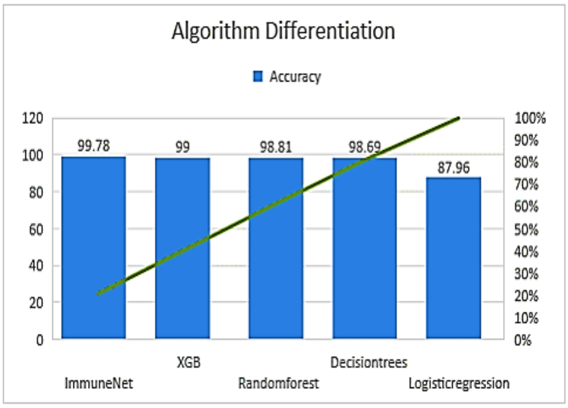

Fig.3. Accuracy Analysis based on different algorithms

Fig.3 represents the accuracy evaluation in detecting the intrusion in hospital environment and the results show that the proposed K-Means algorithm has obtained the highest accuracy in intrusion detection in the hospital data management system.

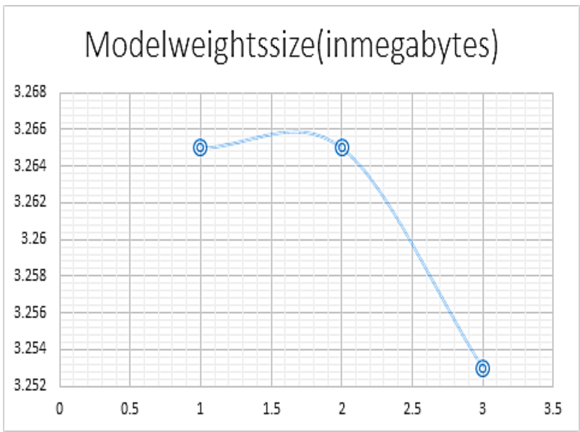

Fig.4. Analysis based on Model Weight

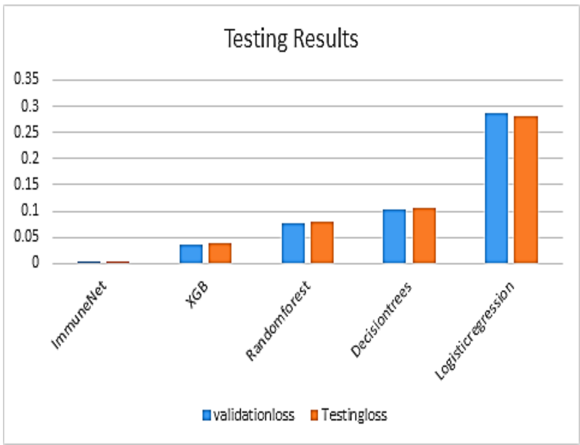

Fig.5. Analysis based on the Testing Results of the model

Fig.4 and Fig. 5 indicates the analysis of the proposed system based on the model weight and testing results evaluation with the existing system respectively. In the research, the existing system considered for analysis are XGB, Random Forest, Decision Tree, and Logistic Regression respectively. In the considered parameters for evaluation, the proposed K-Means have achieved highest performance than the existing models.

V. Conclusion

HMS was developed to address the difficulties associated with managing all of the paperwork associated with each patient associated with various departments of hospitalization while maintaining confidentiality. HMS allows you to manage all of your paperwork in one place, which saves you time organizing and analyzing the patient framework. Hospital Management System performs a differential tasks, which include maintaining patient's medical records, collecting contact info, managing appointment details, tracking bill payments, details of insurance, and so on.

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System of Intelligent Marketing for Healthcare Goods to Hospital

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***Abstract*—A comprehensive Supply Chain Management (SCM) solution is designed to improve the inventory management system and lower the material management costs of medical items in the healthcare industry. Hospitals, a wholesaler, and medical supply firms make up the supply chain in this study. First, the system requirements for effective SCM hospitals and their business activities to increase the effectiveness of material handling, Vendor Managed Inventory (VMI) is the key application of SCMembraced and put into practice. For the departments of pharmaceuticals and place orders, an online procurement system has also been built. Additionally, real-time information exchange capabilities are offered to improve the management of medical inventories. This created SCM system helps hospitals to enhance the purchasing procedures including inventory management of medical supplies, which results in a more than 30% reduction in total inventories. By information exchange with clinics, the wholesaler may get more precise and up-to-date data on the inventory levels including drug usage rates of hospitals, allowing it to estimate demand more correctly. This allows for the timely and efficient supply of necessary goods. The proposed method has greatly reduced the overall distribution network cost of medical items.**

Keywords—Healthcare, Supply Chain Management, Material Handling, Medicals, Intelligent Marketing

I. Introduction

Patients are becoming increasingly inquisitive and worried about the availability of healthcare services as a result of the emergence of global competition in the healthcare sector [1-2]. The increase of the senior citizen population and the growing emphasis on health have significantly enhanced general population health requirements and the spread of better lifestyles [3]. The residential industry, particularly healthcare services, has been impacted by the recent expansion in the worldwide competitive service environment. As a result of the rising rivalry between hospitals daily encouraging patients to make the best decision when choosing any hospital, healthcare associations have started to emphasize the better quality of healthcare services [4-6]. Since it is the most important factor for service providers to succeed, service quality needs to be greatly improved and accurately monitored.

Among the few issues in the research on a marketing strategy that has garnered extensive academic attention over the past three decades is the quality of services and its results [7]. It has become increasingly difficult for researchers, hospital administrators, government policymakers, and therapeutic professionals to meet patient needs, which also contributes to satisfaction and retention. Even so, it necessitates higher expenditures to attract new patients rather than to keep hold of current patients [8–10]. As a result, there is increased pressure on the supply side of the healthcare system. One of the key components of a successful business is customer loyalty, which can only be created and maintained by offering higher-quality services that increase customer pleasure. Such enhanced capabilities are all needed for efficient distribution and management practices [11].

Private providers that are not supported by the government are more focused on making a profit than providing high-quality treatment, which causes patients to seek out private care only when they believe it would be more effective and have superior facilities [12]. The current study fills this vacuum by investigating whether variables if any, influence patients to select private healthcare over public ones if they prefer to go to private clinics [13]. Studies have also shown that people only choose private hospitals when they are dissatisfied with the quality of care they receive from public healthcare providers. They force clients to spend more dollars to receive the required level of service [14]. Paying more on treatment options, clients are becoming more inquisitive & expecting supplemental facilities to receive the quality of services above their anticipations, as well as purely any instance of discontentment manages to pressure them to continue moving towards other competing companies, clients now request accurate and complete data before actually utilizing any type of service by a specific healthcare association [15]

As a result, the management of all service organizations places considerable importance on the service quality arrangement, and hospitals should pay particular attention to providing excellent medical care as well as quality support to their customers [16]. From the discussions preceding, it is clear that it has always been essential—and it still is—for

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vendors to create and sustain satisfaction among customers by providing high-quality products and extensive medical therapies through a better knowledge of service quality as defined by the consumers [17]. This would only be feasible if service providers learned about and understood the perceptions and views of their clients. The current study thus tends to concentrate on patients' perceptions of the healthcare services provided [18]. The links between quality of service, shopping enjoyment, and commitment in various service industries have been the subject of numerous empirical research. However, the present study focuses on the need to improve the circumstances of the medical quality of services provided by clinics in the private industry.

A supply chain is an organization of producers, transporters, merchants, and users made up of raw material suppliers, as shown in Figure 1.

II. Related Works

Data transmission is a crucial component of SCM. Programmes like JIT, CRP, & QR in retail rely on the supply chain being informed about production, scheduling, and shipments [19–22]. Releasing intelligence enhances supply chain coordination, enables more effective material flow management, and lowers production costs [23]. By enabling the integration of disparate information management, component-based software technologies and XML technologies enhance information sharing. An effective medical SCM system has been created and improved in this study to improve inventory tracking and save material processing expenses [24-25]. Clinics, wholesalers, and leading healthcare firms make up the system in this study. The cooperation between a medical distributor as well as several medical centers of a medical center is the main subject of this study.

First, we looked at the requirement specification for efficient circulation management and inventory monitoring in clinics and examined their internal operations [26-27]. VMI, one of the key SCM systems, has been implemented for managing hospital medication warehouses to satisfy those criteria [28]. Additionally, a CAO system, or electronic procurement framework, is created for the departments that make purchases and utilize pharmaceuticals. Researchers have determined that a vital element in completely attaining the intended aim is information exchange through solid cooperation involving clinics as well as wholesalers [29-30]. Clinics may enhance their pharmaceutical product stock management and purchasing procedures thanks to the established SCM system. To more correctly estimate demand and ensure that necessary items are delivered on time and under budget, the wholesaler can estimate the future by exchanging information with hospitals to obtain precise and up-to-date data regarding inventory conditions and consumption of drug volumes

III. Proposed Method

A. SCM in Healthcare

A supply chain is an organization of producerstransporters, merchants, and users made up of raw materialsuppliers, as shown in Fig.1.

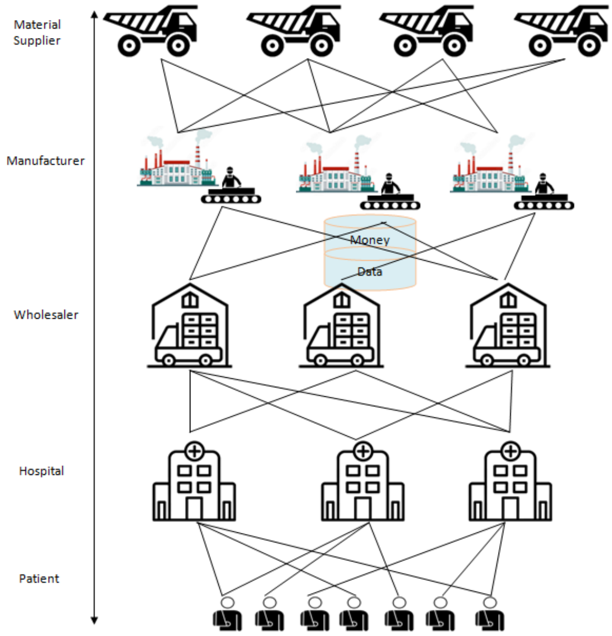

Fig. 1. Composition of healthcare SCM

As seen in Fig.1, a distribution network is a group of manufacturers, carriers, retailers, and consumers made up of raw material suppliers. Commodity management processes may be enhanced by connecting supply chain elements and regulating the movements of commodities, data, and financing in an integrative manner with the use of an SCM system.

B. System requirements

Particularly, medical therapy is crucial to patient care in hospital settings. Following a doctor's precise diagnosis, the patient should receive the best medications at the right time. Based on medical expertise and a fundamental understanding of material management, medicinal items should be maintained well. As circumstances for drug preservation and usage patterns evolved, the legitimacy and safety of medications became increasingly crucial. There are an increasing variety of expensive medicine kinds being employed in medical settings. More specialized physical distribution and effective supply chain connectivity are needed as a consequence of the shifts in the healthcare environments.

Due to hospitals lacking an adequate inventory management system, we had several issues. Before implementing the SCM system, the medical center's ability to share information with the wholesaler was highly limited, which resulted in a high number of emergency orders and average inventory levels. Hospital ordering procedures were also carried out according to general principles. We have examined the following system requirements to design an integrated SCM system that would optimize the material handling of medical items and address these issues.

C. Effective Inventory Control

Hospital inventory control can be enhanced with the use of a suitable classification scheme. Without a categorization system and uniform product control, managing all the

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medicinal items in hospitals is exceedingly inefficient. The ABC inventory control system may be used to classify the items according to their attributes and importance. Because there are several product categories and they vary in importance, discriminating inventory control and ordering strategies should be used. The SCM system decreases user involvement and order processing time through intelligent order management. To improve material handling in warehouses, barcode technology should be used. Although RFID technology may be used to identify items, we have not adopted it because of the technology's infancy. To increase the effectiveness of material handling, hospital warehouse layout planning must be optimized, and the FCFS method for distributing medications is also necessary.

D. SCM System Architecture

Fig.2 displays the general design of the created system. Wards, clinical departments, special dispensaries, inpatient pharmacies, and outpatient pharmacies are just a few examples of departments that request the materials they need, which are subsequently transported from the central warehouse to the departments that requested them.Information about orders, shipping document verification, and daily medication consumption is sent from HIS to the wholesaler's ERP system. Documents about invoices, tax statements, and medicine prices are moved in the reverse direction.

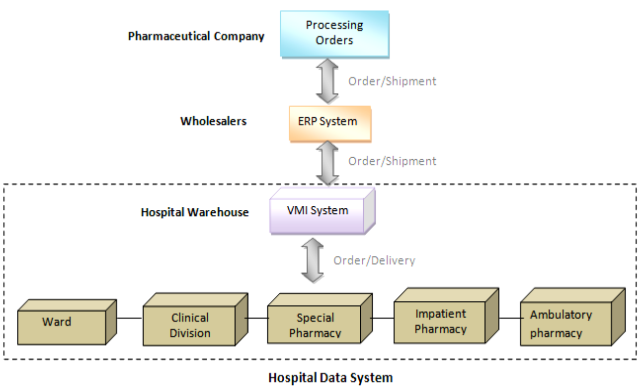

Fig. 2. Architecture SCM system

IV. IMPLEMENTATION

The SCM system had several issues at the time of deployment, including functional and data mistakes, which necessitated ongoing system improvement and modification. Using the Microsoft.NET framework and the C# programming language, we created the SCM applications. C# is a straightforward, contemporary, object-oriented, and type-safe programming language that blends the raw power of C and C++ with the high productivity of rapid application development languages. Two significant application programmes created to integrate the supply chain are described in this section. Each department that uses medications uses the first software, which includes features like "Environment configuration," "Sending document," "Receiving document," and "Receiving delivery order document."With the help of this application, orders may be processed online, and information about hospital warehouse inventory levels and code lists for medical supplies can be shared.

The application displays a list of prepared order papers under the "Sending document" menu. The application offers suggested order quantities for each item when creating an electronic order document, allowing for a quick compilation of the order document. A variety of code lists for medical items, including medication codes, EDI code lists, manufacturer's code lists, barcode lists, and ingredient code lists, are provided under the 'Receiving document' page for hospital users to use. With double the chosen line or using the "Receive" button, one may choose a part of the budget to receive and get the data.

The wholesalers create the delivery document after receiving the hospital's order and completing the delivery. Delivery order papers created by the wholesaler are displayed on the "Receiving delivery order document" page. By double-clicking the chosen line in the data list or depressing the "Receive" button, one can choose a line to receive and obtain the delivery order document. The VMI application software is the second crucial SCM system application programme. Using the VMI application as detailed in Table 1, domain experts delegated from the wholesaler administer the hospital warehouse

TABLE 1.FUNCTIONS OF THE VMI APPLICATION

VMI Function	**Major Roles**
Management of product delivery and receipt	*Every department's control over delivery and reception *Management over the delivery & receipt of goods shipped from the wholesaler
Management of item receipt & delivery information	*Management of item receipt & delivery history information *Inventory management such as physical review of inventory and closing
Management of the delivery request's status	*Tracking the progress of the delivery requests from each department
Base data Management	*Setting up base information needed for warehouse management
Configuration	* Configuring the environmental parameters

A. Benefits of the System

A hospital system made up of eight university institutions has adopted the medical SCM system described in this study. Due to a significant shift in the workers' work processes and a little amount of system instability, there was initially tremendous opposition to the new SCM system. Given that an SCM system comprises several players from numerous companies, collaboration/partnership across organizations is a crucial component of putting the system into place. They have accomplished the intended goals through ongoing system improvement and training. Following the requirement analysis of the SCM system. Following is a summary of some of the main advantages of the SCM system, which come from the effective application of the system criteria. Second, the sharing of information systems built on a solid collaboration has enabled semantic interoperability and improved supply chain monitoring.

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Online ordering with electronic documents provide quick order processing and mistake reduction as opposed to exchanging paper papers via mail or fax. Additionally, the wholesaler has access to data on medicine consumption in hospitals, enabling them to maintain the hospital warehouse's stock. Additionally, institutions have access to data supplied by the wholesalers, such as a listing of contractual items, pricing history, details on prescription treatments, and health codes, as needed.

Third, the use of numerous SCM solutions has substantially enhanced the material handling of hospitals. Based on the categories of things, discriminating management strategies are used to control the inventory of the products. Although it frequently happens that the inventory quantity of goods in hospital information systems does not match the actual number of objects, the discrepancy should be kept to a minimum and the information system's dependability should be increased. The SCM is being implemented at the medical facility with much effort, which has greatly increased the information system's dependability. Hospital ordering procedures are made simpler by providing each department using pharmaceuticals with calculated order quantities to restock products. Figure 6 summarizes the output. Consecutive reading, together with writing operations, produces rapid condensed versions of three peaks. Therefore, the storage requires only a few dozen peaks at one time. On cloud storage, spontaneous read/write operations were incredibly intensive. Cloud drivers appear to be the bottleneck as almost all activities have been researched in Fig.3, Fig.4, Fig.5 and Fig.6.

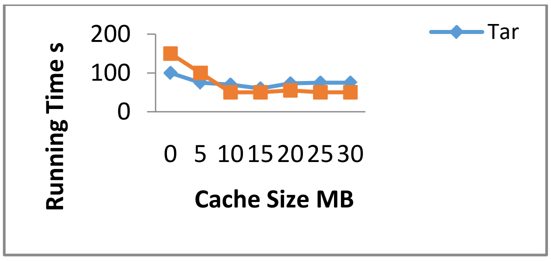

Fig. 3. Target

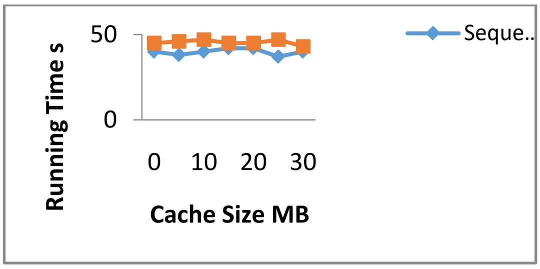

Fig. 4. Sequence

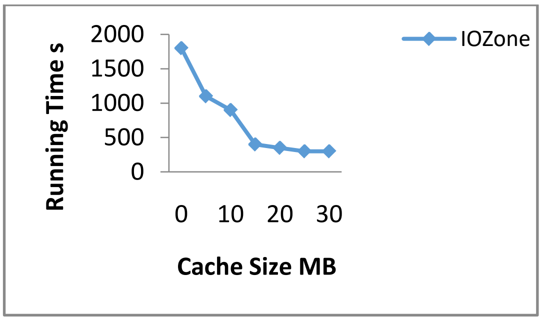

Fig. 5. IOZone

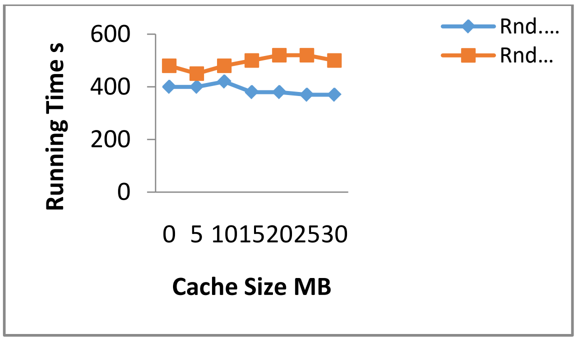

Fig. 6. Cache size workload performance measure

The established system must be regularly evaluated and improved to maintain and optimize the main benefits mentioned above. Collaboration between partners and information exchange in the supply chain are the most important components of a successfully integrated supply chain management system installation. As a result, the wholesaler and the hospitals should promptly submit the information required for supply chain planning. In particular, ongoing information from hospitals, where medical supplies are used and associated data are generated, including drug consumption volume and inventory status, is required.

III. Conclusion

We have created a computer-aided electronic ordering system, effective and efficient information exchange systems, and specialized inventory management, known as VMI. The created SCM system enhances hospital material handling while lowering inventory management expenses and, eventually, raising patient care standards. To increase the overall supply chain's efficiency, several measures are still needed. Medical producers should take part in this sort of cooperative activity to integrate the complete medical supply chain. The manufacturers' assistance was crucial throughout the implementation of the SCM suggested in this study. To fully enjoy the advantages of supply chain integration, all parties in the chain should exchange information. Guidelines for information transmission wirelessly must be defined and approved to expand the advantages discussed in this work.

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Use of Sensor Networks with Self-Organizing Algorithm to Increase the Agricultural Productivity

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Abstract—Traditional farming methods are becoming incapable of keeping up with global population growth. As a result, innovative farming ideas are desperately necessary to meet the food needs of a growing population. Intelligent farming systems based on sensor networks with self-organizing algorithms have gained popularity in recent years as a means of increasing agricultural production. In this study, we will use sensor networks with self-organizing algorithms to boost agricultural productivity. Finally, the paper describes the future applications of appropriate technology in agricultural production.

Keywords—Sensor Networks, Self-Organizing Algorithm, Agricultural Productivity.

I. Introduction

The ratio of agricultural outputs to inputs is used to calculate agricultural productivity. While individual products are typically measured by weight, which is referred to as crop yield, the variety of products makes evaluating overall agricultural production difficult. As a result, agricultural productivity is generally measured as the market value of the finished product. This productivity can be compared to a variety of inputs, including labor and land. These types of comparisons are known as partial measures of productivity. Agricultural productivity is the amount of output generated with a given amount of inputs. Long-term productivity growth is a result of improvements in farmer productivity efficiency and technological advancement [1]. A sensor network is a collection of sensors that monitor data in different locations and send it to a centralized location for backups, observation, and analysis. Wireless sensor networks are networks of sensors that are spatial and temporal dispersed and dedicated to monitoring and recording the physical environmental parameters and transmitting the collected information to a data location. Temperature, noise, pollution levels, humidity, and wind can all be measured by WSNs. Fig.1 illustrates the self-organizing map algorithm.

In general, monthly and annual meteorological statistics provide very rough information about respective weather factors. These statistics do not substantially reflect the overall phenomenon of weather features during a certain period, and they do not give any characteristics on the temporal and sequential distribution of repetition and alteration trends. Instead, these statistics provide very general information [2-3].

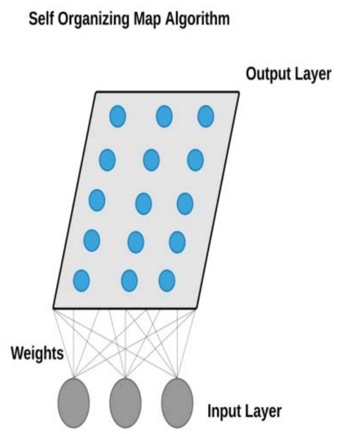

Fig.1 Self-Organizing Map Algorithm

The status of the atmospheric circulation in the surrounding area is used to produce predictions of the weather. Both of these sorts of information are often utilised by farmers as reference guides for crop cultivation; yet, it is difficult for farmers to forecast and comprehend exactly what meteorological phenomena and characteristics may possibly occur within a certain time range. Therefore, the purpose of this research was to use data-mining techniques to discover/induce the annual pattern and distribution of weather types and features of a region based on historical meteorological data, including their occurrence time, frequency, continuity, and intensity, in order to provide agricultural operationists with the ability to anticipate the occurrences and trends of weather types and features during each specified period for the purpose of engaging in appropriate cultivation tasks in advance. SOA makes it easier to provide compound services that encompass the whole of a client's operations; in this context, a customer may be either a citizen or an organisation [4-5]. Existing systems have difficulties integrating the data from the many cloud servers because of these problems. Insufficient

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agricultural infrastructure and support facilities, Inadequate ability on the part of institutions to provide services tailored to the needs of farmers due to the farmers' lack of information about appropriate farming procedures, Agricultural content development and its up gradations [6-8].

II. LITERATURE REVIEW

Mohan et al. (2018) proposed a SOM in conjunction with LDA.Self Organizing Map strategy is an excellent dimensionality reduction strategy for emphasizing the self-arranging outline. The dimensionality lowered data is used to predict climate for a reasonable solution after reducing the measurement [9]. The experimental results reveal that the improved approach outperformed existing methods in terms of climate and crop prediction accuracy. Hidalgo et al. (2021) and Sivakumar P (2015) suggested an unsupervised methodology based on Kohonen self-organized maps for reducing the dimensionality of hyperspectral images. This paper's results are based on an RBF classifier. In comparison to other popular algorithms, the results indicate the reduction of dimensionality methodology based on the maps that are always being self-organized in an effective system [10]. This is due to maps' ability to automate the identity relation that creates a set of patterns that are passed as inputand offers to deal with hyperspectral image features with most advancements. Ghadge, Rushika, et al. (2018) Sridaran K et. al. (2018), and Buvana M et al (2021) propose using a data mining approach to assist farmers in determining soil quality. Thus, the system focuses on assessing soil quality to predict which crops are suitable for cultivation based on soil type and to maximize crop yield by recommending appropriate fertilizer. Kumar, Navsal, et al. (2021)Karnan B et al (2022), and Latchoumi TP et al (2022 used microclimatic variables such as air temperature, canopy temperature, and relative humidity to develop a map-based model to analyze CWSI [11]. The canopy temperature was measured on Indian mustard cultivated in a humid climate.Mekonnen, Yemeserach, and colleagues (2019) provided an in-depth examination of the use of various ML algorithms in sensor data analytics within the agroecosystem [12-13]. It goes on to talk about a case study of Internet of Things-based data options that are driven by an intelligent farm prototype of incorporated energy, food, and water(EFW) schemes.Kumar et al. (2018) surveyed the significance of sensors in PA as well as WSN techniques for remote monitoring in various agricultural applications [14].

Sanjeevi, P., et al. (2020) investigated the WSN structure from the perspectives of throughput maximization, latency reductions, high SNR ratio, least mean square error, and enhanced coverage area. The experimental results show that the proposed technique outperforms traditional IoT-based agricultural production and farming. Hamami et al. (2020) researched to examine the use of WSN in irrigation [15]. The use of WSN technology to manage and control irrigation systems is an optimal solution for ensuring efficient and rational water use and thus contributing to the occurrence of the global water crisis.MobasshirMahbub (2020) recommended systems that are used for fields and create livestock in the fields where the controls are supplied from the embedded systems, and wireless network system [16-17]. This system describes systems with electron circuitry, protocols, and intelligent monitoring devices using the remote process for computers and Smartphones. It then includes some propositions before concluding with a description of the prospective scopes of appropriate technology in smart farming[18].

III. PROPOSED WORK

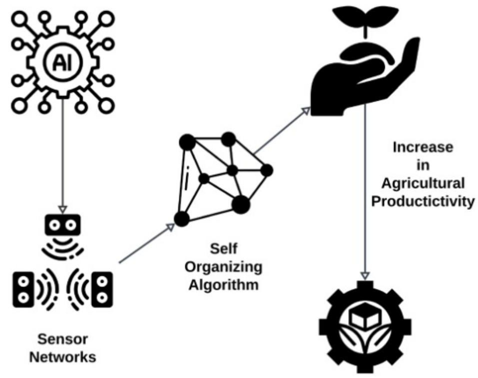

Fig.2 Illustration of Sensor networks with SOM Algorithm in Agriculture

Fig.2 Illustrates the use of Sensor networks with SOM Algorithm in Agriculture productivity increase. Watering, fertilizing, and pesticides are necessary for successful farming and food production. To create an automated type of system that will perform every activity. Systems recommended in this model include agri-field humidity remote motorizationand watering, pest detection and pesticide spraying using automation technique, pH scale tracking and filtering using the copters used for the quad purpose, and agri-field intruder and sometimes it can be an animal alert model, and so on. The agricultural sector has made tremendous progress. These advancements have resulted in a computerized method in which crop growth can be monitored and devices can be controlled using WSN [19]. A WSN's fundamental function is to gather data from a distance and send it across wireless networks that the receiver can monitor. The agri-sector may benefit from the adoption of WSN technology, especially for dispersed data collection from agricultural surroundings and, more crucially, for providing farmers with real-time information from the farming field [20].

Here the suggested model includes an optimization method that can handle time series-based rules to manage a variety of jobs. It is carried out to conserve energy. The only tasks involved are the execution of local data and it’s unloading. More emphasis is placed on queue-based algorithms since queueing is crucial for managing the system's duties is presented in Equation (1).

$$B_{u_m} = P^{*}\left(ru_m \vee \phi_{target}\right) + c(1)$$

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The parameters of the neural network are updated using the deterministic policy gradient shown in the following Equation (2).

$$\nabla_{\phi_{target}} g\left(R^*(u_m)\right) = E_{r_{u_m}}\left[\nabla_{\phi_{target}} f\left(p^*(U_{u_m})\right) \nabla_{A_k} p(U_{u_m}, B_c)\right] \quad (2)$$

The device and critic network parameters are provided by the DDPG using the least-squares method. Buffer queue length L(t n), channel matrix$M(u_m)$, SINR, and offloading ratio are the components of state-space s (t n). The action space A (t n) consists of the energy used by the three levels of the devices and the bandwidth distribution between the layers are presented in Equation (3), Equation (4), and Equation (5) respectively.

$$su_m = -F[\psi_1 j_1 \alpha_3 j_2 + (1-\psi_1)\alpha_4 M(u_m) - Q(u)] \quad (3)$$

$$I_1 = \alpha_1 \sum_{i=1}^{c} F_i(u_m) + \alpha_2 \sum_{j=1}^{c} \pi_i C_n(u_m) \quad (4)$$

$$I_2 = \sum_{i=1}^{c}\sum_{j=1}^{m} \pi_m c_m(u_m) \quad (5)$$

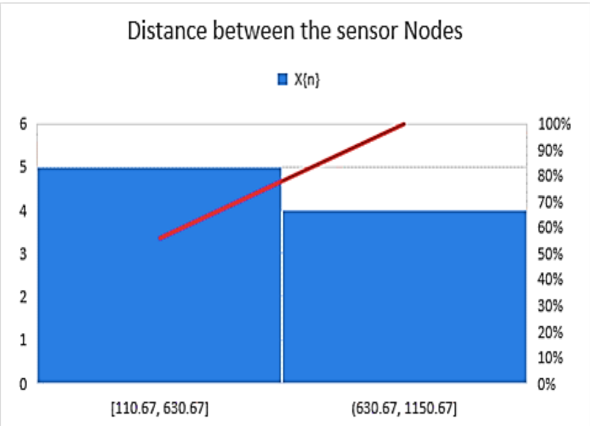

Fig.3. Analysis based on the distance between two sensors

IV. Experimental Results

The distance between two sensors nodes play a vital role in data collection in the agricultural land. The collected data aids in taking necessary action in increasing the productivity of the agriculture is presented in the Fig.3 as shown above.The recommended system also includes a WSN with all the detection systems and some of the sensors that monitor the entire agri-environment. A SOM is an unlabelled dataset that can be processed using an unsupervised learning model in machine ML technique that generates a dimensional representation in the lower range while keeping the data's topological structure, an average-dimensional data set. A SOM is a type of ANN model that, unlike other artificial neural networks, is taught through competitive learning as opposed to error-correction learning

TABLE 1: Algorithm Comparison with the Previous Models

Algorithm	Crop Protection (%)	Crop Yielding (%)	Overall Accuracy (%)
Machine Learning Algorithm	89.78	94.67	95.01
The algorithm used in the existing Model	87.98	91.45	93.60

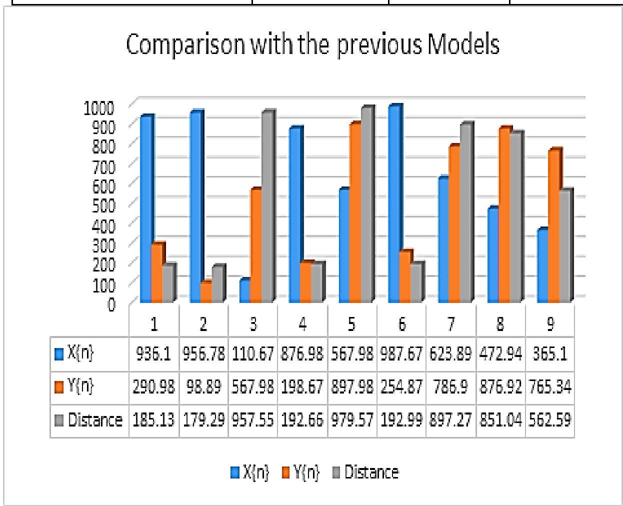

Fig. 4. Comparison on different models on agriculture productivity

Fig.4 and Fig.5 depicts the comparative analysis of the proposed model based on the distance among the different nodes and location of the given area.

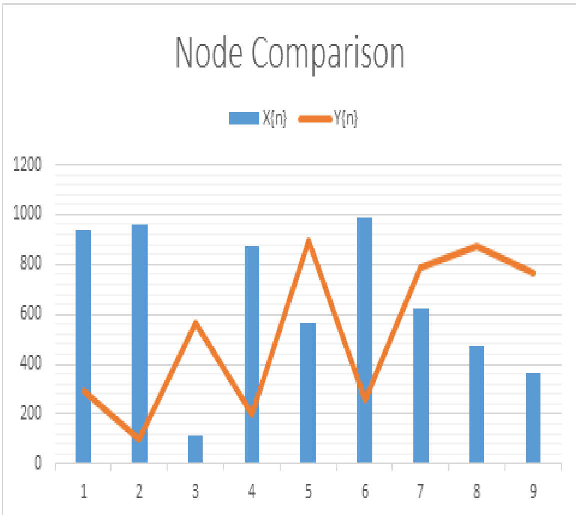

Fig.5. Comparison based on Performance among nodes

V. Conclusion

A mapping is an un-labeled dataset with the ML tool that generates a dimensional representation with a reduced range of increased dimensional data while handling the data's structure. The training process for a SOM differs from that of other artificial neural networks in that it uses competitive learning rather than error-correction learning.

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The SOM, also known as a Kohonen map or Kohonen network, was created in the 1980s by the Finnish academic TeuvoKohonen.

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Application of Automatic Identification of Ontology Hierarchical Structure for Measuring Gene Function

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Abstract—Knowledge within this same genetic ontology annotating has helped explain the occurrences of biological sciences, hence, being a precious resource for therapeutic development. This same genetic ontology was increasingly changing the way individuals manage, but instead understanding the biological material of systems. Designers turn everything into the amount-based methods founder upper categorization conundrum instead establish a procedure that has used these same connections throughout this same Gene Ontology structural system. It alleviates the quantification inequity of optimistic but rather detrimental coaching specimens to make it easier for genomic component prognostication. This aids in the message extraction approaches but instead establishes infrastructure. Conversely, the proposed technique improves classification discrimination by keeping but instead accentuating these same most important learning examples. Furthermore, our upper edge classifiers predicated around hierarchical branch construction consider overall connection amongst targeted categories, resolving general inconsistency among categorization outcomes and the underlying Genes Morphology framework. Their research's overall F-measure effectiveness using the general Genetic Ontology annotating dataset was 50.7% (precision: 52.7%, recall: 48.9%). These research findings show that even though their trained collection seems minimal, it may substantially increase by propagating linked information across parental and offspring branches throughout that forest architecture using geometrical dispersion. Any group or document within complex ontological architecture with any vertical connection can be classified using this same highest categorization paradigm.

***Keywords: F-value effectiveness; upper categorization method; Genetic Ontology; medicinal domain*.**

I. INTRODUCTION

Exploration of understanding basic physiological activities that human creature was individual amongst this same main goals underlying genetics investigation. Its emergence of an energetic constrained vernacular throughout the Gene Ontology (GO) directory. The intended position of multicellular genetics but molecules inside the compartment and practical bioengineering understanding. But rather prevents genomic device characterizations stable all over a wide range of data sets, has always been an excellent example of the above [1]. This GO annotations collection provides a substantial quantity of all relevant functionality identification information, which is crucial during biotechnology test interpretations. Nonetheless, those annotating datasets remain incomplete. Further more, researchers understand some portion of half every genome across every species, while another much lesser number, even those labeled with functional knowledge [2]. Professional personnel retrieves basic information about GO, annotating carefully using textual information but storing it within systems [3]. Making employment using textual analysis methods that aid improves making collection from functionality annotations knowledge has become an increasingly essential challenge because of given overall increasing development of functionality knowledge throughout increasing scientific publications [4].

II. RELATED WORKS

In addition, researchers may examine this grouping of cable network concentrated areas to see whether molecules containing these similar classifications tend to congregate together typically. Support material approach for inferring enzyme functionalities from proteins interactions information, including the functionalities for their nutrient interactions companions. [5-6]. Researchers generalized serial connections for other surrounding molecules to comprehend each enzyme's overall capabilities, hence single functionality across several [7]. First, analyze this same significance from chromosomal information into protein functionality prediction. Researchers used comprehensive characteristic selecting approaches instead of subsequently studying potential links among chromosomal information and peptide functionalities [8]. Molecular domains, protein-protein interactions, transcriptional expressions, phenotypic ontology, evolutionary profiles, and other illness information resources were among those ten genomics information resources examined with muscles. Researchers calculated the overall quantity from every information collection depending upon this same accuracy in their predictions throughout their investigation [9].These practical data-based approaches could exclusively anticipate overall activities and genetics with biological measures, requiring physical measurements from comprehensive anticipated genomes but rather molecules before preparation, which was unachievable

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given several other novel objects within another book [10].

III. Proposed Methods

During classical categorization research, every occurrence is always thought to match precisely a particular classfier. In actuality, every instance seems expected to belong to different software categories [11]. Every article from magazine content, for illustration, can sometimes be classified as belonging within neither this same political business economic categories. Given data results, it must enable every learned classifying algorithm to attribute numerous descriptions to every occurrence (Fig.1). This inter detector includes one amongst several types called classifiers. Every genome that seems anticipated might be associated with many GO principles within that r challenge with predicting genetic expression [12]. In this same vary in severity registry, for illustration, this same chromosome P25686 has been compiled to GO definitions such as 0032436 (good regulatory oversight of mitochondrial pathway these same effectors nutrients, degradative procedure). 0090086 (deleterious requirement of nutrient deubiquitinating), 0030433 (Epithelial nutrient degradative method), 0031398 (optimistic regulatory oversight of nutrient down-regulation). 0090084 (deleterious government oversight of nutrient proteasomes degradation) (negative regulation of the inclusion of the body assembly). Several GO terms explain relevant genetic activities as follows: Favorable regulatory oversight of nutrient de-ubiquitin deleterious modification by endopeptidase casserole dish degradative method, favorable legislation of nutrients ubiquitin by associated nutrients glycogenolysis method, deleterious egulatory oversight of malware endosome arrangement by pathogen endosome legislature by malware endosome legislature by malware endosome legislature by malware endosome legislature by malware endosome legislature by malware endosome legislature by malware endosome arrangement From this result, one might think about genetic functionality predictions from one number commonly known as e founder annotations issue, during which numerous GO topics are used to describe each bacteria's functionality [13]. This work focuses on conceptual identification, meaning detecting whichever GO keywords every detailed scientific description seems connected to, attributable to the excellent analytical quality and unrestricted availability of available scientific explanations.

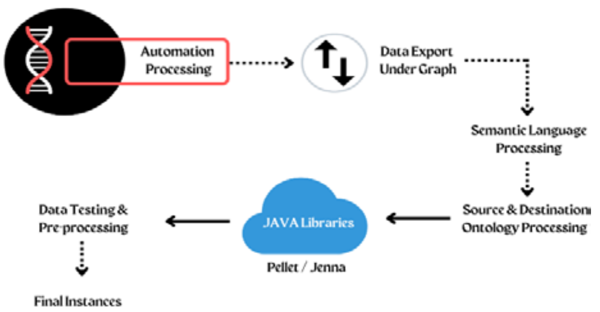

Fig.1.Automatic Identification of Ontology Hierarchy Structure

Those approaches depend upon issue change, but also, these approaches hanging around algorithmic change are those two categories of inter categorization approaches. This same primary principle behind issue transforming techniques was essential to break any inter-classifying challenge down several separate classifiers [14]. Then-current singular category strategies may be employed effectively to solve this challenge. Every student's forecast has been handled simply by any independent singular assessment with its associated predictor. Every category is trained using everything given available learning information, resulting in an overall classification solution that is appropriate for the particular type.Another downside with those techniques was that they ignore underlying connections between categories since they are generally based on actual premises because individual classes remain autonomous. Additionally, every classifying method must be trained using both available relevant learning information that frequently results in an overall unbalance among affirmative among unfavorable learning examples, therefore producing a widespread detrimental influence on broad categorization [15]. Several techniques centered on methodology adaptation work by modifying any established standard categorization system such that they can handle inter-categorization issues.

Humans conduct annotating based upon overall categorization conclusion from that r material within these research provided particular genes and any linked information. These classifications were developed using guided training, having these inputs characteristics were neural keywords within individual documents and original destination classifications being their GO keywords. Researchers use problematic turnaround approaches that educate every individual GO word classifications to establish various genetic classifications. Everyone on relevant classifications was contacted when determining various subclasses for specific genes. Therefore this same labeling for particular mutations were some of these categories, which reviewers provided one favorable result. This horizontal classifications technique is a computer approach that arranges these same subclasses from any branch construction based upon some flat connection. But also allocates individual samples that should identify among individual vertices throughout various branches using said "Keep dividing" principle. Conventional methodologies are less successful than other sorts of segmentation procedures. Horizontal segmentation and upper edge classifications are two prominent approaches to horizontal language categorization. Every vertical interrelationship across this branched architecture becomes "squished" with this same horizontal categorization. Because of building a static categorization framework, each location may not consider neighboring areas. Significant link documentation within every hierarchical architecture between classifications was ignored throughout alternative terms using such a technique. However, researchers feel that several exemplary instances amongst overall computer trained examples that exhibit minor distinctions within individual categories could give crucial classifying teaching.

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Specific data become combined amongst many different learning observations buried throughout this same flattened categorization photographer's development phase, preventing computer learners from correctly classifying individual data near their subclass borders. Their identifying capability improves throughout the research study by carefully picking appropriate retraining datasets at every node within the exemplary forest architecture, generating considerably more reliable classified images. This genetic annotation then turned into one categorization depending upon every GO framework throughout this research. Researchers created another GO network by utilizing relevant physiological processes branching knowledge from Genetic Ontological Annotated (GOA) databases. These vertices within this way keep GO phrases, whereas these connections reflect meaningful relationships amongst them. This network architecture follows this GO annotating institutes' description as with active physiological branches.

Furthermore, through integrating relevant Bibliographic publications into GO vertices, this same knowledge inside this same network becomes augmented, making everything just possible can develop a single robust type at every cluster. Every branch correlates approximately 2 Bibliographic identification (PMID) groups within the current methodology. This segmentation model gets built separately for every individual component of this same GO hierarchy during this same learning step. Every predictor with every source vertex was subsequently performed. All content that should be identified during this same forecasting process, commencing with the subsequent parent network, should identify unless network-provided content corresponds to this existing classification. Assuming something succeeds, corresponding assessors from associated daughter networks continue to network to categorize their provided documents. The continuous procedure continues unless their branch endpoints are reached; however, the entire categorization procedure comes to a complete halt. With the above method, every document referring to any specified school should pertain to their mother subclasses. Else because classifying algorithm will fail even reaching such group's nodes. Earlier in this section difficulty of categorization outcomes that are incompatible with the GO framework is efficiently solved by using another upper categorization approach.

III. Methodology

The following was this complete technique involving corpora preprocessing but instead subsequent generation with appropriate categorization models for every individual GO routing:

Step 1: Retrieve is a but instead part of relationships using this same physiological processing branching from information GO for acquiring this same horizontal connection across all pairing data parental and children networks, and calculate individual network component offspring network group and also descendent graph sets. After that, another directional network containing GO phrases gets created.

Step 2: Retrieve that r collection comprising every present node linked PMIDs under any GO word after resolving that r relationship database containing genomes, GO keywords, and PubMed publications (namely CurNodePMIDSet).

Step 3: Geometrical reproduction: ontologically arrange this same entire fucking network using both parent networks collection collected during Phase 1 and this same parent component PMID collection gathered from Part 2. PMID collections connected to networks being transferred between children towards parental networks. Therefore, every network and another descendent component related to PMID collection (called DescNodePMIDSet) was formed.

Step 4: Retrieve summaries using this exact entire fucking Search was performed explanation papers for every PMID referenced in either CurNodePMIDSet or DescNodePMIDSet. Again, search results have been eliminated from these retrieved abstractions. In contrast, another matrix domain modeling per every processing abstraction has been created even though this information may be described using any scalar.

Step 5: Design different categorization methods per every GO node in that r ordered network, one using unlabeled Data and another using SVM. Furthermore, three times the larger bridge is being used: yet another hundredth from that abstracted texts were chosen because they tested batch every session, while this same remainder is being used because their learning group.

IV. Results and Analysis

Its GO hierarchy's sub hierarchical components. Unicellular organism parentage having identification GO: 0048308 but instead cell organelles distributions have separate is a record, indicating, therefore, this keyword contains 2 parental branches. Original description document from MEDLINE (Fig.2).

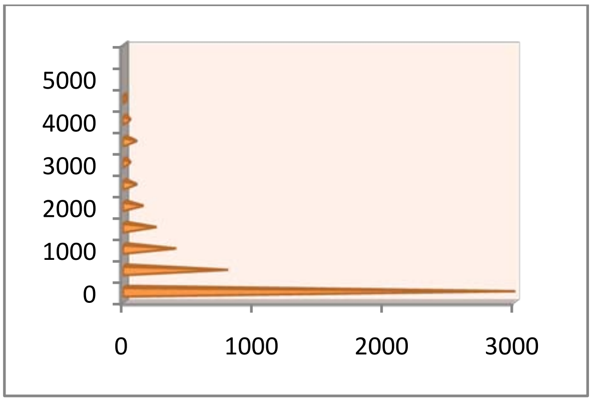

Fig.2.Every GO season's corresponding to distributed content quantities

Quantitative accuracy, remember, but also F-value is used for analyzing individual approaches within this research. Although this same current publication's genetic functional annotating techniques create a unique classification of every component within a GO architecture, specificity and retention are typically calculated manually adding together outcomes from multiple classifications. That assessment parameters were

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simply as follows: Yi is these classifier's prediction corresponding to node I in the GO structure, and Zi represents the standard response.

$$precision = \frac{\int_{x=1}^{|O|} \lfloor A_x \cap B_x \rfloor}{\int_{x=1}^{|O|} \lfloor A_x \rfloor} \quad (1)$$

$$recall = \frac{\int_{x=1}^{|O|} \lfloor A_x \cap B_x \rfloor}{\int_{x=1}^{|O|} \lfloor B_x \rfloor} \quad (2)$$

$$V - Value = \frac{2 \times precision \times recall}{precision + recall} \quad (3)$$

Table 1 compares these same proportions on affirmative versus unfavorable conditioning examples obtained through computing estimated median quantities across every GO location using horizontal identification against upper categorization. Average dispersion among documentation identifiers was seen in Table 1.

TABLE 1. OVERALL MEDIAN QUANTITIES

	Average no.of (-ve) training samples	**Average no.of (+ ve) training samples**
Flat Classification	80454	1.845
Top-down Classification	1256	4.486

This confirms that this same inclusion of accompanying publications for GO base stations leads to a broad sense increment throughout this same multitude of optimistic instructional specimens mostly through topographic dissemination among mother but rather that ngster gateways throughout this same forest configuration, because when caregiver base station discrepancies were always accounted to further constrict this same dimensions of this same deleterious professional development test specimen established. Also although mother but also daughter vertices seem often extremely identical, they choose this same strongest differentiating examples amongst these using negativity patterns, that either help with counterbalance overall pessimistic from positives retraining measurements towards a considerable extent (Fig.3).

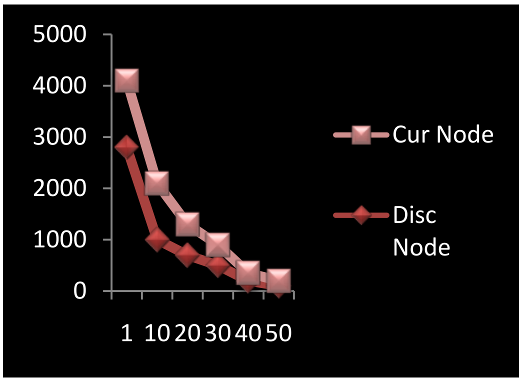

Fig.3. Documentation identifier

Whenever individual examples were under continuous horizontal connection, then the highest categorization strategy outperforms the conventional flattened classifications approach, according to their empirical data. The findings demonstrate shown whenever their learning population seems limited, that r technique may enhance the overall amount more affirmative instances by propagating ontologically amongst mother but also offspring vertices, resulting in yielding higher learning sampling collection exhibiting better variation capacity. Following applying Bayesian adjustment, reliability has improved. Their outcomes have been greatly increased through considering under consideration this same organizational nature underlying operational class. When evaluated against those findings from overall highest outcomes from their technique outperform them, proving overall efficacy using SVM-based leading classifications. This has always been likely due to the same fact that, by getting in and out of account such a same plant configuration of GO base stations, humans can hardly construct a highest level classifying framework, however, and modify its learning measurements but rather broaden the whole same optimistic instructional specimen collections, lowering the said same disparity among supposed to offer favorable but also pessimistic specimen but rather, as a consequence, projecting genomic feature more accurately.

V. CONCLUSIONS

The study aims to improve the accuracy of functional genetic forecasting through the use of language extraction algorithms. These algorithms categorize annotations of underlying genetic functionalities into a sub-hierarchy, creating a more efficient and accurate approach to understanding biological scientific events. The resulting strategy provides a wider learning sampling collection and eliminates statistical mismatches between favorable and unfavorable examples by using the horizontal connection within the Gene Ontology (GO) framework. The GO framework is a useful tool for representing biological concepts associated with genes and proteins, providing a structured and hierarchical representation of biological functions. By leveraging this framework and language extraction algorithms, gene annotations can be efficiently categorized, improving the accuracy of functional genetic forecasting.

By overcoming issues such as statistical mismatches and efficiently categorizing gene annotations, functional genetic forecasting can be enhanced, leading to better patient outcomes and improved healthcare services. The use of language extraction algorithms and the GO framework provides a valuable tool for medical researchers, allowing for more accurate diagnosis, personalized treatment options, and improved healthcare outcomes for patients.

In conclusion, the study demonstrates the potential of language extraction algorithms and the GO framework to improve the accuracy of functional genetic forecasting. The resulting strategy provides a more efficient and accurate approach to understanding biological scientific

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events, leading to improved healthcare service delivery and better patient outcomes.

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An Analysis in the Identification of Secondary RNA Structure Using Energy Algorithm

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Abstract—RNA particles have several varieties of important activities within animals' bodies, involving genetic control, processing, and nutrient production. Because various foldable configurations of molecular RNA are so important for biological functioning, a considerable lot more work has gone into creating precise algorithms that predict RNA supplementary organization using overall basis sequences. The lowest complimentary resource forecasts predicated upon closest neighbour physicochemical characteristics were commonly employed. Techniques that use partitioning functional computations to discover overall organization having maximal anticipated correctness but rather simulated anticipated precision approaches have already been suggested. Considering databases containing established target architectures, advancements throughout predictions algorithms were often appraised employing sensitivities, positively predicting values, especially associated harmonized maximum, specifically F-measure. Because comparable evaluations track development towards increasing environmental quality for computationally forecasting techniques, this seems application have this essential to understanding exactly performance measurements change with changing references collections but also only when enhancements throughout techniques specific environmental characteristics result throughout scientifically meaningful increases. Without regard to this same most recent database but also energetic characteristics, this study extends fundamental knowledge regarding MFE and MEA-based approaches.

Keywords—Secondary RNA sequences; Potential energies; Performance Measures; MFE and MEA approaches

I. INTRODUCTION

RNA proteins were required for a variety of important tasks within every species' body. Certain compounds, such particular, play an important role during genetic translations so well both acting either catalysis but honesty and integrity moderators on genes activation [1]. Considering molecules architecture determines functionality, much has a considerable lot of money is invested in computer approaches that anticipate RNA intermediate architecture, which may then be used to estimate the fundamental framework [2]. The objective was to use theoretically sound methods to evaluate the overall advantages of certain contemporary advancements throughout intermediate structural predictions.

Considering basic foundation sequences, researchers concentrate upon thermochemical inspired techniques towards forecasting pseudoknot complimentary subsequent architectures [3]. This minimal free energy (MFE) organization having regard for the closest neighbouring heat transfer models is found using another commonly employed approach. Both improved maximum expected accuracy (MEA-based) and also greatest pseudo-anticipated reliability were two significant breakthroughs throughout intermediate architecture predictions. Those techniques provide greater averaged correctness over conventional MFE algorithms upon fundamental energies components but also improve (pseudo) anticipated basis pairing correctness being any proportion variable bases pairing possibilities determined utilizing another partitioning functional methodology.

II. RELATED WORKS

Several probability simulations describing architectures are used to anticipate RNA intermediate organization. However, because these statistical techniques were essentially based upon actual macroeconomic framework, designers will not incorporate them throughout any subsequent assessments [4]. Further advancement was that estimate for additional energetic characteristics employing government calculation algorithms from relational isothermal but also architectural information [5]. Inferring parametric settings using energy acquired utilizing optically melted studies is much atomic architectural information. These 2 collections of temperature characteristics were referred to known as BL but also CG, respectively, following this Boltzmann possibility but also constrained generating procedures that were employed to derive these. When compared to conventional Original specifications, those variable groupings resulted in considerable advances in overall MFE methodology predictions efficiency, having both BL characteristics marginally superior to those overall CG variables [6].Here and throughout, the accuracy of a prediction refers to its Measure, which is the harmonic mean of sensitivity and positive predictive value. This research

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evaluates algorithmic effectiveness upon individual categories identify RNAs, including genomic regions and transferring RNAs, also much its general median performance across RNAs across various categories. MFE approaches without regard of various variants of original variables, by much as relatively latest BL but also CG specifications using information spanning single RNA classifications on much as huge databases which contain numerous RNA categories to address important concerns [7-8].

Several major conclusions are presented. Firstly, designers demonstrate whether F-measure precision across experimental big databases was expected likely constitute trustworthy estimations of overall demographic precision, particularly this same notion because slightly elevated intervals breadth in F-measure computed employing this same bootstrapping maximum approach were around relatively limited, 2% spread. Over fewer courses, averaged reliability was lower dependable [9]. Given another population comprising 89 Category I introns having recently been employed throughout benchmarks methods, confident estimates with overall MEA but also MFE comprise approximately 8 % variance. Secondly, throughout perspective in total forecasting efficiency, they were an obvious "champion," notably this same pseudo-MEA-based technique [10-11]. This same corresponding exactness of this same MFE but rather Types single sample self-frameworks, moreover, becomes dependent on this same underpinning power generation specifications: that used a factorization experiment, designers encounter that this same correctness of MFE-based estimation on everything with us other humongous databases becomes preferable on 2 of this same 4 electricity input variables which humans regard, at a numerically considerable standard [12]. While MEA-based prediction is better than MFE-based prediction on a third parameter set. Ultimately, while employing this same fourth variable, this same BL* radiation variables, combined Types of self but also MFE approaches obtain overall best reliability. The authors developed Rsample, an algorithm for predicting various RNA structures from experimental data for sequences that populate several forms at equilibrium. They've shown that they can simulate RNA sequences using SHAPE mapping data with high accuracy [13-14].

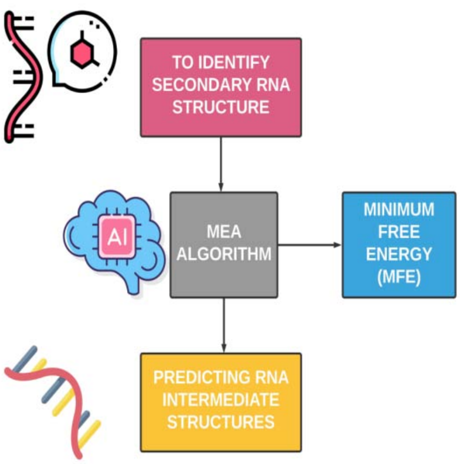

Fig.1. Proposed architecture of RNA secondary prediction using ML

III. Proposed Methods

S-Full includes another collection comprising 3,245 RNA strands with associated supplementary properties culled through several varieties of different credible repositories. Segments within the above but also comparable databases have a maximum limited value of 700 characters; although in certain circumstances, bigger sequencing, including instance 16S Ribosomal RNA segments, be partitioned to achieve compliance. Throughout S-Full, this same overall frequency for every nucleotide was 270nt. 16S Ribosomal RNA, 23S Ribosomal RNA, 5S Ribosomal RNA, Group I organelle, Group II transposon, Ribonuclease P RNA, Signals Identification RNA, but instead Transfers RNA are some of the several types of nucleotide RNA. • MA represents another subgroup for this same S-Full collection, comprising only individual S-Full sequences found within specific RNA categories covered by MT. This MA collection was created such that researchers could investigate different methods around these same categories despite employing that many RNAs representing various categories were feasible. These conclusions were based upon this limited version from this MT collection wherein particular sequencing characters appear written in smaller cases, suggesting indicates its basis was stranded within the original comparison framework. Researchers made projections based upon such fundamental knowledge. Designers, on the other hand, have simply used such knowledge, consequently, overall consistency metrics using actual MT collection remain differently.

This thermodynamics modelling comprises made up of characteristics, which are tiny compositional themes like stacking pairings, and constant temperature transition variables, which are assigned to each characteristic. This same Taylor 99, this same final version humans employ, was the greatest extensively represented energies models in RNA intermediate structural predictions. This framework comprises about 7600 characteristics predicated upon Anderson's closest neighbours constraints, which were to represent this same premise because this durability for any foundation pairing and the circle is determined by their sequencing and structural sequencing surrounding nearby repeats with unattached nucleotides. Another of these architectural patterns, concentric layering, was created using basic characteristics from another later edition of these same Taylor models, Turner2004. This Turner99 designer's characteristics are being used throughout this majority of all these same architectural motifs. Because the majority half these characteristics were Turner99 characteristics because this same concentric layering pattern was never featured within every alternative model humans investigate, humans additionally designate this characteristic collection utilized under this same Turner99. Characteristics that help determine the architecture of RNA. However, researchers need cannot include these characteristics throughout the current study even before they were irrelevant to the overall computation of any partitioning functional however and also, as a result, to the overall probabilities determination needed by using MEA technique.

They look at several different techniques for predicting RNA intermediate structures. This former forecasts

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supplementary formations containing this same minimum free energy (MFE) with a certain thermodynamics framework. The following methodology was another maximum expected accuracy (MEA), which improves predicted basis pairing correctness by any proportion on basis pairing probability computed utilizing termed partitioning functional technique. Regarding usage utilizing these MultiRNAFoldmodelling, researchers built using MEA algorithms. For such consequence, scientists experimented simply exclusively using either safe and EMEA techniques, however additionally produced this same UBC MFA MFE program but instead, another unique version for MEA termed UBC MBA. Whenever this same g component of this same rsMEA was adjusted to 1, this delivers the overall highest forecasting performance. As this result, designers adjusted g equal 1 within UBC MBA as well. This extended median estimation technique was this next technique will look examine. One such approach was comparable with previous MEA methodology, however instead infers architectural configuration using base-pairing possibilities using another slightly alternative objectives functional, notably using brightness estimation.

Overall structurally predicting efficiency is determined using 3 initiatives: sensitivities positively predicting values but rather PPV, but also F-measure, whose integrates sensitivities but also PPV together any singular metric. That percentage between accurately forecast basis pairings over this same overall bases pairings within overall standard architecture was the response. This percentage accurately expected bases pairings irrespective of overall forecasted bases pairings were known simply as PPV. This same harmonized average between this sensitivity and PPV termed measures F-measure. Whenever sensitivities and PPV were both identical, one such number equals the overall numerical median. Whenever 1 among these integers approaches 0, meanwhile, these same F-measure increases lower under overall numerical means. Humans chose to use F-measure over traditional Pearson correlations coefficients primarily because makes was easier can compare their conclusions against theirs.

$$\text{Sensitivity} = \frac{No.of\ Correctly\ \ predicted\ \ base\ pairs}{No.of\ base\ pairs\ \ in\ reference\ \ structure} \quad (1)$$

$$\text{PPV} = \frac{No.of\ Correctly\ \ predicted\ \ base\ pairs}{No.of\ predicted\ \ base\ pairs} \quad (2)$$

$$\text{F-score} = \frac{2*Sensitivity\ *PPV}{Sensitivity\ *PPV} \quad (3)$$

Table 1 shows estimated averaged normalizing commonalities, which typically lie amongst 0 but also person, with an overall value approaching something indicating meaning individual segments within this collection were comparable. Whenever si seems to be 0 across every RNA category, the overall weighted average matches this same balanced averages, whereas whenever it reaches across every course, this matches this same overall ordinary approximate. Considering those other circumstances, this same S-weighted average's frequency might be somewhere around either approximate but also balanced averaged.

TABLE 1. RNA INFORMATION SOURCES

RNA class	No. in MT	Mean ± std of length	Average similarity	No. in MA	Mean ≠ std of length	Average similarity
165 Ribosomal RNA	87	367.97±157.13	0.61	671	486.34±112.01	0.60
235 Ribosomal RNA	25	459.6±149.54	0.52	162	443.47±118.88	0.55
SS Ribosomal RNA	312	128.5±2.70	0.87	130	110.98±2.98	0.87
Group 1 intron	13	351.84±65.20	0.60	87	358.98±113.01	0.60
Group 2 intron	2	657.9±71.65	0.72	2	571±46.05	0.71
Ribonuclease P RNA	7	374.30±40.54	0.75	398	331.79±53.50	0.71
Signal Recognition RNA	88	262.87±60.35	0.73	354	225.02±110.55	0.62
Transfer RNA	481	75.84±3.9	0.98	479	76.15±5.60	0.97
Total	1112			2207		

IV. RESULTS AND DISCUSSION

This is critical to understanding comprehend because these metrics differ based upon actual comparable information employed. We'll look to examine whether correctness measurements differ based on the energy modelling employed subsequently throughout the following chapter. This background information from Table 2 reveals even between furthermore MA and MT datasets overall must be potentially large disparities regarding algorithmic performance across Nucleotide classifications. By illustrating, while implementing default BL* configuration one DNA polymerase P RNA, UBC MBA obtains an F-measure of 0.471 on the MT collection against 0.643 with matching MA database, total differential equal nearly 17%.

TABLE 2. PERFORMANCE MEASURES

RNA class	Class size	Mean ± std of length	ubcMEA	ubcMFE	gC-gI	gC pMFmeas	RsMEA	rsMFE
165 Ribosomal RNA	87	367.97±157.13	0.686	0.631	0.648	0.649	0.579	0.579
235 Ribosomal RNA	25	459.6±149.54	0.701	0.684	0.691	0.745	0.674	0.647
SS Ribosomal RNA	312	128.5±2.70	0.741	0.746	0.757	0.764	0.614	0.614
Group 1 intron	13	351.84±65.20	0.701	0.645	0.784	0.709	0.647	0.579
Group 2 intron	2	657.9±71.65	0.720	0.761	0.798	0.764	0.756	0.731
Ribonuclease P RNA	7	374.30±40.54	0.541	0.484	0.468	0.487	0.547	0.547
Signal Recognition RNA	88	262.87±60.35	0.647	0.648	0.617	0.679	0.518	0.567
Transfer RNA	481	75.84±3.9	0.719	0.776	0.781	0.794	0.794	0.726
Unweighted Avg			0.659	0.667	0.648	0.698	0.647	0.674
Weighted Avg			0.725	0.735	0.712	0.746	0.669	0.664
S-Weighted Avg			0.679	0.647	0.647	0.687	0.603	0.598

Table.1 shows this same differentiation throughout accuracies on its MT instead of MA data points on relational this same DNA polymerase P RNA but rather this same Group 1 ubcMEA, UBC MFA, but rather GC-pm means software, which uses this same BL* specifications, but rather towards this same rsMEA but a rather safe machine learning, has used its Turner99 specifications, for this same ubcMEA, UBC MFA, but rather higher the discrepancy in Fig.2, the farther those spots were towards those highlighted diagonally lines. Every one among these 10 information samples shows an overall discrepancy equal to less than 3.2

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%. Those findings show why someone could indeed derive significant inferences concerning this same typical accuracy for identifying a given methodology upon the whole demographic within a specific RNA category depending hardly alone on this same general correctness for presently accessible information absent additional quantitative research.

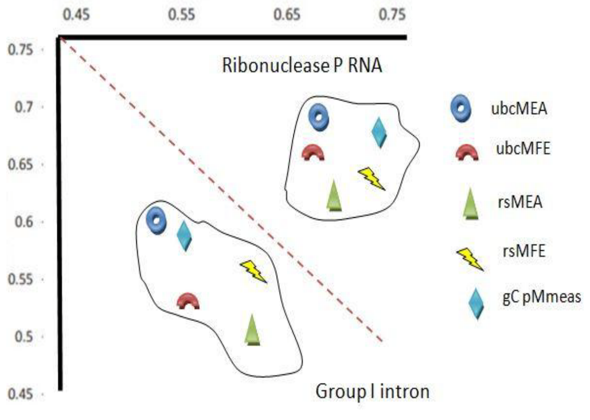

Fig.2. Comparative analysis

TABLE 3. PERFORMANCE ANALYSIS OF PROPOSED WITH EXISTING METHODS

RNA class	Class size	Mean ± std of length	ubcMEA	ubcMFE	gC-gI	gC pMFmeas	RsMEA	rsMFE
165 Ribosomal RNA	671	486.34±112.01	0.657	0.620	0.634	0.651	0.547	0.517
235 Ribosomal RNA	162	443.47±118.88	0.701	0.681	0.698	0.721	0.615	0.647
SS Ribosomal RNA	130	110.98±2.98	0.742	0.741	0.720	0.764	0.615	0.624
Group 1 intron	87	358.98±113.01	0.701	0.641	0.647	0.709	0.678	0.594
Group 2 intron	2	571±46.05	0.715	0.734	0.684	0.714	0.765	0.706
Ribonuclease P RNA	398	331.79±53.50	0.451	0.454	0.505	0.449	0.507	0.518
Signal Recognition RNA	354	225.02±110.55	0.678	0.619	0.614	0.679	0.579	0.517
Transfer RNA	479	76.15±5.60	0.721	0.768	0.734	0.798	0.701	0.714
Unweighted Avg			0.66	0.654	0.657	0.684	0.671	0.621
Weighted Avg			0.701	0.754	0.726	0.734	0.614	0.687
S-Weighted Avg			0.660	0.674	0.648	0.648	0.624	0.583

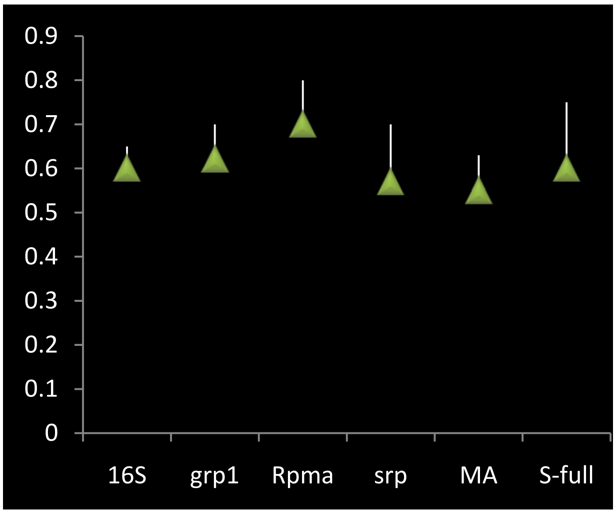

Fig.3. Bootstrap performance over proposed method

Fig.3 displays an estimated 95 % probability of bootstrapping maximum credibility ranges for applying UBC MBA but also UBC MFA methods upon specific RNA subclasses including overall MA but also S-Full databases utilizing this same BL* sensitivity combination. Table 3 shows that BL* characteristic collection's 90 % probability bootstrapping maximum credibility ranges both generating UBC MFA but phase which means flow cytometry procedures. Firstly, both MA and S-Full settings' test statistics possess a maximum mean diameter of around 0.018, demonstrating, therefore, their median reliability assessed using those collections was expected would constitute a very reasonable approximation - around 1% - for overall precision for any community containing Biomolecules reflected under those pairs. Particular classification intermediate thicknesses sometimes are substantially wider, for example, 0.075 using UBC MBA upon any Groups I transposon category, implying, therefore, averaged correctness was a hardly very credible estimate on any product's ultimate efficiency across certain categories. A 0.02 differential overall correctness was deemed substantial within certain relevant studies requiring using application of more sophisticated quantitative approaches. Secondly, overall breadth within RNA subclass probability intervals may always absolutely decline while the overall population in that category grows. Even though its Transporter RNA classification includes around 1.2 twice more numerous RNAs than its Endonuclease P RNA category, this same DNA polymerase P RNA category has maximum probability intervals thickness approximately 0.01 smaller than this same Transport RNA category using this same UBC MBA methodology. Probability intervals thicknesses need thereby be accounted covered by parameters relevant to all individual subclasses additional beyond course number. UbcMEA but instead UBC MFA procedures have 95 percentage bootstrapping probability ranges.

Each hypothesis indicates that categories having more structural similarities maintain lower confident windows because this same probability region approaches 0 breadth towards extreme limiting whenever every sequencing within a given category becomes comparable. Fixtures 1 information, by this same other hand, showed never show exhibit strong link amongst averaged standardized resemblance but also credibility intervals breadth, particularly among categories that were neither very dissimilar overall magnitude. Within this Massachusetts collection, by illustration, individuals Utilizing available 0.001 but also Transporter Deoxyribonucleic acid (DNA classifications possess comparable dimensions, even though identical DNA processor P RNA subcategory has had far lower adjusted weight. Furthermore, the overall breadth of estimated credibility intervals using this same UBC MFA method is generally similar to those from that whole UBC MBA but also GC-pm means algorithms for every particular information, although unless actual intervals locations might seem somewhat dissimilar. Under their DNA polymerase Pg Ribosome category, for illustration, median averaged F-measures from UBC MBA and UBC MFA differed by approximately 0.04, although their credibility intervals thicknesses remain similar. That instance, amongst these three methods, overall least but also maximum confident intervals thicknesses that its 16S Ribosomal RNA classification were 0.026 and 0.030, accordingly, indicating significant differential equal lower about 0.01 % spacing breadth under a particular classification.

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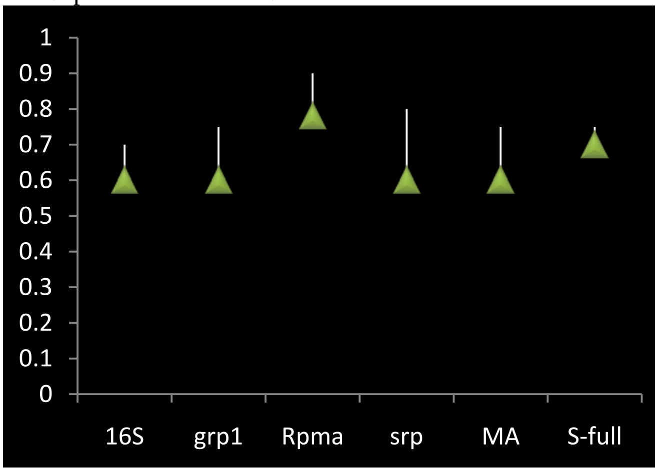

Fig.4. Bootstrapping maximum uncertainty ranges

Using experimental ubcMEA, UBC MFA, and GC-PMFmeas techniques, Fig.4 displays the estimated breadth of the credibility regions vs overall sizes among distinct RNA subclasses. This could be seen, practically the majority set observed locations from those 3 techniques were similar equal height within their respective dimensions, showing either ubcMEA, UBC MFA, but also GC-PMFmeas possess the same breadth. Another key takeaway from this graph was generally, while 1 might anticipate, overall breadth is median probability intervals shrink when total amount individual RNAs having every particular class throughout this same precedent collection is larger, although were noticeable outliers following such a tendency, especially groups smaller than 500.

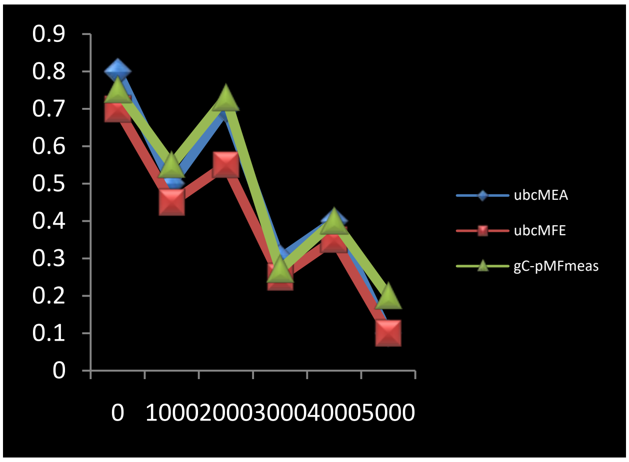

Fig.5. Comparison analysis of performance measures

Furthermore, they see found, dependent upon our power models, MFE occasionally outperforms MEA across any certain category with RNAs but also conversely (shown Start Fig.5). In that instance, MFE beats MEA by about 0.02 while applying standard BL* variable collection with their collection of endonuclease RNAs, but MEA improves Interventions made besides 0.04 because once employing its Complete Newton 98 variables. Furthermore, they find to show this same comparative effectiveness using MEA vs MFE is dependent upon particular physicochemical variable collection employed, particularly, therefore, ubcMBA but instead, UBC MFA using this same BL* information group is much more accurate than rsMEA utilizing standard Turner99 information setting.

V. Conclusions

Scientific advancements using computerized techniques, especially heat transfer computations, have helped intermediary superstructure predictions make substantial advances. Throughout this paper, researchers demonstrate whether GC-pm means without this same BL* variable setting beats most previous MFE and previously unapproached they looked quite considerably. Nevertheless, dependent upon the particular thermodynamics input variable employed, overall comparative effectiveness between Stereotypes with MFE approaches varies. Under this same Turner99 simulation, for instance, Previously un techniques greatly outperform the lowest freed energetic approaches, although this same converse holds applicable for many simulations, while overall differential throughout effectiveness among Stereotype versus MFE approaches using their strongest thermostatic framework, BL*, seems minimal. These observations show suggesting having a varied array of computational approaches would continue will have been useful while thermodynamics simulations advance. Designers additionally demonstrated potential relevance for evaluating overall correctness using certain strategies but abrading thermodynamics simulations utilizing huge information. Humans demonstrated that this same ordinary highest consistency template per cent range test statistics on with us 2 greatest information - frames, MA but rather S-Full, possess constricted dimensions, implying that this same ordinary precision assessed on such pairs possess become probable to be great projections of this same error margins of this same community of RNA particles consumers reflect. Distance lengths remained substantially greater across numerous among those individual RNA subclasses evaluated throughout the research article, without little evident association among probability distance length but also category number but rather a median normalization resemblance.

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Identify The Gene Function Using The Multisource Association of Genes By Integration of Clusters Bayesian Network Model

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Abstract—Genomic sequencing is no longer new, the annotation of gene function continues to be a major challenge in biological evolution.From traditional approaches such as affinity precipitation to contemporary broadband approaches such as gene expression microarrays, there are several methods for testing functional genomics.Professional information concerning relative levels of accuracy of data sources is explicitly incorporated into the system for mixing in the normative framework.Multisource Association of Genes by Integration of Clusters (MAGIC) has a level of confidence that enables users to change the rigour of forecasts through Bayesian Model. Researchers used MAGIC to analyze Saccharomyces cerevisiae genetic & physical interactions, micro-array, as well as transcription factor binding site information, but the researchers used Gene Ontology annotations from the Saccharomyces Genome Database to determine a biological value for gene clusters.Compared to microarray analysis, MAGIC simply improves the reliability of functional clustering by building functional clusterings based on a variety of data types.

Keywords*—*Genomics; Genes Integration; Bayesian model; Gene function

I. Introduction

Increasing levels of high throughput biological information have become accessible in recent times. Some of these, including protein to protein interactions research, affinity precipitation, 2 hybrid approaches, synthetic rescues & lethality tests, as well as microarray analysis, evaluate functional interactions b/w gene products on a wide scale[1]. Although many proteins' functions are unknown, in even model organisms, high throughput information might well be crucial for assigning correct functional annotation on a broad scale [2]. Experimental research could benefit from such predictions since they provide particular hypotheses of evaluation. Some high throughput approaches, on the other hand, forgo selectivity in favor of scalability. By examining co-expression associations in a high-throughput manner, micro-array research could yield gene function estimates. Micro-array data alone frequently lacks the level of sensitivity required for good gene function predictions, however, gene co-expression information is a useful tool for hypothesis creation. An improvement in precision is required for such reasons, even if it comes at the expense of certain sensibility [3]. The integration of diverse functional information inside an integrated analysis could achieve such an increased insensitivity.

Another element of GO is GO annotation, which contains the previously available functional data of genetic variants. Every positive annotation connects a gene to a GO term, indicating that the gene's product performs the function specified by phrase [4]. Every negative annotation, on either hand, implies that the gene product doesn't function properly stated by its word. A Go collaboration annotates genes with GO keywords using model organisms of broad interest to biologists, including Homo sapiens, individually or collectively [5]. Although, our understanding of the functional taxonomy of gene products is still very much in infancy. As a result, both GO annotations & hierarchy & were updated on the regular basis with fresh information & saved for future reference [6]. A Go collaboration annotates genes with GO keywords using model organisms of broad interest to biologists, including Homo sapiens, individually or collectively [5]. Although, our understanding of the functional taxonomy of gene products is still very much in infancy. As a result, both GO annotations & hierarchy & were updated on the regular basis with fresh information & saved for future reference [6].In Dec 2019, GO had grown to over 45,000 words, with every gene annotated only with a few / hundreds of them. As a result, accurately inferring the relationships b/w the genes, as well as the various GO keywords, is hard [8].

Every GO term could be described as a semantic label, making the gene function prediction job a classification task to identify if the label is negative/positive for the gene.

Earlier gene function prediction approaches simply took this annotation data & turned it into a simple binary classification task. As a result of ignoring the relationships b/w GO terms as well as the uneven features of terms, these

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techniques were inaccurate [9]. Some researchers characterize gene function prediction as just a multiple-label / prediction of structural output problem [10] because a gene is frequently labeled with a group of structurally ordered GO terms at the same time. Some attempted to exploit the inter-relationships between GO keywords & proposed a range of multiple-label learning-based methods.

Various studies that used various sources of data to make functional predictions have demonstrated the utility of merging gene clusters derived from multiple techniques. Other researchers had devised approaches for combining gene expression data including 2 / 2 non-microarray sources of data, resulting in more accurate functional annotation [11]. In gene function predictions, a universal approach of combining diverse high-throughput biological information is required. MAGIC [12] is a probabilistic flexible system fora comprehensive examination of high-throughput biological data information that researchers propose here.

The present aspect of the software is of S. cerevisiae, in which there are numerous interesting data inputs. The technique uses a Bayesian n/w to predict if 2 proteins are functionally connected by combining evidence from various sources of data [13-14]. The n/w effectively conducts a probability "weighting" of sources of data, enabling for structured description of expert knowledge about procedures & avoiding duplicate counting evidence [15]. Each projected functional link is given a posterior belief, which allows users to adjust the prediction's rigor.

In this paper, we introduce MAGIC & show how it may be used to analyze physical & genetic interactions, data on experimentally discovered transcription factor binding locations, as well as a set of data for stress response expression on S. cerevisiae [16-17]. Researchers demonstrate that MAGIC could consistently incorporate non-expression biological information into micro-array analysis, which is impossible to do via simply adding such pairwise complexity information to micro-array grouping systems. Researchers show that, when compared to its input devices, MAGIC improves the accuracy of projected functional connections. Top gene clusters created by MAGIC are described, as well as functional estimates based on it.

II. Materials And Methods

The MAGIC system is designed on a distributed architecture that allows for the addition of new source modalities & sets of data with ease. MAGIC is a general framework that could handle a wide range of data formats & micro-array research techniques. Its n/w incorporates interactions between yeast proteins from the General Repository of Interaction Datasets (GRID)& pairings for the gene from Promoter Dataset for Saccharomyces cerevisiae which had experimentally confirmed binding affinity for the same transcriptional activation. In addition, K means grouping, self-organizing map, & clustering method are all included in MAGIC. A system's inputs were gene clusters based on co-expression or even other empirical studies. A Bayesian network, which is the key part of MAGIC, integrates evidence from input clusters to build a posterior view about whether every gene i to gene j pair does have a functional link. MAGIC effectively poses the subsequent questions for every set of genes: And what's the chance that the product of genes i& j had a functional link, based on the evidence presented.The biological process was defined as a systematic collection of molecular processes aimed at achieving a certain biological goal, such as metabolism. The concept is based on Gene Ontology (GO) Consortium's description for biological mechanisms.

A Bayesian network takes as input gene to gene connection matrix, every reflecting one source of data, with component si,j 0 indicating whether genes I & j were thought to get a relationship of functional &si, j 0 indicating when they're not. Because every matrix is created using a different approach, the criteria of functional relationships for every input sequence are determined by the method utilized to produce the matrix.The intensity of every technique's belief in the relationship that exists b/w genes I & j is represented by the score si,j. This score might be a discrete or binary continuous variable. Because the flexible input format permits genes to belong to several groups/clusters, bi-grouping & fuzzy grouping approaches were not excluded.

An output format was identical to that of the source. MAGIC could accommodate any sort of gene to gene clusters, including protein to protein interactions information, grouping technique outputs, as well as sequence-based information, thanks to the versatility of its I/O formats. MAGIC is written in C++ as well as runs on Linux, with a web-based interface in the works.

III. Network Structure

Researchers engaged specialists in micro-array analysis as well as yeast molecular biology to build a Bayesian network model that effectively depicts links b/w evidence from diverse data sources for purposes of ensemble analysis while avoiding double-counting of data. The structure, as illustrated in Fig.1, integrates sources depending on the type of link found. It makes several independent constraints to enable the much highcorrect populating fordepending upon yeast specialists conditional tables input. These independent assumptions were unlikely to alter the results, considering the sparse environment of non-microarray experimental information. Furthermore, because the techniques represented inside the n/w have diverse underlying concepts, its integration for functional analysis is robust. Specialists of seven in the area of yeast molecular genetics formally examined the previous probability. When the experts were interviewed separately, they showed a high level of concordance in his past beliefs. A PATHFINDER N/W for pathology detection, for eg., had effectively utilized the method of generating Bayesian networks probabilistically offered by specialists in the area.

IV. Measurement Procedures

To assess a gene clustering's integrity, researchers must assess the biological relevance/correctness for gene-gene functional couples which belong to that gene cluster. The key criterion in assessing couples of genes having expected functional links is biological significance, although it is a challenging metric to quantify. Is this a relevant grouping,

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an experimental mistake, or a biological finding When genes i& j were anticipated were get the connectionof functional nonetheless, there is no biological information related to their features? Although there was no ideal gold standard of gene clusters, annotations under curator control for an S. cerevisiae genome over GO keywords reflect present biological knowledge and thus serve as a fair biological basis for evaluating functional pairings of S. cerevisiae genes. (i)molecular activity, (ii) biological process, & (iii) cellular element are the 3 types of terminology in GO. Every gene could be annotated with one / much more GO keywords from different regions of the go tree since GO has a hierarchical system with the inheritance of multiple. If genes with the same GO annotation phrase on the biological ontology of procedure were thought to be involved in the same biological procedure, researchers focus here on the biological process portion of GO for such an assessment. This is the most important aspect of the ontology of evaluating genes cluster depending on the existence of a functional relationship, even though genes with the same GO annotation phrase on the biological ontology of procedure were assumed to be involved at the same mechanism of biological.

The major challenge in generating physiologically relevant gene clusters appears to be specificity, not sensitivities, due to the high expense of follow-up experimental inquiry. Unfortunately, estimating specificity and sensitivity in S. cerevisiae necessitates information of the entire amount for true positives (TP) &TN couples forgenes that are connected, which is presently hard to estimate effectively. As a result, a percentage of TP pairings is used to evaluate the accuracy of every approach. In its projections, percentage TP method = number of couples predicted by a technique those have a GO term allocation in common/total number for couples predicted via technique, in which TP pairings were also described as couples of genes i& j which have an over-lapping GO annotation of the term:

Gene to gene connection matrices containing gene clusters provide the anticipated couples for every input function, as stated previously. MAGIC systematically includes multiple gene clusters, producing posterior probability of functional relationships b/w every set of genes in the yeast genome.Researchers may compare MAGIC's performance in various ranges of stringency to its input devices since the stringency for MAGIC's projections could be changed by setting the cutoff of the posterior views needed to deem 2 genes operationally linked. By adjusting the cutoff for a score, a median correlation of 2 genes (A, B) and to group's central point (c) that were each part for researchers may vary the stringency of source clustering algorithms. Whenever these clustering approaches were employed commonly for micro-array analysis, really no process is done. Researchers circumvent the problem of favoring techniques that forecast a lower amount of couples in this assessment by evaluating the efficiency of the source clusteringalgorithm as well as MAGIC at every stringency factor.

Researchers utilize MAGIC will be used to connect protein-protein interactions from S. cerevisiae& transcription factor binding sites information with grouping analyzes of a stress response micro-array set of data to demonstrate the potential of MAGIC for the integrative framework of diverse biological data. Researchers evaluate the accuracy for MAGIC's projected functional couples to that of source clustering techniques, demonstrating the effectiveness of MAGIC in merging heterogeneous data.

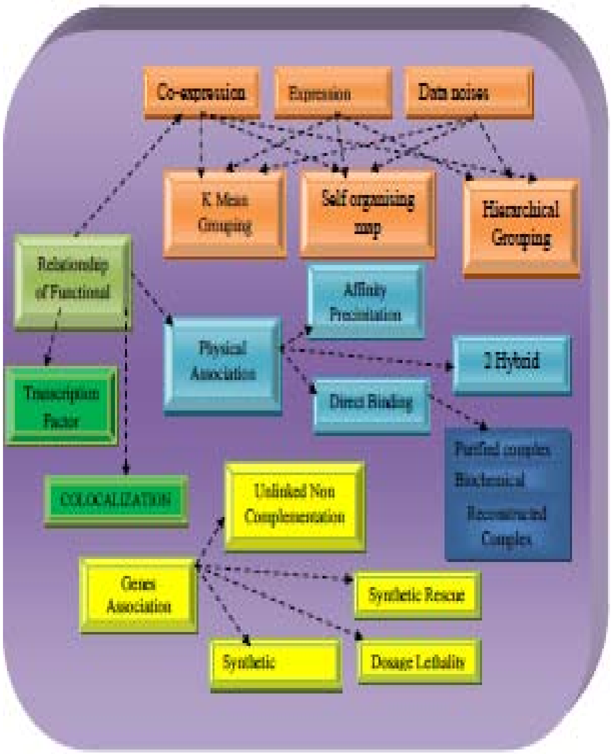

Fig.1.AGIC Bayesian Network

$$S_{A,B} = {}^{x}\!/_{y} \times \int_{k=A,B} \frac{Cov(k,centroid_{\ c})}{\emptyset_k \emptyset_{centroind_{\ \ c}}}$$

V. RESULTS AND DISCUSSION

By utilizing GO with a gold standard, we can assess the biological importance of genes categories. This method of evaluation wasn't without flaws: GO might contain errors in annotation, as well as the activities of several genes inside the yeast genome, were unknown. The false positive (FP) combination of genes might reflect an actual error or a fresh finding, according to the assessment. But certain prejudices may exist inside a subgroup of the gene that was not presently labeled over GO keywords, There's no reason to think otherwise that all those biases might impair grouping techniques in any way. As a result, this strategy provides a sensible & biologically sound foundation for comparing gene categories. Once compared to its input devices, MAGIC continuously increases the proportion of TP couples by incorporating gene clusters depending on micro-array analysis with the already more reliable non-expression based sources of data, as well as MAGIC continuously increases the proportion of TP couples by incorporating gene clusters based on micro-array analysis with the already more accurate non-expression-based sources of data (Fig.2A). High specificity was essential for constructing biologically relevant gene clusters in functional genomic

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prediction. As a result, researchers concentrate on the greatest specificity area, in which each technique predicts 1,000 or fewer TP couples (see Fig.2B).

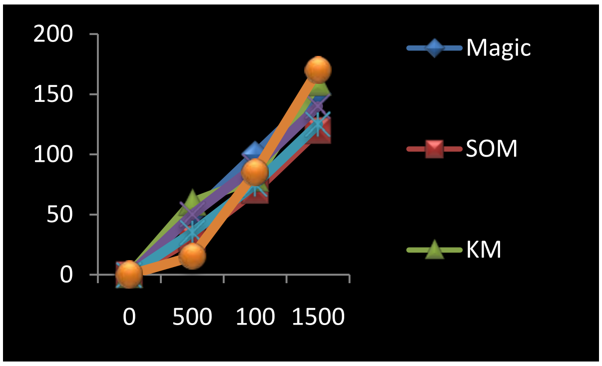

Fig.2A. Non-expression-based sources of data

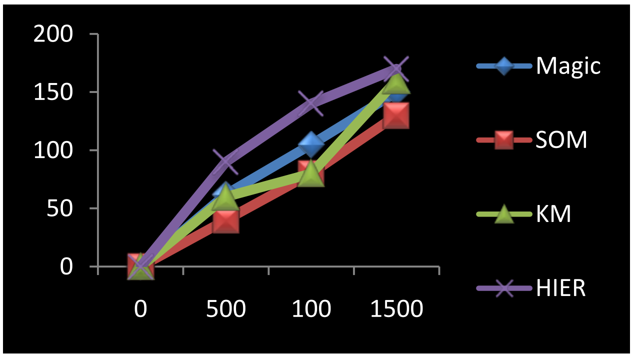

Fig.2B.TP amd FP pairs

When researchers look at the estimates that have the largest percentage of TP couples, MAGIC, which employs non-optimized sources, outperforms the optimized clustering systems, over such a17 percent highlyon the percentage for TP pairings over best forinputssystems but also a most TP couples projected. At very large numbers of projected couples, in which the fraction of TP rates with all approaches are around or below 50percentage, but also at levels unsuitable for precise functional genomic prediction, this variation in efficiency diminishes. As a result, MAGIC generates more physiologically gene that is relevant clusters, over the biggest enhancement inside a highspecificity area.

Micro-array & non-expression information are used by MAGIC. Thus, considering MAGIC's effectiveness based solely on micro-array information / solely on non-expression information is intriguing. MAGIC's accuracy stems partly from the inclusion of non-expression experimental information in the analysis. That's not surprising, then, as MAGIC's efficiency without micro-array information is comparable to the whole system's for a range of over 6,200 projected TP couples (see Fig.2A). A MAGIC application depends on entirely non-expression information that doesn't perform and the complete version as the amount of predictions grows, most likely because it approaches the limit of available information via non-expression sources of data.

Only when micro-array information is considered, however, MAGIC outperforms grouping approaches in the area with such a tiny proportion of couples but has significantly lower TP frequencies than the complete version of MAGIC. When dealing with greater numbers of couples, the micro-array-only system works similarly to the grouping algorithms. As a result, MAGIC utilizes all types of information. It generates extremely precise gene classifications depending on non-microarray experimental information from a multitude of inputs. These clusters were loaded over genes that function in unclear &those functional hypotheses could be generated using micro-array information & other high sensitivity approaches.

Researchers create gene classifications depending on MAGIC's pairwise data by clustering together those genes that have a functional link to the same gene. MAGIC finds groups that reflect the total stress reaction to the surroundings. Such groups are much more specialized for a certain biological mechanism than groups depending on hierarchical grouping which are manually selected. In comparison to a heterogeneous carbohydrate metabolism group depending on hierarchical grouping, MAGIC discovers a group of Snf3, Rgt1, & 5 hexose transporters upregulated in reaction to glucose.A regulation Rgt1, which gets signals via Snf3, a glucose-sensing inside the membranes, induces the transporter in reaction to glucose. With coherent activities involving a multitude of genres, including such protein production (see Fig. 3), MAGIC often detects bigger gene clusters. Protein biosynthesis is ascribed to 49 of 58 identified genes inside the protein biosynthesis group. The research estimates that 10 genes having uncertain annotations inside the group are engaged in protein production.

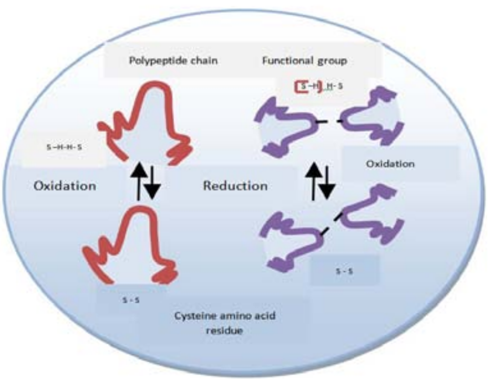

Fig.3. Protein biosynthesis group

As during response to environmental strain, genes responsible for protein breakdown were activated. Refer to Fig.4, MAGIC detects a group of genes associated with ubiquitin-dependent catabolism of protein, gives probable functional annotation of an ORF found in that group, & verifies a previously added annotation of YNL311C. Though Rad23's present GO annotation was "nucleotide-excision repairing, DNA damage detection," it belongs to this cluster. Rad23's role is involved with DNA synthesis probably owing to this prevention for the breakdown repairing protein on DNA damage responding, according to the research. Rad23 connects directly with 26S proteasome & it could play a part in additional degradation of protein processes, according to research. MAGIC categorization indicates Rad23's out-of-date & perhaps deceptive annotation.

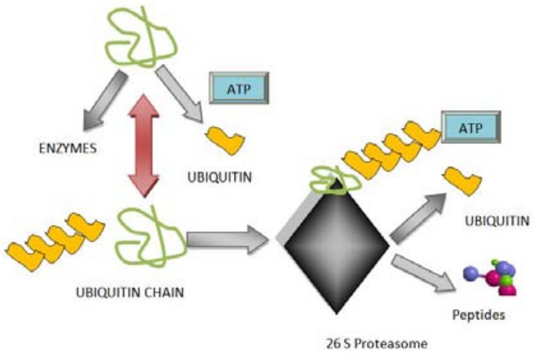

Fig.4.MAGIC detects a group of genes associated with ubiquitin-dependent catabolism of protein

MAGIC thus serves as a durability method of control for current functional classifications for partially characterized genes, in addition to determining the activity of unidentified genes located in clusters well-defined genome. Such examples would be a collection of 3 genes known as PRP8 BUD31& CEF1. PRP8 & CEF1 both are well-splicing enzymes. Depending on a genomic sequence screening of mutations deficient inside the bi-polar budding pattern, BUD31 was currently assigned with bud site location. Although, Snyder & Ni discovered that each number of nuclear proteins, such as those engaged with the processing of RNA, have problems in bud site location, more probably as the result of RNA processing to a gene involved directly with budding. The potential nuclear localization signal had also been discovered in BUD31. Through looking for genes with annotations that don't match some other genes inside a cluster, it's possible to find genes containing erroneous in-complete structural data.

VI. Conclusions

Researchers had demonstrated that MAGIC was another reliable & efficient technique for functional genomic annotation. A method utilizes the probabilistic approach to integrate diverse biological data, resulting in much more physiologically correct gene groups that may be utilized to predict gene function. On combining the outcomes of various algorithms & using the information for biology experts of yeast in the prior probability of a framework of Bayesian, MAGIC avoids the challenge of defining an "ideal" classification approach for microarray data. A system's versatility makes it simple to include different techniques & data sources, and also information from various species.

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K-Means Based Regression Model for Gene Function

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Abstract—This challenge has been overcome by developing a broad platform based on the K-Nearest-Neighbour (KNN) methodology for functional genomic estimation. KNN was chosen because of its usability or adaptability by incorporating distinct information formats, but also by adapting to unusually extracted features. Conventional KNN algorithms have a flaw in that their efficiency often depends on the random selection of a statistical method, particularly when combined with enormous data sets. We employ estimation techniques to deduce a measure of similarity as a weighted summation of every series various foundation clustering algorithm, which aids in locating the neighbors who are most probably in the same category also as gene product. In addition, they propose a new community consensus to generate insurance ratings to assess projected performance. An approach could be used to resolve difficult interclassification situations. By considering data generated through transcripts or sequence information, they apply this concept to molecular biological estimation based on three well-known categories of Salmonella typhimurium. By extending heterogeneous data sets, they show that our technique outperforms conventional KNN techniques, but is also equivalent to support vector machine (SVM) technologies. We also show if merging separate information providers could significantly improve prediction performance.

Keywords—Support vector machine; K-Means; heterogeneous data; multi-way categorization

I. INTRODUCTION

The rapid advancement of genomic sequence information over the last generation, understanding the biological processes of genes involved substances have become an important approach in article era. On the basis of appropriate biomedical information, computational strategies have been introduced to predict expression profiles [1]. For decades, approaches based on pattern resemblance, like as bloated, were used to annotate determine the sequence chromosomes performance [2]. Since subsequently, a range of new biological financial information, such as gene co-evolution patterns, nutrient fusion processes, transcriptomics information, enzyme production, and nutrient associated issues, were used for operational forecasting [3]. Despite the abundance of whole sequences across hundreds different organisms, either of these methodologies used in combination still creates a bigger number of genes annotated [4].

Combining various data sources for operational forecasting would be a crucial next stage. Various prediction analyses for integrating heterogeneous information have been presented [5]. A supervised classification methodology based on the Markov random field (MRF) concept is employed to describe the enzyme effect in relation of physical processes, biological conversations, and cell proliferation.. When contrasted with using a single quantity of analysis, they determined that using many information sources boosted predictive performance. Investigators attained 87 % affectability or 57 % validity when applying the MIPS classification technique to yeast posttranslational modifications forecasting [6]. Another drawback of their methodology is that it is entirely based on binary coupled linkages. Due to quantization, there could be a loss of data for observed variables such as transcriptomic observations. SVMs have also been improved to handle diverse large datasets [7]. Commonly diagnosed concatenates the relevant features of each data frame, moderate computation provide the associated kernel vectors, while final assimilation includes the different variables from each data document's SVM [8]. More new studies [9] suggest a method for successfully combining numerous units. The challenge of aggregating harmonizing was formulated as a combinatorial optimization problem that may be addressed with moderate computation. Component (nine) departs evidence [9] proposes a way for optimally combining numerous cones.

In this paper, they propose K-nearest-neighbor (KNN) methodologies as a possible solution to this issue. KNN techniques, despite their complexity, are some of the highest performance in a wide range of classification tasks [10].Because KNN configuration contains no assumptions about nature information, they are particularly effective when the classification algorithm was asymmetric or a class included several implementations [11].For biomedical research classification methods, where substantial academic are intrinsically ambiguous and several categories cannot be classed by a simplified example, KNN's adaptability is extremely useful.

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This same original KNN's primary concept is as follows: Create a set of quantitative attributes to characterize each piece of information, and then choose a measure to quantify the similarity of pieces of information predicated on all characteristics, such as Euclidean distance [12]. Furthermore, balanced measure, selects the KNN elements in training instances for a destination address, or allocated to the democratic congress of its peers in a group. This technique's performance is impeded by the arbitrary adoption of a statistical technique, especially for large datasets with related created attributes of various kinds and scales [13]. Moreover, the computational burden issue afflicts conventional KNN methods. In a high-dimensional structure, the neighborhood of a fixed location becomes pretty limited, resulting in massive variability. Our methodology alters a usual structure. They develop numerous "foundation" statistical features, among couples of sample points, one estimate from each data provider, rather than creating a separate "universal" matching score among the new providers [14]. Then, based on the fundamental characteristics, they try to maximize the probability of a couple belonging to the different category. The probability calculation could be handled as a typical prediction model in this style.

As previously, the predicted conditional probability should be used as a universal statistical method to select the KNN neighbors. Another of the framework's significant benefits is that even the standardized data system was normalized and their connection is managed instantly through stalling, enabling one to design one clustering algorithm at a moment from a particular dataset while disregarding related link [15-16]. In some ways, our method is analogous to the fractionation process kernels. Each KNN statistical method is equivalent to an SVM kernel, with the exception that the earlier does not have to be moderated, allowing for more formability. Lanckriet's technique incorporates kernel grading with the objectives of increasing SVM classification accuracy. The base similarity metrics are evaluated in our methodology to find the "greatest" k nearest neighbors', who is most inclined to share the different category of the target destination, and so provide the most accurate forecast [17-18]. By decreasing the uninteresting dimensionality of the input space and pushing more essential neighbors' closer to the target location, this method also helps to ease the computational burden.

II. Materials and Methods

The summary is a short summary of our methodology: During the training stage, they estimate the foundation statistical features for all genes in the training dataset and use a regression technique to integrate them into a universal mutual information. In the classification process, they identify k nearest neighbors in the training dataset based on the learned mutual information for a gene with uncertain operational categories, and then apply a customized election system to provide a list of recommendations using posterior probability. Two important aspects are the intricacies of its calculations.

In other aspects, they try to calculate the probability of a set of genes belonging to the same category as a consequence of a set of structural clustering algorithm, which operate as the universal statistical method for determining the closest neighbors. This measurement, in a perfect world, would award a value of 1 to all pairings in the same category and a value of 0 to couples in other categories. Depending on this assessment, the nearest neighbors are in the same class as the template strand, resulting in a prediction. Furthermore, due to the limitations of both collecting data and knowledge on correlating the parameter h, the learning, inference likelihood is only an estimate in practice. Nonetheless, it is an inexpensive KNN framework that incorporates the essential, necessary insights. The matching constant h belongs to the category of traditional regression and classification. (1) To counter this issue, we used two prediction techniques: linear regression or regional prediction.

Let $T_x = \langle l_x^1, l_x^2, \dots . l_p^n \rangle$ be the feature vector

$$log\left[\frac{xr\{D_x=1|Z_x\}}{xr\{D_x=0|Z_x\}}\right] = \int \partial^v Z_x + \rho \quad (1)$$

This varies and is the scale parameter. Because the log posterior probability is asymmetric, supervised classification predictions and could be determined quickly. The probability method is utilized as the statistical method, and the acquired training algorithm reflects the perceived importance of each characteristic. To capture the connections between features, the statistical method might be expanded to complex numbers, presumably including interaction components.

Another way for resolving this issue is to use native instability. In essence, this method calculates the correction factor to matching a different, yet basic predictor (such as a quadratic equation) to each target position simultaneously. Only measurements that are close to the desired location should be used to validate the data, and their ranges for the target position are evaluated accordingly. The local extrapolation model provides more versatility than regression analysis since the prediction curve could mimic any smooth variable. By comparing each simulation in a limited region determined collectively by all the features, this technique could easily incorporate the connection between the characteristics. Regional extrapolation, on either extreme, is more computationally intensive but less extensible. At each random value, a somewhat compact neighborhood is designed to satisfy local algorithms. With discrete features and perimeter data sets, local extrapolation could have problems.

III. Proposed Work

We constructed a basic KNN technique using Euclidean distance, adjusted so that separation relating to an individual source data has a maximum value of 1, assess the performance to the logistic regression both component weighting and the polling mechanism. The basic KNN approach finds this same operational category that receives to most votes from the KNN neighbors provided the k similarity measure. To share power across sections having fair elections, the one of the quickest distance across all sympathetic friends is chosen. We also evaluated the RB-

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KNN approaches against the naive Knn algorithm, which is based on all permutations of datasets.

On the different database, we evaluated the SVM algorithm to evaluate RB-KNN to other approaches for merging massive datasets. They found that combining the kernels delivered the best results out of three ways of combining several data sources: concatenate relevant features, integrate the kernels, and combined the differentiator scores. This approach is an unadjusted variation of the methodology, which determines the strengths of each kernel using a moderately computing technique. Even though the latter option appears to be superior, the necessary technology is temporarily unavailable. Interestingly, in many circumstances, the approximate methodology is almost as good as the weighted method, particularly when all picked kernels have similar estimates of future (William Stafford Noble, personal communication), which seems to be the case in our scenario.

The prologue parameter is a kernel, just as the block signal, because it could be expressed to the embedding of the prologue metricizing bring the three particles together, divide the expressive kernel by 8 and put them together so that all three kernels have comparable proportions. For a variety of purposes, we did not employ the chromosomal separation in SVM. First, because the proximity has been calculated on a single chromosome, an acceptable kernel is not immediately evident. They used the partial derivative of either the Euclidean distance row columns as a kernel in the experimental kernel map approach. This same generated SVM, unfortunately, performs poorly (ROC score =. 581). Furthermore, provided another three datasets, the experimental findings for such RBKNN techniques in Table I show suggesting chromosomal separation are repetitive. As a consequence, the SVM is not penalized over neglecting this data.

TABLE I. VALIDITY OF PERFORMANCE

Combination	Navie km	Glm	loss
1111	0.48	0.59	0.65
1011	0.56	0.52	0.65
1010	0.48	0.49	0.51
1000	0.41	0.42	0.48
0100	0.45	0.47	0.54
0010	0.39	0.65	NA
0001	0.39	0.65	NA

IV. RESULTS AND DISCUSSION

To highlight the capability of proposed strategies regarding component grading and casting, they will first evaluate the results of RB-KNN and that of conventional KNN techniques in this chapter. Furthermore, we'll contrast our methodologies with an SVM-based strategy for combining large datasets. Eventually, we'll look at effectiveness based on the structural categories. A short description of the relationship among posterior probability and forecasting models has been included, as well as aggregate information based on all three classification systems. Furthermore, the chapter discusses the findings of erroneous assumptions, they would examine several of the difficulties with this issue. All of KNN techniques they examined were titled that after techniques, which could be keen (deluded KNN methodology), glm (logistics extrapolation predicated KNN), or less (regional stagnation predicated KNN), but then the information sources. In the sequence of interpretation association, chromosomal separation, block signal, and paralog signifier, this requirement usually expressed in sequence in that each value denotes whether a collected information was included. For instance, Laos. 0001 denotes a KNN approach depending on local extrapolation that only uses the prologue signal, while knn. 1111 denotes a naive KNN method that uses two, four data collections. They used "svm. Comb" to test SVMs on a group of statistics that included the statement, restrict, and paralog statistics. They also tried SVMs in this scenario, termed "svm. Exp," because expression data independently is often employed during operational categorization. They did the 5-fold classification algorithm across each experiment or presented overall results.

4.1 Comparative approach

We evaluated various RB-KNN approaches toward the naive KNN methodology in order to see how effective they are in integrating different data sources using appropriate feature grading and casting algorithms. We investigated the predictive ability of each additional source of information or whether integrating more data sources significantly improve by testing each approach with varying configurations of different databases. By standard, the KEGG classification methodology has been used except otherwise stated. They only looked at the 1603 genes that were allocated to operational classifications. Each gene could be classified into numerous functional categories, with a maximum of 2144 operational categories. Because the naive KNN strategy allows only one forecast for each transcript, they choose the greatest single estimate for each genotype for RB-KNN methodologies the ensure an equal assessment. We discovered also that naive KNN's effectiveness appears highly dependent to k, this same neighborhood radius, but that lower k is typically preferred.

They also discovered that throughout the RB-KNN techniques, using more sources of information seems usually invariably advantageous. Considering some other three data sources, the dataset includes "1011" delivering exceptional results throughout our studies, implying that chromosomal separation is really a superfluous source of data for operational forecasting. The effectiveness of RB-KNN algorithms for information source "1111" is nearly always different downweighting unnecessary features. In glm. 1111, Table 2 provides algorithm values to every source data. Introducing chromosomal proximity to some other three sources of data, on either extreme, leads of considerable fall in effectiveness using naive KNN. Even though only one or two information systems are utilized, loss performed better than film, fore more the variation in performance in different approaches approaches trivial when more information sources were employed. Weights to every data provider are listed in Table II.

TABLE II. DATA WEIGHTS

Sources of Data	Expr Correlation	Chromosomal distance	Block indicator	Paralog indicator

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Weights(w)	1.96 ± 0.15	0	71 ± 0.06	4.61 ± 0.10

The reliability of the RB-KNN and Svm classifiers was evaluated. We employed transmitter operational conditions (ROC). A ROC curve shows the relationship between the likelihood of detection and responsiveness as a function of a weighting factor. Because this is an inter classification task, the overall amount of forecasts typically computed as the sum of the group of genes or the number of subjects, although in the case of KEGG is 1603 * 18 = 28854. Each forecast has a grade assigned to it, such as RBKNN probability value or the SVM differentiate quality. The positive result frequency and sensitivity for one spot also on ROC curve have been computed using forecasts beyond a specified tolerance, which are sorted depending the overall ratings. (One downside of using differentiator ratings to grade forecasts is that they're not equivalent across categories because each group has its own SVM.). Fitting a deterministic sigmoid activation function depending on characteristic ratings for each class separately would be a reasonable solution. They anticipated the instrument for assessing to become more consistent across categories therefore generate higher standing, although the associated ROC rating seems to be definitely lower, just 0.81 as opposed that 0.91 throughout the existing approaches, therefore they didn't use it.

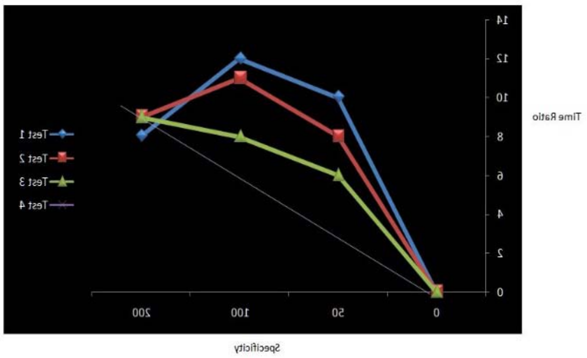

Fig.1. ROC curve assessment

In Fig.1. represents the ROC curves of a few of the techniques they investigated are shown in Table 1. It's worth noting that the overall amount of erroneous categories in this challenge is approximately an astronomical amount more than the proportion of actual categories. Although the techniques' ROC scores seem to be relatively similar, they are only concerned inside this portion of ROC curves where the prediction error relatively minimal in practice. The techniques perform very differently in this area. The ROC curves reveal that the predictive capacities of all the information sources are relatively close, including prologue signal, chromosomal separation, block signifier, and transcriptional relationship listed from greatest to worst. Glm.1000 is a swimmer. The efficiency of methods depends on differential expression is fairly similar, maybe less so. 1000 is a significant improvement. Furthermore, due to increased model adaptability, Laos. 0100 outperforms glum. 0100 (data not shown).

4.2 Performance measurement

Fig.2 demonstrates the vulnerability of four strategies (Exp, Laos 1000, SVM, glum 1111, classifier. Comb) at 50% right for all functional domains. They categorized all estimates based on the genuine operational multiple genes for each technique. Then, to every class, we chose the estimates that were above a 50% confidence criterion and determined the proportion of genes that were successfully predicted. Except for class 15, we found that loss. 1000 significantly beats SVM, Explain in class. This is particularly true in class 17, where swim. Explain has a susceptibility of 8.7% and less. 1000 has a sensitivity of 71.7 percent so at boundary limit. SVMs employing quadratic or circular kernels also perform badly (0 percent, 10.9 percent conversely, susceptibility). That demonstrates that classification methods for class 17 has a unique feature that cannot be captured using SVM modules, but could be detected using RB-KNN techniques in Fig.2.

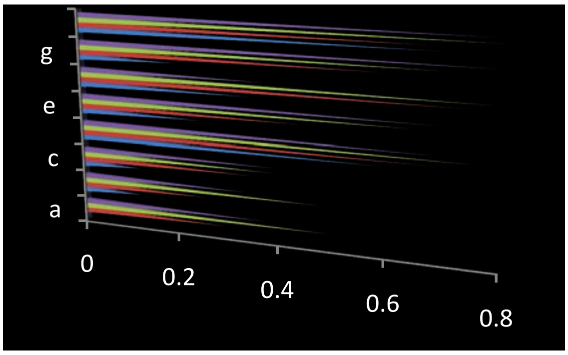

Fig.2. Sensitivity, accuracy in organizational procedures

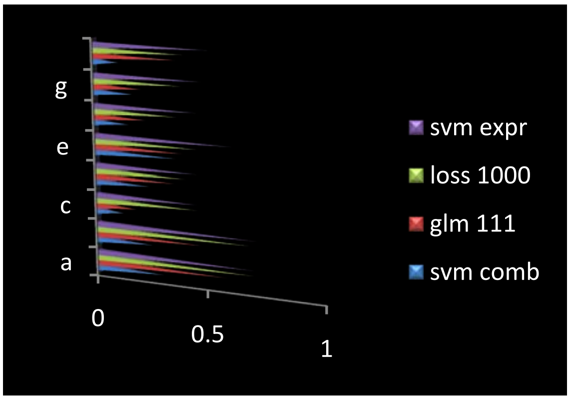

Fig.3. Proposed with existing algorithm comparison

Through all operational categories, glum, 1111 and swam. Comb has reasonably similar effects; both are preferable to technologies based solely on microarray datasets in Fig.3.. Both classes 20 (Cell Digestibility) and category 13 (Interpretation) have excellent prediction performance when all four techniques are used. In darkness, the ROC values for such 2 categories, 1111 are 0.97 and 0.96, correspondingly. Most genes in these 2 categories are recognized to be co-regulated, and most are expressed in integrons, which explains the excellent categorization findings for such 2 categories. Because many representatives of Class 17 (Signal Effector) and Class 16 (Membrane Mobility) have comparing specific protein structures, the prologue signal is useful in both categories .It

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seemed gloomy. 0001 has a responsiveness of 80 percent for another 2 categories, but 76 percent in the other.

They looked at a set of erroneous forecasts with a great deal of confidence. Many of them would be caused by the fact that genes can correspond to different functional groups. Various classification approaches for such genes could focus on the importance of their functional activities, and comments may be lacking. Furthermore, because all genes connect with one another in some way, the beforehand such are hazy. It's hard to see the difference across class 1 "Complex Carbohydrate Respiration"Glucose Metabolism" are two categories. Several genes engaged in signalling pathways (class 17) processes, for instance, are also participating in membrane integrity (class 16). False negatives, or correct forecasts with low levels of confidence, were also examined.

Heterogeneous or small method categories cause a lot of false negatives. Class 10 (Metabolites of Bioactive Molecules), in an instance, has just 24 genes in their database but can be divided into nine classifications. Such classes are notoriously hard to characterize. False negatives are further exacerbated by deserting neighborhoods caused by the lack of knowledge. Approximately 20% of genes in KEGG have no operationally evaluated paralogs, co-expressed genes, or chromosome neighbors with identified measures larger than 5, implying they had professionally foundered genes, evaluated paralegals, or chromosome relations. The only way to overcome this problem is to provide additional training examples.

This research makes a major addition by proposing a new methodology to merging heterogeneous data in the KNN paradigm, which comprises two essential elements: a regression-based grading methodology and a deterministic election process. The prediction model, which takes into account their exceptional acceleration factor affecting, encompassing their interconnections, affects the intensity of each data provider. An election technique made inferential analysis easier by combining component category suggestions from the KNN neighbors, but also producing a sorted list of recommendations having posterior probability. This method also permits a gene to be classified into numerous performance categories. The local estimation technique performs better via one of two information sources, likely to increase model variability, while linear model is more resilient or adaptable, according to our findings. We've shown that merging four datasets produces good outcomes. We produced incredibly competitive performances in comparison towards the Neural Network Based technique, which mixes large datasets. Their ROC curves are extremely similar in accuracy was obtained larger than 50%. SVM performs better for genes located near to class boundary, but at the expense of a significant false alarm rate. RB-KNN algorithms have the excellent potential at same degrees of effectiveness: SVM requires tractor trailer support vectors, whereas RBKNN supports unlimited interpersonal correlations. Furthermore, RBKNN generates supplemental data (e.g., nearest neighbors along corresponding resemblance ratings) to aid throughout the discussion of the data during post-processing.

V. Conclusions

There are several ways in which we might enhance our techniques. We created a single prediction model for all data in the testing phase in this investigation. The prediction accuracy of each source of data, on either extreme, may range from grade to grade, and they may be evaluated accordingly. An amount of training data is such benefit of our current strategy; one disadvantage is the clear lack of performing this task. A one-class-one-model strategy, on either extreme, is the absolute antithesis. For categories with massive populations, an alternative approach is to construct class-specific models. The regression analysis can be very problematic when parameters are highly correlated. To construct more predictive results, you can use principal deconstruction or controlled extrapolation approaches like regression. Another possibility is to employ improvement complex predictive model. For example, from 106 types of experiments, we only derived one fundamental similarity measures, transcriptional association. Nonetheless, some palettes are more useful than some others, or the relationship between them might vary greatly depending on the number of studies used. By employing Correlation analysis depending on all 106 trials, such evidence is omitted. One method would be to divide the operations across different subgroups and calculate a baseline semantic similarity for each group. They could be immediately combined with other sources of data, such as chromosomal similarity, or they can be blended using regression techniques, which could then be correlated with other information. A pyramidal techniques have advantages to use only a few terms for each extrapolation, making it more durable than a conventional framework that incorporates all characteristics. They found overall optimism ratings are directly correlated with forecast performance, however, the association is not continuous, and the values expand as the size of such neighborhood grows. We would want a scoring system which is the more regular overall reliability of standardized methods.

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The Algorithms in Disarray Hashing Technique That Preserves Gene Ontology Hierarchy Application of the Phish Methodology

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Abstract—Gene Ontology (GO) is a systematic taxonomy that employs organize languages to explain the biochemical activities, functional activities, including tissue placements underlying transcription factors. Gene Ontology (GO) markers link proteins to GO concepts as well as show which genetic variants perform the physiological activity specified by the words. Forecasting proper GO descriptors for individuals from a large number of GO words specified by GO, on the other hand, would be a challenging task.To address these issues, researchers present a conceptual approach for functional genomics predictions involved in Gene Ontology Hierarchical Preserving Hashing (Phish). Phish begins by comparing the taxonomy homology of GO keywords. It all then optimizes a succession of hashed algorithms to store huge GO concepts via a small binary format, using a hierarchal structure scrambling method to maintain the hierarchical system between GO words. Following that, Phish uses those scrambling techniques to transfer the gene-term connection matrices into a cheaper region, where it conducts lexical resemblance gene function estimation. Phish outperforms existing similar methods as well as being resistant to the number of encryption schemes, according to experimental observations on 3 model organisms for intercultural gene function forecasting. In particular, researchers use Phish as a BLAST-based gene function forecast component. According to the findings of the experiments, Phish greatly enhances forecasting accuracy.

Keywords: Gene Ontology; Hierarchy Preserving Hashing; gene function; Phish Technology

I. INTRODUCTION

Most biological activities, including those of metabolic, hormone control, including cell signaling, rely on genetic variants, including such enzymes including RNAs [1]. Medication research, illness research, gene collection expression values, as well as other disciplines, could benefit from detailed information on all these genetic variants. Moreover, because detecting the gene functions using wet-lab approaches was labor-intensive, costly, as well as limited bandwidth, operational classifications of genetic variants lagged substantially while behind the speed of acquired genetic information [2-4].Moreover, the operational classifications of genomes were influenced by biologists' research goals, including experimentation morals including people and animals. As a result, developing mathematical algorithms to effectively as well as accurately identify genetic activities was highly necessary.GO was created as a collaborative attempt to enable computerized gene function forecasting as well as to organize biological material of genes as well as their metabolites in a formalized as well as uniform manner among genomic information [5]. The Gene Ontology (GO) would be a collection of concepts as well as a foundation for describing the activities of genetic variants across all species. The GO research was made up of two parts: the Ontology, which uses a directed acyclic graph to organize GO words, hierarchical structures, and goes markers, which link proteins but rather gene products to GO concepts [6].

A GO word in the DAG denotes higher specific operational information than its progenitor words. If a GO word was associated with a gene, its ancestor phrases also were associated with that gene, but not another way around. On the other side, if a word must not be attributed to a gene, then neither would its descendent words [7]. In the field of gene function, structural similarity-based techniques have been intensively researched. Those approaches were predicated on the fact that semantic relatedness produced from gene GO classifications correlates with familiarity estimated from a variety of biological information, including such sequencing, gene expression patterns, as well as posttranslational modifications [8]. These primarily aim to fill up gaps in GO classifications imperfectly identified genes [9].The structures of GO descriptors could be designed to estimate gene function using a tree structure or perhaps a Bays classifier coupled to the data. However, to effectively estimate the likelihood function between GO words, such a template method requires enough annotations [10].

II. RELATED WORKS

As a result, it is incompatible with sparse words assigned to less than 30 genes. In practice, the majority of GO words were sparse words; with various GO words having varying amounts of associated genes, as well as the amounts are quite unbalanced. Because sparse words convey

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a higher precise basic understanding than their parent phrases, which have been linked to many more genes, it's preferable to forecast the future relationship among sparse words as well as genetic mutations. To consider explicitly, researchers employed the GO structure to calculate the relationship between GO words as well as put the results into a gene function predictions algorithm [11]. Their research shows that integrating the relationship would increase forecasting accuracy greatly, particularly for sparse GO keywords. Many gene GO classifications were imperfect, and fresh GO classifications were added to those same proteins on a constant schedule. To predict empty gene GO annotations, a randomized walking systematic model has been used [12]. It must be motivated by the finding that the GO words refilled to a gene usually match the grandchildren of the words previously ascribed to the genes. That approach also generates additional labels for a gene depending on the characteristics of its conceptual surrounding genes as well as the predicted identifiers [13] to take the benefit of annotation from other genes.Just GO evaluations of genes from the very same genus have been used to evaluate those linguistic resemblance alternatives. Because God would be the genus and therefore can tag genetic variation, species with the same GO concepts, the semantic relationship among genes across various organisms may also be assessed [14].

These investigations reveal that GO comments from separate species were complementing to be together, but also that the forecast performance improvement was clear for two varieties with strong homology; however, the increase was insignificant for two varieties having poor homologous recombination.The abovementioned conceptual techniques can't effectively quantify the semantic relatedness among genes having regard to huge GO keywords based on partial as well as sparse GO classifications [15]. Large GO keywords also are a problem for gene function forecasting models that combine heterogeneous biological information.The GO hierarchy could be utilized to make reliable forecasts as well as increase forecasting accuracy dramatically. These GO words reduction approaches essentially use the GO hierarchy largely represented by the gene-term interaction matrices explicitly as well as convert the GO DAG into an undirected one to make management sets. As a result, those who do not follow the GO structure well enough, negatively affected [16]. Humans present a computer methodology based on GO Phish for functional genomics estimation to overcome the difficulties with existing GO words pressure methods. The fundamental goal of Phish would be to solve the problem of accurately guessing gene-to-massive-GO-term correlations. Phish could not only retain the hierarchy system areas And provide words in a cheap environment but rather the taxonomic homology between GO words, increasing the accuracy of gene function forecasting in that storage.

III. Proposed Methods

To evaluate taxonomic resemblance among words as well as preserve the GO hierarchy, Phish initially utilizes a meaningful biological matching score. Then it uses a ranked team scrambling method to optimize a set of scrambling algorithms that could keep GO words' similarities as well as their structures of power. The gene-term correlation matrices were subsequently compressed into a low-dimensional one using these cryptographic techniques.Following that, Phish uses the compressing gene-term interaction matrix to quantify semantic relatedness among genes as well as guesses activities of a gene depending on descriptions of its semantical neighbors. Those forecasts then were projected return to the initial GO words universe, resulting in the formation of gene-to-massive GO term relationships.

The goal of scrambling would be to learn information as well as task-specific hashing algorithm that produce compressed digital signals while maintaining the original information's comparable associations. Phish, on the other hand, seeks to represent huge GO keywords using compressed binary digits that maintain both the taxonomic identity and the structures of power among those. Researchers employ Lin's resemblance throughout this research, which would be a sample taxonomic measurement extensively used during hierarchical Ontology. To accomplish a purpose, researchers utilize a well-known metric called Standardized Discount Cumulative Benefit to assess the integrity of the hierarchical ordering leaderboard:

$$NDCG = \frac{1}{L_x}\int_{y=1}^{n} + \frac{2^{k_{xy}} - 1}{log_2(1+y)} = \frac{1}{L_y}\int_{y=1}^{n} + \frac{2^{k_{xy}} - 1}{log_2(1+s_x^y)} \qquad (1)$$

$$s_x^y = 1 + \int_{v=1}^{n} + sgn(Ham(t_x, t_y) > Ham(t_x, t_v)) = 1 + \int_{v=1}^{n} + sgn(t_x^M(t_v, t_y) > 0) \qquad (2)$$

Humans could see from the approximations in Equations (1) & (2) That NDCG favors phrases having smaller ranking commands over words with big rating values. As a result, rather than include all my words, NDCG was frequently cut at a specific order of popularity. Because the deepest point of branch words in the GO structure was currently 15, q could essentially be set to 15. The bigger the NDCG number, the further the scrambling algorithms coincide with the priority order, according to the specification of NDCG.Whenever the Distance measure between GO words generated respective individual hashes was entirely consistent with hierarchy structure as well as mutual information among tea as well as other words, the maximum NDCG score was reached.By maximizing the NDCG measurement, the desired scrambling algorithms could guarantee that the scrambling algorithms were compatible with the taxonomy resemblance of GO words, as well as preserving the relative ranking of GO aspects. The NDCG across m GO periods was maximized as follows, depending on the above order to prepare:

$$B(T) = \int_{x=1}^{n} + \frac{1}{L_x}\int_{y=1}^{n} + \frac{2^{k_{xy}} - 1}{log_2\left(1+s_x^y\right)} \qquad (3)$$

$$s_x^y = 1 + \int_{v=1}^{n} + sgn(t_x^T(t_v, t_y) > 0) \qquad (4)$$

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IV. Results and Discussions

To assess the effectiveness of Phish-based cross-species gene function forecasting, researchers performance management process in a medieval to current manner. The previous comments seem to be the GO annotations of 3 model organisms completed on 2020-05-07, while the latest comments seem to be the GO evaluations completed on 2021-09-01. Researchers use previous identifiers to educate Phish as well as create gene function predictions, as well as then we could use contemporary identifiers to confirm the predictions. Humans obtained the historical and current GO classifications from Gene Ontology simultaneously, as well as the current ontology documents. 2 GO adheres to the standard of annotating genetic instructions at every genus database to some of the most relevant and comprehensive levels in the ontologism that accurately reflects the biology of the gene product; straight comments were interpretations that have been available immediately in the reference documents.Humans additionally annotation all the parent words of direct connections of a gene to the very same gene using the True Path Rule. Humans exclusively utilize words accessible, including both preserved Ontology data during trials to minimize the influence of GO modification, as performed in CAFA.

V. Comparative Examinations

Baseline as well as Baseline explicitly calculates the semantic relatedness among genes in the same GO words field using the Based feature selection as well as a Cosine measurement approach, and afterward, utilize a comparable KNN classifier as Hash GO as well as InterGFP for functional genomics estimation. ClusDCA seems to be a variation of Cloudscape that employs SVD to condense the Gene Ontology mapping function into a cheap environment before doing gene function estimation in the reduced area, similar to HPHash as well as Hash GO.hash seems to be a variation of Phish that seeks cryptographic techniques immediately using a clustering algorithm of GO instead of using Lin's resemblance. Because the correlation between a nongenetic as well as other genes was 0, those approaches cannot identify activities for genes which annotation was wholly unexplained.

As a result, researchers confirm Plash’s efficacy in sequencing information functional genomic forecasting, which may also generate predictions for genes that seem to be essentially annotated. Researchers use Phish to condense the wide gene-term correlation matrices into a cheap version, as well as BLAST to calculate sequence identity across genes, before estimating the model depending on the collapsed relationship matrices as well as pattern similarities. Humans utilize Rank Loss rather than RankingLoss to keep these things comparable to the rest of the assessment criteria. Throughout this approach, the greater the efficiency, the greater the value of all of the other evaluation criteria. Humans select the most suitable q conditions with the biggest probabilities as the appropriate words of a gene, as well as q has been equivalent to the expected amount of captions of a gene, as completed in an earlier study, as well as humans recognize the top q conditions with the biggest probabilities as the appropriate words of a gene, as completed in a past analysis.

Some measures appear to be related simply to the projected numerical connection matrices. Because all these measures assess gene function predictive performance from either a variety of perspectives, it's challenging for one technique to regularly beat others throughout all measures. To compare as well as quantify the efficacy of refilling GO descriptions of largely characterized genes, researchers perform research on GO classifications of 3 model organisms stored in various decades.

TABLE 1. Prediction on archived GO annotation

Empty Cell	Empty Cell	(Ham)	(Cos)	(BMA)	(G)	Empty Cell	(G)	Empty Cell
MicroAvgF1	BP	1.326	5.8278	1.3267	1.322	1.3306	1.3178	1.3571
MF	1.326	1.3782	5.869	1.3642	1.3683	1.3615	1.4065	
CC	1.3696	1.3496	5.8251	1.3399	1.3487	1.3209	1.3651	
MacroAvgF1	BP	1.3252	5.8479	1.3341	1.3174	1.3486	1.3275	1.3653
MF	1.332	1.362	5.8455	1.3433	1.3593	1.3389	1.3891	
CC	1.2798	1.3324	5.8063	1.3155	1.303	1.2909	1.3501	
AvgAUC	BP	1.4324	5.9209	1.4267	1.4319	1.433	1.4276	1.4384
MF	1.4326	1.4181	5.9277	1.4325	1.4299	1.426	1.4516	
CC	1.4243	1.4078	5.9156	1.4234	1.4253	1.4236	1.4345	
Fmax	BP	1.33	5.8558	1.3569	1.3607	1.372	1.3634	1.4049
MF	1.4082	1.4288	5.8679	1.4208	1.4223	1.4223	1.4463	
CC	1.3831	1.4018	5.8639	1.3808	1.389	1.3891	1.4194	
1 − RankLoss	BP	1.3451	5.8851	1.3537	1.3824	1.3906	1.3534	1.4558
MF	1.3892	1.4308	5.8906	1.4136	1.4173	1.4059	1.4754	
CC	1.3499	1.4054	5.842	1.3967	1.4001	1.3827	1.4555	
AvgPrecision	BP	1.2902	5.7972	1.2912	1.283	1.2941	1.2791	1.3542
MF	1.3677	1.3945	5.8562	1.3624	1.3662	1.3607	1.4256	
CC	1.3208	1.3608	5.8147	1.3295	1.3417	1.3092	1.3788	
MCC	BP	1.3365	5.8592	1.3446	1.3308	1.3596	1.3405	1.375
MF	1.3426	1.3726	5.8557	1.3546	1.3699	1.3515	1.3977	
CC	1.2903	1.3422	5.8158	1.3149	1.3262	1.3044	1.36	
Smin ↓	BP	20.79	24.3039	14.0866	8.1719	7.7425	12.9943	5.8751
MF	2.3713	2.4523	7.2884	2.2527	2.2134	2.2134	1.8398	
CC	3.0564	3.0403	7.6051	3.0542	3.1048	3.0254	2.693	

The revised GO classifications of every species stored in 2021 have been used to verify the predictions, and go classifications of these creatures stored in 2020 were utilized to build gene function, forecasting models.

The neighborhood size k is set to 300; the password bits duration d was adjusted to 60, the parameters were set to 0.1, as well as the variable was adjusted to 0.01. Those settings have been set as indicated by the researchers in the primary documents. The neighborhood, as well as dimension parameters for the methods based, are much like before. Table 1 of the Support and contribution contains the documented experimental data among those contrasting approaches.The boldface information within every column among those figures seems to be the best possible result from multiple methodologies of comparative. Across all 3 species, including across practically all assessment methods,

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Phish beats alternative comparative approaches in identifying gene function, as shown in the following figure. Hash GO, similar to Phish, utilizes network cryptographic algorithms to compress the gene-term connection matrices into a low-dimensional another before doing semantically resemblance gene function forecasting; however, it often falls short of Phish.

These findings demonstrate that the selected GO hierarchal structure scrambling method outperforms Hash GO as well as cloudscape in respect of research including using hierarchical structural linkages among huge GO words. Another intriguing discovery would be that Phish usually fails to Phish, even though they might equally preserve the GO words' hierarchical structures.The reason seems to be that Phish employs the GO dense mapping function, which really only stores the family link areas and provides words and does not properly store additional genetic heritage connections. S, on the other hand, has been used by Phish to store not just too genetic heritage links areas and providing words, as well as other types of associations. Although those who utilize a comparable KNN classifier like Phish to forecast genes involved, two control techniques yield similar outcomes with everyone, plus those who frequently maintain similar findings using InterGFP. This seems to be because those same three techniques employ the high dimension dense GO words universe to quantify the semantic relatedness of genes as well as forecast genes involved. This finding implies that the strength of semantic interaction calculated using huge GO words suffers from superficial as well as inadequate annotating, but the semantic relatedness generated from condensed Y suffers less. The findings for Fax, Smin, and MCC on Early humans were seen in Fig.1 (a), (b), (c) of the Resulted. Phish was extremely resistant to hashing bits sized, or perhaps the complexity of a compacted gene-term correlation matrix. Such consists of results, on the other hand, were susceptible to do and then have oscillations inside the examined d ranges. Furthermore, researchers find that Phish facilitates movement, steady sometimes at d = 5 as well as d = 10, and that this is untouched by password mismatch. These findings show that high numbers of GO words could be represented using simple binary frequent patterns, and that certain GO word seems semantically related enough to be combined. In reality, researchers investigated the responsiveness of d in two additional organisms; the experimental findings reveal identical interpretations of the results, and they've been deleted from this paper to conserve content. Humans could deduce from either of these results that specifying an important performance value of d using HPHash was simple.

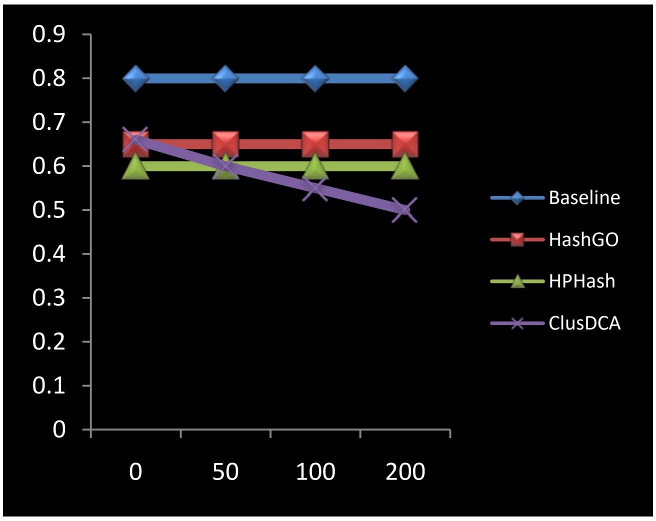

Fig.1(a). Sensitivity analysis of hash codes length

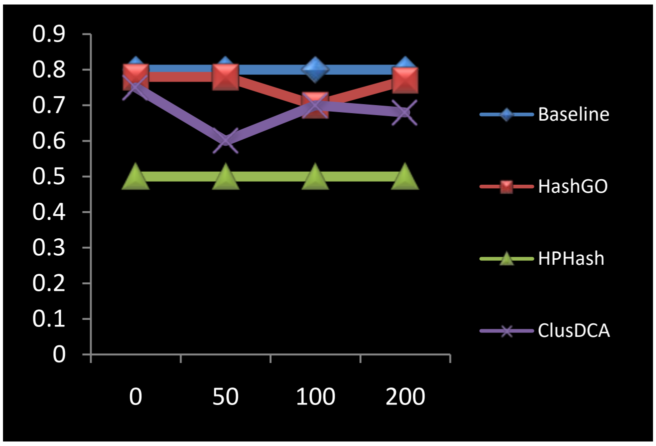

Fig.1(b). Sensitivity analysis of hash codes length

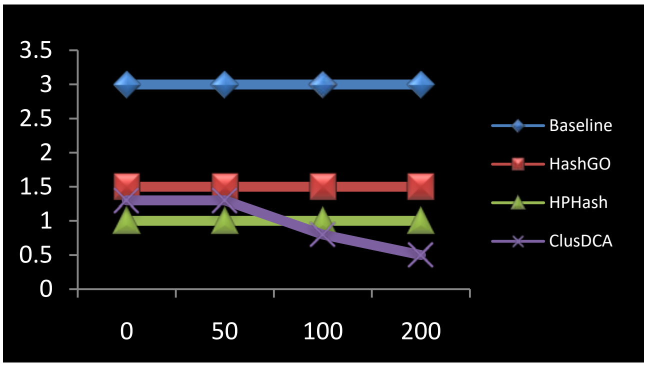

Fig.1(c). Sensitivity analysis of hash codes length

The outcomes on Homo sapiens for various k input parameters were seen in Fig.2 of the Supplemental Material. Humans could see that the initial value of k seems to have little effect on Phish. Many comparative approaches, from the other side, were susceptible to k. Moreover, selecting an efficient k for most of these comparison techniques was difficult since there is no definite trend for selecting an appropriate k that produces superior Fax, Sin, and MCC. Phish, on the other hand, was essentially unaffected by k.The excellence of Phish could be credited to the GO power structure conserving hash functions, which could also effectively start exploring as well as implement the relationship existing between GO aspects, allowing for a more precise measurement of similarity measures among genes, including the replenishment of GO captions as well as the reduction of the influence of imperfect captions. Humans could deduce from all these findings that choosing an efficient k for Phish was simple.

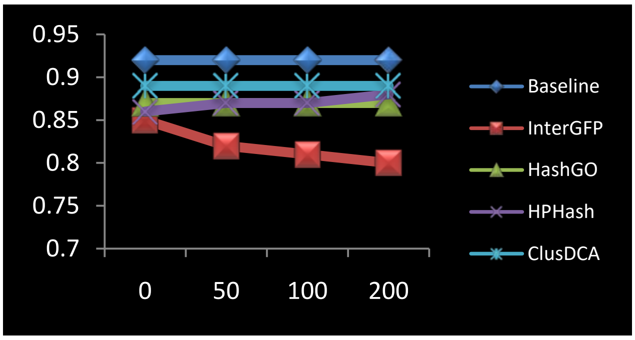

Fig.2(a) . Sensitivity analysis of neighbor size k.

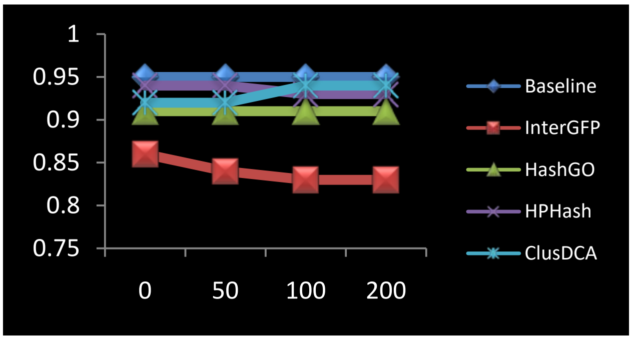

Fig.2(b) . Sensitivity analysis of neighbor size k.

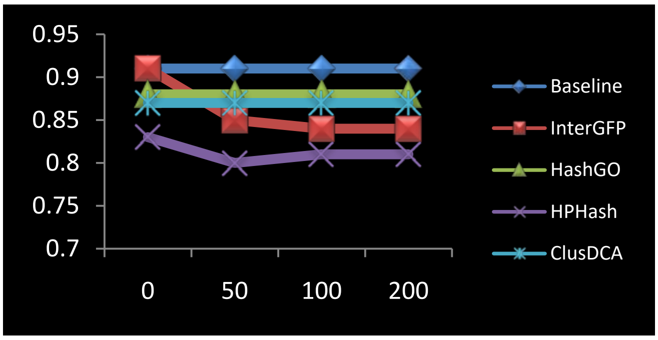

Fig.2(c). Sensitivity analysis of neighbor size k.

Fig.2 (a), (b), (c) displays that BLAST + Phish outperforms BLAST regularly. Since the previous gene-term affiliation structure would be a sparse matrix as well as the compact somebody may not be as sparse, the BLAST predicted gene-term affiliation structure seems to be sparse as well, while the affiliation framework of BLAST + Phish has been retained by cryptographic hash features H and therefore also contains the most nonzero records.Because all these nonzero values affect Aargau, BLAST + Phish occasionally do have a smaller Aargau than BLAST. BLAST + Phish, on the other hand, consistently outperforms BLAST in terms of Fax as well as Sin. The variance among BLAST as well as BLAST + Phish across one of these 3 species as well as assessment criteria also was assessed using signed-rank testing, with a p-value of less below 0.001. Based on this approach, researchers could infer that Phish may be utilized as a component for sequencing information gene function forecast, and it can increase forecasting accuracy greatly.

VI. Conclusions

Among the most important responsibilities in the specific biological age was predicting genetic mutations. Lexical similarity-based techniques were also used to deal with the challenge that has shown considerable success, however, the majority of methods struggle from scant as well as inadequate genes GO classifications. To enhance the assessment of semantic relatedness among genes as well as for functional genomics forecasting, various GO keyword condensing methodologies have been developed. Even during the process of compression, though, individuals might not always obey the Gene Ontology structure, which may impact forecasting accuracy.Researchers offer a Phish based on Gene Ontology Hierarchy Preserving Pattern matching to resolve this challenge as well as quickly predict the relationships among genes as well as huge GO keywords. During the optimization of hashes, Phish may preserve the taxonomic resemblance of GO words as well as the structures of power among those. The hashes reduce strong gene-term connection matrices to a cheap version, making it easier to accurately measure semantic relatedness among families as well as predict gene function.

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Prediction of RNA Function in the Context of Linear Non-Coding RNAusing a Heterogeneous Network Approach

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Abstract—Linear non-coding RNA (lncRNA) has recently attracted a variety of research, critical attention to some intriguing new knowledge about its essential functions. Thousands of lncRNAs were discovered in absurdly short durations because of tools like RNA-Seq. Only a handful of them should be intrinsically depicted, although, due to lesser citation incidence. Wet lab tests to elucidate the roles of lncRNA are complex, laborious, and sometimes ridiculously expensive. This research explores the critical topic of generating molecular docking toward determining the essential functions of lncRNAs. The model provided here uses a measure based on a systematic review known as AvgSim on a heterogeneous network infrastructure to predict various lncRNA (HIN) RNA activities. The same framework is designed with proposed statistics on the lncRNA enzyme or activity relationships and information on the lncRNA co-expression and linkage proteins. The proposed methodology forecasts probable capabilities for 2,695 lncRNAs with a reliability of 73.68% out of 2,758 lncRNAs evaluated for investigation and was performed remarkably better than other methodologies like a random forest for an impartial training dataset. These same linked roles of two well-known lncRNAs are investigated inside as an example. The findings were confirmed by research observations identified in this review.

Keywords—Heterogeneous Intelligence Network; noncoding RNA; statistical approaches; Random forest approach

I. Introduction

They possess essential features like enzyme translating capability and structural conservation, which are also required for biological functions. Until a generation later, many quasi segments of RNA were thought to be 'garbage,' having no specific genes [1]. Recent evidence suggests that lncRNAs play a part in developing cellular mechanisms, including cell-type-specific expression, intracellular element distribution, and sickness correlation [2]. The activity of lncRNAs is engaged by these physiological and morphological attributes because it is no longer considered. Even though many lncRNAs have been discovered to date, the amount of adequately annotated lncRNAs is meager [3]. The asymmetry in lncRNA identification or categorization frequencies is responsible for the lack of functional awareness concerning lncRNAs. Wet labs' investigation to characterize lncRNA operations is costly, consequential, and exhausting. As a result, the computational intelligence approaches anticipating lncRNA activities are an urgent requirement in lncRNA exploration [4]. Consequently, a distinct field of study has evolved in which computer architecture is employed for lncRNA investigation. The web techniques rely more on the channel's implicit information than on the biological features of lncRNAs [5]. Consequently, such attempts gained popularity in a short amount of time. The cornerstone of infrastructure approaches is built on two assumptions. First is the "remorse by association" theory, which holds that genes that regulate biochemical reactions might co-express proteins involved in the same activity [6]. The second is that while executing a function, compounds communicate with others. As an outcome, while developing a model for predicting lncRNA activities, the relationships of lncRNAs, especially their co-expression, should be emphasized [7].

II. Related Works

The interacting links among lncRNA and enzyme are used as the primary component to create a channel in the number of existing methodologies for a statistical sense of lncRNA functions. Approximately 340 lncRNAs were designated categories based on the functionalities of nearby molecules in an encoding non-coding genetic co-expression system. This was among the first experiments at predicting lncRNA function. Molecular interactions were not examined in this study. Interacting protein data from the international lncRNA function and performance tool (link-GFP) into the co-expression system [8]. It identified 1,625 lncRNAs that had biological functions. However, none of the other approaches processed data from Next Generation Technology (NGS).In the available research, all internet techniques rely on the lncRNA - protein association as a critical criterion for developing a predictive model the capabilities of lncRNAs [9].As a consequence, these approaches could be used to forecast the activities of lncRNAs with known protein complexes. The lncRNA-

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lncRNA linkages should be considered in order to employ this same benefit of an infrastructure paradigm. Even with the lack of protein sequence relationships, the proposed study analyses lncRNA-lncRNA interactions and forecasts overall activities of lncRNAs.After the HIN is built, a coefficient of determination is used to determine relevant promoter regions meta-paths [10]. Along certain results were compared, the connectedness metric AvgSim is determined. The features for a Classification Algorithm that predicts lncRNA processes were formed by combining the AvgSim scores along multiple metapaths. In comparison to existing approaches that rely solely on lncRNA-protein interactions for forecasting, the proposed study makes advantage of HIN's meta-path based knowledge. The technique assigns available features to a maximum of 2,695 lncRNAs.The precision is proved statistically using involves attempting through a recent review research [11]. The outcomes of a research study of two well-studied lncRNAs are indeed confirmed.

III. Proposed Methods

The Heterogeneous LncRNA-Protein-Function Connection (HLPFN) is a network which connects five separate binding interactions: proteins connections, lncRNA co-expression, lncRNA operational connections, or lncRNA-protein interrelations and protein function connections [12]. To preserve the heterogeneity of vertices and edges, all connections are retained as independent pairwise models. Fig.1 depicts the multiple transitive vectors required to generate HIN. This same transitive index of subnetworks is constructed as follows.

NPInter is used to gather information on LncRNA-protein interactions. It discusses the interactions of ncRNAs with various macromolecules [13]. To extract enzymes, the lncRNAs are separated from the ncRNAs using NONCODE ID and the particular intervention is limited to 'RNA-protein.' Only 'Human Ancestors' can converse with others. The lncRNA-protein association system is managed as a data structure, with lncRNAs in the rows and enzymes in the columns. The borders are generated based on the obtained contextual information. The analysis of the structure MLP is employed in this work. This method is impossible because of the amount of potential conceptual grows exponentially as the duration of the conceptual expands, rendering the issue unsolvable. One option is to follow the regular patterns identified in HIN research [14].

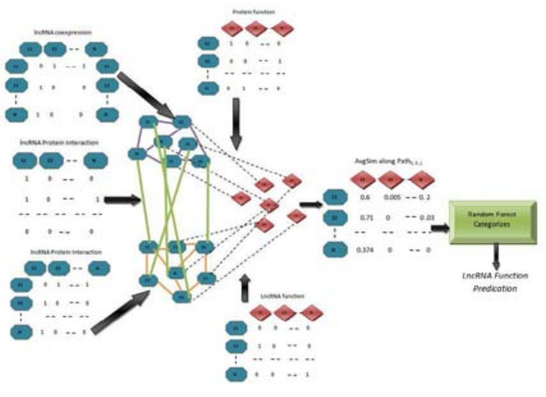

Fig.1. Determining lncRNA expression

$$K_{lp}(x,y) = \begin{cases} 1, if\ LncRNA_x, interacts\ \ with\ Proteins_y \\ 0, otherwise \end{cases}$$

In most cases, increasing overall conceptual duration endlessly in an HIN is pointless. Consequently, the chain of relationships between of expected completion elements might be very extensive in prolonged metapaths. As a consequence, inadvertently increasing conceptual duration is generally unproductive and produces outcomes that are far less accurate. As a consequence of this understanding, most HIN-based approaches specify a conceptual duration maximum limit in preparation. It only examine the meta-paths that are smaller than the criterion. It's critical to ensure that the findings aren't harmed by the removal of longer paths when setting such a threshold.If the findings are impacted, the threshold value should be reviewed, and this technique attempts to justify the maximum permissible setting process. A criterion limit can be established arbitrarily, statistically, or heuristically in most cases.

An observational technique is used in this study. The connection of all life conceptual with real existing life linkages is repeatedly evaluated beginning at duration three. The repetition ends when the number of adversities linked metapaths equals half of the number of favorably connected metapaths. The duration criterion is determined by path length at this point. The next eight lines go into this technique in great depth. The prospective meta-paths to be included in the investigation are discovered in the first stage, which is an incremental method also on conceptual duration. Because of mission is to find a link among lncRNA to service, only meta-paths that begin with lncRNA or conclude with feature are taken into account. The repetition must begin with shortest conceptual conceivable: lf, with a duration of two. In reality, this route correlates to actual function in the HIN and illustrates the actual functional association of lncRNAs. In practice, the iteration begins with a three-length meta-path. Every repetition leads to formation of a vector containing an overall maximum count of the concept of that type among each combination of lncRNAs or processes.The next challenge is to decide the appropriate meta-paths. If the concept question is significant, connectivity features suggest that its number across l or f should be higher. This suggests that the lncRNA is quite likely to fulfil that role. In contrast, if the amount alternative conceptual is low, this same likelihood of such lncRNA performing that purpose is low. A comparison study of the conceptual column is done against the known relationship pattern in order to function this tendency.All conceptual in the meta-path vector that have a significant correlation to established of connections are thought necessary, while the rest are considered invalid. This same terminate requirement is written so that the repetition comes to a halt so when the amount of negatively correlated meta-paths exceeds half of number of positively associated meta-paths. As previously indicated, the repetition begins with a three-length meta-path and continues until the termination point is achieved. A termination condition is satisfied in this study at a conceptual duration of four, that is used as duration criterion.

DOI: rp-9788770040723.073

IV. Performance Evaluations

K-fold cross-validation idea to evaluate overall forecasting accuracy. The specimens TP or TN have accurately predicted advantages and disadvantages correspondingly. FP and FN reflect the amount of incorrectly anticipated positive and negative samples, respectively. It can be produced in the following manner: An indicator value for each connection is calculated using the possibilities supplied by the algorithm. This same forecast value is used to order related couples. True Positives are known relationships with a more excellent predictive value than a certain criterion value point. In contrast, True Negatives are unknown correlations with a lower predictive value than the threshold. False Positives are recognized relationships with a value just below the criterion, while False Negatives are undiscovered connections with a value above the criterion.

V. Results and Discussions

Assuming 73.68% for the model can predict novel capabilities for 2,695 lncRNAs. Different functions were expected for some of the lncRNAs. The factor influencing outcomes suggests that lncRNAs are directly implicated in physiological systems rather than cellular and molecular level capabilities. Many previously unknown lncRNA functions were predicted using this strategy. The functions come from the GO collaboration. The GO ontology tracks parent-child connections using GOBasic, GOSlim, and other operational groups. To comprehend any such activities provided by lncRNAs, various operational GO Terms are grouped according to their GOSlim category. Table 1 shows this category-by-category list. The figure displays a list of functional domains and the number of GO keywords within each classification. It demonstrates that lncRNAs have key roles in cellular mechanisms, growth, cellular component, and metabolism, molecular function. The CateGOrizer program was used to generate these outcomes.

TABLE 1: LncRNAs' Important Features

Go Class ID	Definition	Count	Go Class ID	Definition	Count
GO:0007034	biological process	2647	GO:00014680	kinase activity	24
GO:0007152	metabolism	868	GO:0068159	plasma membrane	20
GO:0004674	molecular_function	494	GO:0004164	signal transducer activity	23
GO:0008271	development	354	GO:008536	behavior	23
GO:0006572	cellular component	369	GO:0005819	nucleoplasm	16
GO:0018040	cell organization & biogenesis	288	GO:0005056	receptor binding	16
GO:0004628	cell	389	GO:00016487	viral life cycle	16
GO:0008159	cell communication	330	GO:006156	protein kinase activity DNA binding	15
GO:0008164	signal transduction	297	GO:0004822	regulation of gene expression & epigenetic	15
GO:0017536	protein metabolism	234	GO:0007952	response to biotic stimulus	15
GO:0007819	transport biosynthesis	319	GO:0006551	RNA binding	18
GO:0008056	binding	293	GO0007463	mitochondrion	18
GO:0003487	cell differentiation	267	GO:00030997	enzyme regulator activity	14
GO:0040156	catalytic activity	204	GO-0008738	peptidase activity	12
GO:0004822	response to stress	299	GO:0005513	cell growth	12
GO:0006952	morphogenesis	273	CO:0008620	nucleotide binding	12
GO:0009551	protein modification	256	GO:0008642	endoplasmic reticulum	11
GO0008463	organelle organization & biogenesis	208	GO-0008813	endosome	10
GO:0005997	cytoplasm	244	GO0008463	nuclear chromosome	9
GO-0006738	protein binding	237	GO:0006997	Golgi apparatus	9
GO:0004513	lipid metabolism	97	GO-0007738	vacuole transcription factor activity	8
GO:0005620	cell cycle	83	GO:0005513	lysosome	9
GO:0008042	ion transport	98	GO:0005620	nuclease activity	10
GO-0007813	response to endogenous stimulus	61	GO:0005042	structural molecule activity	7
GO:0008719	response to external stimulus	77	GO-0005813	nucleolus	6
GO:0009604	hydrolase activity	67	GO:0019997	secondary metabolism	5
GO:0018780	catabolism	69			
GO:0006057	DNA metabolism	75			
GO:0005256	transferase activity	70			
GO.0015741	reproduction	69			

To use a different experimental dataset, lncRNA2GO-55, accessible for downloadable in NeuraNetL2GO, we compare our estimate to two state-of-the-art algorithms, LncRNA2Function and NeuraNetL2GO. The result is evaluated the using F-score, accuracy, and recall measures, and our approach is shown to be the greatest. The benefits of performance assessment are shown in Fig.2. In terms of availability, the proposed methodology has also demonstrated satisfying performance (see Table 2).

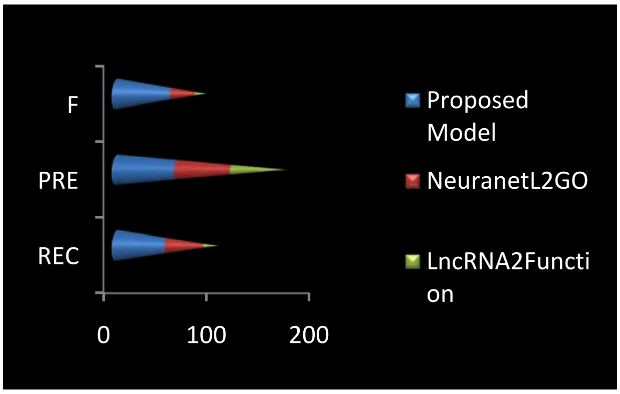

Fig.2. Performance measures

TABLE 2. Comparison of Proposed and Existing Systems

Model	Annotated	Coverage percentage
Proposed Model	52	88.03
NeuranetL2GO	47	94.10
LncRNA2Function	15	29.55

A consideration of the perceived significance of the meta-paths as RF classifier characteristics is offered here. Statistical assurance is also provided that paths proposed by the appropriate path selection procedure are significant. The final section demonstrates the validity by using four as the maximum criterion for the conceptual duration. Furthermore, the appropriate meta-paths chosen are relevant in terms of biological scraps of evidence. The meaning of the unnecessary abstract, lplf, is that one lncRNA connects with an enzyme, which binds with another lncRNA to execute a purpose. According to existing research, enzymes perform operations immediately, while lncRNAs are used relatively infrequently to generate functionalities. Therefore, the conceptual interpretations of all essential meta paths identified either by automated selection procedure or on either extreme are closely related to scientifically confirming lncRNA-function pathways.

This designer's large variety of differences is O, where n is the highest amount of lncRNAs/proteins/functions in the investigation, m or g are the amount and duration of meta-paths, and one or fare the number lncRNAs and activities in the study, correspondingly. It's worth noting that the amount and duration of concepts used in the research significantly impact the total intricacy. Furthermore, these are the variables that we can control by accepting or dismissing conceptual based on predetermined duration criteria.

According to a ROC curve analysis, the gain in outcome for more extensive conceptual was inappropriate to the processing effort required to analyze a more significant number of abstracts of more extensive durations. Fig.3 illustrates the ROC curves for tests with three, four, or five distances. The meta-path experimental with duration four

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performs much superior to one with three. The duration of five conceptual research, on the other hand, does not enhance the outcome to the extent that the increased processing complexity necessary to analyze individual concepts could be accounted for compensated. Furthermore, setting the upper boundary of conceptual duration to four for the particular data set seems to be the best option.

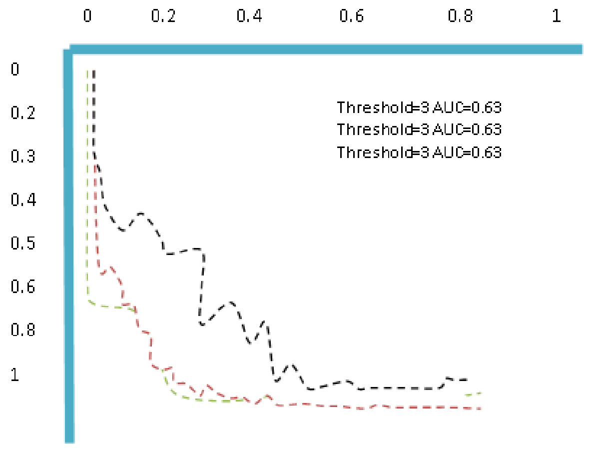

Fig.3.ROC curve for proposed system

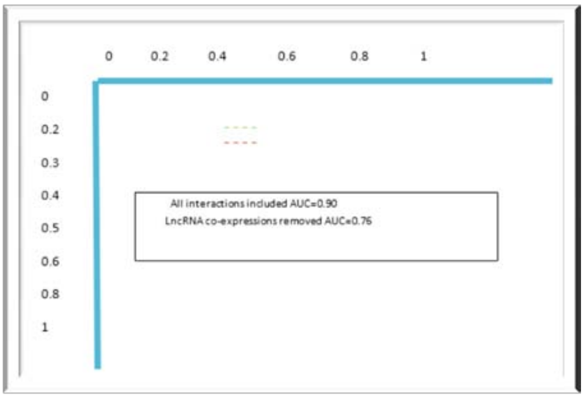

Fig.4.Impact of lncRNA co-expression information

The inclusion of lncRNA co-expression data into the network is among the innovative features of this article. This knowledge aids in the identification of lncRNAs that are structurally comparable. The relationship among lncRNAs was assessed using the co-expression patterns of lncRNAs in 24 organs. Experimental evidence indicates that lncRNAs have tissue-specific production, but that their position has a significant impact on their activity. As a consequence, tissue-specific co-expression features of lncRNAs could help determine important biological lncRNAs.In light of this, it is reasonable to assume that incorporating lncRNA co-expression information has aided in improving predictive performance. An ROC curve examination of the factor influencing outcome in a network with and without lncRNA co-expression data supports this hypothesis. Fig.4 depicts overall results of the analysis. It reveals that when the lncRNA co-expression system was removed from HIN, the AUC dropped consistently.

VI. CONCLUSIONS

The current research topic of fast and effective protein identification of lncRNAs was inspired by the mounting evidence for operational characters played by lncRNAs in biological and cellular processes. Because the wet-lab technique for operationally annotating lncRNAs is costly and complex, algorithmic approaches have become very interesting lately. The research presented here forecasts the roles of lncRNAs analysis of protein behavior data and co-expression information. While previous techniques for identifying lncRNAs primarily focus on protein contact, this method considers lncRNA co-expression patterns and correlation to established benefits and associated proteins. More importantly, the technique can effectively examine the importance of lncRNA-function pairs in a HIN by associating functions with lncRNAs even if there is no protein connection. The model has a predictive performance of 74 percent altogether.

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Support Vector Machines Application for Prediction of Binding Elements

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***Abstract*—During the human thread age, classifying genetic functionality remained among one of both greatest essential as well as difficult challenges. The overall majority that contemporary computer-based prediction approaches compare characteristics that are generally basically proportional against overall polypeptide sequences. Non-sequence attributes from particular proteins, on the same hand, might prove indicative of biological action. Computer training approaches, including Support Vector Machines (SVMs), appear especially well suited towards leveraging similar characteristics. They propose SVM but also empirical masquerading chemical makeup within that paper.Towards this same realm for molecular functionality predictions, comprehensive compilation comprising nonlinear features extracted using polypeptide sequencing. Experimental SVMs enabling classification involving rRNA -, RNA-, but also Mitochondria enzymes were been constructed. Every among these SVMs forecasts when given molecule corresponds into either among those 3 categories based upon its protein acids sequence with the specific restricted ranging association between surfaces charge and also solvents permeable exterior region. Intergenic SVM has continuously obtained >95 percent correctness both personality but also bridge experiments, where quantify both effectiveness algorithm training but instead predictions, accordingly. Overall effectiveness that overall RNA- but rather Genetic material SVMs is considerably varied, spanning between f 76 percent through f 97 percent. These outcomes from overall tests go towards this manner towards upgrading using SVMs.**

Keywords*—Computer teaching techniques; Reinforcement Dynamical Networks; rRNA; RNA- dependent Genetic material proteins

I. Introduction

Genetic transcripts are currently being produced with an extraordinary frequency by sizable genomic decoding studies. Approximately 60 biological chromosomes have been transcribed entirely and otherwise almost entirely throughout just a very couple of months [1]. Hundreds of millions nucleotides can be found within early cretaceous even bacterium genome, whereas hundreds many hundreds can be found throughout mammals but also vegetable genetic material sequences[2]. This massive influx of fresh genetic information puts a lot more strain upon this challenge for determining genetic functioning. Hardly very few prediction computing approaches could maintain current with that speed right now [3]. Almost majority of those approaches use rapid techniques that can explore annotation datasets seeking sequencing, theme, feature, but rather concealed Markov modeling similarities [4].Each request gets expected may have a comparable functionality if there exists enough commonality across each request sequence that another of that repository where functionality seems recognized. Investigators were managed that identify functionalities approximately 69 percent among approximately 4524 hypothetical enzymes contained within this same previously completed chromosome from another archean, M. acetivorans species C2A, using a similar method [5].Though this same former has impressive penetration, they were nevertheless 1500 molecules remaining identified meaningfully given such comparatively short chromosome. That was hardly surprising when just a relatively small percentage among those molecules turned out having to exhibit any new activity [6].

Antibody structure but also functionality, on the one contrary hand, might cannot necessarily be linked within any straightforward sense. That example, development might maintain intrinsic connection amongst fragments composing particular interaction region, although typically small but also fragmented, instead of maintaining complete entirely consistent stretches enclosing everyone those sections amongst enzymes with overall shared interaction functionality [7].Another dynamic mapping if this sequence involves simply measurement for correlations amongst places throughout another range [8]. Such insight invites us to think about properties that aren't proportional towards proteins sequences, as well as ways when comparing complex patterns. Although those double components constitute novel peptide functionality predicting, they were previously employed for previous contexts [9. Researchers used SVM can estimate peptide structure classifications,

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cytoplasmic placements, including digestive domains, such example [10].

II. Related Works

Every among those SVMs functions using unique curvilinear collection the properties of the proteins known called pseudo-amino acids breakdown. Researchers have obtained results that are equivalent to but rather better than those of various modern approaches [11]. Researchers were inclined should expand their applicability toward enzyme functionality forecasting as a direct result of recent positive discoveries. The following is a relatively brief description of SVM. The contribution generating any SVM is one weight matrix, which is simply a combination of properties. [12] That generates another categorization. Provided another trained collection given characteristic matrices with established predicted outcomes, computer SVM knows where correctly discriminate [13]. From some metaphorical sense, those incoming matrices were transferred onto any characteristic region. This binaries classification SVM can use previous learning to construct another plane within the neural characteristic field that best differentiates overall learning variables from 2 classifications [14-15].Whenever each freshly extracted feature was entered, this category that every characteristic vector gets anticipated based upon whichever edge is aircraft everything just translates onto. SVM, computer categorization along with prediction machine that was subsequently established, primarily founded upon strong statistics modeling concepts but also have successfully had to use to the very broad spectrum of tasks, spanning picture detection, word categorization, including medication creation. SVM is increasingly being used extensively to solve proteins categorization challenges, such example folding identification and transcriptional transcription information [16].

This was built through supplementing standard protein chemical compositions using another set of molecular parameters to link all thermodynamic qualities for protein groups dispersed over specified intervals within a given string [17-18]. Those connection equations provide describe their impacts that localized sequential ordering regarding certain thermodynamic qualities, but typically are unaffected by the overall sequence's length, adjacency, even world order. SVM has a very steep subset of features thanks to the sort of anti-hydrochloric content. Any particular pseudo amino protein makeup could be created with just that given Classficatio n use through determining essential thermodynamic features. They constructed 3 prototypic SVM because of an early study with a computer training technique incorporating those key aspects towards enzyme functionality predictions [19].Those SVMs determine when a given question string corresponds to rRNA, RNA-binding enzyme, as well as Genetic information nutrient categories. We have gotten some findings that show how feasible such a strategy is. They may anticipate better results from this technique throughout this same coming through perfectly alright their SVMs while testing using different features matrix methods [20].

III. Proposed Methods

SVMlight, one free open-source program, was employed to make 3 SVMs for predicting amplicon, RNA-binding, and Genetic material enzymes, accordingly. These SVMs used dichotomous classifiers, which means they predicted when either given incoming molecule had any specific functionality. Basic basics underlying SVM are explained within basic subsequent sections. SVM was another statistics information theory-based training system.This core concept could be expressed like the following. These contributions were initially expressed into characteristic matrices, every one of them being assigned into either among 2 classifications. Every category for each weight matrix was determined from every beginning during learning. That category represents this outcome for SVM during predictions. Finally, a convolution operation maps these information matrices onto one subspace, whether smoothly but rather earlier this month.Finally, within neural subspace, another divide was calculated to effectively divide these 2 categories with learning variables. SVM retraining pursues the worldwide ideal but instead prevents too much during most times. Because having those properties, this then was well suited towards dealing handle huge amounts more properties. All whole textbooks about this same use using SVM with patterns recognition. This simplest fundamental principle underlying SVM is informally illustrated in Figure. 1.

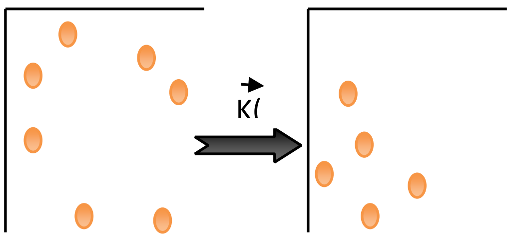

Fig.1. SVM based learning linear translation

Apart from initial breadth between model determined basis values, which has been determined towards reducing any estimation in variable Private equity investment, plus software variable C, which regulates model uncertainty tradeoffs, which been adjusted near 1000 throughout the particular study, most other settings remained fixed near-standard SVMlight setting. SVMlight's specifications and Vapnik's publications are recommended reading for anyone concerned about both nomenclatures and various intricacies. The 40-dimensional incoming features vectors using SVM comprised the pseudo-amino acids content on the human polypeptide. This pseudo amino party makeup involves linking equations used for these charges, pore-volume, but also visible size distribution individual repeats, as well as actual physicochemical characteristics within the actual molecule.

IV. Results and Discussions

This relevant information was used to educate both target genes, Oligonucleotide, and genetic material SVMs. There was one favorable selection but also another deleterious population within a particular database. This affirmative subset's molecules proved recognized that have

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this functionality that exactly SVM had been taught for predict. This functional previously discovered would be absent from that positive subgroup. Irrespective matter whether biological functionality has been confirmed physically versus projected, every phrase annotations within this same SWISS-PROT database being treated sufficient preexisting understanding about that enzyme functionality. Those SMVs' testing findings were presented below. Every SVM was subjected to 2 exams: either self-consistency check with another merge check. Using this soul experiment, using SVM educated using this entire information were applied to estimate overall functionality for each molecule during the given identical database and compare this against recognized functions. Using rRNA binding SVM was tested was found that have relatively close accurate predictions prices: 100% with just using affirmative subgroup, 99.98% overall protein negativity relatively small group, overall, 99.98% for the overall entire dataset. SVM that binds to RNA, their findings were unstable: f 76% with this same positive subset, f 97% with this same unfavorable subgroup, with f 92 percent altogether. Our Genetic material SVM yielded lopsided findings as well, although along with our other manner: 93 percent with exactly affirmative subgroup, 77 percent with this same negatively relatively small group, with 87 percent altogether, as shown throughout Tables 1.

TABLE 1.OUTCOMES OF A PERSONALITY EXAM

SVM	Correct Predication		
	(+ve) subset	(-ve) subset	Overall
rRNA binding	1167/1031= 100%	4698/4891= 99.68%	5795/5936= 98.27%
RNA binding	1069/1364= 73.61%	4557/4691= 96.82%	5783/6399= 93.91%
DNA binding	7912/8356= 89.23%	3512/4690= 76.07%	10619/13651= 84.36%

When this jackknife testing has been used instead of using cross-validation testing, then anticipate their accurate forecast percentages to become considerably greater but instead greater constant. This Jackknifing testing seems less neutral as well as efficient when evaluating highly learned SVM's forecast capabilities since that just removes one input sample again from the learning group during projection. Unfortunately, the terminator of each of the hundreds of sequences might need to be demanded far more CPU effort than could afford. As a result, chose that lesser stringent option whilst nevertheless demonstrating their left-10 percent -out merge approach. Overall CPU durations spent when retraining individual rRNA, RNA, and genetic material SVMs using individual computers averaged 5 minutes, 28 minutes, but also 18 hours, correspondingly, as shown from Table 2. Their median CPU latency during forecast is approximately 2 minutes for each request, based on 10 907 tries. These various retraining timeframes represent what challenging this then was for these SVMs and convergence onto any good separation vector space. Generally speaking, the higher larger learning collection, the usually increasingly challenging it becomes could achieve confluence, resulting in generally incurring a penalty that increases proportionally with its database length.

This research was one of those first to use SVM, using machines intelligence approach, towards creating gene functional predictors. Several SVMs for categorical identification and rRNA-, RNA-, but also genetic material enzymes had been constructed. Every among these guesses which among those 3 types given question molecule corresponds into. Those SVMs were concepts that will be used to assess economic viability with my methodology. Because with these varying amounts overall sequencing but also physiological variety, this same various types human enzymes provide various amounts significant difficulty. By combining the overall learning dataset using SWISS-PROT annotating, they were able could generate an artificial level of distortion that seems nearly identical to those found with actual understanding. Identity but instead bridge testing were used to evaluate overall effectiveness for these various SVMs. We rate their effectiveness as average through excellent.

From their understanding, methods relying upon nonlinear sequence homology had previously identified encoding genes enzymes into any specific course. Those 1056 Crispr molecules within this successfully trained sample, under our PROSITE dataset, belonged into hundreds more distinct translational polypeptide families, everyone with their unique hallmark pattern. Those couples have quite a lot in common. In speaking, oriented" remains minimal. Protein nucleotide commonality, for instance, equals roughly 10% among individuals from either ribosome lineages 30S S4 but also subunit L20, each species which are widely represented within this learning collection. As a protein result, this intergenic SVM's outstanding efficiency throughout this same board unit was largely owing to having been educated using just a single, comparable optimistic subgroup.

Instead, it demonstrates how SVM may locate the component that is similar to a broad group of good coaching information but absent from the negative collection and employ it to acquire optimum categorization. It's intriguing to figure out what this common component is for rRNA-binding proteins. This would assist us to learn much about ribosomal proteins and develop more logical prediction algorithms. Unfortunately, translating the sophisticated SVM internal architecture to biological concepts is also challenging, as it is for various nonlinear learned systems.

The cross-validation testing predicts for such remaining of the coaching collection using SVMs educated on a subset of it. The objective was divided into 2 parts. For starters, it makes a realistic estimate with demonstrable Secondly, precision. This also tests the reliability of prediction ability by switching the section available to projection. The rRNA-binding SVM obtained 95–99 percent accuracy on that sample (see Table 3). The precision is great and constant. The less-than-ideal outcomes are consistent with the coaching set's sequence variability. Utilizing considerably larger negativity selection (f 26 percent overall amount if it's affirmative subgroup) for train model SVM instead of just original f five rounds decreases overall efficiency into 85–93% that seems consistent given their viewpoint.

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The decline is mostly due to a reduced identification rate. The randomly selected, bigger alternative negatives subgroup is likely to have a higher amount of incorrect negatives which have perplexed the SVM. As a result, the SVMs that have been properly educated are expected to produce have stronger predictive greater than that partly educated counterparts when using the original, better balance database. Nevertheless, the fluctuation inaccuracy, although little, brings to think a feature that uses SVM presumably generally pertains towards computational understanding. Specifically, the statistical principles it extracts from the training data restrict its prediction potential. Any "deterministic" regulation which remains aspirational grasps consequently substance in early facts, on the other hand, may have a higher potential for extrapolation. Once that learning information is complete, as appropriate in addition to a low large lot of disturbance, because that SVM isn't very good at it. Used, these 2 types of algorithms can agree.

TABLE 2. Cross Validation Tests Outcomes

SVM	Correct Predication		
	High	Low	Overall
rRNA binding	642/675= 99.01%	601/634= 94.3%	5694/5907= 95.28%
	2761/2618= 91.69%	2773/2851 83.91%	25862/26850= 88.10%
RNA binding	549/638= 91.34%	624/713= 80.61%	5481/6384= 86.94%
DNA binding	1138/1435= 86.09%	816/1352= 78.24%	11317/13607= 80.34%

Both Transcriptome and genetic material are two different types of interaction. Proteins are large divisions with a wide range of sequences and nucleic acid binding modes. The pairwise sequences are typically under 20% in one of these groups, but also there was one overall commonality of 8%. The functions of Antibodies that connect to Genetic material were known as RNA and Genetic material enzymes quite varied. There are nucleic acid-processing enzymes that identify particular monoclonal locations. The correctness of contains SVMs that attach to Ran's, as well as Chromatin within the cross-validation experiment, was 82–91 percent and 78–86 percent, accordingly. We believe that, at the present level on corrections rates, such prototypic SVMs may be employed as an initial pass of functionality predictions, in addition to existing approaches.

Both SVMs demonstrated uneven accuracy in separated findings for the positive & negative subgroups on the self-consistency test: 93 percent vs 77 percent, and 76 percent vs 97 percent, accordingly (see Table 2). Its SVMs' sensitivities are strong for such a better score group, but their selectivity is low. Sensitive & selection swap places for the lower scoring subset. With this information, we can put SVMs to actual usage in the right situation. Moreover, the imbalance might provide us with insight into how to develop. The phenomenon means that the ideal separation hyperplane is fundamentally capable of isolating the vector 1 among them subgroups However, within that characteristics region, they were unable cannot prohibit elements from any alternative group from entering. The characteristics that are connected embedded with fundamental characteristics can be tweaked to provide more acceptable vectors dispersion. If the penetrating is not randomly diffusive, on either hand, using an alternative kernel function of SVM might "bend" the space toward a greater separating.

Our technique is meant to be used in conjunction with others often employed in operational genomics. To transmit its operational annotations between hits into question, a majority of these employ databases searches for similarities on sequencing, motif, profiles, or hidden Markov models. Recently, its complete genomic for its bacteria P. putida KT2440 included 3571 with 5420 accessible sequencing elements given the potential purpose using BLAST & embedded Markov models searches. If assignments were confined on the same approaches, just over one hundredth completed chromosomes from these 3 primary categories all exist to have about 60 percent identification frequency, which seems expected to increase when well chromosomes are transcribed all across that world. Several of the thousands of genes that aren't allocated by this method may have known activities but aren't equivalent matches every molecule that has been characterized. With a particular case, light, it seems to be important to mention because if 're looking for another unique way to express, newly created simulated neuronal network networks technique proteases were allocated with another substantially bigger proportion beyond that for typical person chromosome initial human genome draught publication indicated.

Despite the fact because ANN researchers considered that it hard can evaluate the changes in prediction due to technique differences, the work does demonstrate the potential benefits of using complementary approaches. It's additionally hard to compare the ANN method's effectiveness to ours because various there were several types of proteins investigated. However, they found this fascinating because using the neural approach has some compromise as well inaccuracy when estimating positives and negatives. For identifying Twelve SWISS-PROT groups, as an example, 90% accuracy for estimating positive is followed by the comparable 20–90% efficiency in estimating negatives. When comparing accuracy levels, the proposed technique has proven to be competitive even at this early stage. We hope that combining this with other approaches, will help to improve the protease functionality breadth but instead precision predictions.

V. CONCLUSION

This has shown proven that combining SVM using quasi acids makeup towards any revolutionary enzyme functionality predictions method was viable. These 3 SVMs that developed functioned wonderfully especially simply one prototype. We discovered insights to enhance SVM using assessment testing. SVM achievement depends on features vectors & kernel functional choices, as well as an acceptable and low-noise learning dataset. For greater precise any formula could forecast, that better accurate it is precise any workout setting May been made, therefore greater than group, stronger forecasting capability of the accompanying SVM. However, as the SVMs have demonstrated, being particular in purpose would not

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necessitate sequence similarity. Some of our greatest popular appealing features when it comes to protein functioning, SVM is a great way to go. predictions would be the separation of sequence or operational similarities. SVM requires a lot of computer time to train, test, and tune. Predicting is a pretty quick process. We see another collection of more supervised learning taught may foresee particular functionalities in interpreting information on genetic sequences sequence in the future, supplementing present approaches to provide more accurate, and high-throughput gene function predictions.

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Deep Learning Based Convolute Neural Approach in the Prediction of RNA Structure

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Abstract—Obtaining RNA secondary image data seems to have been increasingly significant in RNA and genetic analysis interest in recent decades. Even though some RNA secondary structures may be discovering approaches, many RNA secondary structure predictions require adequate and reliable analytical modeling. Present RNA robust estimation algorithms were typically focused on the minimal free power approach, which uses an ongoing method to identify the optimum RNA packing condition in vivo while meeting the lowest power and other such limitations. Due to the ecological atmosphere's intricacy, a real RNA architecture constantly provides a good balance of living potential power position instead of the ideal retractable prestige that fulfills the lowest power requirements. Because the RNA compact individual's responsibility for maintaining order position was similar to the minimal free power position for simple sequence RNA, the lowest free power method for forecasting RNA secondary structure does have greater precision. Continuous packing, however, leads the total bioelectrical energy of a lengthier chain RNA to stray significantly from either the simple or cost level of energy. These discrepancies were due to its complicated design, which caused a significant drop in the secondary structure's demand forecasting Convolutional Neural Network (CNN). Researchers present a unique RNA secondary structure prediction approach that combines a deep learning algorithm with a stochastic optimization approach to conformity with huge RNA sequence and an example based throughout this research. We build an extensive convolutionary neural network using present investigation variants plus knowledge construction. We would then derive implied characteristics of accurate processing from huge forecasting of the coupling likelihood of every character in an RNA sequence. An upgraded stochastic optimization analysis is used to identify the best RNA secondary structure based on RNA sequence foundation matching probability. Their multiple access outperforms standard RNA standard biochemical methods in identifying three reference RNA groups, according to the findings.

Keywords—RNA, Convolutional Neural Network, RNA sequence, structure prediction algorithms

I. Introduction

In biological systems, RNA would be a critical component. It is involved in genes coding, processing, and regulation, including expression [1]. The conformational change of RNA determines its activity in a creature. The conformational change of RNA molecules, on the other hand, was complicated and lacked an accurate description to explain it, making it difficult to guess the three-dimensional structure simply from either the primary sequence of RNA molecules. As a result, the basic approach to investigating RNA architecture involves estimating the conformational changes of RNA given the direct line of RNA [2]. Medicinal tests like X-ray absorption and NMR determined the discovered RNA secondary organization. While assessing extended-sized components, natural, controlled experiments were ineffective, costly, and time-consuming. These also aren't appropriate, including all RNA molecules [3]. Howard and Eran introduced the PARS method to anticipate the RNA secondary organization. It uses protein sequences to break the human always double portions of the RNA, resulting in a collection of two RNA pieces that then segment independently to produce an RNA secondary framework [4-5]. On the other hand, Restriction enzymes cannot enter the cell barrier. Therefore RNA must be removed from the organisms. An RNA's original framework would be destroyed, resulting in potential alterations. DMS system wasn't without flaws. It could only identify sets of two sequences in an RNA molecule; the remainder must be simulated using software methods [6]. Furthermore, without using DMS chemicals, which could also articulate the 2' hydroxy team of four positions in an unmatched condition, researchers utilized SHAPE chemicals to examine the different elasticity of the RNA framework at any point and speculate whether the characters were coupled. The partnering item, on the other hand, is unknown. Recently, neither biology RNA approach seems to have been possible to forecast an actual RNA secondary organization in huge volumes, necessitating the use of computer forecasting models to predict RNA secondary constructions [7] accurately.

II. Related Works

While analyzing and commenting, the first methodology employs a posterior probability of RNA molecules containing human evolution. The influence of a given sequence significantly impacts the findings obtained by such a technique. The second strategy does top with a framed plus sequencing matching

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simultaneously, although it uses a lot of computing power. The third approach of comparative sequence data forecasts first rather than analyzes. That technique could produce many potential buildings, but it cannot ensure that they are all true constructions. Machine learning techniques were used in a variety of areas. Some artificially intelligent supervised learning, including the evolutionary algorithms, human brain method, fully convolutional network method, and other approaches, has indeed been developed to anticipate the secondary structure of RNA. All of the studies yielded positive outcomes [8]. However, every one of these algorithms was characterized by small sets, and the accuracy of the model for individual data specimens was poor. Deep neural networks have arisen in the area of artificial intelligence due to advancements in digital technologies, and then they can dramatically enhance predictive performance. Deep learning approaches could leverage underground systems to identify explicit and intuitive characteristics from big data using these characteristics to create a successful forecasting model. Learning techniques have recently achieved significant advancement in developing protein sequence structural characterization [9].

Regrettably, RNA secondary initial design seems more challenging and complex than nutrient supplementary structural characterization. Because every couple of foundations on the RNA must correlate to some other foundation in the sequence. However, every aspartic acid chemical in nutrients isn't linked to certain other peptide acids that make up through structural characterization [10-11]. These works provide a unique computing technique for predicting RNA secondary comprehensive solutions, mixing supervised learning and combinatorial optimization, and recommending specifications for the previously mentioned challenges. Its approach outperforms the modern mainstream methods in terms of accuracy [12].

III. Proposed Methods

A branch structure created by the complementary coupling of consecutive letters and looping sequence analysis of quasi of letters makes up most of the RNA secondary organization. The spinal cord and brain architecture would be another name for this RNA secondary organization. Once every one of the linked characters of an RNA sequence has been established, the sequence information of the whole RNA can be calculated. This research provides a more effective process for RNA secondary structure characterization depending on the Secondary structural forecast problems raised in the literature survey thus far. CDPfold would be a homology modeling approach incorporating a deep neural network, evolutionary computation, and a dangerous sequencing approach. Researchers built a deep neural network to identify the components of successful indirect elements of widescale information and forecast the agreement possibility of every character in the RNA sequence in comparison to protein sequences.

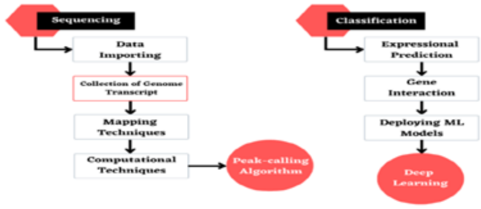

Fig.1.Proposed Neural Model for RNA Structure Prediction

Deep neural networks could use recently gathered RNA sequences as training images, removing the comparable frequency restriction on comparative sequence data. Researchers employed the systematic approach of evolutionary algorithms and the description of the RNA secondary architecture to achieve the base perfectly matched likelihood and the maximal RNA secondary organization for the stochastic findings acquired by the deep neural network. Owing to the employment of the free power approach, this process could reduce the erosion of lengthy sequences prediction performance. Integrating both viewpoints, these works present the method described in Fig.1 for calculating the particular values of every location of the programming grid Wii. Calculations could be used to determine establishments based on the RNA sequencing translating grid. The location of the stem region in the actual building of the RNA was indicated by a sub-diagonal line in the programming matrices with a big approximate solution and a lesser number on both ends. Deep neural networks benefit recurrent neural networks by efficiently extracting the aspects of the units in the grid. As a result, researchers utilized deep neural networks without using computational intelligence techniques to estimate the matching of elements in RNA sequences.

Researchers needed to separate the RNA pattern imprinting matrices from anticipating the coupling of every letter on an RNA sequence. A phrase of fixed length was converted into a vector of size n n using the RNA simulation model. Humans utilize the template matching approach to partition the column into n columns of length d n. The letter d denoted the width of the moving window. As either a result, a vector of dimension d n could be used to describe the characters on every RNA sequence. When employing the template matching approach, the width of the moving window does significantly impact the study. The selected features would be incorrect if the reference image were adjusted excessively. A significant parameter causes additional redundant data in the matrices, resulting in a lengthier learning algorithm and possibly affecting the quality of the resulting forecast prediction models. The duration related to the provision in the RNA must be connected to the result of the moving window following processing. To estimate the size of the given image, researchers would have to collect the root area information about the sample item. The information supplied into the deep neural network must be consistent in quantity, and the magnitude of the RNA sequence matching every RNA sequence varies owing to the duration of the RNA sequence (Fig.2).

As a result, researchers must compute the average scores of the RNA sampling frequency in the experimental results collection and use the figure-to-data

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augmentation techniques during the study. The template matching approach plus normalization of the RNA programming matrices may transform an n-dimensional RNA sequencing into the n-dimensional matrix, that meets the deepest convolution cable network intermediate data specifications.

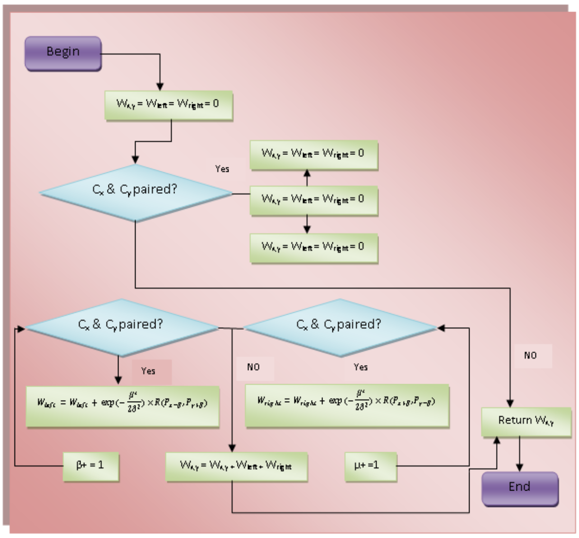

Fig.2. Matrix representation of RNA

IV. Results and Discussions

The researchers chose the 5sRNA with the biggest number and the most homogeneous dispersion without the need for a pseudoknot from among the numerous RNA categories shown in the information. Sequence alignment of the 5sRNA information shows that perhaps the RNA dataset includes certain genomic information that would be the same or comparable to the 5sRNA information. It must be required to normalize the data in the collection in place to evade the impact of the tests by the very same and comparative sequence information. That seems to be, the 5sRNA data set would be designed to filter out essentially equivalent patterns. The overall amount of 5s RNAs employed in the study following redundancy elimination was 1,059. Researchers determine the total of eliminating 5sRNA records into training images, which includes a classification algorithm and a test dataset, in required to practice and correctly assess the appropriate framework. The training examples, verification needs to be set, and a testing set has a 7:2:1 RNA proportion. Table 1 displays the information in the data collection.

TABLE 1. RNA TYPES DATASETS DISTRIBUTION

RNA Type	Number
TelomeraseRNA	35
tRNA	655
tmRNA	419
srpRNA	987
RNasePRNA	504
grp2RNA	9
grp1RNA	96
25sRNA	32
16sRNA	107
5sRNA	1192

The learning training data set the routing protocol and established the set of parameters, followed by the confirmation collection for system identification. As a result, the concluding training dataset was utilized to examine the generalization capability of the entire classification algorithm during the final refinement and the conclusion of the models. Numerous variables in the CDPfold may influence the study's findings, thus the issue variables should be changed first before the experiment started. The width of the moving window seems to be the problem identification variable. From the 5sRNA collected data utilized in the research, researchers estimated the height of the longest stemmed section of all RNAs. Fig.3 illustrates the findings achieved. The template matching product's breadth was determined by the size of the largest stemmed area in the 5sRNA information. This can be seen in Fig.4, researchers additionally estimated that the average duration of the 5sRNA pattern in the sample group.

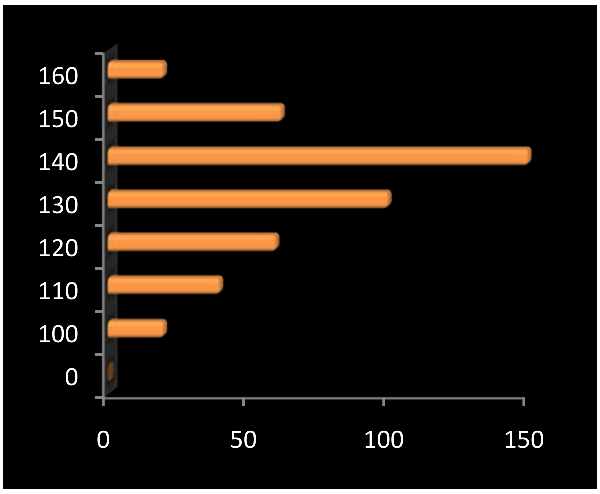

Fig.3. RNA maximum stem length statistics

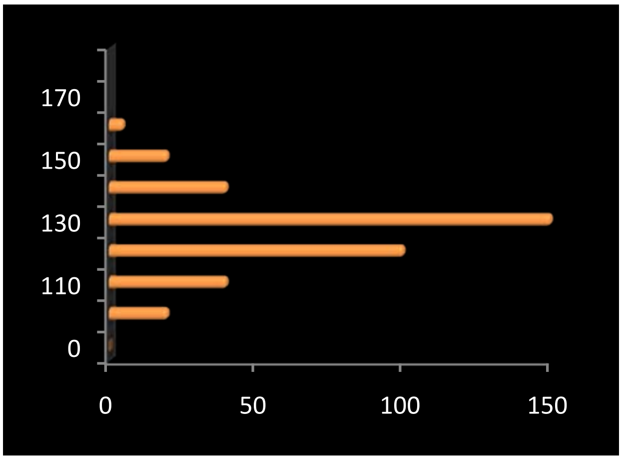

Fig.4. RNA length distribution

Fig.4 reveals that perhaps the 5sRNA pattern has the greatest enhances the overall of 11 contiguous base pairs and the average duration of 120 nights. The concept of picture scalability has been used in the article because the deep neural network does have decent reliability for tilted and sized pictures. That implies that the term referring to the components produced from the moving window may

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be evenly converted into a matrix size of 11 120. Data processing had been used to build the deep learning algorithm presented in this study. An input image, 3 CNN , 3 max-pooling, three fully connected layers, and a final feature overlay make up the learning algorithm. The production gradient. The top k algorithm was eliminated during the testing stage to determine the likelihood that every foundation corresponds to 3 labels. Fig.5 represents the proposed CNN model.

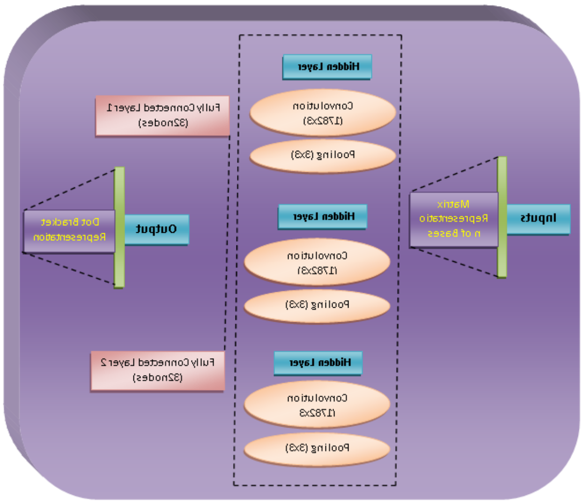

Fig.5. Proposed CNN model for prediction

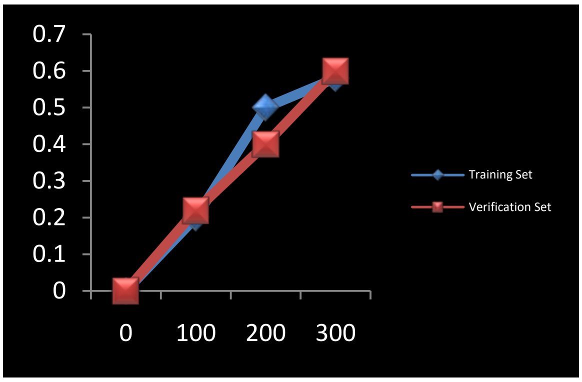

Fig.6. Accuracy of proposed model

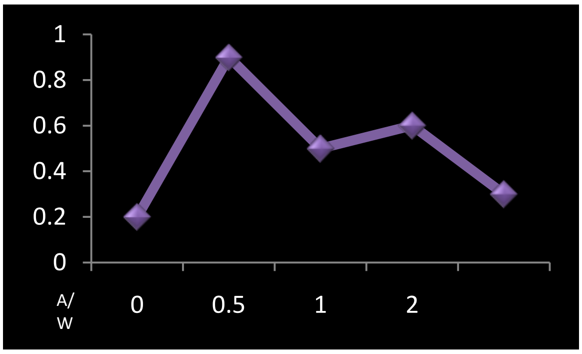

Fig.7. Error accuracy of proposed model

A vector expression matching every compound in the 5s RNA sequence in the training dataset could be constructed using normalization and feature extraction approaches. Every basis has a matching structure labeling. The research findings indicate that the number of single characters within every 5s RNA sequence was more significant than the number of coupled nucleotide sequences. The three types of information sampling in the data set would be imbalanced, requiring the information to be analyzed with high dimensionality. The average pooling information processing approach would be used to rebalance the various sample information in the information source since the number of experimental results was adequate. The deep neural network classifier is constructed using the processed data. The figure illustrates the effectiveness of the artificial machine learning algorithm humans created in the training and testing sets. The system maintains an identical accuracy percentage on the training and testing sets, as shown in Fig.6, and the experimental data wouldn't be over. This picture shows that the system exhibits an identical accuracy rate on the training and testing sets, and the extensive experiments are not entirely. Researchers must choose a suitable number for the weighting x of G-U coupling following identifying the model employed in the research. The swinging couple's length should never be excessively huge or less.

The accuracy of the model would suffer the consequences of negative weighting. Humans ran a lot of investigations to determine the suitable weights. Fig.7 presents the outcomes. Experiments showed that the entire photographer's variance of correctness was optimum whenever the pairing value of G-U coupling equals 0.8. The training and testing information was sent into the learned CDPfold, and the deep convolution show's matching likelihood for every character on every RNA was employed as an intermediary outcome. The likelihood, and maximal adjustment approach, uses those preliminary findings. The ideal sequence information that meets the description of RNA secondary structure was found and matched to the foundation, in reality, confirming their entire simulation study.

Researchers calculated the projected impacts of the developed method framework on the 5sRNA information using the given measures. Humans utilized this very same method to prove other existing methods with the same results. Table 2 contrasts the outcomes of these studies, which were included in the proposed form, with the effects of those other successful shows available today. On the 5sRNA information, Table 2 compares the efficiency of their proposed approach to those of different methods. Their presented individual's detection accuracy was far greater than any of those discovered in those other methods.

TABLE 2. ALGORITHMS COMPARISON

Software	Correct Predication		
	Sensitivity	Specificity	F-score
Sfold	0.634	0.826	0.936
CDPfold	0.895	0.953	0.691
mfold	0.727	0.690	0.680
RNAfold	0.701	0.690	0.705
cofold	0.518	0.608	0.591

The researchers of that kind of research incorporated community and provided optimization methods like the evolutionary algorithms in their technology methodology.

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Those machine learning applications could handle complicated nonlinear issues by modeling evolutionary biology. Furthermore, because the goal is to identify non-mismatching conformational changes of RNA, and the quantity of this kind of outcome, was considerable, the development of every optimization was unclear; therefore, the community and provides method cannot be employed as the optimization technique throughout this research. As a result, the nonlinear control strategy was selected as the optimal approach, and the Nussinov technique was being used to suggest the probabilistic and more excellent correction methods.

V. CONCLUSIONS

Predicting pseudoknots in the present RNA secondary structural characterization would still be a challenge. In this research, pseudoknots were absent in 5sRNA, SRP RNA, and even Tirana, whereas pseudoknots were discovered in most RNasePRNA and marine. Although the number of pseudoknots in every one of those RNAs carrying pseudoknots was tiny, their presence cannot be overlooked. Should not only pseudoknots play a crucial role in RNA functioning, but if the pseudoknot impact forecast were incorrect, this would result in a miscalculation in the tissue-specific stem region. The dots bracket format was employed in this research to illustrate the RNA architecture. On the other hand, the dots parenthesis depiction doesn't depict the incorrect knots found in the RNA structure. As a result, the information, including pseudoknots, was removed from the study. If a protein sequence description of RNA that could describe a pseudoknot was discovered, the CDPfold presented throughout this research could be adjusted to forecast the secondary structure of RNA containing a pseudoknot.

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Prediction of RNA Structure Using Genetic Approach

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Abstract—The challenge of predicting RNA construction with pseudoknots is NP-complete, and the objective is to achieve the best RNA configuration with the least quantity of electricity. Numerous approaches for predicting RNA frameworks, including pseudoknots have been developed throughout the years. Metaheuristic techniques are influential in determining lengthy RNA frameworks in a small amount of time. For a forecasting RNA secondary structure with pseudoknots, we employed two optimization methods: Optimization Algorithm (GA) and Simulations Annealing (SA). We've also employed a hybrid of these different techniques called GA-SA, in which GA is used for universal searches, but SA was employed to searches, as well as GA-SA, in which SA would be employed of universal searches or GA was employed to organic investigation. The efficiency of such RNA structure was calculated using four main computational methods. Methods were built using five databases derived from the RNA STRAND or Pseudobase++ databases. The algorithms' values are compared to that of various other optimization techniques. On all databases, the conjunction of GA and SA (GA-SA) techniques, as well as the other four state-of-the-art techniques.

Keywords—Simulated Annealing; RNA framework; metaheuristic methods; Genetic Approach

I. INTRODUCTION

All living cells contain ribonucleic acid (RNA), which is an important biomaterial. Transcription and translation are the fundamental features of RNA [1]. RNA polymers play a variety of additional important roles in biological activities, including transporting genetic data, regulating gene transcription, and acting as catalysts [2-4]. It is vital to determine the configurations of RNA to comprehend its operations. Physical technologies of estimating RNA architecture, such as X-ray crystallographic NMR, is costly and time [5]. pseudoknot was the RNA secondary structure in which is stem's unmatched leading nucleotides are coupled with the stem's unbalanced inward region.

Two optimization and famous metaheuristic algorithms are Genetic algorithms and Evolutionary Computation [6]. To benefit the local search heuristic, the simulated annealing algorithm was introduced [7]. It could be used as a metaheuristic for both local and global searches. In most cases, evolutionary algorithms are employed in the search strategy. Numerous studies have employed simulated annealing or evolutionary computation to forecast RNA pseudoknotted structure. The knot method depends on the Genetic Algorithm [8]. Itcreate an x n matrix to represent an RNA secondary framework of duration n. Several rows or columns as in incoming RNA sequence were used to designate essential nucleotide [9]. An I nucleotide and j nucleotide, for instance, is represented by row I and column j, respectively. This same value matrix[i, j] = 1 if a member in the matrix is a conventional Watson-Crick base couple or Wobble base couple (GU); otherwise, matrix[i, j] = 0. After the matrix has been filled, a list of the greatest stems, known as the stems list, is generated [10]. The structure and composition of RNA are then built using various combinations of the maximum stems. An optimization algorithm was then used to determine the best solution with the least amount of free power.

For the adaptation calculations, two alternative thermodynamics, power systems were used. Itemployed the same power spectral density in the alternative stem strongly indicates [11]. Itused the updated (D&P) electronic model to updated attributed as an optimization process to evaluate the fitness for individuals in the genetic method. For confirmation of GAknot, itused two databases. The PK168 database, which was acquired from, features 168 RNA pseudoknotted molecules. Another is HK41, which contains 41 elements and is made up of a subgroup of the frequencies used in HotKnots [12]. The main benefits of their technique are that ithave removed the constraint on single development or have made certain changes to the contractors and chromosome structure to boost reliability.

II. RELATED WORKS

Another methodology that enhanced RNA secondary structure prediction employing pseudoknots used a customized version of the free energy function. The DP09 estimation algorithm is used to develop a new proposed scheme. Itbegin by selecting 1057 RNA investment framework pseudoknots from the RNA STRAND database [13] as the training sample. The branches of each chain are then extracted from the learning algorithm and scanned to produce lists of 1-meters, 2-meters, or 3-meters, correspondingly. K-meter was subsequence of such RNA classification which is k segments long. Following that, itcalculate the counts of each k-mere sequence. The optimization algorithm or the GRASP approach is used to create an approach for predicting RNA secondary framework. The GRASP technique's biggest benefit is that it incorporates the benefits of the search algorithm, neighborhood approaches, and excessive heuristics. Itcalculated the free electricity of the RNA secondary configuration using the Turner framework since 2004. The findings demonstrate that the technique outperforms the other approaches [14]. The biggest drawback is that they've only performed with smaller patterns, and the best option isn't always confirmed.

An approach to forecasting RNA secondaryconfiguration of pseudoknots predicated on evolutionary algorithms. Initially, the largest number of consecutive complimentary base couples is determined. K consecutive base pairs are complementary sequence couples of the form (i, j, k), when i or j were the component locations and k was the amount of consecutive basic couples. The requirement [15] should be met by the base pairs. New nearby nations are created at random using subsequent nucleotide sequences. The annealing system's scheduling attributes are created to gradually reduce the temperature until the RNA structure was solved with the least amount of available electricity. The methodology does not use a thermodynamic framework; instead, it uses sequential basepair stacks to estimate the free electricity of the RNA structure [16-17]. Employed 10 RNA pseudoknotted transcripts from the PseudoBase collection to test the method's capability. The computation median Responsiveness and PPV are 92.6 and 84.3, correspondingly, according to the outcomes.

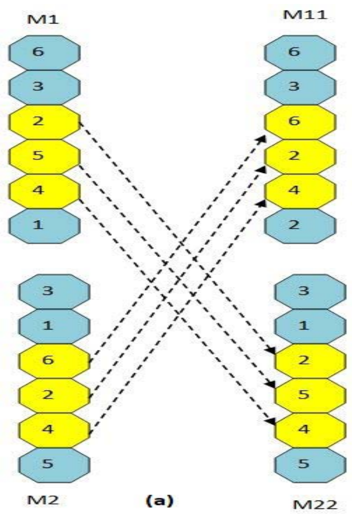
III. Proposed Methods

We used the Simulated Annealing and Genetic Algorithm to estimate RNA secondary system, pseudoknots, in this study. Italso employed the Evolutionary Algorithms but also Simulated Annealing to create two hybrid technologies. GA-SA or SA-GA were the names to the techniques. GA is employed for worldwide searches, whereas SA should be used for local searches in GA-SA. In the SA-GA system, on either extreme, GA was employed for global search, and SA was employed of exploration strategy. There are three basic stages in the methodologies: initiation and population development, iteration, and termination or assessment are all steps in the process.

An RNA pseudoknotted sequence of length n is fed into the population process. Then an unfilled collection named a board of size n n is created. Both the column or row is classified, with the denoted containing the sequence's is a nucleotide. The panel is then covered with the numbers of the set, v = 0 and 1. A stem integer is selected at random from the original population. For each index in the branch quantity, a stem could be taken from the stemmed list. Assume that a stem is expressed (p, q, l). While p denotes to stem's beginning location and q denotes the stem's ending location. In the matrix, p corresponds to I and q corresponds to j. A person is selected at random from the community. The input signal is 21 characters long. As a result, a list is formed, with all integers filled with a dot. From index 19 backward, five opening parenthesis is provided for the stem. The stems of stems 1, 5, and 2 are overlapping. As a result, the architecture is unaffected by these stems. Several alternative possibilities are available for branch 3. First, because the stems are overlapping, branch 3 cannot be inserted. Second, for stem optimization, we can substitute stem 4 with stem 3. Finally, compute the power of both intersecting stems and keep the one with lower power. This method might also be used with the other branches. A helix with fewer seems, on the other hand, generally has more favorable free electricity.

The Genetic Algorithm (GA) is a search-based improvement approach that focuses on biological and ecological choice concepts. It's a well-known approach for finding perfect and nearly-optimal responses to NP-hard temporal making this change. To find the best responses, itused three GA technicians: overlap, evolution, and survivor's choice.

Biological confluence is comparable to the mutation operation. More than one parent is chosen in this function, and one or more offspring are generated. We chose two parents in our method and have them cross to generate two new offspring. Crossover can be carried out in a single location, multiple points, or uniformly. The consistent overlap could undermine the favorable solutions if a single mutation occurs produces a practically identical solution. Itchose a two-point crossover predicated on our retraining research. Two chromosomic, m1 to m2, were randomly selected for community, as seen in



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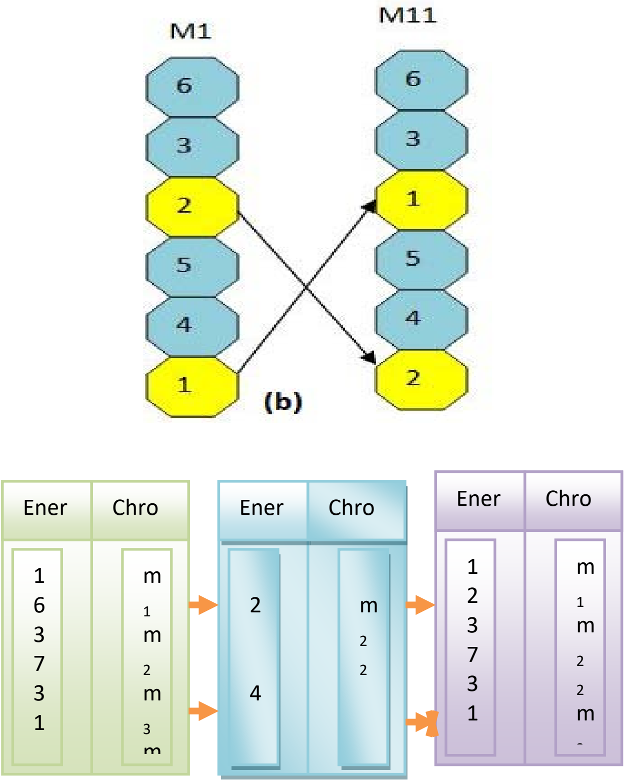

Fig.1.GA 3 Techniques (a) Crossover, (b) Mutation and (c) Selection

Figure. 1(a). To determine the crossovers locations that break each chromosome's three segments, two random digits x and y in the range m1 or m12 were created.For this study, an alternative database called DCC06 to 20 RNA pseudoknotted sequences isselected. The coefficient of Determination improved from repetition 80 to 200. There was no discernible improvement in outcomes after 200 (up to 1000) repetitions. As a result, iteration = 200 is chosen as the optimum number. According to the findings of the experiments, PopSize = 70 is the best fit for achieving improvement. A tiny population may lack all branches, whereas a huge population may have double chromosomesMutation Rate set between 0.05 and 0.4, and the value Mutation Rate = 0.1 yielded the best results. CrossoverRate was also tested from 1.0 to 0.65 before being set at 0.85. A final assessment was conducted using all of these attribute values. It obtains the following result: F-measure = 87.34.

IV. Implementations

The configuration phase utilizes information to Primarily consist or generate the first community. The optimal solutions of the chromosomes are determined at the start of the repetition, and the fittest chromosomes are chosen. The identified community is then subjected to evolutionary algorithms. If no crossover occurs, the offspring is a carbon duplicate of the parent. If it is a crossover, the kids are required up of both fathers' chromosomes. During the crossing, there is no transformation, the progeny is collected without alteration. When a mutation is executed, a portion of the chromosome is altered. CrossoverRate and Mutation Rate are two variables that specify how frequently crossover and mutation will occur. The performance index of the new demographic is computed after each repetition, and the best members are chosen. Variants continue until the halting criteria are satisfied.

The technique of heating systems, copper to modify its internal structure is known as tempering. The metal's new framework is gripped when it cools, and the alloy preserves its newly acquired qualities. Simulated Annealing is a software method that imitates this natural event (SA). The temperature is maintained varied during the crystallization process. The heat is set very high at first, then gradually decreased as the process progressed.

Characteristics employed in SA are listed in Table 1. A variable particular method is summarized in Table 2. The same database that was employed in GA is being used in the procedure as well. This same effectiveness was F-measure = 74.7 when the weather (T), short (T 200). A coefficient of Determination is increasing for temperatures between 200 and 500 degrees Fahrenheit. There was no notable improvement in outcomes after 500 repetitions, and the F-measure was set to 91.3. As a result, T = 500 has been chosen as the ideal temperature range. According to the findings of such tests, PopSize = 70 is an optimal value for maximizing performance. Figure 2 depicts the parameter estimation curve for SA.

TABLE 1.RNA STRUCTURE SA CHARACTERISTICS

Symbols	Description
T	**Intital temperature of the sytem that is decreased over time**
PopSize	**The population size or the no.of individules in the population space**

TABLE 2. PREDICTING THE RNA FRAMEWORK

Serial No.	Temperature Celsius	F
I	250	73.8
II	350	83.7
III	450	90.8
IV	1000	90.8

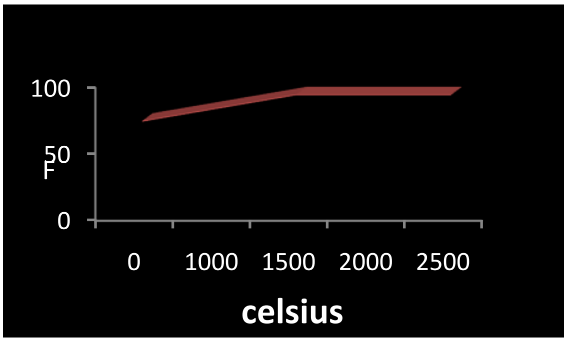

Fig.2.SA parameter modification

Figure 2: SA variable modification The values are defined numbers at the start, but the first community is created. The majority's initial energy is determined, and the person with the lowest energy is chosen. Each cycle generates a set of that individual's neighbors. The person with the minimum energy is chosen from the group of neighbors. For RNA secondary structural characterization to pseudoknots, designers merged to create GA-SA, a hybrid

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approach. On the result of GA, we employed SA of exploration, strategy or SA of explorationengine in this methodology. The GA-SA algorithm was run using the same variables as the GA and SA methodologies separately. GA and SA techniques have some drawbacks in this strategy.

As a consequence, we're considering integrating SA-GA to re-search the optimum outcome to shorter stem portions. Another drawback of GA is that it is prone to become caught in a local optimum. Due to the negative influences of its employees, GA occasionally loses better alternatives. An alternate careful evaluation, such as the Gaussian distribution, could be used to compute the likelihood of refusing or adopting a new construction. A minimum guaranteed position could also be found by searching in varying configurations of a person. This could be accomplished by hybridization techniques such as GA GA or SA SA. The analysis revealed that a hybrid GA-SA system outperforms a single GA and SA system.

V. Results and Discussions

To test our methods, we selected five different data sources. The variable sample was chosen with D-CC06, and the test was conducted with another four. The datasets employed in CC06, Evolutionary Computation, and Simulated Annealing are denoted in the chart as D-CC06, D-SA, and D-GA, correspondingly. IPknot yielded the PK168 database, which comprises 168 pseudoknotted RNA sequences, and the HK41 set of data, which includes 41 sequences. On Windows, the techniques were written in Python. For each sequence of the suggested technique, itaveraged the results often runs. Awareness, Positive Predictive Value (PPV), F-measure, and Protein Interaction Integrity are all measures of prediction accuracy (INF). Reflectivity is characterized as the measure of positive examples of the overall amount of positives in the actual course. In a prediction category, the PPV is roughly proportional positives to total positives. The F-measure, which is a proportional evaluation of excitability and PPV, is the weighted harmonic estimate of resonance or PPV. Matthews' coefficient of determination of connection prediction, often known as INF, is a measure of how accurate a prediction is. The following are the numerical expressions for exposed, PPV, F-measure, or INF:

Basepairs are considered positive in RNA structure, while free bases are considered negative. As a consequence, anticipating a correct base pair is TP, whereas failing to forecast a base pair is FN. TN denotes omitting away free bases as such, whereas FP denotes transferring them as a specific gene. Designers did not use TN in RNA-PSPP because it is not specified formulae.

TABLE 3. Comparison performance measures

Dataset	**GA**	**SA**	**GASA**	**SA GA**	**Result of the algorithm mentioned in references**
PK168	90.54	80.12	83.47	81.76	74.10,73.4,71.5
HK41	75.65	77.55	88.52	98.22	76.1,76.23,56.75,67.01
DGA	88.66	88.55	40.58	95.25	80.87

TABLE 4. Comparison of proposed with existing system

Dataset	**GA**	**SA**	**GASA**	**SA GA**	**Result of the algorithm mentioned in references**
PK168	100.54	82.12	83.47	86.6	76.88,76.5,74.6
HK41	77.55	70.145	84.51	97.44	75.6,7.30,54.50,76.51
DGA	93.47	87.50	77.80	98.60	85.87

Table 3 related that GA-SA would be the greatest PPV in the D-SAor PK168 databases solely, and the HK41 database includes the SA-GA method. On the D-GA database, the technique has the greatest PPV. Furthermore, the PPV of all four of our methods is greater than the PPV of the methodology database. The GA-SA method has a great outcome on all databases, as shown in Tables 4. In addition, SA-GA, along with GA-SA, has a high score on the DGA database. In comparison to previously created algorithms, four of methodologies would be a greater F value or INF. In respect of F value as well as INF, GA-SA method outperforms the database technique.

These optimization methods, SA-GA or GA-SA, exceeded both pure GA but also SA techniques as well as connected comparative methodologies. Designers talked about the drawbacks of using GA or SA to establish our technique, as well as the reasons for and benefits of convergence. For the choice of stems, we employed a variable called u. It aids in the reduction of huge sequence processing time. Itsplit larger RNA architecture branches into numerous smaller stems during hybridization. As a result, the low-energy branches are more thoroughly investigated. The performance of the two methods was significantly improved as a result. We've also used a large data set to refine the methods. That was extremely useful in determining the optimal number of criteria for the algorithms. As an outcome, the technique gives better outcomes when such deserve the right are used. For its smart optimization method, decomposition of huge branches, and full energy estimates, GA-proposed SA's hybrid metaheuristic methodology attained the highest results.

VI. Conclusions

This paper describes an implementation of the Evolutionary methodologies or Simulated Annealing to RNA secondary configuration determination including pseudoknots. The construction to SA-GA or GA-SA optimization methods of tackle the issues is our vital contributor to this research. One of the most difficult jobs was implementing GA to the persons established by SA and implementing SA to GA persons. To determine the optimum RNA structure, four energy estimates were used. The energy calculations for pseudoknotted and pseudoknot fewer structures have been established. In the hybrid version, the local search algorithm looks for all feasible structures based on the results of the universal query optimizer. Almost every type of pseudoknot may be found in our database. It can anticipate pseudoknots of the second element. It cannot, nevertheless, anticipate exceedingly complicated pseudoknots. The findings show that GASA and SA-GA perform significantly better than solo GA or SA outcomes. The GA-SA and SA-GA techniques outperform established methods. The GA-SA algorithm predicts RNA structures

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with both short and long sequences quite well. On all databases, GA-SA outperforms three techniques and all four state-of-the-art technologies. In the future, these techniques could be extended to evaluate performance using alternative energy assumptions.

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Identification of RNA Structure Over the Protein Surface Using Neural Network

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Abstract—In post-transcriptional control, protein-RNA interactions are crucial. Estimating the relationships from a protein sequence, on the other hand, is challenging.We demonstrate that localized physical properties of proteins sequence surfaces may be used to estimate qualities like RNA backbone component bonding preferences and various bases employing a deeper learning method called Nucleic Net.Nucleic Net could reliably reconstruct association forms identified through structural science investigations on a wide range of problematic RNA-binding enzymes, including Fem-3-binding-factor 2, Argonaute 2, and Nuclease III.Additionally, we demonstrate that Nucleic Net could obtain agreement with tests like RNA compete, Immunohistochemistry Test, &siRNA Takedown Benchmarking even without witnessing either through Vitro and in vivo analyte results.Nucleic Net may therefore be used to anticipate probable binding slots & binding RNAs for earlier discovered RNA interacting protein, and it offers statistical efficiency for RNA patterns in specified interaction sites.

Keywords—Protein-RNA; Fem-3-bind; NucleicNet; binding RNAs

I. INTRODUCTION

mRNAs experience several interweaving events following transcribed before becoming converted into functioning proteins [1].Contacts among RNAs and RNA-binding proteins were often used to regulate such post-transcriptional controls, that offer cells more options for fine-tuning their proteomes. RNAs were substantially controlled in organisms with 2 modalities of particular encounters: straight identification of RNA motifs on the RBP surfaces or an indirectly RNA-guided method [2-5].In the first scenario, the RBP comes into immediate touch with the RNA strands.The Pumilio FBF family, for example, can govern translating by direct base-protein interaction, such as UGUR patterns on RNA transcripts1.The RBP interactions with the core or non-Watson-Crick sides of the base in its later situation, allowing WC-edges for targeted identification [6].Specific insertion of a guide-RNA onto its RBP is required for engaging essential enzyme of RNA interfering and gene-editing complex, for illustration.The WC margins of gRNA are subsequently used to identify its targeted D/RNA, whereas other sections of the gRNA stay in interaction with the RBP [7].Knowing the roles of RBPs, discovering RBPs, and creating RNAs for RBP identification and control all hinge on knowing the selectivity and processes of RNA-protein connections.

The emblem image for every RBP or analytic ratings on specific RNA sequences may be used to depict specific trends acquired using these approaches is generally [8].Interacting processes for several of these described RBPs, including hnRNP, Nova, and PAZ, have also been elucidated using structural deconstruction approaches. Despite these accomplishments, experimental tests are limited by reaction, detecting, and scaling constraints [9].Although pyrimidines were higher photo activatable than purines, Ultraviolet crosslinking tests preferred uridine-rich patterns. However, ribonucleoprotein co-crystals could plausibly confirm the biochemical basis of the tested particularities, one and a several like these co-crystals would barely describe the confusing patterns on emblem diagrams [10].Computational techniques can help improve experimental outcomes in that regard. The body of sampling research findings, assays, and frameworks can be improved in this genre to find previously misunderstood/unacknowledged specific features. Exemplary test-based computer techniques, such as Deep Bind and variations, may combine and educate over RBP assay information to predict a specific pattern that is compatible with widescale experiments [11]. Other structures haven't been thoroughly investigated.

II. RELATED WORKS

Provided a three-dimensional protein shape and its amino acid sequence, these last techniques often, with the unit of residue, regional protein sequences contexts, and additional structure data may be retrieved, and RNA-RBP sequences from the Protein Data Bank [12] were employed to build algorithms. As a result, assay-based approaches are less reliant on experiment information, to begin with [13].Nevertheless, because of the minimal number of characteristics accessible, their prediction value is restricted to distinguishing RNA-binding regions from non-binding sites, i.e., Binary prediction based on protein residues positions and scores lacking the favored base/sequence and other revealing contact modes [14].Computation procedures, on the other hand, are scaled and cost-effective, making them useful complementary to experiment methods.

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Nucleic Net is evaluated using information from three main references, structure, in vitro, and in vivo investigations, 2 tests were performed on structure information, one in comparison to an exterior reference, and the other in the absence of an exterior standard [15]. We demonstrate that Nucleic Net could successfully distinguish RNA-binding regions from non-sites on protein interfaces, outperforming all current sequence-based techniques and When comparing to our non-redundant 7-class database, which we properly built, Nucleic Net has a class-averaged AUROC of 0.77 for all 6 RNA components and non-sites, and 0.66 for its 4 bases, demonstrating how it could identify RNA components. To test the correctness of our Nucleic Net PWMs in working with RBPs that effectively identify RNA patterns at the interfaces through vitro, we used an RNA competes for assay. In all eight cases, we demonstrate that Nucleic Net PWMs are similar to RNAC PWMs in selecting optimal interaction 7-mers from all conceivable 7-mer sequences without further coaching just on test results [16-17].Ultimately, we also looked into downstream possibilities that may be useful in vivo RNAi research. We demonstrate that the Nucleic Net scores may describe in vivo asymmetries in humans Argonaute 2 guiding string loads as well as the varying knockdown rates in differential siRNA configurations [18].

III. Proposed Methods

In this paper, we offer Nucleic Net, a structure-based computing system that tackles the following issues: We devised methods of effectively learning from the PDB, allowing us to anticipate contact types for various RNA components – phosphate, ribose, adenine, guanine, cytosine, uracil, and non-site – and display these on any protein surfaces. Its logo diagrams and placement weight matrices (PWMs) acquired to Nucleic Net could also be used to grab a codified possibility in personal RNA segments; an emblem drawings and placement weight matrices (PWMs) acquired to Nucleic Net could be used to rate the binding possibility of individual RNA segments; Nucleic Net demands no outer assay insight to extract logographs constant to assay information, which include RNA compete, Immuno precipitation Test, &siRNA.Nucleic Net could be employed to discover unique RBPs and their interaction pockets/preferences by explaining over diverse RBP families. Our workflow is based on the FEATURE vectors architecture, which uses high-dimensional features vectors that represent physical information on proteins interfaces. Because of the discontinuous radically dispersion design, this rich vector field not only covers most characteristics produced in previous applications but can also compensate for small changes in local topology. Because training from such a high-dimensional input field is difficult, deep residual networks are developed and developed for this task.

IV. Results and Discussions

Our objective in Nucleic Net is to forecast whether the physicochemical atmosphere offered on-site is appropriate to interact with an RNA and if so, the binding preferences to every sort of RNA component on every position of a protein's interface. We recast the issue as a guided seven-class categorization issue in terms of computing. As a result, we develop a Nucleic Net end-to-end teaching as shown in Fig.1. In begin, surfaces positions of ribonucleo protein complex were obtained from the PDB & classified into seven groups, each of which corresponds to coupled RNA components and non-RNA-binding sites. The FEATURE software is subsequently used to describe the physical atmosphere at every site. Then, in such a hierarchical way, deep residue networks were groomed to correlate every physical atmosphere to any of the seven categories (see Fig. 2). Lastly, the network's variables are tuned using typical category crossing entropy losses back propagation. Notice that all teaching information came from three-dimensional components in the PDB; we didn't employ any information from outside experiments. After Nucleic Net has been trained, raw surfaces feature retrieved with FEATURE on the question protein's surfaces site may be used to infer binding preferences for every category on a location-by-location premise.

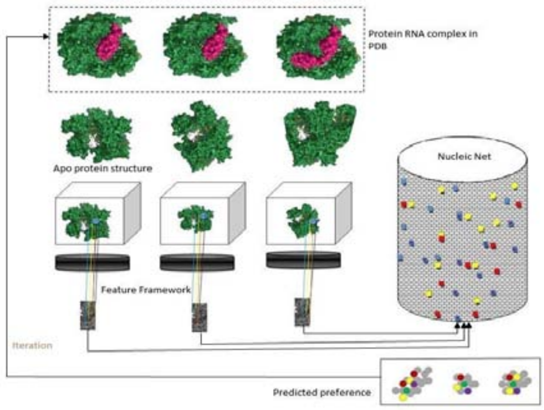

Fig.1. Proposed System

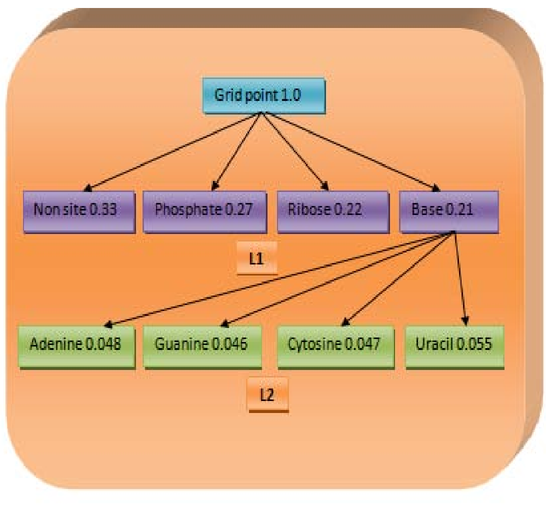

Fig.2. Performance of data statistics

On a location-by-location level, a connection to every category. Not only were binding locations of all 6 types of RNA components anticipated and displayed on the surfaces of protein, but such precise data may also be integrated into logo drawings or score interfaces for RNA sequence, which separates our technique from preceding studies.As a result, a feed-forward module's output would be bundled into 3

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power components: a Visualization subsystem which displays top expected RNA components as a ground storyline (see Fig. 3a–c), a Logo Diagram subsystem that creates the logo diagram, and a Logo Diagram subsystem which creates the emblem diagram. The hidden Markov system, which encompasses both the positions of the base and the geometrical restrictions for possible RNA patterns, may be described as the latter two components (see Fig.4).Our estimates are compared to structural biology studies using the Visual component. To evaluate our estimates to in vivo or in vitro test information, we employ its Logo Diagram & Score module.

Fig.3. Binding motion prediction

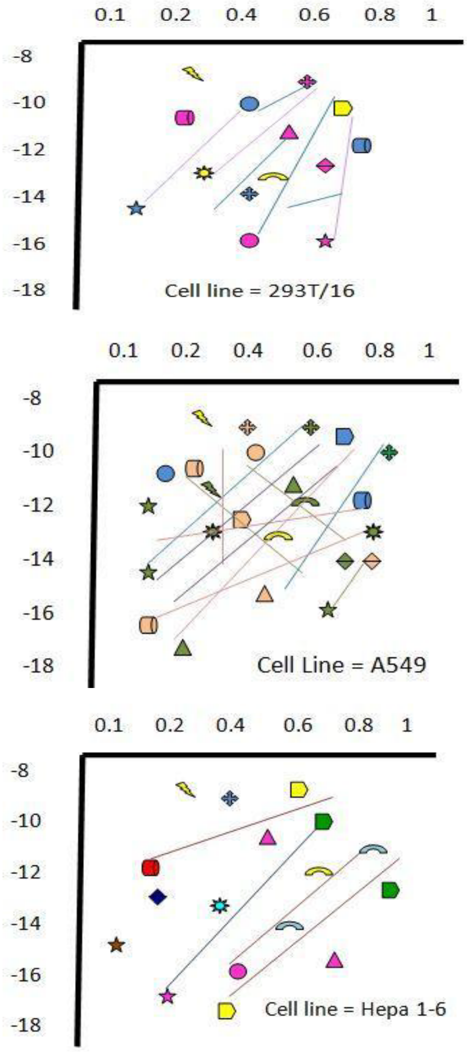

Fig.4. Experimental analysis

Validation scheme

From established ribonucleoprotein structure from the PDB, a variety of verifiable basic truths may be retrieved. Firstly, we use a binary categorization to separate RNA-binding proteins from non-RNA-binding residues. Many computerized predictions on protein -RNA interaction handle this basic challenge. In general, a protein residue in a co-crystal is deemed RNA-binding if at minimum one of its elements is at a specific range from RNA molecules. Both 3.5 Å and 5.0 Å cutoffs were evaluated in the last few research. The benchmark RNAT database, which includes 175 RNA-binding protein chains, was created by grouping protein chains based on their sequencing and structure similarity and then transferring annotating of RNA-binding residues between comparable chains to mitigate the impact of strands error types.We compared Nucleic Net against a wide variety of state-of-the-art classifiers based on sequencing data using this grounding reality (see Fig. 2).Employing our Nucleic Net prediction, which operates on grid cells across its protein surfaces, we assigned the binary tag to every protein residue, The voting for two coarse classifications, RNA binding site, and non-site was based upon scoring matrices around 30 grids neurons nearest near a proteinresidue.'RNA-binding site' refers to the six finer classifications. Reference proteins are not tested throughout learning. Nucleic Net surpasses all other approaches in each of the abovementioned length cutoff values (see Fig. 2). As the result, Nucleic Net's fundamental applicability as a method for predicting universal RNA-binding locations is demonstrated.

Its capacity of Nucleic Net to extract interaction locations for the six specific RNA components presented is next assessed, this comprises Phosphate, Ribose (R), & other sugars. Cross-validation was done using a properly chosen and vetted non-redundant database comprising all protein-RNA complex architectures from a PDB, that has 158 complex architectures & around 280,000 grid cells. The 158 proteins were sorted into 3 folds. Two folds are employed for teaching and one-fold for assessment every session. BLASTClust structural homology of less than 90% was prohibited across folds. Individual proteins, rather than grid cells, are a resolution of the pass, that reduces bias for protein length. Every class's achievement in terms of AUROC, F1-score, Accuracy, and Recall. On the mean, an AUROC of 0.66 may be obtained for the base. Surprisingly, an AUROC of 0.97 recapitulates its ability to distinguish between site and non-sites. The reliability of each protein's category classification is also evaluated.

Structure-based approaches have the advantage of being able to uncover and identify binding sites on proteins interfaces. Although earlier structure-based approaches could only show binary categories, our approach can show all six typical RNA components in more detail. Three sample RBPs are used to highlight the specific ability of their technique: Refer to Fig. 3a for Fem-3-binding-factor 2, Human Argonaute for Fig. 3b, and AquifexaeolicusRibonuclease III for Fig. 3c.RBPs that bind directly with single-stranded RNA motifs via base interactions, such as FBF2, are an illustration, hAgo2, on the other hand, is an RBP that works in an RNA-guided way via backbone or non-WC edge interactions. AaRNase III, the 3rd instance, has a double-stranded RNA-binding domain. Employing the displayed tool, we show the top anticipated binding locations on such proteins in every interaction category in Fig.3. Following extracting RNAs from the ribonucleoprotein combination, projections are generated on

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the protein architecture in all instances. Many of these proteins, as well as their homologs, was left out of the instruction. Whenever nucleotides engage specifically to protein residues while superposed on a ribonucleoprotein architecture, we see a substantial predilection for nucleobases, as seen in the central panels of Fig. 3.Sequencing logo diagrams were created by average the Nucleic Net rating at nucleobase sites on the lengthy natural RNA thread in the bottom panel of Fig. 3.Nucleic Net has successfully recreated the exact binding selectivity acquired by structure biology investigations in all situations.

Duplexes with such a guiding strand rotational speed with less than 25 RPM are often removed, leaving 222 duplexes for testing. A histogram of Nucleic Net score differential QguideQpassenger among the guiding and guest threads of each duplex is generated for every dataset (see Fig. 4).As per Nucleic Net research, the favorable differential suggests that the guiding was anticipated greater positively than the passengers when binding, that is the intended consequence. In conclusion, advantageous changes may be seen in 76% of the examined duplexes. A paired T test and a Wilcoxon indicated rank test was used to determine the statistical importance of such variations. In all samples, both analyses passed the p-value 0.005 criteria, demonstrating Nucleic Net's capacity to estimate short RNA asymmetries determined by a vivo scenario. Varied guide sequences having various loading effectiveness can impact RISC construction in siRNA reduction studies, resulting in varying silence effectiveness. We examine how effectively Nucleic Net's projected guide-hAgo2 connections may describe such disparities. In this case, we gathered knockdown standards for shRNA licensed by the National Institute RNAi Consortium through a company's webpage and compared them to the Nucleic Net value.Econometric analysis was performed independently on every item to account for the variation of cell cultures and targeted proteins and was limited to objects with greater than an information value. Trends are removed from entities having a knockdown frequency variation of less than 0.1.

To study RNA-binding characteristics of proteins, experimental tests and assay-based computational techniques are critical beginning points. Nevertheless, because atomic and topological features of RBPs were removed from research, little could be deduced regarding the overall chemistry of base-protein interactions, i.e., the source of specificity, except for detecting RNA structural patterns. This knowledge gap might be bridged by clarifying additional ribonucleoprotein co-crystals, according to some. Even as structure deconstruction methods become more conventional and libraries of co-crystals grow, effective strategies to harness this huge abstraction structure information remain elusive. We demonstrate that in a purely structure-based computer paradigm, relevant predictions regarding RNA-binding locations & interactions modalities for RNA components may be inferred simply by sensing the immediate physicochemical surroundings through a large residual network. Most crucially, our findings reveal that these structural lessons may be used to correlate with state-of-the-art in vitro and in vivo behavioral test information, implying that actual RNA-binding relationships with verified biological consequences can be captured. Structure-based paradigms, on the other hand, are subject to several restrictions. For starters, the specialization that is additionally maintained by RNA–RNA interactions were not taken into account, in ribosomes, for instance, the RNA contents outnumber the amount of the protein by many folds, allowing mistakes in RNA–protein connections to be balanced by RNA–RNA interactions33.Those proteins were not included in our study since they are not found in our database. Furthermore, base stacking, base-pairing, and bulges can aid RNA-protein interactions mechanisms in some circumstances, such as in FBF2 and RNase III.

V. Conclusions

Despite their distance from the protein surfaces, those portions can influence enthalpic/entropic cost during the interaction process and so should not be overlooked. Structure-based approaches of ribonucleoprotein complexes could be expanded in the coming to include retraining using RNA-structure annotation & RNA-relevant physical characteristics; This might be useful in figuring out how target-D/RNA binding works in RNA-guided machines like Argonautes and CRISPR/Cas. Lastly, protein movements in RNA-binding processes are ignored by structure-based techniques. For integrate RNAs, Argonaute and RNase III, for example, might need substantial structural modifications. Furthermore, when a protein binds to distinct RNA strands, it might experience structural alterations. Nevertheless, the overall advantages of structure-based approaches for retrieving chemical binding specificity sequences are significant, and this genre might soon become widespread.

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Genome Based Computational Technique to Identify the Functional RNA in Protozoan Parasites

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***Abstract*—Operative RNAs, including non-coding RNAs (ncRNAs) and cis-acting RNA elements involved in posttranscriptional genome regulation, are found based on two distinct computerized examinations of Trypanosoma genomes. Based on compliance with comparable trypanosomatidLeishmaniabraziliensis, the expected possible ncRNAs are discovered in the first analysis. Several of the expected ncRNAs are novel categories having undetermined characteristics, such that predictions have a low estimated incorrect fraud threat. This research uncovered several mechanism regulatory motifs in the subsequent research we used to develop a classification that can distinguish between actions that aren't identical. The first genomic sequence analysis of trypanosomatidfRNAs helps focus the research on practical approaches and accelerates the discovery of those elements. These functionality predictions classifiers built upon cis-acting regulation regions may potentially be used to offer homology-independent annotating for the trypanosomatid genome when combined with existing approaches.**

Keywords*—*RNA elements, gene regulation, trypanosomatid genomes, ncRNA, trypanosomatidfRNA

I. INTRODUCTION

Functionality RNAs (fRNAs), and RNA components functioning on the RNA levels, were being extra acknowledged as their extensive architectural, regulation, and catalysis activities are disclosed [1]. Another type of fRNAs is the cis-regulatory factors found inside the 5' and 3' non - translated sections (UTRs) of mRNAs, primarily engaged in post-transcriptional control of gene activity [2-4]. Current advances in computational approaches for fRNA predictions have revealed a large number of RNA components that are engaged in post-transcriptional regulation mechanisms. While important in numerous organisms, post-transcriptional control is particularly important in the class with multicellular worms known as trypanosomatids. It is the primary method for regulating gene translation.Trypanosomatids, including Trypanosomabrucei, Trypanosomacruzi, and many Leishmania species, cause significant human & animal infections with a higher frequency and fatality rate if left uncontrolled [5]. For trypanosomatids, genomes are translated as polycistronic mRNAs, then trans-spliced [6]. Numerous cis-acting fRNA factors, including in U-rich components (UREs), shorter intervening degeneration retroposons (SIDERs), and others, are involved in genes translation control, which happens mainly around or following spliced [7]. Those features primarily control mRNA integrity or translational rates by interacting with various trans-acting proteins, several of which are unidentified [8]. While little empirical evidence has been discovered, this has lately been suggested that miRNAs may function in post-transcriptional genome expression.

II. RELATED WORKS

Comprehensive functionality experiments with numerous organisms bearing expulsion mutations of the putative regulatory region are required to identify cis-acting fRNA components experimentally [9]. The scenario of ncRNAs isn't much clearer since it's unclear where in the genomes there must be looked for & how that screened research must be conducted. Because of the absence of significant conservation markers within their sequencing, automatic recognition of fRNAs using genomic patterns was not as reliable as recognition of protein-coding RNAs. Which were exceptionally trustworthy based on analytical and technological evaluations, it provided a computerized analysis of the genomes for T. brucei and L. braziliensis in the hopes of discovering a group of preserved ncRNAs.We showed that this technique could identify a significant variety of possible ncRNAs, both identified and unknown [10-11].We look at possible Premi RNAs within prospective ncRNAs and find that the occurrence of miRNA sequences maintained across T. brucei and L. braziliensis was very improbable. We also employ a new strategy for identifying shorter regulation RNA motifs in T.brucei genomes' 5' & 3' UTRs, which are homology-independent [12-13].

Those motifs list the more operationally relevant sections of possible cis-regulatory fRNA components to go along with our projected ncRNAs. Such regulation patterns could be employed for predicted genetic activity and provide fresh suggestions into the regulatory processes for protein production in T. brucei.

III. PROPOSED METHODS

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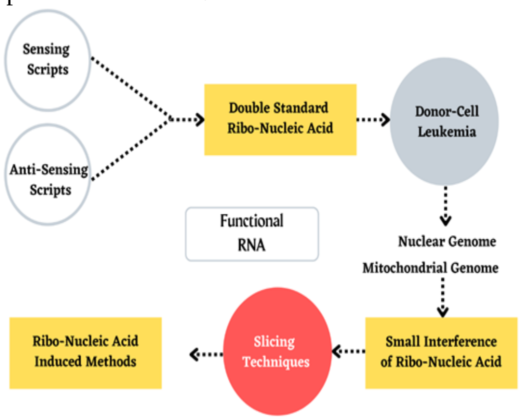

Fig.1.Proposed Model for Identifying Functional RNA

Fig.1 represents the sample model for identifying the functional RNA using computational techniques. The binomial-based method was used to find preserved genome areas. Shortly, after disguising LCRs with mreps, the 2 sequences of T. brucei and L. braziliensis were matched for so every screen of 25 nucleobases. N, the quantity of preserved nucleic acids, has been ascertained. This same likelihood of noticing N kept nucleotides out of 25 nucleotides has been estimated under the assumptions of impartial replacement and predicated on binomial dispersion of mutants. Territories demonstrating proof of Lastly, similar areas separated by less than 25 nucleotides are linked together to form a unique area.

QRNA was employed to find sections of the same genome areas that retained structure RNA component sequences. Long sections were broken down into 80-nucleotide overlapped chunks, one of them overlapped by 40 nucleotides alongside the neighbor segments. Intersecting regions having RNA values greater than 0 were consolidated, QRNA values were reassessed, and probable f RNAs containing final positive RNA values were chosen. The proportion of preserved encoding regions identified as fRNA was used to compute the ratio of the erroneous positive. LCRs were calculated using TIGR's 'mreps' and 'must,' which are denoted in lowercase characters as Supplementary Files 1. This same importance of every applicant has been determined by correlating its QRNA rating to a dispersion acquired by irregularly flipped T. brucei-L. brazilensis pairings: so, every ncRNA person's connectivity was regarded individually, and sections to similar preservation trends have been moved arbitrarily. Sections with gaps were exchanged with just too many gap-containing sections, mismatched with the discrepancy, and compared with the game.

FIRE, a newly created method, can detect DNA and RNA motifs that are redistributed throughout distinct sequencing groups, i.e., were highly represented within specific groupings but deficient in another. We employed FIRE to find themes that are spread disproportionately across various activities. First, T. brucei functionality classifications were obtained from the KEGG pathway dataset. It divided these genomes into 2 categories, with each route depending on whether or not people are engaged with this pathway. Then we employed FIRE to look for 5' and 3' Unique registration motifs which were significantly overrepresented and underrepresented within one of the 2 groups. Based on newly reported splicing position estimations, the genome of matured 5' and 3' UTRs were recovered in T. brucei genomes. The motifs generated by the various algorithms were gathered, and duplicated motifs were deleted.

Because KEGG employs an automatic workflow to allocate genomes into templates routes depending on overall similarity with existing proteins, KEGG annotations might never correlate to the specific activity of elements. Nevertheless, we assume that the genome connections will be preserved due to this method. For example, if two genomes were allocated to the identical pathway in KEGG, they are highly likely to have similar activities, especially if the KEGG allocated features were incorrect.We used a naive Bayesian network to predict gene-function connections based on expected regulatory mechanisms in the 5' and 3' UTRs.With a naive Bayes network, the qualities required to classify items are presumed to be unconnected. Considering any collection with identified motifs, the chance for genetic g corresponding to clusters is determined as:

$$A(h \cup \partial | G^N) = \cap_{g_x \partial G^N} A(h \cup \partial | g_x)$$

IV. Results and Discussion

That anticipated false-positive percentages employing coded areas will never apply to noncoding areas. This should be indicated if it has used values other than the RNA grade from QRNA, such as the COD & OTH ratings. However, because translating sequences develop in a particular fashion, QRNA activity might change across coded and non-RNA, noncoding genetic areas. Moreover, RNA architecture in the encoding gene might be targeted for selection. In conclusion, as explained in the section "Identification of Highly Important Candidates," it used a different, exceedingly careful approach to quantify the false positives frequencies of the ncRNA estimations. Addition Item 1 contains the comprehensive listing of every discovered ncRNA variant and its accompanying data. As illustrated in Fig.2, most of these contenders may be classified under multiple homologous groups. This prediction could be deemed highly credible when numerous homologous sequences are separately estimated to be ncRNAs. Cluster 10 is particularly significant because of its size, implying that the members of this class are found throughout genomes at a great rate.It was just postulated that trypanosomatids might employ miRNAs to control the amounts of specific mRNAs depending on a computer examination of the T. brucei genome. This research, however, contradicts our present understanding of miRNA genesis management. Mirna appears to have evolved in a distinct branching of living, albeit convergence development in numerous lineages was not feasible. As this result, we chose to look at probable miRNA precursor amongst our projected ncRNAs using a basic but particular technique that considers a few architectural and thermodynamics parameters for identifying pre-miRNA structures. Employing 250 pre-miRNAs chosen at randomized from 24

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various species for reference sequencing, the accuracy of pre-miRNA predictions utilizing our parameters is predicted to be about 32.4 percent ± 2.1 percent.According to research findings, there are very few retained miRNA genetics in T. brucei. However, it's worth noting that several of the previously anticipated T. brucei miRNAs might be addressing mutant surfaces polypeptides that aren't seen in L. braziliensis. In addition, some miRNAs expected are likely to bind preserved components like the 20S proteasome likely & should thus be anticipated to discover in our analysis if they are preserved. While this would not rule out the existence of miRNAs in its T. brucei genomes, it may imply that its genes should be reexamined for these components.

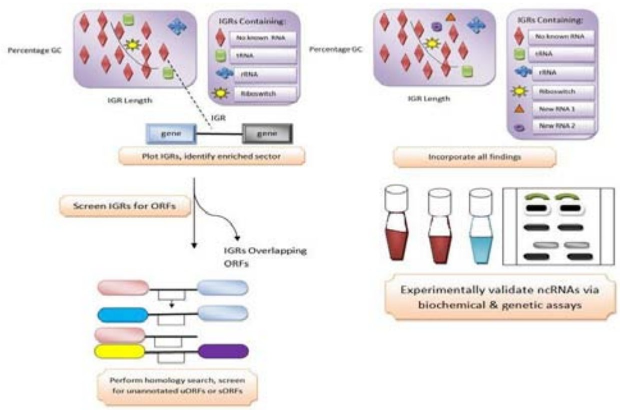

Fig.2. Proposed Architecture of ncRNAs

This was dismissed when a potential ncRNA is exceeded with greater than three randomization variations. This screening process yielded 117 very important unique potential ncRNAs, 53 of that did neither intersect nor were comparable to any documented characteristics of the T. brucei genomes, suggesting that it may be wholly unique ncRNAs (see Table 1). The RNA model, not the COD or OTH modeling, had the most significant rating across the 117 contenders who could never intersect within a decoding sequence, even though it was initially chosen solely based on the RNA score and neither COD nor OTH values. The determined p-value gives an additional, more cautious metric for measuring our program's accuracy. If the majority of the non-coding genomes are made up of non-RNA randomized elements, a p-value of 0.001 corresponds to around 0.887 kbp of false positives.This is more than 5.7 kbp of our contenders are meaningful at this level, showing an accuracy of around 85 percent at this level.

TABLE 1. PREDICTED CLASSIFICATION OF NCRNAS

	With in 100 bp of a non overlapping coding	ncRNA cluster	With in a stand switch region	elsewhere	Total
Overlap psaidogene	1	1	1	30	33
Overlap unlikelyproteins	1	2	2	1	6
HomoloeoustorRNA	1	2	2	1	6
Homologous to rRNA	5	5	3	1	14
Total	8	10	8	33	59

Nevertheless, depending upon its placements, a rough assumption may be made about the ecological role of distinct possibilities. For instance, there are eight unidentified potential components in the surroundings of code sequences. Such components might regulate structures found with between 5' or 3' UTRs of coding segments that regulate post-transcription genes. In addition, the string switching area is also discovered that includes one unidentified potential fRNA. Because polycistronic mRNA production begins at strand flip sites, this fRNA might be a component of the resulting transcript's 5' end. It could be implicated in its localization, post-transcriptional treatment, or control.

We evaluated the occurrence of mechanism motifs in the 5' and 3' UTRs of T. brucei genomes using a homology-independent technique using FIRE, a newly constructed approach. FIRE was found to detect several recognized, and new regulating components in upstream and downstream domains grouped similar on its activity patterns having such a near-zero false positives discovery rate. We employed FIRE to look for 'function-specific regulation components in T.brucei genes' 5' and 3' UTRs: genes with similar activities are frequently co-regulated, implying that they must have identical cis-regulatory components. As a result, grouping genes based on their actions could be employed as a stand-in for grouping transcripts based on the activity trends. This method is especially beneficial in species whose gene regulatory happens mainly at a post-transcriptional stage, like trypanosomatids, where transcripts profile techniques cannot discern the fluctuations of protein production.

It discovered Sixteen mechanism motifs in T.brucei 5' UTRs and 21 mechanism motifs in T.brucei 3' UTRs.Based on the results of running FIRE across ten subgroup pairs with gene-function combinations, we should expect a reliability of 75.3 % for finding mechanism 5' UTR themes & 84.8 % for 3' UTR themes. Most motifs discovered through FIRE had an orientations bias, meaning it primarily appears in a specific direction relative to the coding sequences. RNA patterns are known to have this characteristic. Furthermore, two of the common themes of 3' UTRs have placement biases, which means it likes to be located within a certain distance from the forward decode sequence's final codon. This feature has been seen in various regulating patterns in other species, increasing the likelihood of whether the anticipated pattern can have a biological function.

RNA motifs

It developed a naive Bayesian network that can determine if a genome belongs to a definite pathway based on the presence or absence of patterns within 5' and 3' UTRs. For example, this naive Bayesian network can be used to detect T. brucei proteins for various pathways consistently; see Fig.3, just as fewer themes were required to provide the most significant feasible predicting ability, as illustrated in Fig.3. Introducing more motifs to this classifier, on the other hand, does not influence its predictive strength, making the building of successful nave Bayesian networks easier. It might be possible to significantly increase the functional annotations of T. brucei genomes by integrating our technique with additional functional prediction techniques. Extra Item six contains a

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detailed analysis of functional predictions in T. brucei employing our technique.

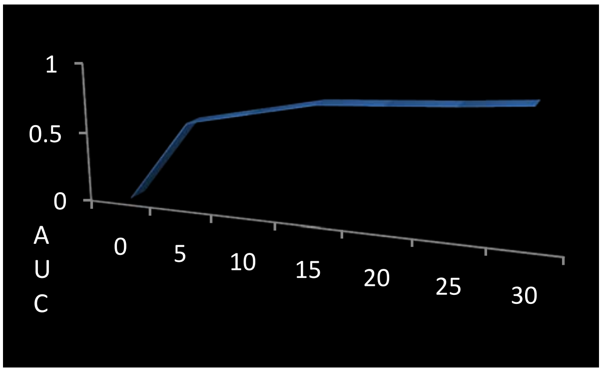

Fig.3. Proposed system prediction using regulatory motifs

V. Conclusion

The ncRNAs identified in this work might be employed in investigations to understand trypanosomatids' operational RNA repertoire better. In addition, the options with no existing homologs are expected to be unique ncRNA classes in T. brucei, making them even more fascinating. Discovering the function of these ncRNAs would help us better comprehend the infections' biology. Nevertheless, because we only looked at two chromosomes for this work, our list of anticipated ncRNAs was much but comprehensive. Analyzing a wider number of trypanosomatid genotypes could uncover additional ncRNAs and offer a more comprehensive picture of those species' non-coding functioning transcriptomic.

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A Computational Technique to Measure the RNA Stability in Structures at the Genome

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Abstract—RNA can no longer be regarded as a single component of the transfer. Conversely, a series of RNA molecules are identified, which revolutionizes our understanding of how cells were controlled. Inside neurons, huge and short ARNs, now make a vast repertoire of biochemical properties. RNA plays an important role in the basic management of vital biologic functions. NRAs, like enzymes, require three-dimensional models to produce them. Despite advances in our understanding of RNA folding and deployment, we still have a limited comprehension of such atomic processes through which RNA molecules become biologically important. Furthermore, because of volatile RNA molecules, it is difficult to quantitatively check RNA structures using X-ray crystallographic or NMR. As a result, numerical techniques to predict ARNs' 3D structure have become increasingly important in the research of RNA performance spectroscopy pathways. The basic principles of the RNA structure are first described, along with descriptions of data sets and methodologies to evaluate individual RNA sub-frameworks, as well as 3D frameworks.

Keywords—genomic DNA; biological RNA; structure elements; Computational techniques

I. Introduction

Enzyme elements, intracellular genetic placement, food production legislation, and development, especially instability, were assumed to alter RNA particles. The structural properties of such a huge category of actions are determined by the (3D) structure of RNA molecules, but also their connection with other nuclei in the cell [1-2]. The figure of actual RNA configurations has increased exponentially, but since the 1960s, when the first architecture was demonstrated, only recently has the rate of new configurations been predictable [3]. In addition, in the late 1970s and early 1980s, the first statistical techniques to predict the linkage of RNA sequence were established. It took another ten years for the Western team to plan the first 3D RNA structure.

Only certain computer-based forecasts of 3D structures of the biggest RNA particles have een made to date [4]. Despite the limited quantity and variety of observed RNA configurations, computer techniques for RNA configurations determination have become one of the primary instruments for assessing phenotypic variation in RNA molecules and its connection to performance [5]. The majority of the available methods are predicated on the idea that RNA folding is a hierarchical mechanism, and that understanding its conformational changes could better determine its 3D configuration better. As a result, computational intelligence methodologies have been implemented in recent decades, which try to anticipate the potential associations of nucleotide sequences in RNA based on its composition.

II. Related Works

Furthermore, the expanding quantity of structure determination of RNA molecules, as well as early seeks to name their patterns, opens the possibility of using comparable methodologies similar to those applied to the forecast structure of proteins. It is, of course, more difficult to estimate large 3-D RNA structures using comparable techniques than to estimate protein complexes. This claim is based on two characteristics of RNA: its bending is especially notable by its specific genetic or frequent themes, yet RNA sequence durability is primarily limited to tiny single-nucleotide segments while maintaining strong crystalline materials sustainability initiatives [6]. Both criteria demand that an RNA particle's two bands be determined while predicting its 3D structure, but that's acceptable comparing methodology be limited to RNA configurations that match an accurate complementary sequence with more than 60% close similarity in shown in.

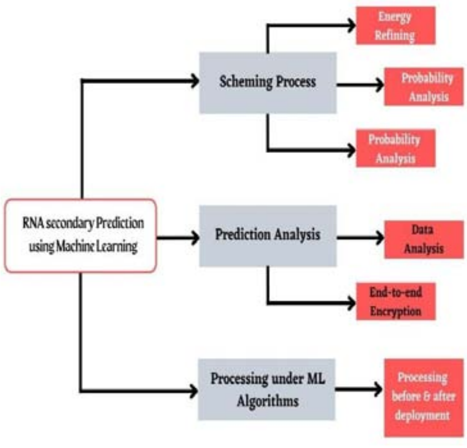

Fig.1. Proposed architecture of RNA secondary prediction using ML

Indifference the deoxyribonucleic, a multitude of possibilities In terms of structure, RNA consists of waste

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materials, phosphates, and aromatic groups. The phosphodistrics bond links waste and phosphates, providing a framework from which aromatic bases are regularly bound through the C1 atom of the venous fraction. Hydrogen bonds and assembly connections at bases cause RNA molecules to bend as they are generated. However, the WC genetic material retains the canonical helices intact. In addition, nucleotide groups can engage in ribose or phosphatase molecules, as well as in non-anionic base-base connections, resulting in unique RNA morphologies. RNA supports complex 3D structures due to pair interactions between nucleotides. A lot of three hydrogen bonds between coupled nucleotide bases are expected to hold a radical pair in RNA. The swells, stem connects, stem-loops and pseudo nodes that make up the genomic sequences of an RNA molecule are generated either by the configuration of the base couple in the framework. Stem-loop takes, coaxial layering, Loop-loop contacts, and triple or quadruple propellers are examples of tertiary relationships that keep that entire [14] 3D RNA frame together. The authors conducted a thorough examination of numerous methods for predicting N1-methyladenosine and N6-methyladenosine sites. They've addressed a wide range of key topics, including dataset quality, operational algorithms, sequence and genomic characteristics, model performance, feature selection, and software utility, all of which are critical for the construction of successful predictors. [9-10]. The scientists examined computational approaches for quantifying RNA levels in single cells using the Single-cell RNA-sequencing (scRNA-seq) technology. They then analysed eight imputation methods, assessed their power in recovering original genuine data, and ran a variety of analyses to see how they affected cell type clustering, discovering differentially expressed genes. [11-12]

III. Proposed Methods

The NDB section contains information on all compounds that include nucleic acids, including categorization and interactions of nucleic acids using enzymes, frame configuration aspects, and baseline pair identification [7]. The SCOR database, as well as the SCOP database for functional areas, organizes the RNA patterns into a hierarchical classification scheme.The RNA structural category distributed each entrance by the physiological functions of their particle, motif, and research framework; the RNA operational study divided each entry into the natural process of particle, themes but also study framework; and the RNA tertiary conversation cluster separates RNA frameworks by intramolecular connections that diverge of WC or non-WC base couple.

The AFM provides another form of data that could be of great value in RNA modelling. RNA molecules can now be seen to highlight properties such as dual or nanomaterial domains, as well as their connections, through various improvements in this method. The AFM is especially useful for determining the structure of RNA molecules of reasonable size with several secondary building components that could be positioned on a substrate while maintaining local geometries. In addition, A FM may reveal other patterns because it is a one-molecule approach. AFM images, like the 2D level courses of cryo-EM research, could theoretically be used to code structure restrictions shown in Fig.2 .

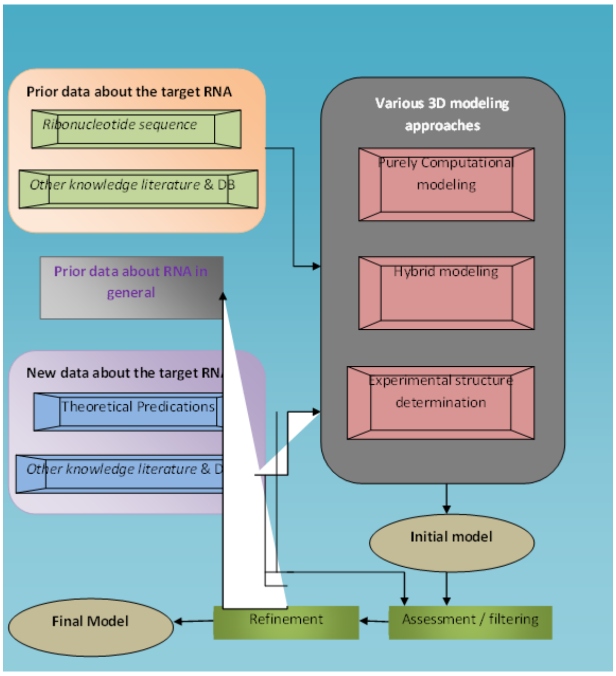

Fig.2. 3D structure architecture of RNA.

IV. Results and Discussions

Prediction of conformational changes in an RNA sequence can help researchers learn more about its final shape and composition. Regional contacts occur first and are significantly larger than tertiary connections in the NRA simulation procedure, which is architectural. Consequently, the secondary structure of RNA serves as a frame for the 3D structure of RNA. This feature implies that the sequential RNA information could be estimated even without tertiary relationship information. The first approaches for forecasting the conformational changes of RNA molecules were built along with the concept that the optimization approach and Nussinov's methodology could be used to detect the lowest free-energy configuration for such a native state. The institutions were established particularly for such approaches employing actual calorimeter investigation or confirmed RNA configurations published in the PDB and were predicated on physics' free electricity estimates. Nevertheless, the minimal free energy methodology does not check whether the final product chosen or projected is the native configuration or often corresponds to a quasi-native configuration. The employment of a hybrid algorithm for substandard structural components, the computing of all unsatisfactory sequences towards the effective bending interior, or the identification of unsatisfactory strategies predicts on RNA texture analysis are all examples of MFE concept applications.

The horizontal developmental forces on genetic variants of RNA are seemingly ignored when predicting changes in conformation from a short sequence. Accordingly, the several variants of forecasting the secondary framework for RNA facilitate the implementation of limitations on the sharing of common sequence characteristics. The secondary structure [15] of RNA is more likely to be preserved through development than the sequence. A second alteration to an RNA molecule is said to repair a mistake by restoring the baseline couple relationship. This approach is used in several protein structure forecasting methods which attempt to discover such a correlation between different locations in a multiple sequence alignment. The concept of mutual information was used to gather correlations between bases in the initial deployment of such a method.

4.1 RNA Structure Analysis

Predicting the three-dimensional configuration of an RNA molecule is simple, but generally requires human involvement. A completely automated methodology, unlike the current state of protein structure prediction, is incapable of the presence of a large 3D RNA structure from its sequence. Nevertheless, in recent years a series of different innovations for the manual or automated characterization of the RNA structure has been created. ERNA-3D, for example, builds a 3D structure of RNA independently, starting with its QA: Should it be 'from'? Secondary [16] configuration..v MANIP assembles complete RNA structural models using either RNA patterns or segments from a library of choice. The final refinement protocol incorporates basic canonical and noncanonical coupling requirements, as well as covalent morphology, stereochemistry, and van der Waals contact requirements. By utilizing the dimensions or relationships between the bases on known RNA structures, the MC-Sym software creates 3D RNA structures. During the construction process, reasonable limits could be placed on the framework for the preservation of specific structural components. To reduce the stability of the anticipated framework, MC-Sym employs numerical simulations modelling.

Integer programming is used in RNAmoIP infrastructure to modify expected or known structural properties that allow such integration of 3D RNA patterns. Assumptions are then used as models in the MC-Sym program for building entire 3D structures. Researchers give government approaches to the prediction of a secondary RNA structure, including pseudo nodes, mathematical optimization approaches have received a lot of attention recently [8]. The RNABuilder program for the software application creates a template RNA configuration by processing mechanics and pressures to various levels of detail. Caution connections, certain sequence lengths, and certain whole molecules are kinematically hard, while other bonds are malleable. The rigid base concentrating on specific atoms is subjected to forces.

4.2 Comparison of Experimental Methods

The different approaches mentioned above generate different kinds of structural features, and their implementation presents unique obstacles. Different methods used to determine the architecture of many NRAs, especially those designed to capture the internal system with extreme accuracy, have proven their resistance. A hybrid strategy, which combines several experimental and analytical methodologies, has turned out to be an efficient means of determining structures for even the most "challenging" RNA targets, going by the shortcomings of the methods used independently. The methods of selection for determining 3D structures of RNA at the atomic level are MX and NMR. Patterns derived from crystallographic information are frequently snapshots of a compound that assumes several configurations in its native state, whereas structures derived from NMR provide an ensemble to coincide with the structure of the compound under investigation. Other methodologies such as cryo-EM, SAS, and AFM, which provide the accessible entire shape of such examined targets in environmental circumstances, can be used to compensate for MX and NMR inadequacies, which include the design to regulate the monomer or complex under research.SAS methodologies provide low-resolution tertiary shape information of an enzyme under physiological circumstances, extending disturbed or adaptable areas, as well as facilitating the assessment of intramolecular' dynamics, such as transcriptional activation, complex formation, folding, adaptable domain circulation, and aspect in the process occurring in reaction to foreign circumstances.

Only coarse grain structural components that capture the average arrangement of atoms in a molecule could be constructed using SAXS and WITHOUT data only. SAS approaches may also be used in a variety of methodologies. A current example is the use of SAXS in conjunction with microfluidics technologies and overall modelling with MD to generate a consistent RNA environment.Chemical probes and impression approaches paired with MS, EPR, or FRET can be applied to value restrictions in medium or long-range connections, or binding affinity sites, which greatly improves collected information. Additionally, dispersion measurements are not determined by the size of the target compounds, and so complement methods like maximum level NMR or cryo-EM, which are typically confined to larger and smaller items, respectively. Cryo-EM, NMR, and MD were used to solve the framework of 30 kDs HIV-1 RNA Dimerization Signal, demonstrating that merging methodologies that expose the general structure with methodologies that focus on local structural properties allow for structural [13] characterization of molecules that exceed the limitations of the conventional methodology.

4.3 RNA 3D structure modeling approach

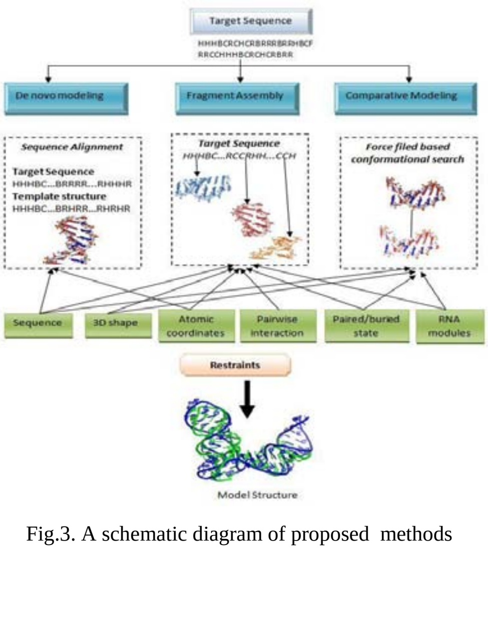

Fig.3. A schematic diagram of proposed methods

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The first and most important step of this type of modelling is to identify a formed structure and link the sequences of goals and models. Therefore, the particular availability of empirically resolved RNA 3D structures that can operate as substrate threshold the overall efficacy of comparison modelling, and this scheme is strongly reliant on macromolecular structure datasets in Fig.3.

Comparative modelling can typically generate incredibly accurate designs for target molecules with high sequence identity, such models, indicating a narrow phylogenetic relationship. Like proteins, evolutionarily similar RNAs with different sequences often maintain the original tertiary creases. Due to configuration differences and increasing difficulties in generating precise sequence alignments, the likelihood of creating an appropriate model reduces as the evolutionary distance between the target and the prototype increases. In practice, comparisons can be modelled using models that are not biologically related to the target, but this requires the unconnected model to be structurally highly comparable to the objective. Comparative analyses based on erroneous frameworks or appropriate frameworks with erroneous guidance are almost always erroneous.

In two ways, the atomic coordinates of experimental measuring structures are frequently used in contrasting modelling techniques. One set of approaches transfers the structural core's atomic coordinates from the template straight, keeping the backbone in areas of continuous conformance, and 'patches up' backbone incompatibilities produced by insertions or deletions by patching the template with short segments from other constructions. Geometrical comparison is used to replace bases when the motif architecture or subsequent segments are out of phase with the destination.

These approaches require no energy calculations, and classification is mainly used to reduce vertebral column deviations and severe conflicts between implanted segments and the centre. Another class of comparable modelling approaches, such as Modular or MacroMolecular Builder, uses target-template congruence to assign correlations between residue and then apply spatial constraints to the template strand depending on the principles for comparable positions in the pattern. After that, the target gene is bent to respond to those constraints. A force field is also used to perform an optimization technique, ensuring that the final product is nearly exact. Geometrical restrictions based on generic statistics from 3D RNA structures can also be implemented to ensure adequate stereochemistry. Protein structure data could be used in both types of techniques to control segment selection or restrict propellers to create optimum connections and shape.

V. CONCLUSIONS

Finally, we submit that approaches to modelling the 3D structure of RNA that permits the use of experimental values as restrictions should be greatly improved. For starters, there are a variety of experimental procedures that are not able to determine the architecture unambiguously but produce data that can be used as restrictions in computer models. Since much of this information is low-resolution and uncertain, process models must be modified to accept them appropriately, and suitable analytical structures must be used to allow choice among numerous options and to accept a fairly high level of constraints that could be inaccurate. Second, modelling techniques often rely on experimental data produced by an industry that can be misleading. MX and EM data, for instance, are typically used in 3D statistical approaches rather than dispersion structures or 2D images. Similarly, slope information is used indirectly to generate projections of the secondary structure rather than immediately. As a consequence, we consider that substantial progress in 3D structure determination could be achieved by modifying existing techniques to use experimental results at an early stage in the procedure, in parliamentary procedure to prevent distortions. This may require the development of new approaches to address experimental results in the prediction phase, bringing methodological concepts closer to the type of real information collected in studies. This trend towards progress can also encourage theoreticians to work in close collaboration with experimenters. Computational methods that treat raw data may be able to get more details of cellular mechanisms that have been explored in the research laboratory, and may yet contribute to the emergence of novel physiological functions.

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Generalized Deep Neural Network Classifier for Non-Code RNA

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***Abstract*—The longest non-coding RNAs have been extensively explored as well as published in current history for their participation in transcriptional copying, immunological reaction, developmentally induced pluripotent stem cells, tumorogenesis, including hereditary control, among other cellular activities. Many theoretical and simulation techniques for genome-wide searches as well as showings of ncRNAs have been developed, each with its own set of constraints, based on sequence properties such as size, frequency, as well as a backbone structure. In comparison to other classification methods, the suggested Deep Neural Network (DNN) seems to be a rapid and precise substitute for identifying lncRNAs. Utilizing annotated image learning algorithm from LNCipedia as well as RefSeq file, the data preserved ink-mere patterns would be used as an exclusive characteristic for the DNN classification model, yielding a precision of 98.07 percent, responsiveness of 98.98 percent, as well a clarity of 97.19 percent, including both, on the validation set. The enhanced classification performance was due to the k-mere data benefits created using the Shannon entropy algorithm. Such implementation of an appropriate has also been evaluated on a published human DNA collection, and it is 99 percent accurate in identifying recognized lncRNAs.**

Keywords—non-coding RNAs; Deep Neural Network;ClassificationModel; Shannon entropy algorithm

I. Introduction

Ribonucleic acid (RNA) would be a large molecule that encodes specific genes in a series of DNA nucleotides across a nucleic acid string, allowing it to be transmitted from one generation to the next with great accuracy as well as adaptability [1]. Different forms of RNA could be distinguished by a variety of characteristics such as stimulation, transcription, movement, as well as meandering characteristics, all of these are important in core dogma. RNA was already divided into 3 types based on its functions: messenger RNA (mRNA), transfer RNA (tRNA), plus ribosomal RNA (rRNA), which perform as data stages in the polypeptide manufacturing equipment [2]. Furthermore, because most of these products need not translate for polypeptide and rather operate as ncRNA, the genetic information was categorized as interpreting RNAs as well as non-coding RNAs. Furthermore, with the improvement of greater RNA generation sequencing, snRNAs may now be approximately categorized. Moreover, the PLncDB provides data on botanical lncRNAs, whereas the income website provides similar results for humans [3]. The ncFANs web application may be used to functionally annotate lncRNAs, while DIANA-LncBase contains extensive data across both suggested as well as practically proven miRNA–lncRNA relationships. In rapidly discovering ncRNAs in novel genomes, computer detection systems supplement different techniques. Several regulations as well as guided having to learn algorithmic techniques for predicting ncRNA have indeed been presented in the previous, based on a combination of characteristics significant sequence characteristics. To evaluate the transcript levels of lncRNA, the 1 regulation technology utilizes preconFig.d probing spanning shared entrance as well as inhering regions to help identify ncRNA strings [4]. Some other methodology employs the lncRNA genomic following are the examples in the tumour as well as non-tumour cells to determine possible lncRNAs implicated in oncogenesis.

II. Related Works

Multicolour information has previously been utilized to determine ectopic as well as atopic endometrium lncRNA as well as an mRNA transcript treatment in people, as well as to anticipate lncRNA activities using founder mRNA classifications. Including both lncRNA as well as mRNA, the ArraystarLncRNA Production as well as Transcription genotyping permits monitoring of complex formation or methylation locations at transcription factors. Furthermore, some resources, such as fans as well as NRED expressions Database, leverage which was before microarray information to functionally annotate lncRNAs, making use of such a coding-noncoding transcription founder system [5].

RNA-seek information can also be used to detect the existence as well as the architecture of lncRNAs using a range of information. LncRNA2Function, as well as NONCODE, were consumer online interface services for investigating the functioning of the body lncRNAs using RNA-seek information. RNA-immunoprecipitation seems to be a modern approach for identifying lncRNA that connects to associate with a particular enzyme. That method has been used to uncover Xist, which reacts with PRCII. The RNA-IP approach is used in several Registered Motif as well as

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Millipore products to purify peptides as well as recognize associated lncRNAs with ribonucleic transcription factors. TaqMan quantitative PCR tests are included in Digital Equipment products to calculate the transcription of specific lncRNAs. To produce genomic sequence assessments of chromosome patterns, a chromosome handwriting technique is most commonly utilized. The genome's transcriptional areas were identified, as well as the sites of lncRNAs were identified as well as investigated. Genome sequencing allows for maximum identification of RNAbound proteins and DNA in subsequent tests utilizing chromosome separation by RNA filtration [6-7]. Those regulation techniques, on the other hand, are getting more and more complex. Genotyping has limitations in that this was not sufficient to identify RNA components having lower expression levels, and tagged information was needed to research lncRNA activities [8]. Because SAGE seems to be more costly than sequencing, it must be rarely used in huge investigations. To forecast the types of ncRNA, the authors constructed a computational predictor. Deep learning was employed straightforwardly and effectively. When compared to existing methodologies, the proposed tool has produced the best results.

RNA-sick does have several benefits over typical microarray technology for investigating the expression of genes. It's better at recognizing rare transcriptomes plus finding novel therapeutic processing variants including noncoding RNA components [9-10]. Additional signature properties that might also aid in the condition based on lncRNAs should be included in present approaches and strategies. Even though the approaches outlined above were proved to be instrumental in detecting lncRNAs, rare examples have been documented. The transcription factor RNA stimulator had long been described as ncRNA, but somehow the decoding product was discovered later [11]. While further information regarding lncRNA becomes available, this ambiguity would be resolved. Traditional methods rely on the width of the open reading frame (ORF), and ORF preservation, but rather on architectural protein structures. Because of the lncRNAs' complicated characteristics, a great number of computer training approaches have recently been created. To distinguish lncRNAs from mRNAs, for example, a variety of structural characteristics like protein content, secondary structure, and peptide size were employed to build SVM models. SVM is used by the Coding-Potential Calculator (CPC) to train as well as category component information [12].

These approaches show how to construct as well as retrieve sequencing characteristics as well as genetic testing characteristics to evaluate the programming ability of genes using lengthy, greater ORFs having resemblance (BLASTX) to associated genes. Combining every one of these elements altogether and then using the information from the server as inputs would be a basic as well as straightforward first stage. Therefore, to fully use the information's possibilities for physiologically meaningful interpretations, technologies that really can extract features recurring patterns from the information are required [13-14]. Technologies based on machine learning were very well to solve various Bioinformatics challenges using greater precision. These could cope with massive datasets with high dimensionality, as well as versatility in modelling a variety of data collection techniques.

III. Methods and Discussions

The goal of the research would be to create DeepLNC, a generalized deep neural network (DNN) classification for distinguishing lncRNAs from programming RNAs (mRNAs). To easily categorize the lengthy component of the ncRNA family, researchers used the k-mere probability contents to estimate the k-moire patterns as the only descriptor of lncRNA. Using a forward selection-backwards elimination (FSBE) feature extraction technique, many consistencies on varied permutations of k-mere characteristics have been used to choose the end selection of characteristics. The word k-Meir refers to the mixture of potential subsequences of fixed size in a prospective learning as well as the assessment sequence's complete phrase. The fundamental idea underlying k-mere additional comprehensive selection would be to take advantage of the complexity of the k-more regular recurrence vs. the total available data of the entire program, which would be critical for the genomic enhancement of any given pattern. To discover as well as understand the likely k-mer configurations with several more goal mappings, we use DNN, a probability deep learning method. (1) The Shannon entropy approach had been used to minimize the information's intricacy as well as obtain tallies, including all non-unique k-meres. Shannon entropy, indicated by H as well as written as, was among the most critical indicators used in statistical mechanics.

$$H = -\sum_i^N (p_i log_b \text{i}) \quad (1)$$

Wherein pi seems to be the likelihood of finding the k-meres in a transcript. Including its shared execution of the multi-thread H2O system, the DeepLNC technique lowered the deeper connection for collecting k-Mars when compared to those other classic data mining algorithms. The new method was already verified to show that it outperforms prior techniques like CONC, CPC, lncRNA, as well as PLEK. To use our custom-built classification model, researchers matched DeepLNC to PLEK. PLEK identified mRNAs with a 75 percent average accuracy, while DeepLNC successfully identified 82 percent of mRNAs. PLEK was used to identify 98 percent of lncRNAs, however, our suggested technique recognized 99.8 percent of lncRNAs. As indicated in Fig. 1, information sources have been considered: preparing for the exam. Patterns, as well as descriptions, were collected from the LNCipedia collection, the most recent edition of the lncRNA data set, including contains 111,685 humans identified lncRNAs as well as includes complete descriptions of eukaryotic lncRNAs. mRNA transcribed from the RefSeq database was used in the testing dataset. Wikipedia provided 80,214 people with lengthy transcribed affirmative training data. RefSeq provided 99,395 nutrient transcriptomes for the pessimistic training dataset.

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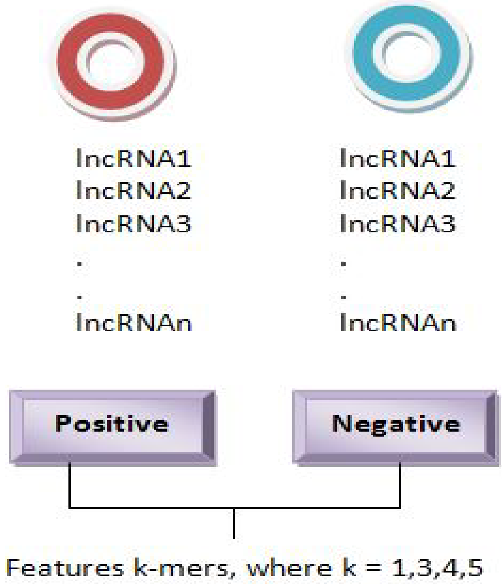

Fig.1. Combimations of K-mers range

Researchers discovered that k-more pairings of 2, 3, as well as 5, produced better results in lncRNA identifying when tested against information delivered that used a simulation model across all possibilities of k-mer utilizing FSBE. Furthermore, the DeepLNC seems to have a restriction in verifying the greater of k-Meir, which would result in substantial growth in the training dataset, which is above our computer's processing capacity.In Fig. 2, the achieved diagnosis based can be seen in the kind of correctness against any k-more pairings, whereas TABLEI displays the combination of multiple pairings for every value of k.

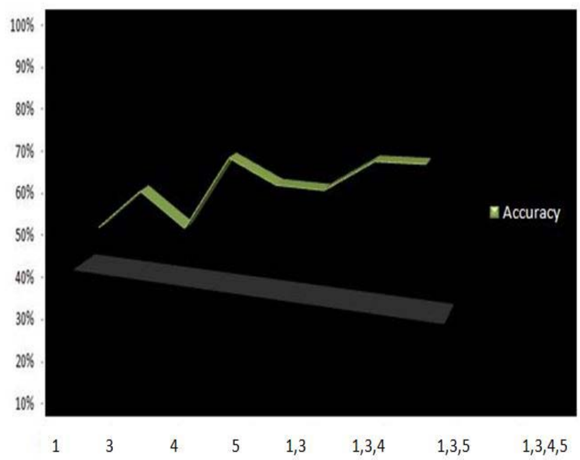

Fig.2. Performance Analysis

TABLE I. CLASSIFICATIONS OF FEATURES

Value k	No of possible Comination	Total
1	4^1	4
3	4^3	64
4	4^4	256
5	4^5	1024
Total Feature = 1128		

IV. ML &DEEP NEURAL NETWORK

Designers used DNN as the major predictor to learn their sample. DNN would be a collection of machine learning techniques that have been significantly reliant on the collected data used to develop several multilayer models of non-linear operational insight. Classification technique, analytical classification, multilayer deep learning methods, including multi-layer perception are among the technologies that could demonstrate to be multipurpose since they use a combination of human comments, experimental investigation, as well as various Bioinformatics techniques. Several important traits, researchers predicted, might aid in the characterization of heterogeneous lacunas. DNN was validated k-mar rates of lacunas as well as programming transcripts segments.To distinguish lacunas from mRNAs, a binary class model was developed using the k-mar segmentation method as well as the implications of the DNN technique. Using tenfold cross-validation, the recognition system acquired a good performance on the training sample. With lower dimensionality as well as superior hierarchy surface feature reduction, the suggested DNN optimization technique tackles non-linearity in information. Using an advanced gradient supervised learning; allows for worldwide error detection and correction of numerous fully connected layers. Through the stages of DNN, the incorporation of advanced optimization techniques like Dynamic Teaching Dropouts as well as Nesterov's Accelerated Gradients allowed the least amount of classifier, the fastest growth of mistake reduction, as well as the highest predicted performance. Ox data H2O has been used to build the DNN. This is free software advanced analytical system that does statistical modelling using Hardtop.

The REST API has been used to link Ox data H2O to R for information processing. Machine learning algorithms were described as a multi graze artificial neural network (ANN) that is learned utilizing a backpropagation algorithm and learning algorithm. Researchers utilized the tan h learning algorithm because their information was queasy. Excellent predicted reliability was achieved because of innovative features. Our encoder DNN's forecast evaluation was done utilizing a conventional matrix that included various conventional performance indicators, as shown in Esq. (2), (3), as well as (4). The performance of the predictor has been further assessed utilizing just a few statistical parameters obtained from the test results: true positive (TP), true negative (TN), false positive (FP), as well as false negative (FN). TP denotes accurately guessed lacunas, TN denotes properly identified programming RNAs from negatives collection, FP denotes negatives objects that have been wrongly categorized as lacunas, and FN denotes instances wherein genuine lacunas were mistakenly classified as non-lacunas.

$$Accuracy\ (ACC) = \frac{TP+TN}{TP+TN+FP+FN} \qquad (2)$$

$$Sensitivity\ (SN) or\ true\ positive\ rate = \frac{TP}{TP+FN} \qquad (3)$$

$$Precision\ or\ positive\ prediction\ value\ (PPV) = \frac{TP}{TP+FP}$$

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(4)

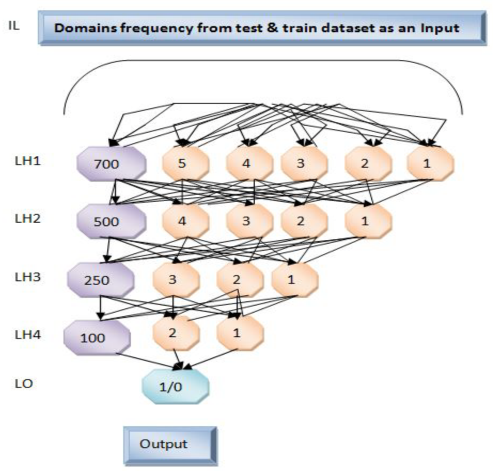

Fig.3. Training phase of DNN

The number of hidden neurons employed, the representation of the input classification model, as well as the set of independent vertices all influence the system performance of DNN. Even though the suggested DNN structure has a larger number of information vertices, the sparse structure of the data frame meant that the load optimization algorithm required lesser model parameters. In addition, as shown in Fig. 3, the number of hidden nodes was set to '4'. On an i7, 2.6 GHz AMD system with 14 GB RAM, every folding cross-validation for the learning algorithm takes about 20 minutes. Various researchers have been used thousands of high approaches to identify lacunas. Furthermore, the characteristics of lacuna were yet to be adequately depicted. As a result, developing a method that would be, independently of previously forecasted traits and could be equally adapted to large datasets has become much more important. The concept of cognitive characteristics was critical for categorization, thus humans sought to use the traditional k-more value in their research. Lastly, the suggested k-mere utilization patterns combined with complexity computation were found to be superior characteristics for identifying lacuna. K-mere strands with greater lengths give important information than those with small distances. DNN consistence on ten methods learned on positively and negatively databases, as well as a combination of processes utilizing tenfold pass on training examples with only an intake dropout's proportion of 0.2 as well as a concealed washout proportion of 0.5 for every surface, were examined. In the very same training sample, every learning variable was repeated five times.

The maximum accuracy (ACC) was 98.07 percent, and the Matthews coefficient of correlation (MCC) was 0.968104, indicating a strong efficiency because the outcome had been very nearly 1. The You den's Index (J) was determined to be 0.968208, indicating that the examination has a low false-positive rate (FP) as well as false negatives (FN) when compared with other methods. DNN, as demonstrated in Fig. 2, is much more effective than some other machines attempting to learn classifications from their information showing a myriad of benefits. TABLEII summarizes the effectiveness as well as the assessment of their algorithm. TABLE IIPerformance and analysis of DeepLNC in detecting lacunas At various decision ranges, researchers investigated the effectiveness using the receiver operating characteristics (ROC) curves, where insensitivities (TPR) are shown against a factor of the false alarm rate (1 - specific).

TABLEII. DETECTING LNCRNAS PERFORMANCE ANALYSIS

Performance	Ranges
TN	15.315
TP	14.675
FP	140
FN	454
Accuracy	0.977134
Precision	0.968974
Sensitivity	0.979481
Specification TPR	0.979481 0.034897
NPV	0.97

The area under the ROC curve shows the product's actual quality as the approaches suggest. Deepen was able to get a ROC score of 0.9930, indicating provides a positive performance of the classifier. Fig. 4 shows the efficiency, clarity, susceptibility, as well as particular characteristics of their DNN classification during the 10-fold pass on the training images [15]. E-mail information is usually accessible. When there is so little knowledge regarding Lacuna, it is a difficult category of the crane to study. Deepen, the technique that can be implemented throughout this work has a high degree of precision as well as forecast frequency, and that can be suitable for determining novel lacunas.

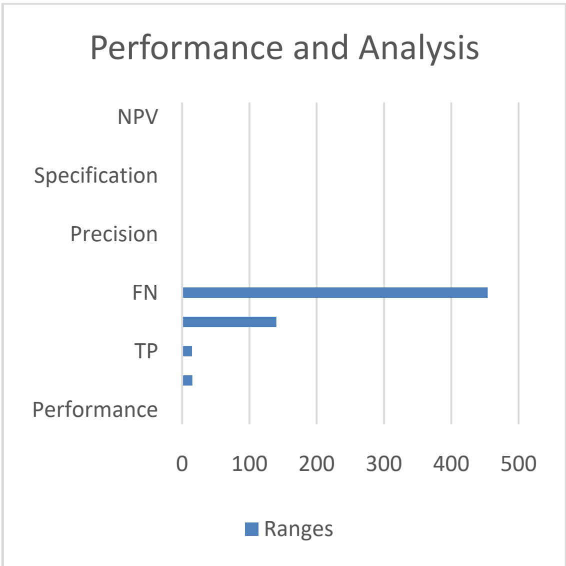

Fig.4. Performance measures of DNN

Several lacunas have been incorrectly classified as programming transcribed; consequently, using DNN classification, most mistakenly projected lacunas could well be removed from high false collections. DNN could also be used to characterize additional cranes with restricted as well as preserved information. Utilizing freshly formed permutations, extra composites changes can be made to this system. Because epigenetic patterns were also extremely complicated and could be properly understood by any straightforward quantitative tool, humans plan to use this

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classier on lacunas from different microorganisms in the long term, with a special emphasis on the human genome with environmental, interpersonal, as well as farming relevance, and those with pathological importance.

V. Conclusions

There seems to be a high correlation between lacuna as well as sickness as well as dysfunction in humans. Having a greater in-depth understanding of the characteristics of those cranes, the insight could become even more widespread. Because description lacks full functioning data, forecast models could be effective in rejoining the split threads in the next years, which would be useful in a greater understanding of illness aetiology. Unanswered questions such as the significant role of lacunas in symptoms can range from neurodegenerative disorders to melanoma, different legislation transcribed in disease-specific circumstances, as well as molecular orbital, chemical imbalances, as well as genetic variation of lacunas in various metabolic processes, could indeed aid us here in a system that determines lacunas as well as connected biological markers for diagnosis of diseases, therapeutic interventions, as well as prognosis. A recently developed elevated classification technique could emphasize fundamental principles in lacuna biology that have yet to be highlighted to build a solid foundation for lacuna heredity. Thereby, the ultimate focus of lacuna prognostication, as well as marginalization from programming RNA, would be to see if these lacunas could be used as substantiation in clinical diagnosis, painkiller object tracking, or perhaps even identified critical biological molecules that have been previously labelled as "hypothetical" caused by a lack of well-established proof. The illustration shows could aid in a better analysis of the different processes that underpin the involvement of lacunas in common diseases.

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Effects of Channel Coding with Spatial Diversity on BER for 5G Mobile Communications

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***Abstract*—Now a days the life of people without wireless devices are unimaginable. People use wireless mobile phones not only for communication purposes but also for all their personal needs such as internet banking, health monitoring, online shopping, educational purposes and much more. This makes the researchers to work over the continuous improvement towards wireless communication in order to satisfy the needs of people. In order to support all the technical needs of future wireless communication, various research has been developed. In this paper, a brief study on equalization technique, coding technique and diversity technique has been made. From this it is noted that diversity can be provided by using Orthogonal Time Frequency Space modulation technique.**

Keywords*—*Equalization technique, Coding technique, Diversity technique, Orthogonal Time Frequency Space (OTFS) modulation.

I. Introduction

General structure of a wireless communication system has been depicted in "Fig. 1". The performance of the wireless communication system can be deteriorated by both inter-symbol interference & fading. Frequency selective fading results in Inter-Symbol Interference (ISI) [1]. Inter-symbol interference occurs when one symbol intrudes with other ensuing symbols due to channel distortion. This makes the communication uncomfortable to the user. These results in loss of signal power by degrading signal to noise power ratio and even sometimes implies to temporary failure of the communication systems when there is severe drop in signal to noise ratio. This makes the system more liable to the errors due to synchronization.

When the transmitted signal gets affected by means of time, frequency or position, the variation in the signal is called fading. Fading in wireless communication is considered as major problem while considering a wireless link [2]. The communication channel which suffers from fading is known as fading channel.

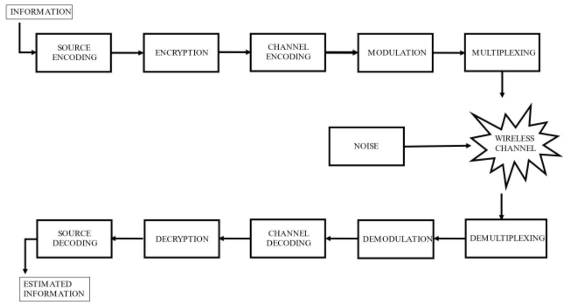

Fig. 1. General Structure of a wireless communication system

The fading can be caused due to multipath propagation or wave propagation i.e., due to atmospheric changes (such as rainfall, thunder, lightning) and obstacles present in the environment depicted in the "Fig. 2". There are two different types of fading which have been listed in the "Fig. 3", according to [1]. Hence there arises research to work towards these fading environment and certain mitigation techniques have been noticed to combat these fading environments and that have been denoted in "Fig. 4".

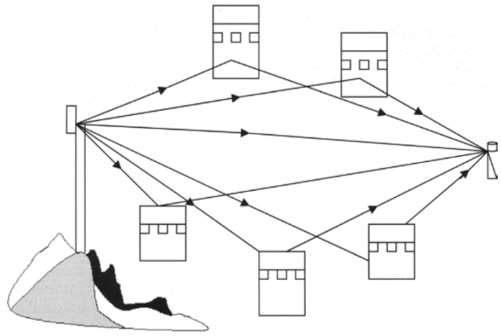

Fig. 2. Multipath Propagation

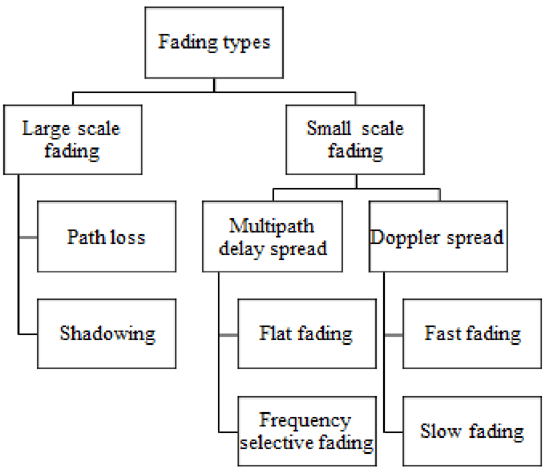

Fig. 3.Types of Fading

II. Equalization technique

Equalization is the signal processing technique that is usually implemented to combat the problem of inter-symbol interferences. In order to achieve perfect data transmission through a wireless channel, it is necessary to design an equalizer at the receiver side.

The different classifications of equalizers have been listed in the "Fig. 5". The device used to function the above process is called an Equalizer. The main objective of the equalizer is to force the Inter-symbol Interference to zero.In general,

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Equalizers were usually designed to compensate the channel effect, which deteriorates the system performance.

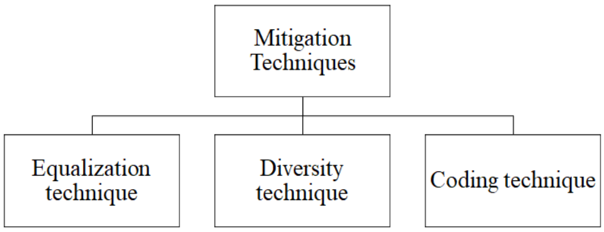

Fig. 4. Mitigation Techniques

Zero forcing Equalizers eliminates the inter-symbol interference at the slicer input whereas the Minimum mean square error equalizers trade-off between minimizing the inter-symbol interference and minimizing noise at the slicer input. The Zero forcing Equalizers found to achieve maximum diversity with minimum complexity [3].The Decision feedback equalizers (DFE) outperforms the zero forcing equalizer when the channel has severe amplitude distortion. Also, a non-linear DFE achieves higher data rate rather than conventional DFE [4]. In Minimum mean square error equalizers, the mean square error has been reduced by incorporating prediction filter.Fractionally spaced equalizers are based on Nyquist-rate sampling, usually 2 x symbol-rate sampling, avoids synchronization problems associated with matched filter front end.All the above equalizers perform with known channel state information. When the channel state information is unknown at the receiver an adaptive equalizer is opted.

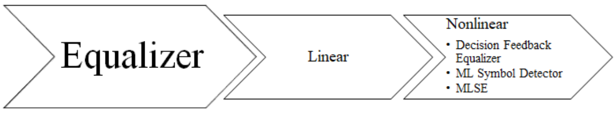

Fig. 5. Types of Equalizers

The adaptive equalizer tracks the time varying characteristics of the channel and thus known as adaptive equalizers. This equalizer significantly improves the system performance in presence of fading channel with raise in SNR value [5]. Adaptive Equalizers works on two operating modes, decision directed mode and training mode. Among the two operating modes, the training mode is mostly preferred. In the training mode, the transmitter can generate data symbol which is known to the receiver. So that, the receiver uses the known training signal at the slicer output. Once a certain time has been elapsed, then the slicer output is utilized and the corresponding data transmission begins. In Blind equalizer the transmitted signal is equalized based on the information of transmitted signal alone. It employs using Interleaving/Deinterleaving, advanced coding and ML criterion.

III. Diversity Technique

The effective technique to mitigate fast fading problem in wireless communication is the diversity technique [6]. Different types of diversity schemes have been listed in the "Fig. 6". Diversity can be achieved by transmitting multiple copies of information signal via N number of different channels. The main objective of diversity technique is that if some of the signal may undergoes fading and others may not. The various types of diversity include Temporal diversity, Frequency diversity, Spatial diversity and Polarization diversity.

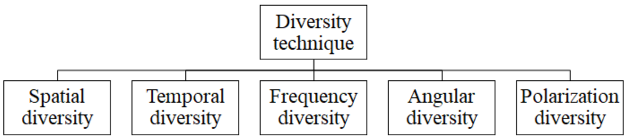

Fig. 6. Classification of Diversity technique

TABLE 1. Different Methodology of Diversity

S.No	Diversity	Methodology
1	Spatial	M number of transmit antennas & N number of receive antennas
2	Temporal	Different time slots
3	Frequency	Different frequency slots
4	Polarization	Receiver antenna with different polarization

A. *Space Time Block Codes*

The technique in which multiple copies of information source is transmitted through M number of transmitting antennas and received by N number of receiving antennas in order to enhance the performance of communication systems in table 1. The several copies of information source were generated by a space time encoder, which encodes the single information source. Then it sends the several copies of information source in the form of blocks using all M number of transmitting antennas at different time slots. Hence named as Space Time Block Codes [7]. A sample space diversity model has been depicted in the "Fig. 7". When the information regarding the channel is known to the receiver, then the system can able to achieve full diversity. However, it is little difficult that all the information about channel is known to the receiver. The channel state information can be predicted by sending some training signals to the transmitter and by this making the receiver to estimate the channel state information. In the communication system with two transmit antennas and M receive antennas were constructed. At the receiver a combiner combines all the received signal and pass through the Maximum Likelihood Detector. Here the transmit diversity technique with Maximum Likelihood Detector outperforms the Maximal Ratio Receiver Combining.

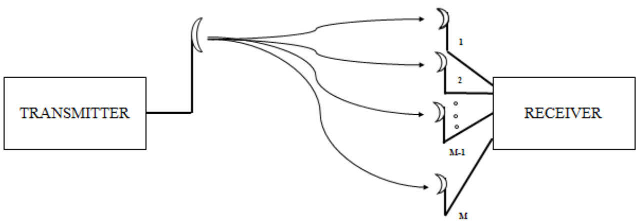

Fig. 7. Space Diversity

The comparison made between MIMO - Space Time Block Codes (STBC - MIMO) and MIMO - Spatial Multiplexing (SM - MIMO) schemes has been tabulated in

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the table 2. Both the STBC-MIMO and SM-MIMO were used to improve the performance of the wireless communication systems by means of coding gain and diversity gain by supporting multiple number of users at the same time. Sometimes, the SM-MIMO outperforms the STBC-MIMO system in table 2.

TABLE 2.COMPARISON OF STBC-MIMO AND SPATIAL MULTIPLEXING-MIMO (SM-MIMO)

Parameter	STBC-MIMO	SM-MIMO
Input	Single stream (single information split into many).	Multiple streams (different information source).
Receive antenna	Single or many.	Same as or more than the number of transmitting antenna but not less than that.
Channel estimation	Least square method is used.	Least square method is used.
Channel equalization	Maximum Likelihood decoding or Maximal Ratio Combining is used.	Zero forcing or Minimum Mean Square Error Equalizer or Maximum Likelihood decoding is used.

IV. LOW DENSITY PARITY CHECK CODES

The error correcting codes along with diversity technique will enhance the performance of a communication systems [8]. Here we discuss the linear error correcting code called Low Density Parity Check Codes (LDPC), which is best opted for error correction of information with high block size. It is also named as linear block code with sparse parity check matrix. In which sparse means there are many more zeros than ones. As it has very low ones, it is named as low-density parity check codes. Robert Gallager invented the LDPC codes in 1963. In 1981, R.M Tanner gave the pictorial representation of the parity check matrix called the Tanner graph.For example, consider a parity check matrix equation(1),

$$H = \begin{bmatrix} 1 & 0 & 11 & 0 & 10 \\ 0 & 1 & 01 & 1 & 01 \\ 1 & 1 & 00 & 1 & 10 \end{bmatrix} \qquad (1)$$

"Fig. 8" depicts every column is denoted as bit node in circle representation and every row is denoted as check node in square representation. The edges correspond to 1's in the parity check matrix (H).Check node 2 denotes the row 2 of the parity check matrix(H). for LDPC $HC^T=0$. For the above matrix,

$$H = \begin{bmatrix} 1 & 0 & 11 & 0 & 10 \\ 0 & 1 & 01 & 1 & 01 \\ 1 & 1 & 00 & 1 & 10 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ c_5 \\ c_6 \\ c_7 \end{bmatrix} \qquad (2)$$

$$C_2 + C_4 + C_5 + C_7 = 0 \qquad (3)$$

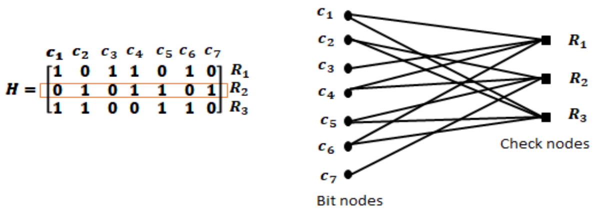

Fig. 8. Tanner Graph

In this equation (2) & equation (3) denotes that C_2, C_4, C_5, C_7 belongs to single parity check code (SPC). Every check node in the tanner graph enforces a SPC. Each SPC is named as local constraints. By using this we can easily decode.Tanner graph is a proper solution for decoding the LDPC codes. By simple decoding of each single parity check codes, we easily decode any large size matrix and thus it is well opted for 5G wireless communication systems as error correction codes.

"Fig. 9" is noted that the MIMO system with LDPC codes will provide excellent performance improvement in terms of BER [9]. On comparing turbo codes and other higher order codes, the non-binary LDPC provides improvement in the system performance by means of Bit Error Rate (BER) corresponding to Signal to Noise Ratio (SNR) [10].Error correcting codes can be combined with diversity technique to further improve the fading channel impairments, also a non-linear detector outperforms other linear combiners [11]. LDPC along with optimum combiner results in very good BER performance [12].

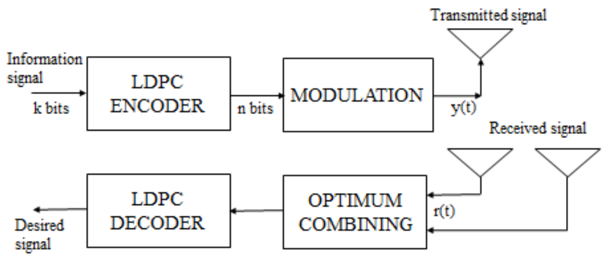

Fig. 9. LDPC System Model

V. ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM)

In the emerging development in the wireless communication, a very high data-rate is craving in many applications. But we know that along with the raise in data rate there arises a big issue in case of symbol duration [13]. Here arises the problem called Inter-Symbol Interference (ISI), which needs complex equalization technique. An OFDM system splits the entire channel into more numbers of subchannels through which high-bit-rate data can be transmitted parallelly, so that the OFDM system does not suffer from the problem of ISI. In [14-16], full space and frequency diversity can be achieved by Combining Bit Interleaved coded modulation (BCIM) along with Space time block codes (STBC) and orthogonal frequency division multiplexing (OFDM).

However, OFDM technique suffers from synchronization error and it is found difficult to equalize multiple dopplers [17-18]. It results in unequal subchannel

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gain, which degrades the system performance. A new modulation technique has been found to outperform the OFDM technique named as Orthogonal Time Frequency Space (OTFS) Modulation [19].

VI. ORTHOGONAL TIME FREQUENCY SPACE MODULATION (OTFS)

From [22], OTFS modulation takes place by use of two transforms at both the transmitter and receiver shown in “Fig. 10”. The importance of OTFS has been known from the literature survey summarized in Table 3. The two-dimensional information symbols from the QAM modulator in delay doppler domain is converted into a two-dimensional complex number sequence which is in Time-Frequency (TF) domain [20-22]. This can be made happened by using Inverse Symplectic Finite Fourier Transform (ISFFT) and Heisenberg Transform (HT).

HT converts the TF modulated symbols to time domain signal and makes it suitable for transmission via channel. On the receiver section the vice versa of the transmitter has been processed by using Symplectic Finite Fourier Transform (SFFT) and Wigner Transform (WT). This scheme provides promising solution for high-speed vehicular communication.

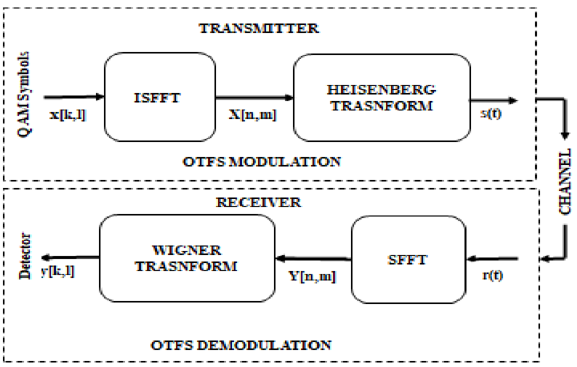

Fig. 10. OTFS Modulation and Demodulation

TABLE 3. LITERATURE SURVEY

Author	Year of Publication	Findings
Xiang Wang [14]	2020	Frequency Division Complementary Coded Code Division Multiple Access (FD-CC-CDMA) provides High diversity gain compared to OFDM-DS-CDMA.
Tadashi Ebihara [17]	2020	Doppler-resilient orthogonal signal division multiplexing (D-OSDM) along with MIMO achieves reliable error rate compared with normal OFDM system.
Zuwei Chen [19]	2020	A Discrete-Cosine-Spreading (DCS) aided M-ary DCSK scheme provides high data rate with minimum BER under multipath fading channel.
Huan Ma [21]	2022	TD-DCSK is compared with STBC-DCSK, OMC-MIMO-DCSK, and conventional DCSK system and proven that TD-DCSK provides high data rate.
Farah Arabian [15]	2022	Diversity alone cannot provide reliable communication link. There is also some error control coding is required.
Qi-Yue Yu [20]	2022	Space time domain parity check transmit diversity provides better BER performance compared to classical space time block codes in case of both the frequency selective and frequency non selective fading channels.
Jaewha Kim [18]	2022	A new method of Gamma Evolution has been used to derive upper bound on BER, to analyse the performance of LDPC for higher data rate
HuiyangQu [16]	2022	An Enhanced Data Detection scheme has been developed in order to cancel the interference and also to provide spatial and multipath diversities.
S.M. Alamouti [6]	1998	Error control codes can provide better diversity by incorporating of time diversity.
M. Kalaivani [7]	2014	Using STBC-OFDM, Full diversity can be achieved in case of known channel state information.
DAN FENG [10]	2018	Compared to turbo codes and other higher order codes LDPC can provide better improvement in system performance in terms of BER.
Zhen Mei [11]	2017	Error control coding technique along with diversity technique can further improve the system performance.
Beng Soon Tan [9]	2011	MIMO system along with LDPC support improving the efficiency in terms of BER.
EnisAkay [13]	2006	When the Bit Interleaved coded modulation technique combined with STBC-OFDM system, then frequency as well as space diversity can be achieved.
Sharma [12]	2009	An optimum combiner has been developed to support LDPC to improve the system performance.

VII. RESULTS & DISCUSSIONS

In order to support all the technical needs of future wireless communication, various research has been developed. It is clear that full diversity can be achieved by employing Parity check transmit diversity scheme [20]. Also, by employing enhanced data detection along with proper equalization technique, BER performance can be improved in consideration with higher order modulation technique for MIMO OTFS systems [16]. From this article, it is clear that the performance of a communication system can be improved by using the new modulation technique OTFS, along with suitable equalization technique.

VIII. CONCLUSION & FUTURE WORK

From the study, it is noted that the new 2D modulation technique, Orthogonal Time Frequency Space (OTFS) modulation provide improved latency when compared with Orthogonal Frequency Division Multiplexing (OFDM) technique for an high speed vehicular communication. Also, the future work can be proceeded by combining low density parity check codes along with STBC-OTFS in order to support future mobile communication with high mobility.

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An Overview of different Autonomous Vehicle Algorithms for Sensing and Route Planning

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***Abstract*—The topic of self-driving cars has recently gained popularity. This paper presents an overview of several algorithms often employed in autonomous vehicle sensing and path planning. We have compiled a list of different algorithms used for these two purposes and provided a description of the same. A brief description of different sensors typically used in autonomous vehicles has also been provided. Sensor algorithms have been divided into 'Locational and Positioning' and 'Environmental modeling'. Location and Positioning Algorithms require the use of GPS, IMU, and Encoders to estimate accurate distance and use some variant of the Kalman Filter. Environmental modeling algorithms mainly rely on Cameras and use deep-learning object detection models like YOLO. There are also methods that require the use of Cameras with LiDAR and RADAR. For path planning, a description of the two most popular methods A* and Dijkstra has been provided along with their comparison.**

***Index Terms*—Autonomous Vehicles, Positioning, Environment, Heuristics**

I. Introduction

The term autonomous vehicle refers to any vehicle that does not require human interaction to perform its task. Lately, with the increase in technology, especially advancements in the field of deep-learning, capabilities of autonomous vehicles have increased tremendously. A typical autonomous vehicle consists of standard locomotive machinery, sensors in order to gain insight into the environment, a central dedicated CPU that gives signals to the locomotive machinery based on user input (such as target destination, etc.) and a map database. Autonomous vehicles equipped with such technology can most possibly improve energy efficiency, reduce the risk of collisions and reduce pollution [1]-[2] since most autonomous vehicle are electric in nature. These are various algorithms available that coordinate the working of an autonomous vehicle(used by the CPU) that we have categorized. The paper focuses on different algorithms involved in different parts of the system. We start with the sensors. Sensors themselves can be categorized into various parts[3]. They include sensors like LiDAR[4], RADAR[5]-[6], Camera[7]-[8], Ultrasonic Sensors[9], GPS (Global Positioning System)[10] and IMU (Inertial Measurement Unit)[11]. Focusing on the routing algorithm or the main algorithm, there are many, however, they can be broadly classified into heuristic[12]-[14] and nonheuristicalgorithms[15]. These algorithms are also dynamic, they have an inbuilt obstacle avoidance system. The main input for these algorithms is the sensor values and the map database.

Heuristic algorithms may also take into account information like traffic density which would probably require an internet connection. Heuristic functions are mostly dependent on the heuristic function provided[16]. In path-finding algorithms, modern heuristic algorithms perform better than non-heuristic algorithms[17]-[18]. For our paper, we shall only consider one heuristic algorithm[19]-[20] (A*) and one non-heuristic algorithm[21](Dijkstra).

II. Sensor Overview

A. LiDAR

LiDAR, which stands for light detection and ranging, is most commonly used to determine object ranges. It works by directing a beam of laser at an object and calculates the distance from the beam source by calculating the time it takes for the reflected laser beam to return. Using algorithms like SLAM(Simultaneous Location and Mapping), it is even possible to generate visual 3-D representations of the environment and as such, this sensor is extensively used in autonomous vehicles for environment detection to determine object ranges.

B. RADAR

RADAR(radio detection and ranging) is an algorithm very similar to LiDAR except for the fact that it requires the use of radio waves rather than laser beams. It is mostly used for the detection of objects and has been used in defense for detecting enemy vehicles. For use in autonomous vehicles, RADAR is generally used with radio waves having a frequency of 24,74, 77, and 79 GHz. Generally, two types of RADAR exist that have been used in autonomous vehicles namely Impulse RADAR and (FMCW) Frequency Modulated Continuous Wave Radar. Impulse RADAR emits only one pulse, the frequency of which remains constant. FMCW RADAR, on the other hand, emits pulses continually at different frequencies. FMCW is widely used owing to its high-depth perception[22].

C. Camera

A Camera is a form of sensor that records images of objects. It is comprised of a lens and a shutter used for projecting the lens image on a surface(typically a photosensitive film or an electronic sensor) or directly translated into electronic signals. In autonomous vehicles, a Camera is typically used with an object detection algorithm which detects surroundings and objects of interest. Using Photogrammetry methods,estimation of the ranges of objects is also possible. Most popular object detection methods for use with camera in Autonomous vehicles are YOLo(You Only Look Once) and SSD(Single shot detection) as they are faster than most object detection algorithms. Camera is the most widely used sensor for autonomous vehicles and in most scenarios has replaced LiDAR, RADAR and ultrasonic sensors.

Ultrasonic Sensors

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This sensor is used in fusion with other sensors in environ- mental modelling for error correction and to get an accurate reading of the ranges, It works similar to a LiDAR and a RADAR by using Ultrasonic Waves to determine the distance of objects. It works at a very high frequency and as such is limited to close range detection only. Ultrasonic sensor can be found in almost every modern car these days. They assist in parking.

D. GPS

It is a satellite based radio-navigation system. Most autonomous cars contain a GPS receiver which receives data from satellites continuously. For accurate measurement, the GPS typically receives data from 4 or more satellites. Satellites used for transmission of GPS signals use an atomic clock which provides the broadcast time to be encoded in the signal. The reciever uses the broadcast time, satellite location and the time that the data was received to calculate current location.

E. IMU

It is a fusion of a gyroscope and an accelerometer. Gyro- scope is used for the measurement of rotation and accelerometer is used for measuring odometry. In scenarios where GPS signals are not available, IMUs are used for location and positioning of autonomous vehicles. IMU's are typically used in co-ordination with encoders.

F. Encoders

An encoder is a sensor attached to a wheel or a rotation de- vice to measure rotation. It works similar to an accelerometerby measuring odometry of a vehicle given wheel radius. BothIMUs and Encoders are used to measure relative position of an autonomous vehicle. There are 4 main types of encoders namely optical, mechanical, magnetic and electromagnetic. The specific type of encoder typically used in autonomous vehicles is an incremental rotary encoder which can be of any type. Incremental rotary encoders are used widely because of their accuracy and ability to provide real time data with efficiency.

III. SENSOR ALGORITHMS

A. Location and Positioning

Autonomous cars have a map database kept inside them or obtain it through a server connection; nonetheless, for route planning, the current position with regard to the map must be estimated. A GPS system is used to determine the current approximate position however this is prone to errorand GPS outages. [23] provides a way for combining GPS, IMU sensors, and encoders. It is an odometry model that is based on Ackerman steering geometry and is computed using encoder data from the rear two wheels and steering. Because there is sensor fusion, it employs the Unscented Kalman Filter (UKF).

B. Environment modelling

There are various algorithms used for this purpose. For autonomous vehicles, the representation of environment should be dynamic i.e. it should take into consideration changes in the environment as well. [24] proposes a very simple solution based on Camera. It uses and object detection deep learning algorithm YOLO v2 trained on a set of vehicle images which is then used for identification of vehicles. They pass the information from YOLO v2 to a ROS node which then estimates the approximate distance of the vehicle. [25] proposes a similar method which uses Tiny YOLO and estimating neighbouring vehicle speed by tracking their taillights. [26] presents an approach to this problem for indoor environments by using a 2D LiDAR and a low cost camera.

IV. MAIN/ROUTE PLANNING ALGORITHMS

A. A* algorithm

A* is a well-known heuristic-based technique that is commonly employed in graph search issues. In 1968, Stanford Research Institute's Peter Hart, Nils Nilsson, and Bertram Raphael suggested it. By transforming the map to a graph and using heuristics as information supplied by sensor values, the route planning issue might be described in A*. The A* algorithm takes a greedy approach. It is a development of Dijkstra's Algorithm. The A* algorithm's evaluation function is provided by

$$f(n) = g(n) + h(n) \tag{1}$$

where$g(n)$ is the cost of getting to the current place and $h(n)$ is the expected cost of getting to the destination. The euclidean distance function or any other distance function may readily determine $h(n)$.

$$h(n) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

where (x_1, x_2) and (y_1, y_2) represent the co-ordinates of the current location and destination respectively. We can find their values using their latitudes and longitudes of the two points. We can also include heuristics like traffic and sensor information for more efficient path planning. The time complexity of this algorithm dependent on the heuristic function. [20] proposes an improved A* algorithm for path planning which focuses on obstacles and path proposals using circle equations. The algorithm proposed is more effective and faster by about 200%.

B. Dijkstra's algorithm

EdsgerWybeDijkstra, a computer scientist, devised this technique in 1956. It's a well-known non-heuristic path planning algorithm. This algorithm determines the shortest pathbetween two points on a graph. Given the current position and destination, this method returns the shortest distance or the shortest cost path. [27] describes how to apply this method on a network of interconnected roadways. Although Dijkstra always finds the shortest path, it does not ensure time efficiency. Because we must consider traffic, the shortest road is not always the quickest option. This approach has a temporal or time complexity of $O(V^2)$ when utilising an adjacency list representation of a graph, where V is the number of vertices in the graph.

Algorithm 1 A* Algorithm

1: **function** A*(*start, goal*)
2:*openSet* ← *{start}*

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```
closedSet ← {}
cameFrom ← {}
gScore[start]   0 ← {}
f Score[start]   ← heuristic(start, goal)
while openSetis not empty do
  current   ← the node in openSetwith the lowest
    f Score
  if current is goal then
    return   reconstructPath(cameFrom, current)
  end if
  remove current from openSet
  add current to closedSet
  for all neighbors neighbor of current do
    tentativeGScore ← gScore[current] +
      dist(current, neighbor)
    if   neighbor is in closedSet and
      tentativeGScore   ≥gScore[neighbor] then
      continue
    end if
    if   neighbor is not in openSet or
      tentativeGScoregScore[neighbor] then
      cameFrom[neighbor] ← current
      gScore[neighbor]   ← tentativeGScore
      f Score[neighbor]   ← gScore[neighbor] + heuristic(neighbor,
        goal)
      if neighbor is not in openSetthen
        add neighbor to openSet
      end if
    end if
  end for
end while
return failure
end function
```

C. Comparison between A* and Dijkstra

However, because A* is primarily dependent on its heuristic function, its optimality can only be established by the effectiveness of its heuristic function. Dijkstra has consistently outperformed in circumstances with little to no traffic. However, while dealing with traffic and having to include sensor data, A* performs better if these data are incorporated

Algorithm 2 Dijkstra's Algorithm

```
function DIJKSTRA(start, goal)
openSet   ← {start}
closedSet ← {}
cameFrom ← {}
gScore[start]   ← 0
while openSetis not empty do
  current   ← the node in openSetwith the lowest
    gScore
  if current is goal then
    return   reconstructPath(cameFrom, current)
  end if
  remove current from openSet
  add current to closedSet
  for all neighbors neighbor of current do
    tentativeGScore ← gScore[current] +
      dist(current, neighbor)
    if   neighbor is in closedSet and
      tentativeGScore   ≥gScore[neighbor] then
      continue
    end if
    if   neighbor is not in openSet or
      tentativeGScoregScore[neighbor] then
      cameFrom[neighbor] ←current
      gScore[neighbor]   ←tentativeGScore
      if neighbor is not in openSetthen
        add neighbor to openSet
      end if
    end if
  end for
end while
return failure
end function
```

TABLE I COMPARISON OF DIJKSTRA AND A*

	Dijkstra	A*
Advantages	Guaranteedtofindshortestpath Canuseheuristictoguidesearch Noneedforadmissibleheuristic	FasterthanDijkstra Canusedifferentheuristics Consistentlyfindsoptimalpath
Disadvantages	CanbeslowerthanA* Doesnotconsiderdistancetogoal Nowaytoguidesearchtowardsgoal	Requiresadmissibleheuristic NotguaranteedtobefasterthanDijkstra

into its heuristic function. This is owing to the fact that A* might easily incorporate dynamicity in it's approach.[28] also suggests that A* is more efficient than Dijkstra in terms of destination finding if provided appropriate heuristic. [29] compares computational efficiency of both the algorithms in a static scenario whereas [30] compares both the algorithm in different applications on the field. The results of which are summarized in the table below.

A* relies heavily on it's heuristic function and therefore it may or may not be faster than Dijkstra. We can see that Dijkstra outperforms A* in long distance path planning algorithms however in terms of time and memory A* is moreefficient. In dynamic environments, A* always outperforms Dijkstra.

TABLE II IMPLEMENTATION RESULTS FOR A* AND DIJKSTRA ALGORITHMS

		Metric Type	Result
A*	Static short distance Dynamic	Time Time	Faster than Dijkstra Faster than Dijkstra
Dijkstra	Staticlongdistanc Stati c	Time	Faster than Dijkstra

V. CONCLUSION

An overview of different popular algorithms have been provided and a comparison of two path planning algorithms has also been provided. Most of the sensor methods require the use of camera only owing to developments in distance estimation methods and the low cost of using only one Camera sensor however, a few methods still use a fusion of Camera and Lidar. In path planning algorithms, Dijkstra provides the shortest path, however A* may also consider information from sensors and traffic information. A* is shown to more efficient than Dijkstra.

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A Secured Photo Sharing framework Using Blockchain Technology for cross-social Platforms

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***Abstract*—Online Social Networks (OSN) have grown in popularity as a result, for the previous few years of the quick development of mobile applications and the explosive expansion of online engagement. As technology and the Internet become more accessible, so has the ease with which users can upload and share photos on Social Networking Sites (SNS). Therefore, it is necessary to safeguard the confidentiality of the same. On the other hand, those methods lose their utility as soon as someone posts the images on other platforms, this unauthorised disclosure of the user's private information causes negative effects and endangers the user's safety. In order to present effective spreading control for cross-social network picture sharing, Photo Chain, a blockchain-based framework, has been created with the goal of protected photo sharing. Combining blockchain, Gaussian Blur for face masking, Pre-Hash Algorithm for photo integrity verification, and Access Control, sharing, and access without having to worry about potential harm to user's interests. To maximize the adaptability of re- posters without jeopardizing the privacy of the former, a vivid privacy policy generating algorithm has been created. The concept also incorporates robust photo ownership identification technologies to stop illicit reprinting. The project culminates with the execution of a prototype and setup in a nearby simulated social setting. The extensive tests and safety measures investigation demonstrate the suggested framework's competence, security, and efficiency.**

Keywords—Block Chain, Cross Social Network, Photo Sharing, Security, Pre-Hashing Algorithm, Gaussian Blur Algorithm, Privacy Preserving.

I. INTRODUCTION

A digital communication tool is social media. Users may participate in conversations, share information, andproduce material for the internet via social medias. Some of the examples for social media can take include social networking sites, photo and video sharing websites, blogs, instant messaging, podcasts, widgets, virtual reality, and other platforms.

Fig. 1.1. Social Media

Most of us today use social media sites like Instagram, Twitter, Snapchat, You Tube, and Meta to communicate with potential virtual mates. These devices leverage online social media networks to alert users of news about their friends, favourite celebrities, and significant global events. Social media is now widely used by many people as part of their daily lives. Numerous billions of people use social media to communicate and share information. Social networking offers you the freedom to connect with loved ones, learn new things, pursue new interests, and seek entertainment.

Frequently used social media platforms and tools: Blogs: A forum for casual conversations and talks about a specific topic or point of view.

Meta: The primary social network in the world, with regularly active users creating private accounts, adding other users as friends, and exchanging communications like status updates to communicate current information. The brand-generated pages can be liked by meta users.

Twitter: A social networking or microblogging platform that enables quick status updates to be exchanged between users and organizations (140- character limit).

YouTube/Video: Uploading videos and browsing websites.

Instagram: An app that allows users to add digital filters, frames, and other creative effects to photos they want to post on social media.

LinkedIn: A topic where a group of professionals with comparable interests can share data and participate in discussions.

II. RELATED WORKS

- KambizGhazinour, John Ponchak [1] This study aims to reduce the security risk for common users by developing a GUI-based metadata reader and editor. The underlying risk, which is concealed in all shared media, can be brought out in the open and reduced by bringing the capacity to examine and modify metadata to various platforms.R. Regin, B. Sneha [2] It displays an adaptive concealing policy indication mechanism that, when shared with several clients, offers a policy to the client. Based on their level of trust in the recipient, this policy aids the client in deciding whether or not to share an image.

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- PrashantAbhang, S.B.Rathod [3] The main concept was to create a participant-free tagging technique that would enable the automatic association of a user's account with a specific person's face. In this instance, adversaries were unable to use malicious tagging assaults to share photographs on social media.

- Lei Xu, Ting Bao [4] It is implemented a fine-grained confidentiality managing of photo sharing by means of image processing algorithms. A notion for access controlling in photo sharing in which a image is broken up as several layers that are containing single blurred face. A viewer's final image is created by superimposing specific layers in accordance with their privacy settings. For photo sharing in OSNs, Edwin et al. developed a multi-party admittance architecture that enables access control granularity to be gradually tweaked from photo-level to face-level.

- Mary Jean Amon, RakibulHasan [5] I-Pic and COIN are privacy-preserving sharing systems that let users publish privacy options so that nearby photographers can learn about and respect their preferences. They alert registered users whenever another person nearby takes a picture and tell them whenever another user does so. So, in the current study, we also investigate how often, infrequently, or never people exchange photographs.

- PooryaAghdaie, BaariaChaudhary [6] Genuine facial pictures from two separate people are used to create a morphing image. The final morphed image may be compared to both genuine persons because it has traits from each, allowing for verification. Two methods are used to create morphed photos. In the first method, a morphing image is produced by alpha blending two real facial photographs.

- HarshaliChandel ,Dr. A. M. Bagade [7] Social networking sites (SNSs) are a limitless form of communication that allow people to stay in touch across borders. SNSs are more than just a web application; they are a component of human civilization. SNS use has outpaced conventional forms of communication in practically every industry, including that of news organizations, large and small businesses, governments, and well-known individuals. The abundance of technology and services has made it easier to share information with friends and family, including news, photographs, personal preferences, and information.

- VatsavaiSrija& T SaiDurga [8] Utilizing the K- Nearest Neighbours technique, we are studying the face matching notion. In our project, we are employing the Ball-Tree technique, one of the many sub-methods in the KNN algorithms. Binary Tree Method is another name for the Ball-Tree algorithm. Each node in this technique generates a D-dimensional hypersphere that contains a subset of the searchable points. The prediction parameters are saved in a CLF file when the B-Tree is constructed.

III. PROPOSED METHODOLOGY

With the help of fairness and without any potential risk to the user's safety, Photo Chain, a combined block- chain, Gaussian Blur for face masking, Pre-Hash Algorithm for photo integrity verification, and Access Control, Mechanism realises secured data sharing, retrieval, and access.

Algorithms and Techniques used

- Smart Contract
- Gaussian Blur
- Pre-Hash Algorithm
- Access Control Mechanisms
- Hash-Key to verify the integrity in photo shared

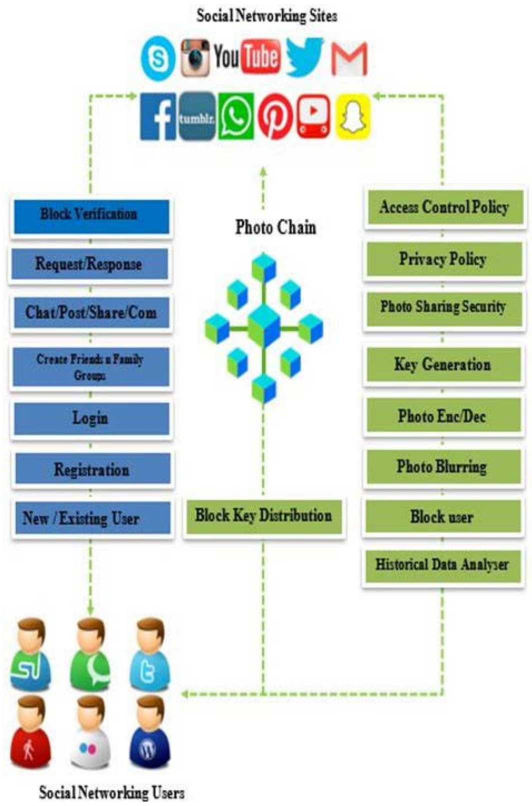

Fig. 3.1. Proposed Architecture

1. SN Web App

The development of SNS as a platform that people may use to connect with others who share their interest, abilities, environments, and real-life connections is taking place. SNS come with a range of formats and facets

2. End user C-panel

2.1. Register

Users of the App must first register their data in order to access and share pictures on the website. In order to access the current and contact information shared by friends, one must first log into the application. They can upload the image as either private or public. Wherein others have the ability to make friend requests, accept them, and intend to reveal secret representations of the medium.

2.2. Login

The user will exhibit many social network functions, including editing his profile and performing the actions of

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viewing and adding friends, searching for other users, and seeing user profiles.

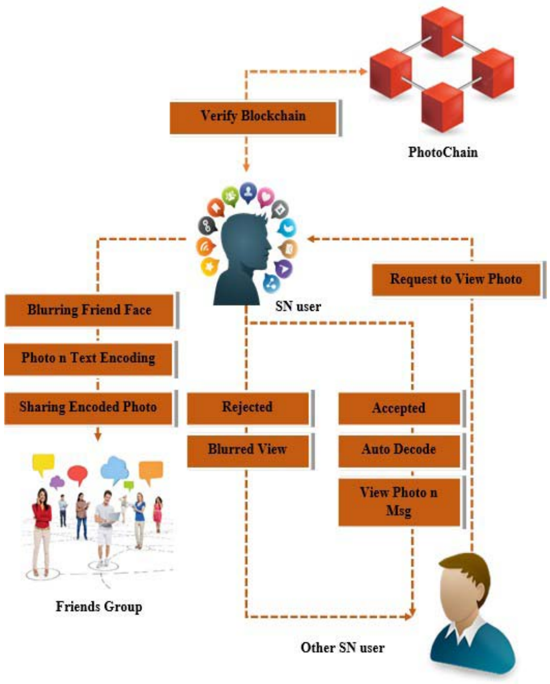

Fig. 3.2. System Flow

2.3. Add Friends /Family Groups

The log-in/log-out button for the social platform is called Friend Request. A greeting and the profile picture are made public after logging in. The proposed prototype has three operating modes: setting up, sleeping, and functioning.

In order to organize the area by selecting the "Pick-Friends" button, a user must physically locate the group of "close friends" from the list on the social networking platform.

2.4. Share/Post/Comment/Chat

Users that post photos can limit their sharing to their friend's in-lists. The projected plan complies with the co-owner's disclosure guiding principle and the list of communications of owner's privacy process.

2.5. Policy mining

Users can choose whether to make an uploaded image public or private; only eligible users who have permission to see public photographs can then access these images; otherwise, they will be hidden. The owner of the content should make available the key forthat image if people wish to see private content. Since representations in the same class are also anticipated in a comparable level of confidentiality fortification, policy mining is conducted inside the same class.

2.6. Policy prediction

This process generates a vast number of application policies while returning to the user the most promising applicants. In terms of offering the anticipated guiding principle of a recently uploaded photo for personal reference, this represents a step towards selecting the best candidate method.

2.7. Request/Response

There are two ways to react to a friend's request: either click the buttons labelled "confirm" or "not now" to decline the invitation.

3. Photo Privacy

3.1. Key Generation

During this process, the personal information of the photo is protected using the selected protection tool and a secret key (or set of keys) given by the sender. The proper management of all the encryption keys used in the system is a relevant difficulty in addition to offering an appropriate security level and an effective implementation. A centralised strategy has been suggested in which the trusted Key Server stores all of the keys.

To produce unique keys for each image and region within it, the server must be able to detect images in a unique way. As previously noted, the encrypted image's metadata contains this particular ID. The encrypted image's metadata contains this particular ID. The hash of the image could be used as ID as an alternative strategy. The drawback of utilising the hash as the ID is that it must be performed in the mobile application, which could be costly depending on the size of the image and could result in security issues if hash collisions are discovered. More significantly, the key server would have the ability to examine some usage patterns and identify instances where two users encrypt the same image.

3.2. Photo and Message Encode/Decode

Image and Message Encoding

Form-sampling, residual, and down-sampling layers make up the encoder network. Fig. 2 depicts the encoder network's organisational structure. Numerous skip connections are used in the reset to combine shallow and deep features at various stages of convolution. The shallow feature is with numerous low level competent particulars about the framework and colour on the image that can be used to create steganographic images. The findings of constructing an encoder network havingtopology alike to the U-Net have shown how the skip connection can effectively reduce steganographic image distortion and improve visual quality.

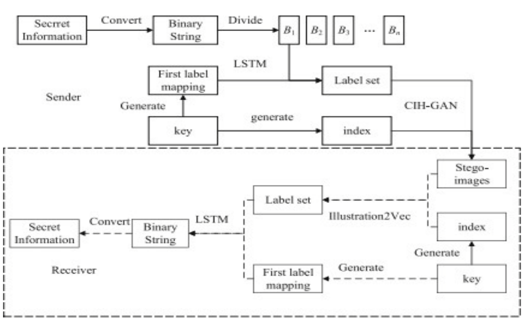

Fig. 3.3 Image and Message Encode and Decode

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a. original image

Image and Message Decoding

The decoding network, made up of 6 layer complete Convolutional Network (CN) that pulls out secret colour image-S' from the steganographic image-C'. The encoder and decoder networks from the previous part make form the generator in the proposed model HIGAN. Past studies have shown that both three-channel colour and single-channel grayscale secret images can be successfully recovered using the decoder network's architecture. Following each of the 3 convolutional layers having stride-1 and padding-1, the Batch Normalization method and Real Activation Function are used. However, Sigmoid Activation Function was employed subsequent to the ending layers. The decoding network eventually discloses the hidden image-S.

b. generated image

Here, the CNN parameters includes,

Designing: The nature of the shared images, the intended use case, and the system's performance needs will all have an impact on how the CNN architecture for a blockchain-based secure photo sharing framework for cross-social networks is designed.

Image Pre-processing: The images is necessary to guarantee that they are in a format that the CNN can use. The pictures may need to be resized, their pixel values normalized, and they may need to be converted to grayscale or RGB format, among other things.

Network Architecture: Given that it will have to analyse a lot of images in real time, the CNN architecture needs to be effective and scalable. Additionally, the architecture ought to be able to handle various picture sizes and aspect ratios.

Hyperparameters: It has a number of convolutional and pooling layers to acquire features from images and fully connected layers to categorise the images, is a well-known architecture for image classification.

The CNN should include security measures like encryption and secure authentication since the framework is built on blockchain technology to make sure that only authorised users can access the shared pictures.

3.3. Photo Blurring

A Gaussian function, commonly referred to as Gaussian smoothing, blurs an image. It is a typical effect in graphics software, usually intended to decrease detail and visual noise. Unlike the bokeh- effect due to the out-of-focus of lens / shadow on the object as a result of standard lighting. The proposed technique produce the smooth blur appearing same as translucent screen.

4. Privacy Violation

A policy's current state Individual users are in charge of the privacy policy's current state. The policy should take into account the person's exposure needs as well as their privacy demands. Defend or post If the policy is satisfied, the co-owner receives the notification. The photo is only posted once the owner has permission to upload it; otherwise, it is not.

5. Photo Chain Integration

Based on blockchain technology, the decentralized SN data sharing and storage system Photo Chain decouples user data and programs to return ownership of the data to the users.

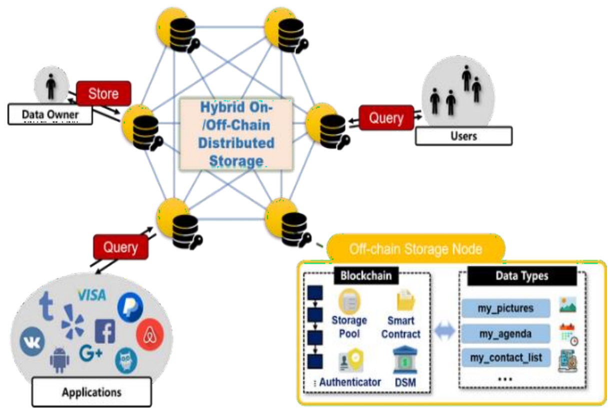

Fig. 3.4. Photo Chain Integration

We employ Personal Data Store to increase off-chain storage for internet data. With the use of a distinctive identity assignment (i.e., Web-ID) and certificateless cryptography, we also established an identity establishment mechanism that can support Web ID- based authentication functions. In order to automatically store and securely distribute social data, we design a general framework that uses smart contracts.

Level – 0

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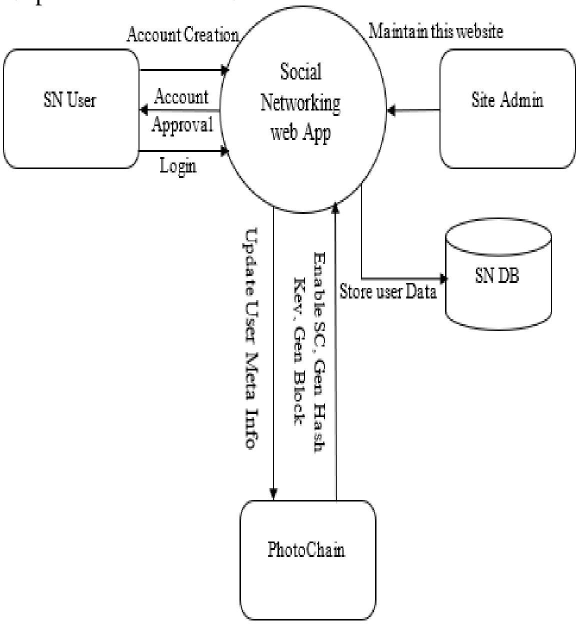
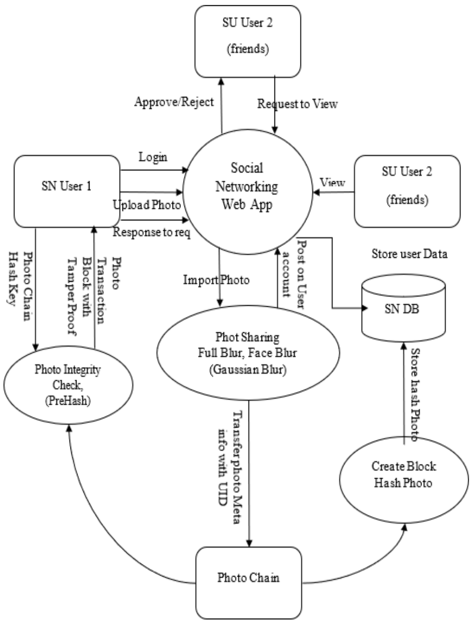
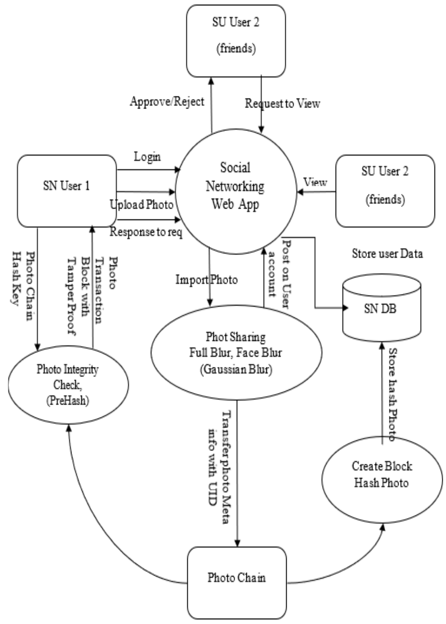


Level – 1



Level – 2



IV. Implementation

- The framework's architecture should be created in a way that enables users to safely store and exchange photos across various social networks. It ought to be built on a blockchain network that offers a decentralised and impenetrable picture storage system.
- For instance, a smart contract can be created to limit who has access to shared photos.
- Integrate social networks: The framework needs to be linked with various social media platforms, including Twitter, Instagram, and Facebook. The social networks' APIs can be used to accomplish this.
- Implement a secure authentication method: A secure authentication method should be used to guarantee that only authorised users can access the shared photos. Digital signatures and public-key encryption can be used together to accomplish this.
- Implement encryption and decryption mechanisms: Encryption and decryption mechanisms should be used to ensure the privacy and confidentiality of the shared pictures. Algorithms like RSA or AES can be used for this.

Overall, a combination of technologies including blockchain, smart contract, encryption, and decentralised storage systems is needed to implement a blockchain-based secure picture sharing framework for cross-social network use. To enable users to safely keep and share their photos across various social networks, the framework should be created with security and privacy in mind.

V. Conclusion

Due to the widespread use of smart mobile devices with high-resolution cameras and user-friendly social networks programs, sharing photos has become an easy and popular hobby. Yet, the majority of photo sharing sites don't have a reliable method for safeguarding users' privacy. In this

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project, we created, put into practise, and assessed Photo Chain, an expanded control framework for blockchain-enabled, privacy-preserving photo sharing across several social networks. By regulating the actions of the users after them in a dissemination chain, it aids social networking users in maintaining the privacy criteria assigned to their uploaded photos. Without interfering with the display phase, it ties the access control policies to the images in the interim. Photo Chain may therefore enable social networking users to conceal private areas from prying eyes across many social networks. Photo Chain not only protects the shared photos so that no unauthorized users can access them, but also enables users to blur their image search so that the search can also be shared to a cross social networking site obliviously without leakage on the query contents or results. Additionally, Photo Chain not only safeguards user privacy but also minimises system overhead. Results of the evaluation showed that it is effective the idea of photo chain, which offers privacy, confidentiality, and integrity. The suggested plan prevents unwanted users from accessing the private information while also ensuring that legitimate users continue to share information without interruption.

In future work, we will further develop our system by taking into account more user-related attributes and security levels of various groups in order to provide access control with a finer grained. We plan to investigate how the most recent technological advancements, including federated learning, can protect user privacy in Cross SNs in the future.

TABLE 1: RESULTS OF ACCESSING THE PHOTOS

Groups	**Can't view**	**Viewable**	**Download**	**Re - upload**
Friends	5.6%	90.4%	76.4%	23.2%
Strangers	50.5%	50.4%	43.6%	8.1%
Others	75.2%	22.8%	11.3%	2.3%

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Evaluation of Agrometeorology Using Bootstrap Aggregation with Streamlit

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Abstract*—Machine learning has proven to be an effective tool in enhancing the accuracy of agrometeorology predictions and agricultural production forecasts. By analyzing factors such as temperature, rainfall, humidity, soil quality, pH levels, and geographic location, advanced ML techniques such as Random Forest, Logistic Regression, and Naive Bayes provide valuable insights for farmers to make informed decisions. Utilizing these predictions can result in increased crop yields and more sustainable agricultural practices. The integration of machine learning into agrometeorology has the potential to revolutionize crop production and management. Therefore, machine learning plays a critical role in agrometeorology by improving predictions of agricultural production, enabling farmers to optimize crop selection and management practices, leading to higher yields and better sustainability. The evaluation show that the proposed approach using Bootstrap Aggregation and Streamlit can effectively predict crop yield based on weather and crop-related data. The web application provides an easy-to-use interface for farmers to input data and receive predictions, which can help them make informed decisions about crop management and planning.Overall, the integration of machine learning in agrometeorology holds great potential for transforming crop production and management.

Keywords— Machine learning, Random Forest, Decision Tree, Naïve Bayes, Streamlit.

I. INTRODUCTION

Agriculture has always been the main and most important activity in every culture and civilization that humans have ever known. It plays an important role in the developing economy and is essential to the existence. The Indian economy and the destiny of humanity depend on this area as well. Furthermore, it accounts for a sizable amount of employment. The amount of production needed has dramatically expanded as time goes on which depends on mean based absolute error [1].

People are utilizing technology incorrectly to create larger profits. The hybrid plant varieties are continually evolving. But unlike naturally grown crops, these types don't offer the necessary components. These artificial methods damage the earth. All of this causes a greater environmental impact [4]. A variety of machine learning classifiers, such as logistic regression, naive bayes, random forest, and others are used to push a pattern in order to perform accurate prediction and stand on the erratic patterns in temperature and rainfall. The random forest approach provides the best level of accuracy, according to this research of the aforementioned machine learning classifiers [14]. The system forecasts crops based on the collection of historical data. The information is provided using historical data on the weather, temperature, and a number of other variables [16]. This application runs an algorithm and displays a list of crops that match the inputted data and their anticipated yield values.

II. RELATED WORKS

Recent literature has examined the application of machine learning and data analytics in predicting agricultural production [2]. This involves using algorithms like random forest classification, Naive Bayes, decision tree, SVM, and improved extreme linear machine to forecast crops based on historical data such as weather, temperature, and soil quality. A mobile application for Android is under development, which will utilize user-entered criteria, such as temperature, to make predictions. The primary objective is to develop an affordable and precise weather forecasting system for remote regions. Previous studies have also explored the use ofmachine learning in plant biology, disease diagnosis, and image processing to enhance crop production and agricultural productivity [5].

The algorithms employed include random forest, naive bayes, decision tree, and others. An Android mobile application is being developed to aid farmers in selecting suitable crops based on various factors, including temperature, humidity, and soil quality [9]. The research employs various techniques such as Kalman Filter, linear discriminant analysis, and extreme linear machine to enhance crop yield prediction. Additionally, the study focuses on designing a weather forecasting system for remote areas using machine learning and data analytics approaches[15].

Aruvansh Nigam, et.al,..[1] agriculture has been recognized as the primary means of providing for human needs, serving as a vital occupation and a major industry in India. Traditionally, farmers relied on their observations of their crops and animals to ensure healthy yields without the use of chemical interventions, thereby maintaining diversity in their cultivation lands. However, in recent times, the changing weather patterns have adversely affected these elemental resources, resulting in a decline in food production and security. Unfortunately, this trend is

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reflected in the decreasing GDP in the agricultural sector. For instance, in 2005, the sector contributed 17.2% to the GDP, but this figure plummeted to 11.1% in 2012, 5% in 2018, and further down to 2% in the first quarter of 2019-2020. The majority of farmers, accounting for around 80%, hail from rural areas, and any drop in crop production revenues will have significant impacts on their livelihoods and the industry as a whole.

Nithin Singh, et.al,..[13] Weather forecasting involves predicting future weather conditions. In this context, a research paper proposes a method of predicting rainfall by analyzing real-time data from sensors that measure temperature, humidity, and pressure. The authors suggest that machine learning algorithms can improve data analysis and prediction without needing specific programming from users. Machine learning enables systems to learn from past data and improve their forecasting capabilities without requiring an understanding of the physical processes that govern the atmosphere. Therefore, this approach has the potential to be used as a weather forecasting method.

Prior research on the implementation of machine learning in agriculture, including investigations into plant biology, decision-making, soil, water management, and crop management, have been analyzed [3] and [7]. The current research indicates that further investigations are necessary to fully leverage data mining techniques in the agriculture sector.

Weather forecasting is a subject that has captured the attention of researchers from diverse fields due to its significant impact on human life worldwide. In recent years, the increasing availability of large-scale weather observation data and advancements in information and computer technology have encouraged many researchers to explore hidden patterns in vast datasets for predicting weather patterns [13].

H. Sak, et.al,..[16] Training both GMM-based and deep learning-based acoustic models for predicting speech recognition requires significant computation time. To overcome this challenge, researchers have proposed an acoustic model based on the CTC algorithm, which does not require the GMM-based acoustic model, since it does not use the forced aligned HMM state sequence. However, previous studies that utilized a LSTM RNN-based acoustic model using CTC were limited to small-scale training data. In this research, a large-scale training corpus was used to train the LSTM RNN-based acoustic model using CTC, and its performance was evaluated. The results showed that the proposed acoustic model achieved a Word Error Rate (WER) of 6.18% and 15.01% for clean speech and noisy speech, respectively, which is comparable to the performance of the hybrid-based acoustic model.

PR Naveen Kumar, et.al[14] The emergence of machine learning has led to its increasing application in diverse domains, including precision agriculture. Farmers often face unstable economic conditions due to the wrong selection of crops to grow in their fields. This problem can be tackled by leveraging machine learning techniques to recommend suitable crops. However, mapping crop recommendations using classification techniques can be challenging due to various factors that impact crop selection, such as soil characteristics, macro and micronutrient composition, pH value, humidity, rainfall, temperature, and more. Fortunately, machine learning algorithms are now capable of performing advanced tasks such as multi-class classification, multi-label classification, and multivariate regression. Various classification algorithms such as decision trees, k-nearest neighbors, logistic regression, support vector machines, AdaBoost, and XGBoost can effectively perform multi-class classification. Additionally, predicting suitable crops requires finding optimum parameter values. Currently, crop yield prediction is a popular task that is being integrated with remote sensing techniques.

III. Proposed Methodology

A Random Forest model can be employed to predict human dehydration by analyzing various physiological and environmental factors collected from wearable devices. The collected data will be pre- processed and used to train the model with the scikit- learn library in the Jupyter notebook, which will then be optimized to achieve the highest accuracy possible. The model will be deployed on a Flask web server and presented as a web application, enabling users to input their data and receive a prediction about their hydration levels. HTML, CSS, and JavaScript will be used to build the web application, which will send data to the server via an HTTP request.

The Jupyter notebook will be used for data pre-processing, model training, deployment, and testing, allowing for model fine-tuning by incorporating feedback from medical experts and continuously retraining the model with new data. A dataset for crop prediction typically includes a variety of input features related to the crop growth and health, as well as a corresponding output value indicating the expected yield or quality of the crop. Some common input features in a crop prediction dataset may include: phvalue, soil type, whether condition, humidity etc.. The size and complexity of the dataset can vary depending on the specific application and the number of input features and output values. Larger datasets with more input features and output values can help improve the accuracy and reliability of the predictions generated by machine learning models.

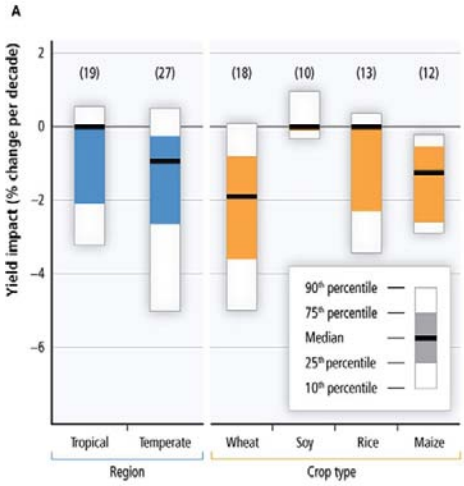

Fig. 1. Feature importance of the dataset

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The raw data is transformed into a clean data collection using a method known as data pre processing. Although the data are gathered from numerous sources, analysis is not possible because they are gathered in raw form. By utilizing a variety of techniques, such as the replacement of missing values and null values, it can transform data into a format that is understandable [6]. The final step in the data preparation process is the separation of training and testing data. Because training the model frequently necessitates as many data points as possible, the data has an uneven distribution [8] and [10]. The initial dataset used to teach machine learning algorithms how to learn and generate precise predictions is the training dataset, which in this case takes up 80% of the dataset [11] and [12].

A. *Factors Affecting Agrometeorology*

Crop productivity and yield depend on various factors that need to be considered to estimate the annual crop output. These factors include temperature, rainfall, humidity, soil quality, pH level, andgeographic location. In the early days of agriculture, only a limited number of crops were cultivated, and most food was obtained through foraging in the wild.underneath a wide.

Changes in climate patterns have a direct impact on agriculture. With increasing temperatures and changes in precipitation patterns, it becomes difficult to predict crop yields and patterns.The topography of a region plays a vital role in determining weather patterns. Mountains, valleys, and other landforms affect precipitation and temperature distribution, which in turn influence crop growth.The use of technology in agriculture has increased significantly over the years. Weather forecasting, remote sensing, and precision agriculture tools are some of the technologies that have revolutionized the way agriculture is practiced.

B. *Algoritms*

1) *Navie Bayes*

Naive Bayes is a probabilistic algorithm commonly used for classification tasks, including crop prediction. The basic formula for Naive Bayes can be expressed as:

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)}$$

where P(Y|X) is the posterior probability of class Y given input features X, P(X|Y) is the likelihood of the input features given class Y, P(Y) is the prior probability of class Y, and P(X) is the marginal probability of the input features. To use Naive Bayes for crop prediction, you would typically start with a dataset of input features related to crop growth and health (e.g., soil quality, weather conditions, nutrient levels, etc.) and a corresponding output value indicating the expected yield or quality of the crop. Naive Bayes algorithm is used to build a model that can predict the output value based on the input features. The specific formula for Naive Bayes in crop prediction would depend on the particular features and output value being predicted, as well as the specific implementation of the algorithm being used.

2) Decision Tree

Decision trees are a popular machine learning algorithm used for classification and regression tasks. They are also commonly used in crop prediction to make predictions based on input data. Start with a dataset of training examples, where each example is a set of input features and a corresponding output value. Choose a feature from the input data that best separates the examples into different groups based on their output values. Create a node in the tree for this feature, and split the dataset into two or more subsets based on the feature's values. The formula for a decision tree can be expressed mathematically as:

$$Y=F(X)$$

where y is the output value being predicted, x is a vector of input features, and f is a function that maps the input features to the output value using a tree- based decision-making process.

3) *Random Forest*

Random forest is a popular machine learning algorithm that uses a combination of decision trees to make predictions. The formula for random forest can be expressed as follows:

$$Y=F(X)$$

where y is the output value being predicted, x is a vector of input features, and f is a function that maps the input features to the output value using a combination of decision trees. To use random forest for crop prediction, you would typically start with a dataset of input features related to crop growth and health (e.g., soil quality, weather conditions, nutrient levels, etc.) and a corresponding output value indicating the expected yield or quality of the crop. You would then use the random forest algorithm to build a model that can predict the output value based on the input features.

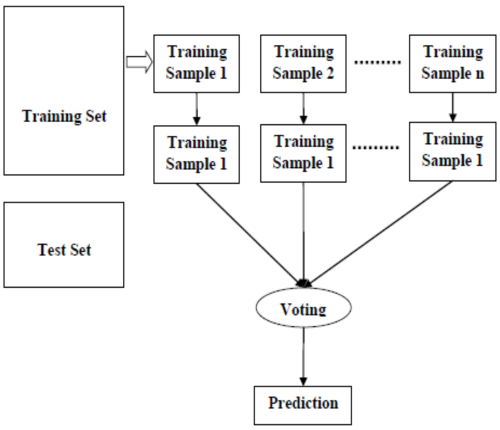

Fig. 2. Random forest classifier

C. *Analysis of Navie Bayes, Decision Tree and Random Forest*

Random forests are an ensemble learning method that consists of multiple decision trees, where each tree is constructed using a random subset of variables selected uniformly from the entire forest. By using the bagging technique to train the data, RandomForest improves the accuracy of the results. We chose the Random Forest approach to achieve high accuracy because it provides accurate predictions for both model-based predictions and actual results in the dataset. The model's predicted accuracy of 91.34% is evaluated.The proportion of true positive predictions among all actual positive instances in the dataset. This is useful when the cost of false negatives is high.

The proportion of correct predictions made by the model. This is a common metric used in classification tasks. A decision tree incorporates individual decisions, while a random forest combines multiple decision trees. Consequently, it is a slow but thorough process. On the other hand, a decision tree is quick and efficient with large datasets, especially linear ones. However, the random forest model requires extensive training.

It is important to consider the characteristics of the data and the goals of the analysis. Decision tree may be a good choice if the goal is to understand the relationships between the features and the target variable. Naive Bayes may be a good choice if the data is high-dimensional and the goal is to predict the class. Random Forest may be a good choice if the data is noisy and the goal is to improve the accuracy of the predictions. It is recommended to evaluate multiple algorithms and compare their performance using appropriate metrics.

TABLE 1. ALGORITHM WITH ACCURACY LEVEL

ALGORITHM	ACCURACY
DECISION TREE	87.82
NAÏVE BAYES	91.49
RANDOM FOREST	92.81

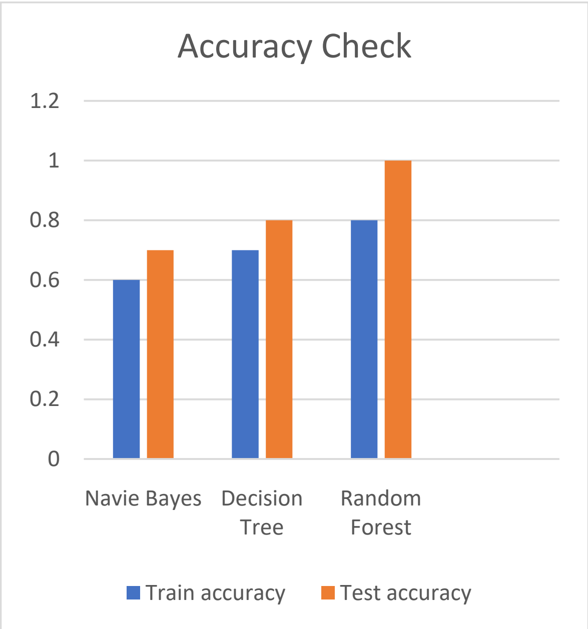

Fig. 3. Accuracy analysis

IV. SYSTEM ARCHITECTURE

The proposed system architecture involves using a weather API to retrieve data on temperature, humidity, rainfall, and other variables. The data is then sent to the server and stored in its database. Users can create an account on the mobile app by completing a single registration. The model used for prediction is Random Forest, which is a collection of tree predictors that utilizes the bagging approach to train data, leading to improved accuracy. The expected accuracy of the model is 91.34%.

Streamlit is an open-source framework that allows developers to create interactive web applications easily. In this step, a web application can be developed using Streamlit that allows users to input the data and get the output of the Bagging technique applied to agrometeorology.

The final step in the system architecture is to evaluate the accuracy of the Bagging technique applied to agrometeorology. The evaluation can be done by comparing the output of the Bagging technique with the actual weather data. The evaluation can be done on a regular basis to ensure that the system is accurate and reliable.

The application layer receives input from the presentation layer and retrieves data from the data layer. The machine learning algorithms are applied on this data to generate insights and predictions related to agrometeorology. Bootstrap aggregation, or bagging, is used as an ensemble method to combine the results from multiple decision trees to improve the accuracy of the predictions.The presentation layer is responsible for the user interface and visualizations, which are built using the Streamlit framework. The application layer is responsible for the business logic and analysis, and is built using the Python programming language with the Scikit-learn library for machine learning algorithms. The data layer includes the agrometeorological data that is collected from various sources and stored in a database.

The application layer are then passed on to the presentation layer, which displays them to the user in an interactive and user-friendly manner. The user can interact with the system through the web interface provided by Streamlit and explore the various visualizations and analysis generated by the system.

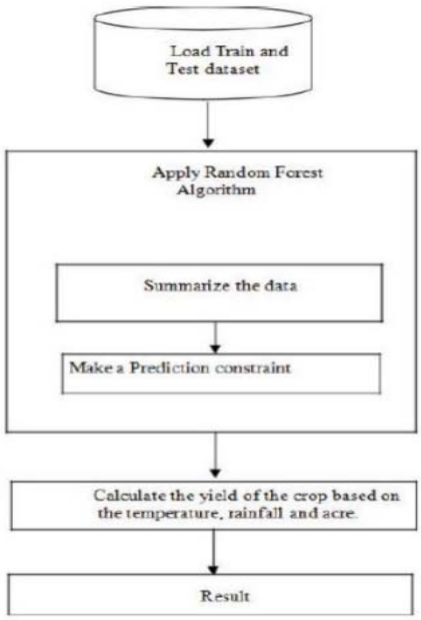

Fig. 4. System Architecture

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A. System Analysis

Python 3.8.5: Python is the programming language that serves as the basis for machine learning analysis. The necessary output is provided via Jupyter notebooks, which also show how the analysis is done.

Python Flask Framework: Flask is a Python microframework. WSGI (Web Server Gateway Interface) tools and the Jinja2 template engine are used in the development of Flask. Flask is used in this research as the back-end framework for building the application. Thanks to a collection of modules and libraries, the developer may design applications without writing the low-level code required for protocols, thread management, etc.

Streamlit : Streamlit is a popular Python-based open-source app framework that enables developers to create data science and machine learning applications quickly. With Streamlit, it is possible to develop online applications with ease. The framework supports several Python libraries, including NumPy, pandas, scikit-learn, Keras, PyTorch, and SymPy (LaTeX). Using Streamlit, developers can create interactive and visually appealing web applications without worrying about the underlying code.

V. Result and Discussion

This article uses machine learning approaches to improve agricultural output. The method that produces high accuracy forecasts the yield of the correct crop. With input libraries like Scikit-Learn, Numpy, Keras, and Pandas, Python 3.8.5 is used to implement the machine learning algorithms. An Android application that was created questioned the outcomes of the machine learning study. The crop name and accompanying yield were shown through an Android app built with Flutter.

The results of the evaluation would depend on the specific implementation and data used in the system. However, the Bagging technique is known to improve the stability and accuracy of a model, and applying it to agrometeorology can potentially improve weather forecasting in agricultural settings. Streamlit can also provide an easy-to-use interface for users to input data and receive real-time output. The evaluation of the system would require comparing the output of the Bagging technique with actual weather data to determine its accuracy and reliability.

The crop that can be cultivated in a certain district at a given period was predicted using the Random Forest Classifier, which had the highest accuracy.

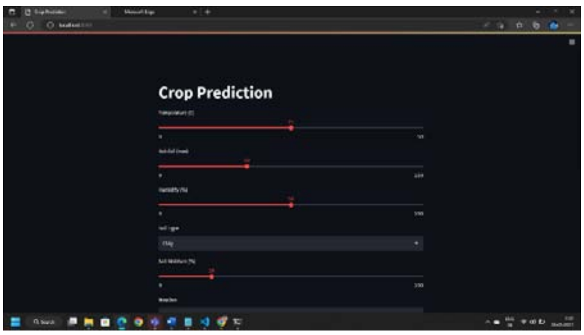

Fig. 5. Crop prediction before submit

This article uses machine learning approaches to improve agricultural output. The method that produces high accuracy forecasts the yield of the correct crop. With input libraries like Scikit-Learn, Numpy, Keras, and Pandas, Python 3.8.5 is used to implement the machine learning algorithms. An Android application that was created questioned the outcomes of the machine learning study. The crop name and accompanying yield were shown through an Android app built with Flutter.

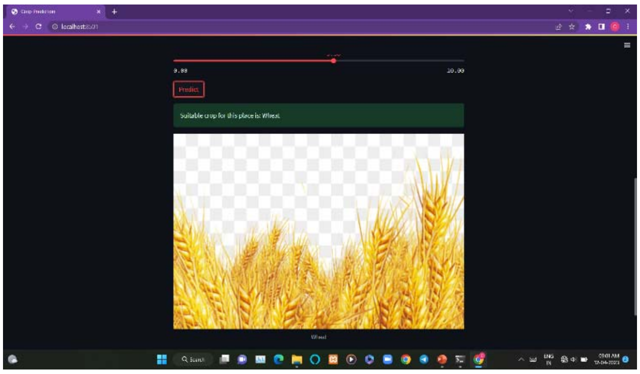

Fig. 6. Crop prediction after submit

VI. Conclusion

The objective of this project is to assess agrometeorology using Bootstrap Aggregation (Bagging) in combination with Streamlit. Bagging is a statistical method that employs bootstrapped samples to decrease the variance of machine learning models and enhance the consistency and accuracy of the outcomes. Streamlit is a free, open-source framework that streamlines the development and sharing of interactive data applications, including machine learning models.

The process involves collecting data on various agrometeorological variables such as temperature, humidity, rainfall, and others. This information will be utilized to train a Random Forest model employing the scikit-learn library in a Jupyter notebook. The optimized model will subsequently be deployed on a Flask web server and integrated into a Streamlit web application for straightforward use and interaction. The web application will permit users to input their data and receive predictions on their crop yields. The project aims to uncover the factors influencing crop yields and assist farmers in making informed decisions about crop selection and management.

The Bagging technique can improve the stability and accuracy of the model, while Streamlit provides an easy-to-use interface for users to input data and receive real-time output. The evaluation of the system's accuracy and reliability would require comparing the output of the Bagging technique with actual weather data. However, further development and implementation of the system are needed to determine its effectiveness in improving agrometeorology.

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Xception Framework for Predicting Pneumonitis Using Deep Learning

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***Abstract*—Pneumonia is a lung disorder that can be brought on by infections with bacteria, viruses, and fungi. To identify the location of inflammation in a picture, a pneumonia detection system is being built. An experienced radiologist can identify the illness from chest X-ray images. This will examine how various pre-processing methods, including X-rays, can identify and categories numerous diseases. Computer-aided diagnosis systems are therefore required to direct the practitioners. For the purpose of predicting pneumonia, this system employs a deep neural network algorithm using the Xception framework. CT lung pictures are entered into the system and converted to pixels.Active contour technique analysis is used to determine the presence of holes in the lung lobes. The classification of CT scan images for consumer with coronavirus infections using CNN models is the main goal of this study. The test results revealed that the software can distinguish between photos that are infected and those that are not. The Xception network detects pneumonia cases more effectively.**

***Keywords*—Machine Learning, Deep Learning, CT Scanning, CNN.**

I. Introduction

Pneumonia is a lung inflammation that mostly affects the tiny air sacs known as alveoli. The most frequent infectious cause of death in the US is pneumonia. Although it affects people of all ages, the very young, the elderly, and the chronically ill experience the clinical signs that are the most severe. Pneumonia is typically brought on by bacterial or viral infections, while it can also be brought on by other microorganisms, certain drugs, and illnesses such autoimmune diseases. It typically appears on a chest radiograph as a region of increased opacity (CXR). Among them, millions of people, mostly those over 65 and those with chronic conditions like diabetes or asthma, are susceptible to the contagious and lethal infection pneumonia. Pneumonia is responsible for more than 15% of deaths worldwide, including those of children under five. Chest X-rays [2] are thought to be the most efficient way to diagnose pneumonia. For the purpose of classifying pathological and normal chest X-rays, we investigated the performance of various pre-trained CNN model [3] versions in this study, followed by various classifiers. The study's main contributions are as follows. The evaluation of the most effective pre-trained CNN model with hyperparameter tuning of the best analyses classifier to further enhance performance involves comparing them analytically, presenting them with various classifiers to suggest the best classifier in the same classification field, and presenting them with the most effective pre-trained CNN model.

II. Literature Review

PranatiRakshit [9] in 2020,lung nodules is classified and recognized using a convolutional neural network approach. Because of the large respiratory organ, double overlap with the ribs, and low contrast of the lesions, it can be challenging to identify respiratory organ nodules on an imaging test. For detection and classification from CT scan pictures, a CNN based deep learning (DL) strategy is suggested. Using common evaluation metrics, the findings are compared to those obtained using traditional machine learning techniques in the literature.

Anuradha. D Gunasinghe [5] predictions for lung disease in 2019. In the medical field, early lung disease detection and diagnosis are crucial because they facilitate the management of consumer subsequent clinical care. The initiative primarily considers pneumonia while also taking consumer respiratory issues into account. In this study, chest X-ray pictures are utilized to predict lung disease (pneumonia) utilizing convolutional neural networks (CNNs) and machine learning and deep learning frameworks.

SubratoBharati [15] using hybrid deep learning to identify lung conditions in x-ray pictures. This can include conditions including fibrosis, asthma, TB, chronic obstructive pulmonary disease, and pneumonia. The early detection of lung illness is crucial. a novel hybrid deep learning architecture that combines CNN [8], the spatial transformer network (STN), the VGG, and data augmentation. The innovative hybrid strategy used here is called VGG Data STN with CNN (VDSNet). The technologies for execution used are Jupiter Notebook, TensorFlow, and Kera's.

Ali Serener[6] lung illness forecast for the coming year, 2020. Early detection of lung disorders will enable the doctor to save the consumer life. This study explains how machine learning was used to predict and manage lung illnesses. The methodologies used in this study to identify lung problems include merging the analysis of consumer data with data from chest X-rays, as well as employing the Caps Net network and CNN's well-known pre-trained model for this type of data. N. Mohanapriya[11] using Deep Convolutional Neural Networks (DCNN),Lung Tumor Classification and Detection from CT Scan Images in

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2019[12]. Maximum or average pooling replaces input values with maximum or average values to lessen output sensitivity to minute input changes. To lessen the sensitivity of the output to minute input changes, maximum or average pooling replaces input values with maximum or average values.

III. PROPOSED SYSTEM

The Xception framework can be a useful tool for pneumonitis prediction. Convolutional neural networks are used by the Xception framework, a deep learning system, to identify photos. This is a suggested method for using the Xception framework to forecast pneumonitis. A sizable dataset of chest X-ray pictures, both with and without pneumonitis, will be gathered as data. In data pre-processing, the photos are resized to a uniform size, the pixel values are normalized, and the data is divided into training, validation, and testing sets. Using the Xception framework, a deep learning model may be created to categories chest X-ray [8] images as either normal or showing symptoms of pneumonitis. Models are trained using the training data set, and performance is enhanced by applying methods like data augmentationand transfer learning. Model performance on the validation set is assessed, and the model's performance is then improved by adjusting the model's parameters as needed. The goal of model testing is to evaluate the final model's performance using test data that hasn't been seen before. Deployment is the process of transferring the trained model to a local or cloud-based server environment and integrating it into a web or mobile application that can accept chest X-ray pictures as input and produce the anticipated diagnostic.

The images of CT [10] Pneumonia are supplied into the system and converted to pixels. Holes in the Pneumonia lobes are examined using the active contour approach. The fissure nodule is taken into account when doing the contour adjustment. With the aid of various lobe segmentation probability levels, the candidate nodules are extracted. Candidate nodules that have been pruned are used to extract the hybrid features, and various features are used to create feature vectors. Sort the Pneumonia lobes based on these characteristics to forecast Pneumonia illnesses. The Xception CNN [8] model is used in the proposed study to identify pneumonia infections from degraded CT scan pictures to a sparse matrix.To increase the detection accuracy, an Xception CNN-based detection model is suggested shown in **Fig 1**.

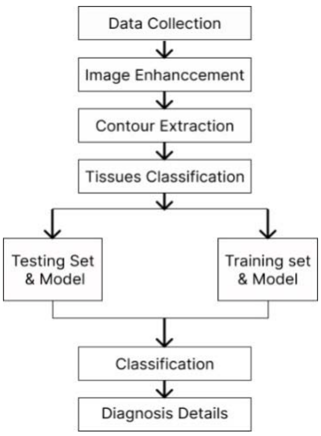

Fig 1.Proposed Architecture

A. Data Collection

To diagnose pneumonic nodules, computed tomography (CT) is used in conjunction with the most basic strategies. In this module, the image of theCT scan [5] with various sizes and formats. Dataset can be collected from KAGGLE environment.It is used to identifying relevant sources of medical imaging data, such as hospitals, research institutions, and publicly available datasets shown in **Fig 2.**

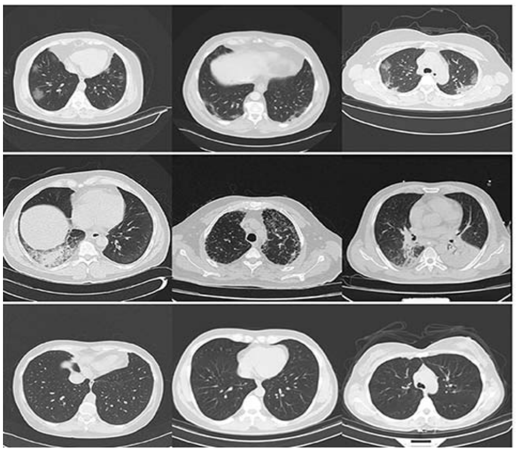

Fig 2. Data Collection

B. Image Enhancement

The lowest level of abstraction, intensity images, are used to describe operations where the input and output images are integration, transformation, and reduction pre-processing procedures. By the use of CNN algorithm to resize the scan image for future process. It can also implement median filtering algorithm to remove the noises in images. Contrast adjustment: This technique can be used to increase the image's contrast, making details more visible. This can be especially beneficial in improving lung structure and making the presence of pneumonia more visible.Sharpness enhancement: This technique can be used to improve the image's edges, making the boundaries of the lung and pneumonia more visible.Noise reduction: Noise can reduce image clarity, making it difficult to predict pneumonia accurately. To reduce noise and improve image quality, techniques such as median filtering and wavelet filtering can be used.

C. Contour Extraction

Lung related features areextracted based on shape features.Active contour modelling is used to first segment the lung. The initialization is this step's fundamental component. It causes nodules that are not isolated to become isolated. Then, using stochastic characteristics, regions of interest are found. Lung tissues are segmented and boundaries are detected. Histogram equalization: This technique improves image contrast by equalizing the distribution of pixel values. This can help to increase the visibility of the lung and pneumonia information. Multi-scale analysis: This technique analyses the image at various scales, allowing for a better understanding of the image structure and the presence of pneumonia. Before using machine learning algorithms to predict pneumonia, these image enhancement techniques can be applied to chest X-

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rays [8]. This can improve prediction accuracy and help healthcare professionals make more informed decisions. The borders of items or regions of interest can be extracted from an image using the contour extraction approach. Contour extraction can be used to segment and extract the areas of the lungs from chest X-rays or CT scans in the context of predicting pneumonia from medical imaging data. Then, machine learning models [14] that are trained to predict the existence of pneumonia can use the extracted contours as input features. Edge detection, thresholding, and segmentation methods like region-growing, watershed, or level set methods are a few of the methods used for contour extraction. Following the extraction of the contours, feature extraction and selection can be used to further reduce the dimensionality of the data and enhance the machine's accuracy. Shape descriptors, texture characteristics, and statistical measures of intensity are often retrieved features from contour data. While contour extraction can be a valuable technique for identifying useful features from medical imaging data, it should be noted that it is only one step in a more comprehensive process for predicting pneumonia. Data pre-processing, feature engineering, model choice, and validation are further crucial factors. Furthermore, using medical imaging data for diagnostic [7] purposes calls for specific knowledge and need to be carried out under the guidance of a qualified healthcare practitioner.

D. Tissues Classification

The classification is the final step of the system. Lung disease are classified using Convolutional neural network algorithm [10]. Gather and prepare the tissue image dataset for the CNN's training and testing. The collection ought to contain photos of various tissues that are labelled and creates the CNN architecture to analyze the incoming images and determine which tissue type corresponds. Convolutional, pooling, and fully linked layers are typically included in CNNs and used the prepared dataset to train the CNN. The CNN gains the ability to recognize the characteristics that distinguish between various tissue types throughout training. By placing the trained CNN to the test on a different collection of images that weren't used in training, taken for classification. This makes sure that the model has acquired the ability to generalize to fresh, unexplored tissue pictures. Use the trained CNN to categories fresh images of tissue. CNN receives a signal. The process of classifying tissue in order to anticipate the existence of pneumonia entails examining diagnostic pictures, such as chest X-rays or CT scans shown in **Fig 3**.

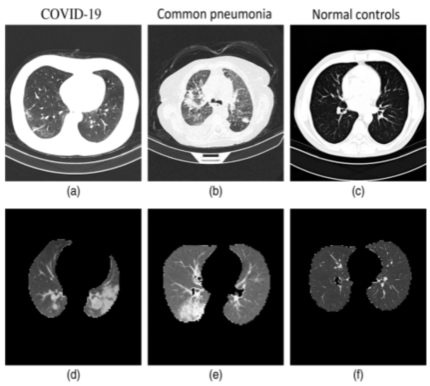

Fig 3.Image Classification

E. Diagnosis Details

Based on classified tissues, disease predicted. Diseases such as COVID [8], Pneumonia, Tuberculosis, and normal. Based on this disease prediction, we can provide the precaution details to users. Lung infection known as pneumonia can be brought on by a number of microorganisms, such as bacteria, viruses, and fungus. Clinical assessment, physical examination, and diagnostic testing are frequently used to diagnose pneumonia.The following diagnostic procedures may be carried out by a healthcare professional if a consumer exhibits symptoms that point to pneumonia:Chest X-ray: This examination can show whether the lungs are inflamed or filled with fluid.Blood tests: These tests can assist identify the kind of microorganism that is infecting you and gauge how serious your condition**.** Sputum culture: In this test, a sample of mucus or phlegm from the lungs is taken, and it is examined for the presence of bacteria or fungi.A flexible tube with a camera is used during a bronchoscopy procedure to see inside the lungs and collect samples for analysis.Depending on the origin of the infection, healthcare professionals can diagnose pneumonia based on the findings of these diagnostic tests and select the best course of therapy, which may include antibiotics, antiviral drugs, or antifungal treatments shown in **Fig 4**.

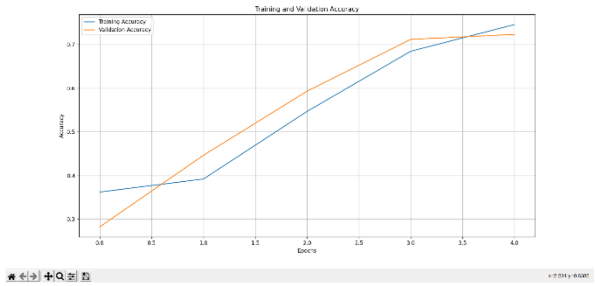

Fig4.Data Count

IV. Results and Experiments

Based on accuracy, we assess the system performance. An accuracy of 98.857% was attained by the suggested model, and high F1 and AUC scores of 99.002 and 99.809 supported its effectiveness. Accuracy is the capacity to differentiate between successful and unsuccessful cases.A method for identifying lung conditions using an X-ray [4] dataset. Images of CT Pneumonia are supplied into the system and converted to pixels. The feature vectors are created using various features, and the hybrid features are derived from trimmed candidate nodules. Based on these features, classify the Pneumonia lobes to predict the Pneumonia diseases. In 2016, Francois Chollet unveiled the deep convolutional neural network (CNN) architecture known as Xception. It is a variation on the Inception architecture where depth wise separable convolutions are used in location of the standard Inception modules. With fewer parameters and quicker calculation, the model can attain state-of-the-art performance on picture classification tasks thanks to this design decision. Pneumonitis, an inflammation of the lungs, can result from a variety of conditions, including allergies, infections, and contact with irritants. Chest X-ray pictures can be classified using deep

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learning models, like Xception, to assist in the diagnosis of pneumonitis [6]. The promise of deep learning models, such as Xception, for pneumonitis diagnosis has been demonstrated in a number of research. For instance, a study published in the Journal of Medical Systems in 2020 classified chest X-ray images as normal or abnormal, including anomalies including pneumonitis, using a deep learning model based on Xception. Using the Xception-based model, the study revealed an accuracy of 92.2% and an area under the receiver operating characteristic curve (AUC-ROC) of 0.981 [15]. A similar method was utilized in the Journal of Healthcare Engineering in 2021 to categories chest X-ray images as either normal or exhibiting signs of pneumonitis. This method combined the Xception model with transfer learning. The Xception-based model has an accuracy of 95.1%, sensitivity of 96.5%, specificity of 93.8%, and an AUC-ROC of 0.976. Using deep learning, the Xception framework has demonstrated potential in predicting pneumonitis, reaching good accuracy and AUC-ROC [11] values in numerous experiments. Before it can be employed in therapeutic settings, however, additional validation and testing must be conducted, as with any AI modelimplementation and the system configuration for training the CNN by using PyCharm shown in **Fig 5**.

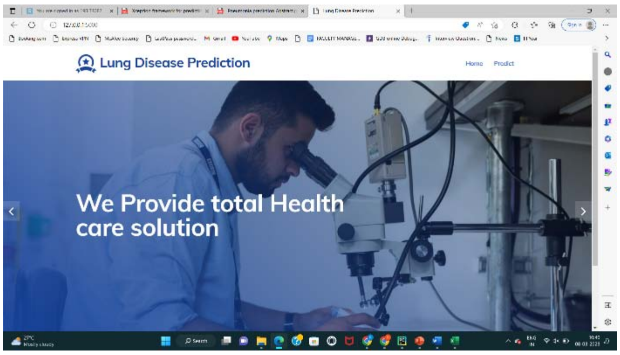

Fig5. Home Page

It cleaned up the data and provided it as input so that the model could be trained again to forecast the sickness. This work Pneumonia diseases are detected using Xception CNN model from CT scan [13] images decomposed to sparse matrix. An Xception CNN based detection model is proposed to improve the detection accuracy shown in **Fig 6.**

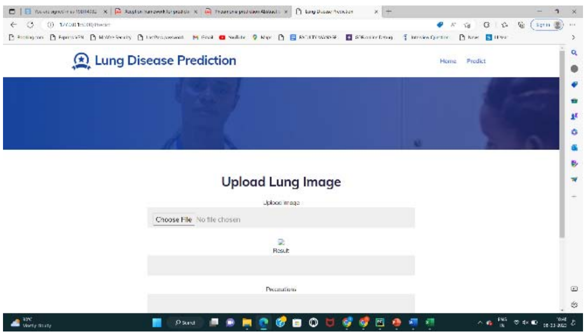

Fig 6. Predict Page

The number of datasets needed for training, validation, and testing a model for predicting pneumonitis using deep learning depends on various factors such as the complexity of the model, size of the dataset, and the variability of the images in the dataset. However, as a general rule of thumb, a minimum of 1000 images is recommended for a binary classification problem such as detecting pneumonitis in chest X-rays [9].Three sections of the dataset should be created: training, validation, and testing. The validation set is used to adjust hyperparameters and prevent overfitting, the testing set is used to evaluate the model's ultimate performance, and the training set is used to train the model. It is suggested that 70% of the dataset be used for training, 15% for validation, and 15% for testing [14]. The precise split, however, may vary based on the quantity of the dataset and the model's complexity. For example, if we have a dataset of 3000 chest X-ray images, we can split the dataset into 2100 images for training, 450 images for validation, and 450 images for testing. It is important to ensure that the images in each set are representative of the overall dataset and have similar characteristics, such as age, gender, and ethnicity, to avoid bias in the model shown in **Fig 7**.

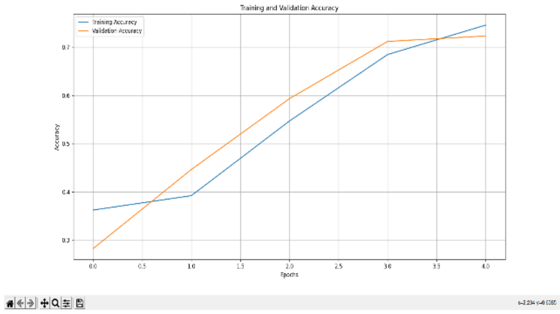

Fig7.Train, Validate, Test Dataset Count

V. Conclusion and Future Enhancement

To identify bi-classification and multi-class classification issues, as well as linear and nonlinear classification issues. This enables us to analyses high-dimensional data using this new methodology and also Compared to artificial neural networks, it is superior in some ways. Another suggestion for merging various topologies was to use a weighted classifier. The results of the experiment, including the accuracy, recall, precision, and AUC score, demonstrated how robust the model was. The proposed model achieved an accuracy of 98.857%, and its efficacy was validated by high F1 and AUC scores [15] of 99.002 and 99.809, respectively. The suggested methodology produced better results when compared to other approaches developed especially for this dataset. Future technologies that make it feasible to more accurately estimate weights for various models would be exciting, as would a model that predictions while taking into account the consumer past.

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Agribot - Using Rasa Framework

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***Abstract*—India's economy and society are largely dependent on agriculture, and the nation currently has one of the highest percentages of farm producers in the world. Because they are ignorant of new technologies and criteria that could help them increase productivity, farmers lose production. Farmers require technological assistance and support. From January 2015 to September 2017, all call records from the Kisan Call Center (KCC) were made public by the Indian government. Farmers and agriculture experts provided the researchers with similar KCC datasets. We identified four key areas in need of information support based on both sources: plant protection, pests (diseases), weather, and best practices.Natural language and in-depth learning The use of chatbots has increased significantly in recent years. They are used in many different fields, such as personal assistance, reservation systems, and customer service. To overcome challenges in their fields, farmers continue to rely significantly on the advice of their colleagues. Inadequate usage of these technologies has prevented farmers from receiving the crucial information on time. This project aims to develop "AgriBot," a closed-domain ChatBot for the agricultural industry. Farmers can interact with closed-domain and get expert advice about their industry. The basis for "AgriBot" is the RASA Open-Source Framework. The "AgriBot" deciphers the user's words to determine the issue and entity, then retrieves and distributes the solution from the database.We tested the Bot with existing data and found it to be promising.**

Keywords—Rasa, Deep Learning, NLP, KCC, Agribot, Personal Assistant

I. INTRODUCTION

By leveraging natural language technology to respond to questions on agriculture, horticulture, and animal husbandry, our Agri Chatbot can have a significant influence on marginalized communities. The farmer will be able to access localized information and agricultural information, including weather forecasts and the current market prices of different crops in his or her region. On the Kissan website, a farmer can send a direct message to our AI-enabled Chatbot and receive a response in their native tongue. Our approach would make it possible for the farmer to ask as many questions as they like, whenever they like, which would help current farming technology spread more quickly and to more farmers.

Below are a few examples of chatbot developments in the field of agriculture:

This research uses a virtual conversational assistant to ask a question about agriculture and receive a text response. Further improvement is possible by responding in the respondents' native tongue, and production and rainfall predictions are also possible. In its path to efficiency, sustainability, and meeting the world's food demands, agriculture is predicted to experience exciting times in the future thanks to the use of cognitive technologies. Natural Language Processing techniques are used by this conversational assistant to comprehend user inquiries in their native tongue. This will enable the machine tounderstand input queries that are grammatically incorrect [1]. The user queries go through a pre-processing stage where they are first tokenized into words, stop words like a, is, and the like are eliminated to reduce the likelihood that the queries will be classified according to their respective classes, and finally the steaming process is carried out where the words are converted to their root words. For the classification method to process the words effectively, they are first transformed into a bag of words and then into a vector form. The training dataset is then used to train the bot. The gradient descent approach is used to form a neural network from the training set of data and optimize error [2].

The same pre-processing steps, classification steps, and neural network formation are applied to the test data set. To obtain accurate findings, the class with the highest probability is iterated.

We aim to create a chatbot that can respond to farmers' basic questions and possibly offer some agricultural information. We therefore have total visibility throughout the agricultural value chain thanks to the traceability software we are utilising from Source Trace. It affects how farmers live, aids in the adoption of data-driven agriculture by an organisation, and promotes improved stakeholder relationships and trust[6]. Half of India's workforce was involved in agriculture, which contributed 17–18% of the nation's GDP. In 2014, the employment rate in agriculture and closely associated businesses including forestry, animal husbandry, and fisheries was over 31%. In 2016, these sectors contributed 15.4% of GDP.

In order to enable remote contact between users/farmers and the agricultural environment, this project aims to develop a chatbot that makes use of natural language processing. Our goal is to develop a chatbot that can respond to common inquiries from farmers and provide knowledge and solutions related to agriculture. This chatbot can learn on its own and improvise responses because it has received training in natural language processing [3].Farmers or agriculturists are the study's intended audience. Their efforts will be based on the developed model. The results of the study will therefore be useful to agriculturalists.

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II. MATERIALS AND METHODS

We suggest an Agribot as a solution, which is interactive for farmers and can quickly and effectively respond to their questions[4]. The workflow begins with the bot responding with a "hello" message, after which farmers will ask questions and the bot will provide potential answers based on the trained dataset we provided for training. We use RASA as a tool to create personalised AI chatbots using Python and NLU (NLU). The user can train the model and add custom actions as well.

A. *Data Overview*

On the Rajasthan KCC dataset, we are working. The researchers received inquiries from farmers and agri-experts that were comparable to those they discovered in the KCC dataset.

They identified two key areas in need of information support based on both sources:

- Plant Protection: In the KCC dataset, 30.59 percent of the farming calls—or nearly half of the dataset—were about questions relating to plant protection.
- Weather: In the KCC dataset, 46.67 percent of the farming calls—or nearly half of the dataset—were connected to weather-related inquiries. Farmers eagerly awaited weather updates because rain can wash away expensive insecticides that have been sprayed and because the ideal time to harvest crops depends on the weather.
- Market Information: 13.5% of farming-related questions concerned market data. It primarily contains inquiries about the mandi rate and market rate of a select few crops, including guar, groundnut, and others.
- Fertilizer Usage and Availability: In the KCC dataset, 20% of the farming calls—or nearly half of the dataset—were connected to inquiries about plant protection. It informs the farmer on the type of fertiliser needed for the crops, among other things.
- Soil testing: In the KCC dataset, 10% of the farming calls—or nearly half of the dataset—were connected to inquiries about plant protection.
- Nutrient Management: In the KCC dataset, 28 percent of the farming calls were related to plant protection related questions which is almost nearly half of the dataset.It gives insight to farmers the nutrients that need to be given to the pulses and crops. The rest of the data set includes minor factors like varieties, Government schemes, etc.

Data from the Kisan Call Center (KCC) is comprised of questions posed by farmers and the KCC's replies. The complete corpus is accessible on the official website of the Indian government, "data.gov.in," under the name Kisan Call Centre[10]. Data in CSV format is available from the years 2006 through 2020. Every month, a different catalogue is kept for each district in each state. There are 11 fields total on each call log, including the KCC agri-response. expert's

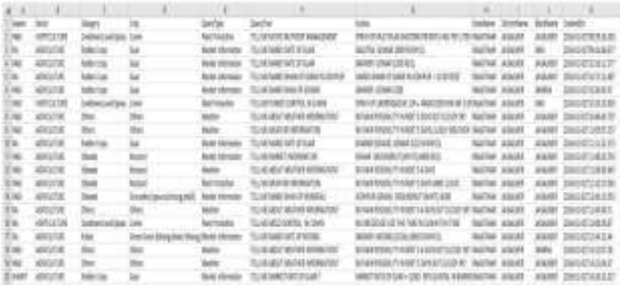

Fig.1 Different Variables in the data

- Season: Details about the season during which the query was posed.
- Sector: What industry was the question about? Examples include agriculture, horticulture, animal husbandry, and fishing.
- Category: Which category, for instance—vegetables, animals, cereals, drugs and narcotics, etc.—does the query concern within a given sector?
- Crop: Which crop is in question? Examples include potatoes, paddy, wheat, bananas, goslings, and others.
- Query Type: such as Plant Protection, Weather, Nutrient, Management, etc., fall within the general category of specific question posed.
- Query Test: The user's actual inquiry.
- KCC Answer: Response given to caller Kisan by the KCC agent.
- State Name: State in which the question has been asked.
- District: The state where the query was posed.
- Block Name: Block in the neighborhood where the question was posed.
- Created On: Date that the question was posed.

B. *Exploratory Data Analysis*

For our investigation and demonstration, we examined the Rajasthan data set from 2015 to 2020. There were 1,16,163 searches. More than 50% of inquiries are on the season Rabi, which is followed by Kharif and NA. According to industry-specific analysis, agriculture and horticulture account for about 85% of all enquiries.

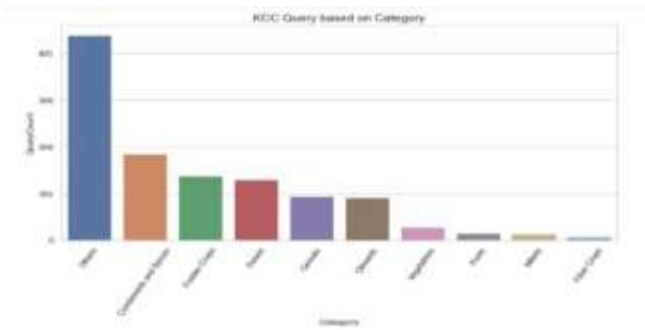

Fig. 2. Describes different Crop Types In each season

DOI: rp-9788770040723.086

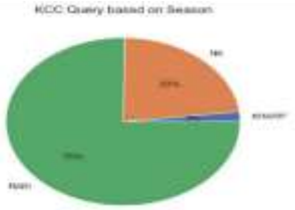

Fig 3 Shows the different Queries by the farmers across various sectors

As we look more closely at the questions, we discover that the two most important agricultural seasons in India, Kharif and Rabi, come up frequently. This data can be used to scale up or down the number of servers required and to calculate the infrastructure needed to host the solution [11]. Farmers ask questions in a number of subject areas, with agriculture and horticulture being the most popular ones. This is also in line with the fact that the majority of Rajasthan's agricultural production consists of cereals, vegetables, and pulses. This allocation could help the both of them become more effective.

Farmers have a wide range of queries, with season and crop-related inquiries being the most common.

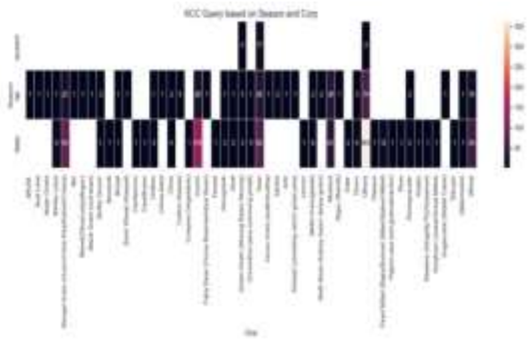

Fig 4 Shows different Queries from farmers on various crops and season of the region.

C. RASA Framework

Rasa is a tool that builds customized AI chatbots using Python and NLU (NLU). Rasa offers a platform for building AI chatbots that make use of natural language comprehension (NLU). Moreover, the user can train the model and add unique actions [12]. Slack, Microsoft Bot, and Facebook Messenger are just a few of the platforms where chatbots created by Rasa have been implemented. Rasa is composed of two primary parts:

- **Rasa NLU** (Natural Language Understanding: The open-source natural language processing programme Rasa NLU ascertains the user's request, extracts the entity from the chatbot in the form of structured data, and helps the chatbot understand what the user is saying.
- **Rasa Core :** Instead of utilising an if/else statement to determine the best course of action, a chatbot system with machine learning-based dialogue management forecasts the best path of action using a probabilistic model like an LSTM neural network. Under the hood, reinforcement learning is also used to improve the prediction of the best course of action.

D. ChatBot Implementation

Before beginning programming, Rasa must be installed because it is an open-source framework. Using a virtual environment to prevent version inconsistency across various components is strongly advised.

Environment Preparation

- Download and Install the latest python library using below commands for windows machine.

pip install python

- To create a virtual environment, decide upon a directory where you want to place it, and run the venv module as a scriptwith the directory path.

python3 -m venvchatbotenv

- Once you've created a virtual environment, you may activate it.

  \chatbotenv\Scripts\activate.bat

- Install the rasa framework on the same directory.

  pip install rasa

- initialize rasa project.

  rasainit

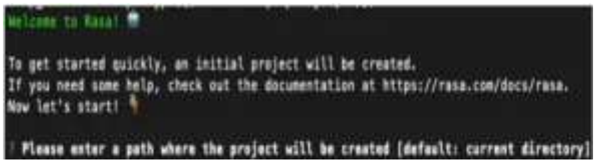

Fig 5. Shows the default screen of the Environment preparation.

E. Model Pipeline Design

A pipeline-based general framework is Rasa NLU. Rasa has a lot of versatility as a result.

Each component's data processing order is specified by a pipeline. Some components are dependent on one another. The pipeline will fail if even one of these dependence conditions fails. Rasa NLU examines each component's dependence requirements individually. Rasa will halt the program and issue the appropriate errors and warnings if any of the dependency requirements fail [13].

- **Language model component:** This loads the language model files to support the following components. There are multiple inbuilt language models available and we have used **LanguageModelFeaturizer in Agribot**.

Components	Model	Notes
SpacyNLP	spaCy	Pre-trained spaCy models need to be downloaded in advance. For more details, please check the spaCy official website.
MitieNLP	MITIE	MITIE needs a pre-trained model. You need to pre-train or download a model from the internet.
HFTransformersNLP	Transformer	To use the HFTransformersNLP component, install Rasa Open Source with pip install rasa[transformers]. HFTransformersNLP is deprecated in the newer version of Rasa 2.x, and LanguageModelFeaturizer now implements its behavior.

Fig 6 – Shows different language model files that supports Different components.

DOI: rp-9788770040723.086

- **Tokenizer component:** Languages and tokenizer components have a close relationship. All languages cannot be supported by a tokenizer. You should select the right tokenizer based on the language that will be your target. Space-splitable languages can employ "Whitespace Tokenizer." In other words, if English is your target language, you should utilise "Whitespace Tokenizer." You should utilise "JiebaTokenizer" for Chinese. In languages (like Japanese, Chinese, or Korean) that don't employ space to break words, "Mitie Tokenizer" (which makes use of a pre-trained model from MitieNLP) is typically used for word segmentation. The tokenizer you choose should be compatible with the language that your pre-trained model uses. [14] [17] Currently, "Spacy Tokenizer" supports 63 different languages. We have supported English language hence "**Whitespace Tokenizer" is used for our Agribot.**

Components	Requirement	Model	Notes
WhitespaceTokenizer			Tokenizer using whitespaces as a separator
JiebaTokenizer	Jieba	Conditional Random Field	For Chinese
MitieTokenizer	MITIE	Structured SVM	
SpacyTokenizer	spaCy	Multiple models	

Fig 7 – Shows DifferenetTokenizer for differentrequired languages.

- **Featurizer component:** Features supplied by upstream components are necessary for entity extraction as well as intent classification. To perform feature extraction, developers can employ a variety of components [18]. Developers can freely select and mix those components, as they have feature union functionality implemented. We have used **RegexFeaturizer in Agribot.**

Component	Requirements	Notes
MitieFeaturizer	MitieNLP	
SpacyFeaturizer	SpacyNLP	
ConveRTFeaturizer	Tokenization	Based on ConveRT from Poly AI.
LanguageModelFeaturizer	Tokenization	Based on Transformers from HuggingFace.
RegexFeaturizer	Tokenization	This component reads regular expression configurations from training data.
CountVectorsFeaturizer	Tokenization	Based on Bag-of-words model. Usually used in toy projects.
LexicalSyntacticFeaturizer	Tokenization	Gives linguistic features, for example, whether it is the head or tail of a sentence or whether it is a number.

Fig 8. Shows different type of feature Expressions used according to the Requirements.

- **Entity extractor component:** Rasa is compatible with several entity extraction components. With a few exceptions that can be utilized together under specific circumstances, the majority of those components shouldn't be used together. A few components can only create predefined entities; they cannot be educated on the entities that the developer creates. Rasa suggests DIETClassifier [21] because it typically performs better; as a result, we have followed her advice.

Components	Requirement	Model	Notes
CRFEntityExtractor	sklearn-crfsuite	**Conditional Random Field (CRF)**	
SpacyEntityExtractor	spaCy	Averaged perceptron	Pretrained entities.
MitieEntityExtractor	MITIE	Structured SVM	
EntitySynonymMapper	Existing entities		Standardization of synonyms.
DIETClassifier	Tensorflow	CRF on top of a transformer	
RegexEntityExtractor			Use lookups and regular expressions in the training data.
DucklingEntityExtractor			We need to run a Duckling server for it.

Fig 9. Different Entities that RASA supports.

- **Intent classifier component:** This element is used to categories each query's intent[13]. DIETClassifier is suggested by Rasa for improved performance.

Components	Requirement	Model	Notes
MitieIntentClassifier	MITIE	Structured SWM	
SklearnIntentClassifier	Scikit-learn		
KeywordIntentClassifier			Based on the keywords matching. Usually used in toy projects.
DIETClassifier	TensorFlow	CRF on top of a transformer	
FallbackClassifier			Set intent value to nlu_fallback if the other component gives too low a confidence score on intent.

Fig 10.Shows different Classifier to be used for better performance.

- **Structure output**: This generates structured data from the prediction results that have been organized. This portion of the pipeline is a built-in function rather than a component. It cannot be directly accessed by developers as a component.

Fig 11. - Shows the Pipeline of the Data Processing.

The following pipeline is designed for Agribot

```
pipeline:
 No configuration for the NLU pipeline was provided. The following default pipeline was
 If you'd like to customize it, uncomment and adjust the pipeline.
 See https://rasa.com/docs/rasa/tuning-your-model for more information.
   - name: WhitespaceTokenizer
   - name: RegexFeaturizer
   - name: LexicalSyntacticFeaturizer
   - name: CountVectorsFeaturizer
   - name: CountVectorsFeaturizer
     analyzer: char_wb
     min_ngram: 1
     max_ngram: 4
   - name: DIETClassifier
     epochs: 100
     constrain_similarities: true
   - name: EntitySynonymMapper
   - name: ResponseSelector
     epochs: 100
     constrain_similarities: true
   - name: FallbackClassifier
     threshold: 0.3
     ambiguity_threshold: 0.1
```

Fig 12. Shows the snippet of the Pipeline that was followed.

F. Session Configuration

The session is a conversation between the user and the bot. One session can persist for multiple dialogue turns. Currently,[22].

Rasa supports two types of session configurations

- **session_expiration_time:** specifies how many minutes after the user receives the most recent message the

DOI: rp-9788770040723.086

message will expire. If it is set to 0, there is no expiration time.

- **carry_over_slots_to_new_session:** decides if the system should carry over the slots from the previous session to the new session. If set to false, the previous session's slot values will not be sent to the next session.

G. Training Data Preparation

- **nlu.yml:** We have training data for several intentions in the NLU training data file. The name of the intent and the name of the entity make it simple to determine its meaning. All of the training data for our project is kept in the data/nlu.yml file. We'll show you a portion of the training file right here.

```
- intent: bot_challenge
  examples: |
    - are you a bot?
    - are you a human?
    - am I talking to a bot?
    - am I talking to a human?

- intent: guar_rate
  examples: |
    - TELL ME MANDI RATE OF GUAR
    - TELL ME MANDI BHAV OF GOWAR
    - TELL ME MANDI BHAV OF GWAR

- intent: weather
  examples: |
    - Asking about weather forecast?
    - TELL ME WEATHER FORECASTING
    - TELL ME ABOUT WEATHER INFO
    - TELL ME WEATHER REPORT IN JAISALMER
    - TELL ME WEATHER INFORMATION
    - TELL ME WEATHER INFORMATION?

- intent: fertilizer_in_wheat
  examples: |
    - TELL ME FERTILIZER IN WHEAT
    - what will be the good fertilizer in wheat
```

Fig 13. Shows the stored training data in yml file format.

- **stories.yml:** Rasa gains knowledge from conversations and organises it through story-based instruction. A high-level semantic method of capturing talks is the tale. Together with user expressions, it also documents when the system's state changes correctly.

```
- story: happy path
  steps:
  - intent: greet
  - action: utter_greet
  - intent: mood_great
  - action: utter_happy

- story: sad path 2
  steps:
  - intent: greet
  - action: utter_greet
  - intent: mood_unhappy
  - action: utter_cheer_up
  - action: utter_did_that_help
  - intent: deny
  - action: utter_goodbye

- story: path3
  steps:
  - intent: guar_rate
  - action: utter_guar_rate
  - intent: goodbye
  - action: utter_goodbye

- story: path 4
  steps:
  - intent: weather
  - action: utter_weather

- story: path 5
  steps:
  - intent: pest_mus
  - action: utter_pest_mus
```

Fig 14.Shows the stored user expressions from user's.

- **domain.yml:** All the knowledge a chatbot requires is defined by a domain, including intents, entities, slots, actions, forms, and responses. All of this information provides precise definitions of a model's inputs and outputs. This is the domain file that has been prepared for Agri Chatbot.

```
intents:
  - greet
  - goodbye
  - guar_rate
  - weather
  - fertilizer_in_wheat
  - fertilizer_in_kalonji
  - disease_control_of_onion
  - disease_control_of_cumin
  - fungal_disease_control_of_gram
  - pest_mus
  - pest_must
  - control_of_blight

responses:
  utter_greet:
  - text: "Hey! How are you?"

  utter_goodbye:
  - text: "Bye"

  utter_guar_rate:
  - text: "BALOTRA  GOWAR 2900 RUPAY/Q."

  utter_weather:
  - text: "Partly cloudy,No Possibility of Rain."
  - text: "NO RAINFALL NEXT FIVE DAYS"

  utter_fertilizer_in_wheat:
  - text: "SPRAY ZINK SALPHET 33% 5 GM+BUJHA CHUNA 2.5 GM/LITER WATER"

  utter_fertilizer_in_kalonji:
  - text: "SPRAY SOLUBLE NPK  18:18:18 GRADE 10 GM/LTR WATER"
```

Fig 15. Shows the clear definitions of the inputs and outputs of a model

H. Train the Model

We can start the model to modify the weights based on training data once we have prepared all of the training data and placed the file or appropriate folder structure. In order to verify the accuracy of the module, we may also prepare the testing data. The interactive shell creation and execution commands are listed below.

- **rasa train**

This command will train the model using the NLU train data, story data, and configuration. By doing this, the model zip file will be created and saved in the default model folder.

- **rasa shell**

With this command, you can interact with the bot by running the Rasa server and launching the interactive command line interface.

III. Result And Discussions

The user was able to communicate with AGRIBot and it was able to recognise the entity and intent for which it was taught.The Bot shared the user with the proper response it had found in the database. Even for questions that were beyond the capabilities of the Bot, it performed effectively. The AGRI ChatBot is intended to seamlessly respond to beneficiary questions, and it is an effort to give mass farmers access to a channel of communication through which they can ask questions and receive answers at any time without having to be concerned about call centre operating hours or network congestion problems. We decided to add the chatbot to this platform because the Kissan website has one of the most popular chat platforms in India. The user can then continue with their questions when the bot responds to their greeting with an appropriate welcoming message about itself. The bot will check to see if the user is satisfied with the response after providing the information and will then welcome any additional questions. If the response is unsatisfactory, the bot will give the farmer the phone number to call the call centre during business hours.

The NLP algorithms can be integrated in a variety of ways to build up a solution on the RASA platform, which is the foundation around which the bot has been constructed.

DOI: rp-9788770040723.086

We can use the platform's pre-built models or feed it any custom models to create the final model utilising transfer learning with the given data.

Fig 16. The above figures show the snippet of the response from the bot for all scenarios where the confidence rate was high enough from our bot.

Possible Queries from the "FARMER"	Output From "THE AGRIBOT"
TELL ME MICRO NUTRIENT MANAGEMENT	SPRAY OF MULTIPLEX (MICRONUTRIENT) 4 ML PER LITER WATER
TELL ME MANDI RATE OF GUAR	BALOTRA GENWAR 2900 RUPAYE/Q
TELL ME MANDI BHAV OF GWAR IN JODHPUR	MANDI BHAV OF GWAR IN JODHPUR = 5150 RS/QT
TELL ME MANDI BHAV OF GENWAR	BARMER GENWAR 5200
TELL ME FUNGUS CONTROL IN CUMIN	SPRAY OF CARBENDAZIM 12% + MANCOZEB 63% WP 2 GM PER LITER WATER
TELL ME ABOUT WEATHER INFORMATION ?	NO RAIN POSSIBILITY IN NEXT 5 DAYS BUT CLOUDY SKY
TELL ME WEED CONTROL IN CUMIN	NO WEEDICIDE USE THIS TIME IN CUMIN THIS TIME
TELL ME MANDI RATE OF MOONG	BARMER MOONG (LOCAL) [illegible] RUPAYE/Q
TELL ME ABOUT WEATHER INFORMATION ?	NO RAIN POSSIBILITY IN NEXT 3-4 DAYS BUT CLOUDY SKY
TELL ME ABOUT MARKET INFORMATION OF TIL	JODHPUR (GRAIN) TIL (BAJAR) [illegible] RS/QT
TELL ME PEST DISEASE CONTROL IN MUSTARD	DRENCHING OF HEXACONAZOLE 2 ML PER LITER WATER IN ROOT ZONE
TELL ME CONTROL OF APHID IN MUSTARD ?	SPRAY OF DIMETHOATE 30% EC 2 ML PER LITER WATER
TELL ME DOSE OF UREA IN MUSTARD FOR TOP DRESSING	DOSE OF UREA IN MUSTARD FOR TOP DRESSING= 65 KG PER HECTER
TELL ME ROOT ROT CONTROL IN CUMIN	DRENCHING OF CARBENDAZIM 1 KG PER HA IN ROOT ZONE WITH IRRIGATION
TELL ME PEST CONTROL IN GUAR	SPRAY OF IMIDACLOPRID 17.8% SL 0.5 ML PER LITER WATER

Fig 17 – Shows all the Queries from the Farmer tested by us and the Replies captured from the Agribot developed in Tabular form.

A beneficiary may ask some questions that are not relevant to the FAQ in response, which the bot might not be able to address. When this occurs, the bot will choose for a fallback response because it has less than a 70% confidence in its ability to respond to the inquiry.

We have tested the built model and found it to be satisfactory in providing a relevant response.

A. *Discussion on the Result*

Almost half of the population in India depends on agriculture for a living, making it a significant source of employment. The general public requires information on a variety of topics, including weather, seeds, crop protection, schemes, etc. The KCC was created with this objective in mind, and it has been assisting farmers for a number of years. The weak network connectivity and scarcity of contact centers, however, impede the flow of information that is so important to farmers. In an effort to close this gap, AGRIBOT chooses the advantages from both ends.

We strive to use a chat channel to provide farmers with the information they require, while at the same time using the massive KCC dataset.

In an effort to test the bot, we have built out a FAQ-like chatbot that can respond based on previously asked questions using a tiny portion of Rajasthan's KCC data set for the last five years. Our goal was to have the bot react to the beneficiary's general inquiries. The bot responds to the queries fairly well in our minified dataset.

IV. Conclusion

Agribot is the first attempt to combine two previously distinct economic sectors for the laudable goal of providing Indian farmers with information promptly and easily. In order to provide the end users (farmers) with a smooth user experience via the Kissan Website and assist them in finding answers to their questions at any time, big data technology and mobile technology have been combined.

On the one side, this will save call centre expenses, and on the other, it will allow the beneficiaries to get the information whenever they need it without having to wait for KCC to open or worry about network congestion problems. The system also introduces a balancing act in that it either responds to inquiries that it can understand from the current corpus or else offers the end users a seamless way to contact a call center for support by supplying the call center number.

Although the solution in this paper is only a proof-of-concept, it can absolutely be developed further and made into an enterprise solution because the sample testing results were encouraging. The following stage allows us to include additional solutions to expand the corpus depending on any new queries submitted by users and their resolution using the KCC representative's suggestions.

A. *Future Scope of AgriBot*

Virtual Conversational Assistant Chatbot

Here, a text response to a question about agriculture is provided. Further improvements can be made by responding in their own native tongues, and productivity and rainfall predictions can be added. In its path to efficiency, sustainability, and meeting the world's food demands, agriculture is predicted to experience exciting times in the future thanks to the use of cognitive technologies. Natural Language Processing techniques are used by this conversational assistant to comprehend user inquiries in their native tongue. This will enable the machine to interpret input queries that are grammatically incorrect. The user queries go through a pre-processing stage where they are first tokenized into words, stop words like a, is, and the like are removed to reduce the likelihood that the queries will be classified according to their respective classes, and finally the stemming process is carried out where the words are converted to their root words. For the classification method to process the words effectively, they are first transformed into a bag of words and then into a vector form. The training

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data set is then used to train the bot. The gradient descent approach is used to form a neural network from the training set of data and optimize error.

The same pre-processing steps, classification steps, and neural network formation are applied to the test data set. To obtain accurate findings, the class with the highest probability is iterated.

- TEXTUAL ASSISTANT CHATBOT: Agricultural chatbots are essential to the agriculture sector since they help all farmers and those with an interest in agricultural operations by assessing their questions and giving them the right answers. Most questions may be answered by this Question-Answer system accurately and without the need for human intervention. Greater human resource utilization and the avoidance of unnecessary costs related to the opening of additional contact centers would result from this. Natural Language Processing techniques are used by this conversational assistant to comprehend user inquiries in their native tongue. This will enable the machine to interpret input queries that are grammatically incorrect. The user queries go through a pre-processing stage where they are first tokenized into words, stop words like a, is, and the like are removed to reduce the likelihood that the queries will be classified according to their respective classes, and finally the stemming process is carried out where the words are converted to their root words.
- GPT BASED CHAT BOT: Generative Pre-Trained Transformer is referred to as GPT. The term "generative language model" refers to Chat GPT. In reality, it is regarded as an AI chat that has been programmed and created to carry on normal conversations. OpenAI, a research firm, owns Chat GPT. By creating innovations and attempting to raise their levels by assessing the quantitative and qualitative data in various ways, GPT-based chat bots have provided solutions. Upgrading to these tiers will definitely assure two-way communication. The worst error any chatbot can do is to make the user wait for a response; in this case, the farmer. This will let the user down and make them look for other options. Based simply on online data, this new machine-learning model was able to produce any kind of writing. And it was the most accurate representation of its kind ever made! The GPT-based chatbots are so advanced, according to Open AI, the company that created the technique, that they can pass the Turing test.
- INTEGRATING BERT MODEL WITH RASA: BERT is an acronym for "Bidirectional Encoder Representations from Transformers." It is a machine learning method based on transformers that Google created for pretraining natural language processing. Jacob Devlin and his Google colleagues developed and released BERT in 2018.In order to understand the context of the statement, BERT uses bidirectional training, which reads the sentence from both directions. Just keep in mind that BERT is an encoder. It is lacking a decoder.

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Machine Translation from German to English and English to German

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Abstract—Language is the foremost method of human communication which consists of grammar and vocabulary. Language majorly consists of words which are structured in a meaningful way. The natural human language is expressed through speech or writing. A computer is a binary machine i.e., it understands codes which are strings of 0s and 1s aka binary digits ("bits"). Binary Language is also known as Machine Language. A computer does not understand the natural human language. In an endeavour to bring the computers and the humans closer, by allowing a computer to analyse the sentence spoken by a user aka input speech recognition and process what does it mean, Natural Language Processing (NLP) was devised. NLP combines the fields of Artificial Intelligence (AI) and analyticalsyntax so that humans and computers can communicate with each other effortlessly. Today, mobile devices have applications such as Alexa, Siri, among others, that make it easy to do tasks like add activities to a calendar or search for a contact using voice command. All these applications use in some form or another natural language processing and machine learning.

Keywords—LSTM, RNN, Bidirectional, Embedding, English, German, Machine Translation

I. INTRODUCTION

Language is the foremost method of human communication, which incorporates both grammar and vocabulary. On the other hand, a computer understands Machine Language, which are numeric codes in the form of algorithms. Machine Language allows a computer to directly execute operations. These codes or algorithms are strings/combinations of 0s and 1s aka bits. A computer cannot understand the human language in its natural form.

To overcome the gap between the machines and humans, Natural Language Processing (NLP) was devised. It enables a computer to process the input speech recognition and analyse what the user stated. NLP combines the fields of computational linguistics and Artificial Intelligence (AI) so that both computers and humans can communicate effectively.Today, applications such as Alexa, Siri, among others, in the smartphones have made it easy to do tasks like add activities to a calendar or search for a contact by voice.

To be able to talk with mankind, a computer program should understand grammatical syntax, word meanings or semantics, correct use of tenses aka morphology and conversational pragmatics. Numerous regulations which are to be taken care of are staggering and explains the reasons of failure of previous attempts at NLP. Instead of taking a rule-based approach, of lately NLP has changed its method to a pattern learning based computer programming. Here we have attempted to develop a Machine Translation model that can translate sentences from the given source material into other language, without human intervention. We have taken sentences of German language as database which is to be converted into English language and vice-versa. The idea behind this project is to allow the two parties to communicate and exchange ideas from different countries.

II. LITERATURE REVIEW

For translation of text or speech among different set of languages, Machine Translation (MT) was devised. It uses software which substitutes word in one language with an equivalent word in the target language. Results produced with this approach were not satisfactory, as at times an appropriate word match might not be available in the target language. Also, a single word, depending upon the context, may have multiple meanings.

To overcome this issue, modern machine translation took a holistic approach. Here an attempt has been made to check whether there is meaningful translation of the entire sentence from one language to another rather than simple mechanical substitution of words. It analyses the influence of all the text elements and words on one another.

Machine Translation models are found to give the best results in domain or occupation specific test samples, as it reduces the scope of allowable substitutions.

A. *Machine translation origin*

The origins of machine translation can be found in the works of Al-Kindi, a ninth-century Arabic cryptographer who developed methodology for systemic language translation, which included cryptanalysis, frequency analysis, probabilityand statistics, all used in modern machine translation.

On the 7th January 1954 the IBM-Georgetown experiment was conducted in which an IBM machine translated 60 sentences from Russian to English for the first time in the history. To advancing research in the field of machine translation, researchers continued to get together by making forums like Association for Machine Translation

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and Computational Linguistics was formed in 1962. The French Textile Institute used Machine Translators to translate abstractsvarious languages like French, English, German and Spanish in the 1970s. Brigham Young University began a project to translate Mormon texts using automated translation in 1971.

In the research done by M.D.Okpor[11] it is evident that more innovations were included as the time passed. In 2012, Google made a pathbreakingannouncement that Google Translatetranslates roughly enough words to fill 1 million books in one day.

B. *Machine translation methods and techniques*

i) *Statistical machine translation*

Statistical machine translation or SMT is a machine translationmodelwhere language translation is done using the statistical probability of the words, which are extracted from the analysis of multi-language texts. Warren Weaver in 1949, first thought of statistical translation models,including the idea of applying Claude Shannon's information theory to the model. Statistical machine translation produces translations using statistical methodsas probability, mean, mode, variance, standard deviation et ceterabased on multi-language text collections. When such compilations are available, good results can be achieved translating similar texts.However, such collections arerare for many language pairs. Though, newer approaches into Statistical Machine translation such as METIS II and PRESEMT use minimal collection sizes. Theyfocus on derivations of semantic structure with the help of pattern recognition that prediction of words. With some additional development, these techniques allow for SMT models to operate off a monolingual text compilation. SMT's biggest flawis thatit depends on large amounts of parallel texts to learn. It faces problems with linguistic-rich languages and is oftenunable to correct errors with single words.

C. *Neural machine translation*

Deep learning-based approach to MT, neural machine translation has made great progress in machine translations overtaking the SMT as the primary commercial way of machine translation. In this model, the word sequence modelling is first accomplished using a recurrent neural network (RNN). A bidirectional recurrent neural network, also known as an encoder, is used by the neural network to encode a source sentence whereas for second RNNa decoder,is used to predict words in the target language. RNNs, however, face difficulties in encoding long inputs into a single vector as shown by D.Bahdanau [14]. Itwas compensated by a mechanismthat allowed the decoder to focus on different parts of the input while generating wordsfor the output. NMT has become a widely used technique for machine translation, and other related NLP tasks such as dialogue, parsing, and summarization.To address the multi-word expression translations like idiomatic phrases, and low-frequency words, language-focused linguistic features have been used in state-of-the-art neural machine translation (NMT) models as mentioned by F.Meng[12]. Through his research C. Kobus[7] has showed that the neural machine translation (NMT) as a methodology for machine translation has led to astounding improvements in machine translation, particularly in terms of human evaluation, compared to statistical machine translation (SMT) systems.

III. MATERIALS AND METHODS

A. *Sample Data*

We have data from News commentary Ion the same topic in German and English. We will also use Europarl V7 and Common crawl in German and English. We will use this data to train two models:

1) English to German
2) German to English

These two models will be incapsulated in a layer where the user can select which model to use. We would use different NMT methods such as RNN, LSTM, Bi-directional RNN, Bi-directional LSTM, Bi-directional RNN with embedding and Bi-directional LSTM with embedding. This is done so as to evaluate the performance of various Neural Network algorithms to find the algorithm best suited for the task. We will define the Neural networks in functions so we can initialize two objects. One object shall handle English to German translation and the other will handle German to English translation. Ouraim is to make an application that is an End-to-End translator which has the most optimum performance.

B. *Exploratory Data Analysis*

We have 3 sets of files in English and German each. Each data set contains about 2 million sentences.Sentences from each dataset are cut into 300 sentences each, to get a smaller training set which has 900 English sentences and 900 German sentences. This now is usedto train the neural networks. This is done as to limit the size of the dataset and ensure it can work on a machine with a limited computing capability. The different datasets are combined into respective English and German datasets to provide a consolidated dataset. We first read these files into lists to clean the data and perform tokenization. In general pre-processing, we make all the data in lower case, remove the spaces at front and back of the dataset and remove the punctuation marks. Further pre-processing is required to make sure that each index of the list contains a sentence. In the second pre-processing, we tokenize all the words of the sentence and get a tokenized sentence and a tokenizer. The tokenizer is a list of all the words of the language with their corresponding id number. This helps to give a numerical value to words and helps in putting the file in translator. We define two tokenizer an English Tokenizer and a German tokenizer.

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Fig. 1. Data after Pre-processing

C. Base Model and Architecture.

We have used RNN models, LSTM models, Bidirectional RNN models, Bidirectional LSTM models, Bidirectional RNN Models with Embeddings and Bidirectional LSTM Models with Embeddings. We made the models as functions that can be used to define separate models for both English to German and German to English translation using the same model definition function. We trained the model to 20 epochs, for each model the optimizer is Adam with a learning rate as 0.1.Sparse Categorical Cross-entropy has been used as loss function. The models do not have a lot of layers. This is done to ensure that the models can even work on the limited computing power. We are using a GRU layer and Time Distribution layer in RNN. An Embedding, LSTM and Time Distribution layer in LSTM. A bidirectional layer, GRU layer and Time Distribution layer in Bidirectional RNN. A bidirectional layer, LSTM layer, Repeat Vector layer, LSTM layer and Time Distribution layer in Bidirectional LSTM. An Embedding Layer, bidirectional layer, GRU layer and Time Distribution layer in Bidirectional RNN. An Embedding Layer, bidirectional layer, LSTM layer, Repeat Vector layer, LSTM layer, three dense layers with ReLU activation and one dense layer with Sigmoid Activation layer and Time Distribution layer in Bidirectional LSTM.

Fig. 2. RNN Model

Fig. 3. LSTM Model

Fig. 4. Bidirectional RNN

Fig. 5. Bidirectional LSTM

Fig. 6. Bidirectional RNN with Embeddings

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Bidirectional LSTM with Embeddings

```
In [512]: # define model

from keras import losses
from keras.optimizers import SGD
from keras.layers import RepeatVector
def bidirectional_emb_lstm_model(input_shape, output_sequence_length, german_vocab_size, english_vocab_size, learning_rate=0.001
    model = Sequential()
    model.add(Embedding(max(german_vocab_size, english_vocab_size) ,128 , input_length=output_sequence_length))
    model.add(Bidirectional(LSTM(128, return_sequences=True, dropout=0.50),input_shape=input_shape[1:]))
    model.add(LSTM(128, input_shape=input_shape[1:], return_sequences=False) )
    model.add(RepeatVector(output_sequence_length))
    model.add(LSTM(128, return_sequences=True) )
    model.add(TimeDistributed(Dense(max(german_vocab_size, english_vocab_size), activation='relu') ))
    model.add(Dense(3000, activation = 'relu'))
    model.add(Dense(512, activation = 'relu'))
    model.add(Dense(256, activation = 'relu'))
    model.add(Dense(5000, activation='sigmoid'))
    model.summary()
    sgd = optimizers.SGD(lr=0.001, decay=1e-6, momentum=0.9, nesterov=True)


    model.compile(loss='sparse_categorical_crossentropy',
                  optimizer=sgd,
                  metrics=['accuracy'])
    return model
```

Fig. 7.Bidirecteional LSTM with Embeddings

IV. Results

The LSTM model was the most accurate model. However, it suffered from overfitting. The rest of the models struggled to learn from the given datasets and were unable to give any predictions. To improve the model, we need a larger dataset with more computing power, which is possible with the use of cloud computing, to increase the model accuracy. The model needs to be deployed on Cloud services to use the optimum infrastructure available for translation and be available on demand. Cloud services can help the model to be accessible anytime. Using the cloud infrastructure will increase the speed of translation as well as the speed of processing training data. Cloud infrastructure also helps in multiple users using the model at any given point of time. We can then use this data to further increase the accuracy of the translation. Analysing the user base, we can optimise the model to be more available in regions where the model is used the most.

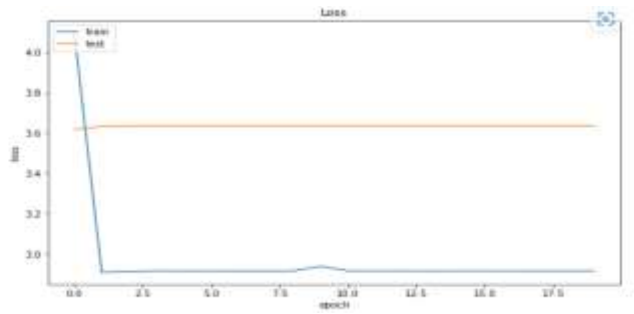

Fig. 8. Graph for RNN model

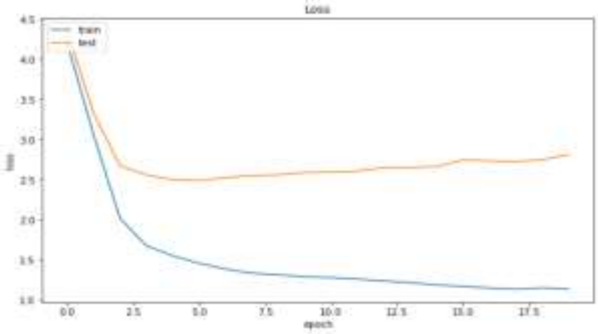

Fig. 9: Graph for LSTM Model

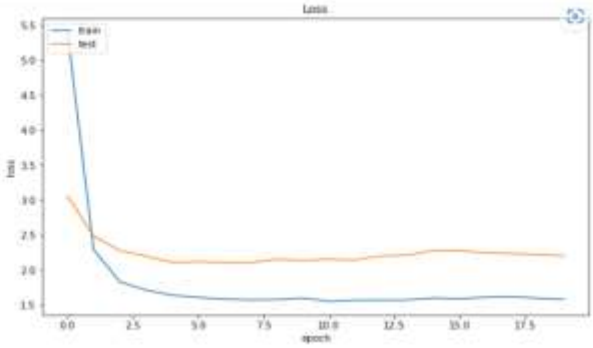

Fig. 10. Bidirectional RNN

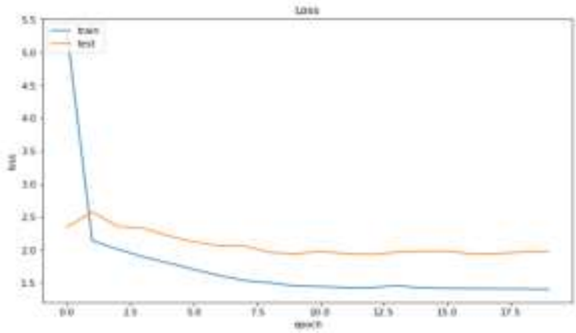

Fig. 11: Bidirectional LSTM

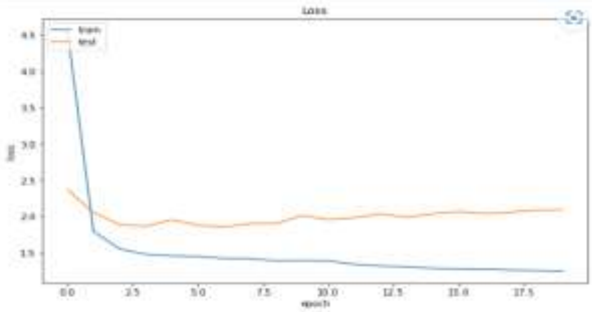

Fig.12. Bidirectional RNN with Embeddings

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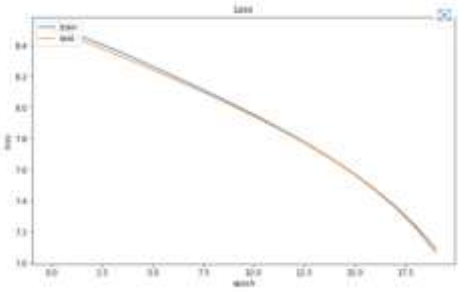

Fig.13: Bidirectional LSTM with Embeddings

V. Discussion And Conclusions

The above results illustrate the need for bigger datasets and as a result increase in computing power. This could be done on the cloud where the computing power is available on demand. The increased computing power will allow us to feed more data into the model leading to better learning and accurate predictions of the model. Using cloud infrastructure, we can also make the application be accessible anytime and anywhere. This results in multiple users accessing the application at a time. Increase in user base can then be further used to feed more data to the model and further increasing accuracy.

Also, from the available models, the LSTM model is the most preferred although it suffers from overfitting.

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Social Media Analytics For Political Domain

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***Abstract*—This paper aims to study influence of social media in Indian elections to forecast the mood of the public. Taking the Gujarat election of 2022 as a case study, the paper attempts to gauge, what is the public sentiment in social media (twitter in this case). It attempts to understand public opinion and sentiment towards political figures, parties, policies, and events. It attempts compare the actual election result output with the model prediction. During the study Twitter data was extracted for certain hash tags to extract domain data. The different process like, natural language processing (NLP) and sentiment analysis are used to determine the emotional tone of any tweet relates to a particular hashtag. The goal of sentiment analysis was to classify tweets into different categories such as positive (In favor of ruling party), negative (not in favor of ruling party), or neutral, based on the text of the tweet. Attempts were made to implement a model using Transformer based model for sentiment analysis. The steps for the same is described in this paper.**

***Keywords*—Gujarat Elections 2022, Forecasting, Bagging, Boosting, AFINN, Sentiment Analysis, Natural Language Processing.**

I. Introduction

Sentiment analysis is the method of identifying the mood or sentiment of a the text content. It classifies the words or combination of words as positive, negative or neutral sentiment in text. It's regularly utilized by businesses to come across sentiment in social facts, gauge emblem recognition, and apprehend customers. It makes a specialty of the polarity of a textual content (advantageous, neutral, bad) but it additionally goes beyond polarity to discover specific feelings and feelings (irritated, glad, unhappy, and so forth), urgency or even intentions[1]. Depending on how we need to interpret customer comments and queries, we can outline and tailor your classes to meet our sentiment evaluation desires.

Social media has become a powerful tool in the political domain, allowing political candidates and parties to connect with voters and promote their agendas. Social media analytics, the practice of analyzing social media data[3] to extract meaningful insights, has become an essential tool for political campaigns. It offers a way to measure sentiment, identify trends, and gain a deeper understanding of voters' preferences and behaviors.

One of the primary applications of social media analytics in the political domain is sentiment analysis. By analyzing social media content, such as tweets, posts, and comments, sentiment analysis can provide insight into how voters feel about a particular candidate or issue. This allows political campaigns to adjust their messaging and outreach strategies accordingly.

Another application is social network analysis, which can identify influential users, communities, and networks. By understanding the structure and dynamics of social networks, political campaigns can target their messaging to key influencers and amplifiers, who can help spread their message to a broader audience.

Social media analytics can also provide insights into voter demographics and behaviors. By analyzing social media data, political campaigns can identify patterns in how voters engage with different types of content, such as videos, images, and articles. This information can be used to optimize content and messaging for maximum impact.

In present times, humans express their feelings and thoughts more freely than ever. As a result, sentiment analysis has become an essential tool for monitoring and identifying sentiments across various forms of data. By automatically analyzing consumer feedback, such as survey responses and social media conversations, businesses can determine what satisfies or frustrates their customers[2]. This facilitates the customization of products and services to better meet customer needs.In this paper, we would be focusing on the sentiment analysis of twitter data on the backdrop of certain Assembly elections in India. We would explore whether the data conveys positive, negative or neutral sentiments towards a political party prior to elections. We would be exploring Machine Learning techniques to understand how to utilize twitter data to analyze the sentiment and give insights for political parties on how to improve their public appeal.

The future scope for social media analytics in the political domain is immense. As social media continues to play an increasingly significant role in politics, the need for advanced analytics tools and techniques will only grow. Here are some potential areas for future development:

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Predictive Analytics: Predictive analytics involves using machine learning algorithms to forecast outcomes based on past data. In the political domain, predictive analytics could be used to forecast election results, predict voter behavior, and identify emerging trends.

Real-time Analytics: Real-time analytics allows for immediate insights into social media conversations. In the political domain, real-time analytics could be used to monitor political events, track sentiment, and identify emerging issues.

Personalization: Personalization involves tailoring content and messaging to specific individuals or groups. In the political domain, personalization could be used to target specific demographics, such as age, gender, or location, with customized messaging and content.

Ethical Considerations: As social media analytics becomes more advanced, there will be increasing ethical considerations around the use of personal data[4] and privacy. Political campaigns will need to be transparent about how they are using social media analytics and ensure that they are not violating individuals' rights.

In conclusion, the future scope for social media analytics in the political domain is promising. As technology continues to evolve, new tools and techniques will emerge, providing political campaigns with even more advanced insights into voter sentiment, behavior, and preferences. However, ethical considerations will need to be at the forefront of development to ensure that social media analytics is used responsibly.

II. Literature Review

A. *Ensemble Learning*

Ensemble Learning is a technique based on combining multiple classifier algorithms to produce an output that has greater accuracy in the text classification in comparison to using these algorithms individually for the same task. Ensemble approach is found to improve the accuracy of individual classifiers using methods like Bagging, Boosting, Stacking and Voting.

Bagging: It is short for Bootstrap Aggregating, is a commonly used ensemble method in machine learning that enhances the accuracy of a single model by merging the predictions of multiple models. The Bagging technique works by generating multiple sub-samples of the training data, obtained by randomly selecting instances from the data with replacement, and then training a distinct model on each sub-sample.

Boosting: It is an ensemble learning technique in which multiple weak learners are combined to create a single strong learner. Unlike bagging, which creates independent weak learners, boosting uses a sequential approach in which each weak learner is trained to focus on the mistakes of the previous weak learners. The final prediction is made by combining the predictions of all the weak learners, with more weight given to the predictions of the stronger learners.

Stacking: It is an ensemble learning technique that combines the predictions of multiple base models using a meta-model, or "stacking model". The basic idea behind stacking is to train several diverse base models that have different strengths and weaknesses, and then use a meta-model to combine their predictions. The stacking process involves splitting the training data into two or more sets, where the base models are trained on one subset of the data and the meta-model is trained on another subset. The base models can be of different types and can use different learning algorithms, while the meta-model is typically a simple model, such as linear regression or logistic regression, that is trained on the predictions of the base models.

Voting: It is an ensemble learning technique that combines the predictions of multiple base models by taking a majority vote. The idea behind voting is to train multiple diverse base models, each of which makes predictions on a given set of inputs, and then use a voting scheme to combine their predictions into a final prediction. In binary classification problems, voting can be done by taking a simple majority vote, where the class that receives[5] the most votes is chosen as the final prediction. In multi-class classification problems, voting can be done by taking a plurality vote, where the class with the highest number of votes is chosen as the final prediction.

B. *Deep Learning*

Deep learning is a subset of machine learning that is characterized the use of neural networks with multiple layers. In traditional machine learning approaches, feature engineering is often a critical step, where features are manually defined and extracted from the input data. However, in deep learning models, features are automatically learned and extracted from the data during the training process. This is achieved by passing the data through multiple layers of nonlinear transformations, which allows the model to learn more complex and abstract representations of the input data.

Deep Neural Networks (DNN): This is a type of artificial neural network (ANN) that incorporates multiple hidden layers between the input[6] and output layers. These hidden layers enable the network to learn intricate and abstract representations of the input data. A typical DNN architecture includes an input layer, one or more hidden layers, and an output layer. Each layer comprises a group of interconnected neurons that are linked to the neurons in the adjacent layers. The neurons perform nonlinear transformations on their inputs using activation functions, generating outputs that are transmitted to the next layer.

Convolutional Neural Networks (CNN): This is type of deep neural network that is particularly suited for video and image recognition tasks. It is designed to automatically learn spatial feature layers from raw inputs such as pixels in images. CNNs are designed to automatically learn and extract features from raw image data without manual feature engineering. A key feature of CNNs is that they use convolutional layers. A convolutional layer consists of a set of filters[7], each filter being a small matrix of weights. These filters are applied to the input image in sliding window mode to compute the dot product between the filter and each local input region. The result of the convolution operation is a series of feature maps representing the presence of different patterns or features in the input image.

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Recurrent Neural Networks (RNN): Recurrent Neural Networks (RNNs) are a specialized type of deep neural network that excel at processing sequential data, such as time series or natural language text. Unlike feedforward neural networks that treat each input independently, RNNs maintain an internal state that enables them to capture the temporal dependencies of the input sequence. The distinctive characteristic of RNNs is their utilization of recurrent connections, which enable information to be propagated from one time step to the next. At every time step, the input is combined with the prior hidden state to produce a new hidden state. This operation is executed for each time step in the sequence, and the final hidden state is utilized to generate a prediction. This concept was introduced by Hochreiter and Schmidhuber in 1997.

C. *Transformer Architecture*

Transformer-based models have revolutionized the field of natural language processing (NLP) by outperforming previous state-of-the-art models on a wide range of NLP tasks, including sentiment analysis. In a transformer-based model, the input text is first transformed into a sequence of embeddings, which capture the meaning of each word in the text. The embeddings are then processed by a series of transformer layers, which learn to model the relationships between the words and their context.

During training, the model is fed a large dataset of text that is labeled with their corresponding sentiment. The model learns to predict the sentiment of the text by adjusting the weights of its parameters to minimize a loss function. Once the model is trained, it can be used to predict the sentiment of new text by feeding it through the same process of embedding and processing. The output of the model is a probability distribution over the possible sentiments, which can be used to determine the most likely sentiment. Overall, transformer-based models have shown to be highly effective in sentiment analysis and have achieved state-of-the-art results on several benchmark datasets.

A pre-trained model named "distilbert-base-uncased-finetuned-sst-2-english" was used.DistilBERT-base-uncased-finetuned-SST-2-English is a pre-trained language model developed by Hugging Face that is based on the BERT architecture. It has been fine-tuned on the Stanford Sentiment Treebank (SST-2) dataset for English language text classification. The model uses a smaller and more efficient architecture compared to the original BERT model, which makes it faster and easier to deploy on devices with limited computational resources.

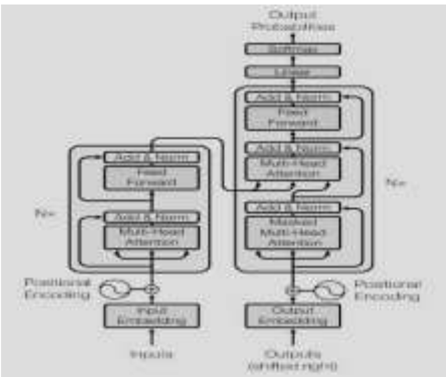

Fig1. Steps in Transformer Architecture

Advantages of Transformer Architecture

Large Vocabulary: Transformer models can learn to understand a much larger vocabulary, which allows them to capture the sentiment of text that contains words that are not included in a pre-defined word list.

Context Awareness: Transformers can consider the context in which words are used, which can lead to more accurate sentiment analysis.

Cultural Relevance: Transformer models can be trained on text from multiple cultures and languages, making them more suitable for sentiment analysis in a global context.

Up-to-date: As transformer models can be re-trained on new data, they can adapt to changes in language usage and sentiment over time.

Sophisticated Methodology: Transformers are a complex type of deep learning architecture that have demonstrated exceptional performance in numerous Natural Language Processing (NLP) tasks, such as sentiment analysis, surpassing previous state-of-the-art results.

III. MATERIALS AND METHODS

A. *Dataset*

With the advent of a wide range of social media applications, there are millions of data generated which involves a wide range of topics across the globe. It is observed that people are more vocal about their opinions on the social media platform. Twitter is one such platform which serves as bridge between common people and the authorities involved in the governing body.

Recently we have seen surge in the usage of twitter by political parties to orchestrate their political campaigns and to reach out to people to every corner in the country. People are becoming more and more vocal about their political opinions which gives us an immense opportunity to mine these data points and try to arrive at some conclusion based on people sentiments.

This research involves the study of Twitter data associated with Indian State elections conducted during 2023.The study aims to analyze and understand the sentiments and opinions of people through their twitter comments.

B. *Model Building : Steps*

1. Data extraction using Twitters APIs
2. Data understanding through data dictionary
3. Tokenization
4. Data preprocessing
5. Data Encoding
6. Sentiment Analysis using Transformer Architecture (DistilBERT base uncased finetuned SST-2)

C. *Sample Dataset*

As for initial model, sample dataset containing 1212 tweets were taken which are associated with Gujarat State election. The dataset used is extracted from Twitter using the hashtag #gujaratelections2022

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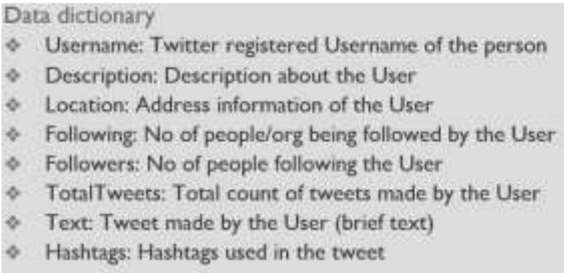
Fig. 2. Sample Tweets


Data dictionary

- Username: Twitter registered Username of the person
- Description: Description about the User
- Location: Address information of the User
- Following: No of people/org being followed by the User
- Followers: No of people following the User
- TotalTweets: Total count of tweets made by the User
- Text: Tweet made by the User (brief text)
- Hashtags: Hashtags used in the tweet

Fig. 3. Standard Data Dictionary for Twitter Extract

D. Data Pre-processing

The twitter data is unstructured and it contains a lot of noise and unwanted information. Data pre-processing is required to filter out such noise and unwanted information. Further, it simplifies the vocabulary used for analyzing sentiments from the tweets. The model will use different data prepossessing techniques such as Tokenization, Lower case conversion, Stop words removal, Punctuation removal,Stemming,Lemmatization and Parts of Speech Tagging.

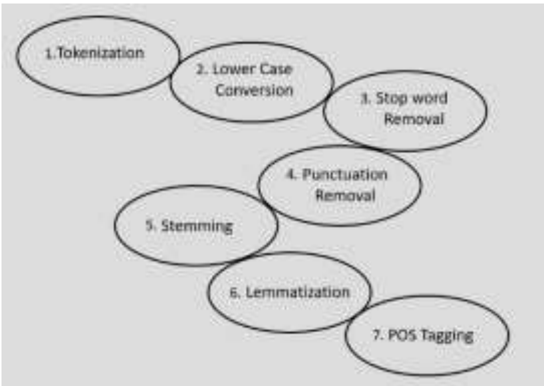


Fig. 4. Data Pre-Processing Steps

Encoding Techniques: Encoding techniques refer to methods used to represent data in a format that can be easily processed by a computer system. Techniques like Bag of Words, Binary Bag of Words, Bigram, Ngram, TF-IDF(Term Frequency-Inverse Document Frequency) are being utilized in this study.

Fig. 5 Encoding Steps Used

IV. RESULTS

This model reaches an accuracy of 91.3 percent on the development corpus from which it was trained. This reduces our training time drastically instead of training the model fresh from start using our data. The model output shows that the sentiment of the people is positive towards the ruling party in the State of Gujarat during 2022 India State Elections.

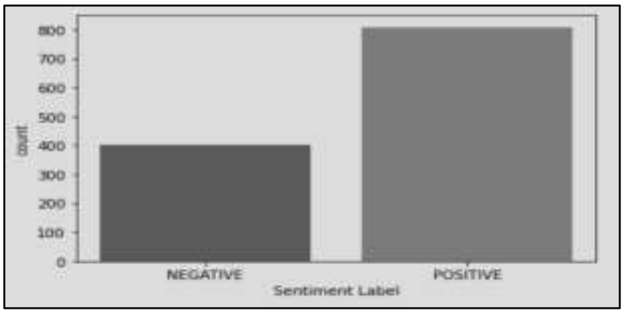


Fig. 6. Sentimental Labelling

The bar graph shows the distribution of the tweets after applying the sentiment analysis using Transformer model (distilbert-base-uncased-finetuned-sst-2-english). Majority of the comments in this dataset convey positive sentiment towards the ruling dispensation.

On analyzing the most frequently occurring words in the set of positive tweets, we found that there is a generic positive sentiment towards 'amitshah' (as shown in word clouds below).

Fig. 7.Positive (In favor of ruling Party) tweets WC

The above word cloud captures the basic sentiments of the Tweets, that were identified as supporting the Ruling dispensation prior to the 2022 election. The words like Choose and Amit Shah were repeated multiple times.

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Fig. 8. Negative (Against ruling Party) tweets WC

The above word cloud captures the basic sentiments of the Tweets, that were identified as opposing the Ruling dispensation prior to the 2022 election. The words like change and Shah ignored were repeated multiple times here. However, the word cloud for Negative comments also have used words like Amit Shah Magic and Shah for Gujarat, which in a way also conveys positive sentiment. Hence Word Cloud is not a apt representation for Negative Sentiments as such.

V. Discussions and conclusions

A. Conclusion

Through this study it is concluded that Transformers models have been shown to be very effective in performing sentiment analysis of social media data. Social media platforms like Twitter, Facebook, and Instagram generate huge volumes of text data that contain a wide range of sentiments, opinions, and emotions. Transformer models excel in handling this type of unstructured and noisy text data because they can capture complex relationships between words and their context, as well as handle variations in sentence structure and grammar.

The results indicate high positive sentiment towards ruling political party.The influence of Third-Party Social Media Agencies and paid tweets has the potential of introducing a bias in the final outcomes. Techniques and Methods to identify and eliminate this bias is an opportunity, that can be considered as a future scope.

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Cost Prediction in Acquiring Customers Using Machine Learning

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Abstract—Cost prediction for customer acquisition is a very significant assignment because it has evolved into a critical business metric that aids companies in determining the resources they will need to continue to expand and acquire new clients. So, customer acquisition cost is the sum of money that a business pays to bring on a new client. Nevertheless, developing an appropriate cost prediction model for customer acquisition is not a straightforward process because there are numerous independent variables in both the presented Food Mart X data set and real-world situations, as well as numerous categorical data with high cardinality. The hardest challenge that draws the attention of researchers and practitioners is estimating the required cost.

In order to estimate the cost of acquiring a customer, this paper uses a machine learning approach. The findings demonstrate that, in comparison to conventional estimating methods, machine learning techniques may be utilised to anticipate Cost on Acquiring Customers with High Accuracy Rate.

The proposed model in this research was trained on the Food Mart X data set, having the records of 48k customers. An analysis of the results of the implementation for the proposed methods showed that the cost Predicting process using Decision Tree algorithm (DT), Random Forest algorithm (RF) and Bagging Forest algorithm (BF) has the ability to predict the costs required to acquire the customer. Out of those, Random Forest algorithm (RF) has shown highest accuracy inpredicting the required cost to acquire customer compare to decision tree and bagging method. Literature also shows the development of neural network model for predicting the cost but it's not cover here in this study.

Keywords— Decision Tree (DT), Random Forest (RF), Bagging Forest (BF), Deep learning neural Network (DNN), Root Mean Squared Error (RMSE).

I. INTRODUCTION

Customer Acquisition cost is being vastly used by the business to improve the vision and positioning of the resources and capital. "Even in well-managed organisations, there can be a high level of client churn," it has been noted. We must find replacements for these lost clients.Clients could leave as they get older and move through the family life cycle. If their personal circumstances change and they no longer require or appreciate your product, we could lose our current clientele. These unpredictable reasons of client loss suggest that customer acquisition will always be required to replace natural attrition. Hence in today's world, there is a need of accurate model through which a businessman can simulate those condition and can able to forecast the cost. These types of models can be used at various places such aspredicting the cost of goods, raw material, commodities such as steel price etc as these prices directly hit the final product prices as well the overall business.

II. RELATED WORKS - LITERATURE SURVEY

Regression analysis, which is nothing more than a statistical approach used to assess the relationship between a dependent/target variable (here, the cost of customer acquisition.) and one or more independent (interdependent) factors, may generally be used to create cost prediction tasks.

Cost forecasting is typically carried out using descriptive, predictive, and prescriptive analytics.

*Descriptive Analytics:*Statistical techniques used in descriptive analytics [19] include data gathering, analysis, interpretation, and presenting of results. In essence, this form of analytics aids in determining what occurred.

*Predictive analytics:*In the context of price predictions, predictive analytics [19] involves analysing recent and previous data to estimate the likelihood of upcoming occurrences, outcomes, or values. Many statistical methods, including machine learning and data mining (the detection of patterns in data), are needed for predictive analytics.

A. Cost Prediction methods and techniques

The development of considerably more efficient and precise predictive algorithms has been made feasible by the developments in statistics during the past 20 years. What potential uses are there for cost modelling and estimation?

Traditional Costing Models

DOI: rp-9788770040723.089

1. ***Analog Method:***

By evaluating similar products that have been manufactured or purchased in the past, this method calculates the cost of a new product. Although this strategy is unreliable, it can be utilised in very early stages (such as a feasibility study) when the details of the project or service are unknown. In this study, we won't linger on this kind of fundamental estimate.*Analytical Method*

By simulating the industrial production process, it calculates a product's cost. This approach is based on the product's cost structure, and it estimates each intermediate component using the materials & components used, the process costs (labour and machine), as well as any additional structural expenses.

This kind of approach necessitates a thorough understanding of the subject; thus it occasionally fails when particular precautions are not taken or when methods are changed abruptly.

2. *Parametric Method*

This technique uses statistical modelling to determine the price of a good or service. This method models the evolution of the cost as a function of specific factors known as "cost drivers" by using historical data from similar goods and services to build equations or statistical laws.

These models are typically based on regressions that are linear, multilinear, polynomial, or logarithmic.

- Major problems with this type of method are as below:They don't handle missing data well, so highly clean databases are needed.
- They manage "breaks" or threshold effects ineffectively. Because the manufacturing process can change, the price, for instance, may behave linearly up to a certain point before drastically changing (size, weight, volume, etc.).

3. *Non-Parametric Method*

The shortcomings of conventional parametric approaches have mostly been resolved by the advancements made in the fields of algorithms and machine learning, which have also improved their performance and scope of application.

The "random forests" approach, which Leo Breiman and Adèle Cutler formally proposed in 2001 (Breiman, L., Random Forests. Machine Learning. 45, 5-32 (2001)) is a statistical method. nonparametric that uses "Bootstrap" approaches to create numerous decision trees that are trained on slightly different data subsets.

In both regression and classification, Pierre Geurts [2] introduced and described how bias-variance trade-off is accomplished. The bias and variance of the statistical model are significantly influenced by the choice of variables and attributes.

In order to assist farmers in predicting the amount of rain that will fall, Wanie M. Ridwan et al. [1] employed four distinct regression algorithms: Bayesian Linear Regression (BLR), Boosted Decision Tree Regression (BDTR), Decision Forest Regression (DFR), and Neural Network Regression (NNR).

A. Krishna et al. [2] attempted to identify the best algorithm by using various machine learning techniques to predict the sales of a retail store. They used both conventional regression approaches and boosting techniques, and discovered that the boosting algorithms produced superior results to the conventional regression algorithms.

Based on a number of independent variables, a regression model is used to forecast or predict the value of the dependant variable—cost.With the evolution of Machine Learnings and advancement in internet speeds, Machine learnings are now being extensively used to predict the continuous numerical as well classification problem. The two giant E-commerce Industry- Amazon &Flipkart are extensively using the machine learning algorithms in predicting their customer acquisition cost.

B. Machine Learning Algorithms focussed here are as follows:

1. Decision Tree Regression
2. Random Forest
3. Bagging Forest

Some of the case studies has been done for improvement of sales forecasting problems by Deep Neural Network also.

III. Proposed Work

A. Materials and methods used

This dataset has sourced from https://www.kaggle.com/datasets/ramjasmaurya/medias-cost-prediction-in-foodmart. It contains the information regarding demographics of existing customers. This dataset has two files, one for training (36,256 rows & 41 columns) and other for testing (12086 rows & 41 column). Also, one additional file was provided, which contain information about feature values and their description.

In these features, Cost is a dependent variable and the remaining features are called as independent variable. Here we need to predict the value of dependent variable using independent variable. For validation of model in the last, we have created a validation data set from the training data set.

From the literature survey & preliminary study, we applied following 3 regression models on the dataset:

1. Decision Tree Regression
2. Random Forest Regression
3. Bagging Forest Regression.

IV. Implementation

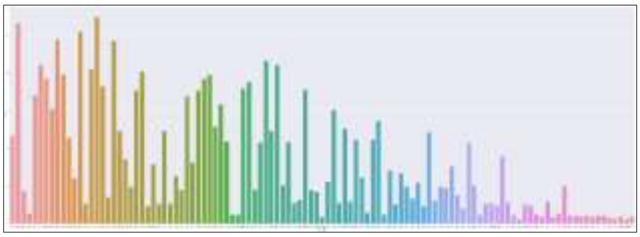
A. Dataset, data collection, data pre-processing

After collection of datasets- we started to understand the datasets. During data pre-processing, we faced challenges like “high Cardinality”, “Non-Linearity”, “Collinearity” as these data set has 16 categorical type data. Out of these 16 categorical data, 6 categorical data have a high unique value, such as., “Media Type”, “Store City”, “Brand Name”, “Promotion Name”, “Food Department”, “Food Category” thus suffering from high cardinality issue.

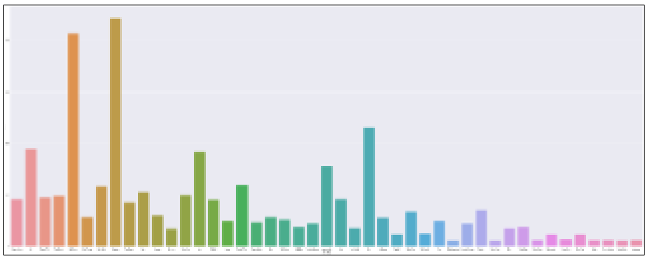
DOI: rp-9788770040723.089

Some of the categorical type data count plot has been plotted to understand the curse of dimensionality which are as follows:

1. Brand Column Count plot is as follows to shows the number of unique values:

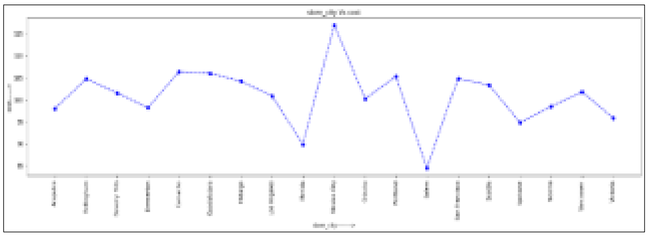


2. Similarly, food column category count plot is as follows:

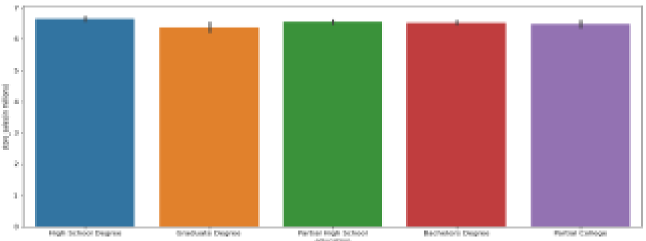


Through “One Hot Encoding” – when have converted all these categorical types data & it leads to final 298 column leading to large dimensions. We have also tried to check the relation between dependent and independent columns. Some of the relation is as follows:

- *Relation between Store city and Cost*



- *Education vs Cost*



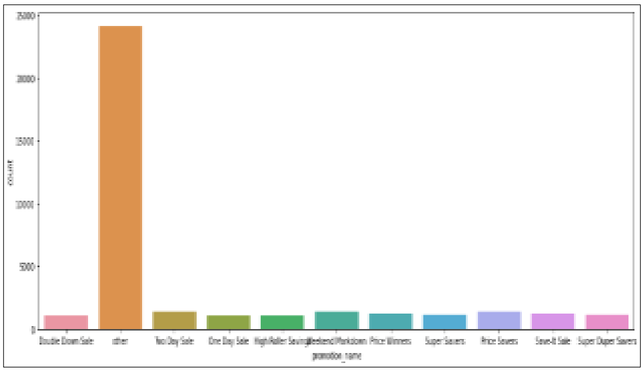
To reduce the dimensions, we have also calculated another attributes from some of the related columns, for e.g., we have calculated & made a new column for “Profit” from the two given columns namely store_sales& store cost to overcome the problem of large dimensions.

B. Exploratory Data Analysis and Evaluation of Models

1. EDA for Analysis-1:

Model has been made using only Top 10 features & grouping rest into “OTHERS”. Thereafterconverting Category data to numerical type using Label encoders.

- Top 10 features for Promotions is as below:



- Top 10 features for Food Department is as below:

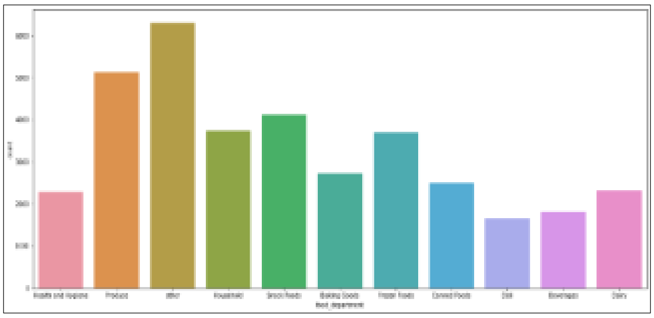


TABLE-1: RMSE AND SCORE FOR ANALYSIS-1

Model	**Test RMSE**	**Train RMSE**	**Test R2 Score**	**Train R2 Score**
Decision Tree	28.22	28.18	0.11	0.11
Random Forest	14.60	7.41	0.76	0.93
Bagging	15.11	7.95	0.74	0.92

Result of test score for both random forest and Bagging reveals that the model is overfitting. Overfitting might happen due to the high variance which might have introduced. Hence another analysis is envisaged where instead of label encoding, one-hot encoding shall be applied.

Joint Plot for analysis-1 is shown in fig 1, 2 & 3:

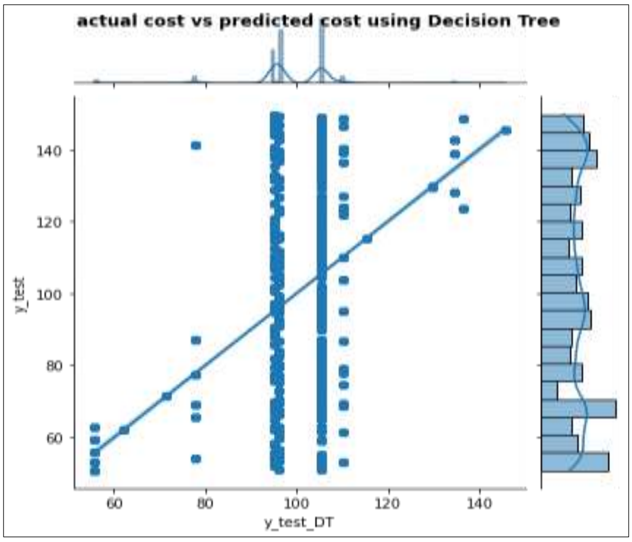


Fig.1. DT Based Model

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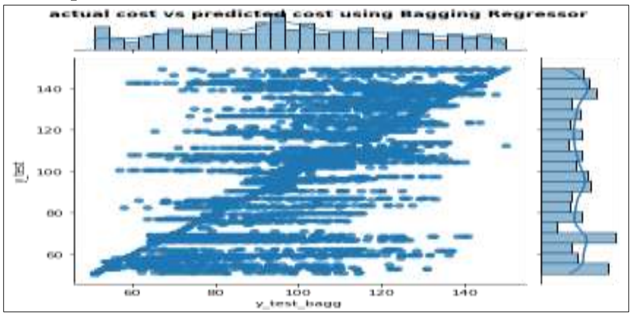

Fig.2. Bagging Based Model

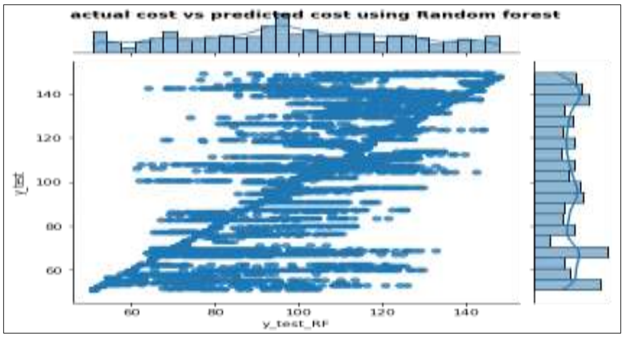

Fig.3. Random Forest Model

2. *Analysis-2*

Model has been made using all features but this time instead of using Label Encoder, One hot encoding has been used to remove the bias error which might have come due to Label encoder in Analysis-1.

Results are mentioned under section-5.

However, since frequency encoding was applied on only one feature, it is not sure whether this will work in real life problems as well. So, - Analysis-3 with another method of encoding called as target encoding has been done.

Target encoding involves replacing a categorical feature with average target value of all data points belonging to the category. *Python Code for Target Encoding which shall be used in Analysis-3:*

```
fromcategory_encoders import TargetEncoder
te=TargetEncoder ()
te.fit(X,y)
```

3. *Analysis-3*

Model has been made using all features but this time instead ofLabel Encoder & One hot encoding, “Target Encoding” has been applied on the categorical columns and results were further found to be improved compared to the results of Analysis-2.

TABLE3: RMSE AND SCORE FOR ANALYSIS-3

Model	Test RMSE	Train RMSE	Test R2 Score	Train R2 Score
Decision Tree	1.49	0.34	0.99	0.99
Random Forest	1.18	0.59	0.99	0.99
Bagging	1.38	0.59	0.99	0.99

Joint Plot for analysis-3 is shown in fig 4,5&6:

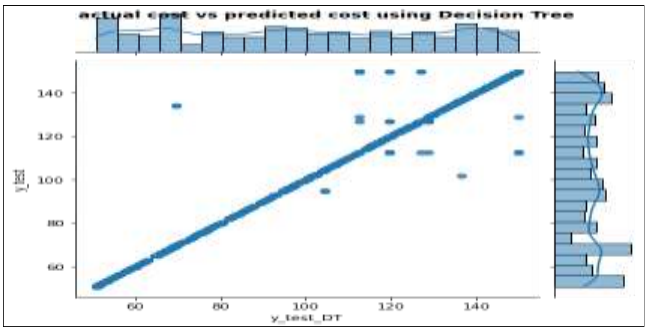

Fig.4. DT Based Model

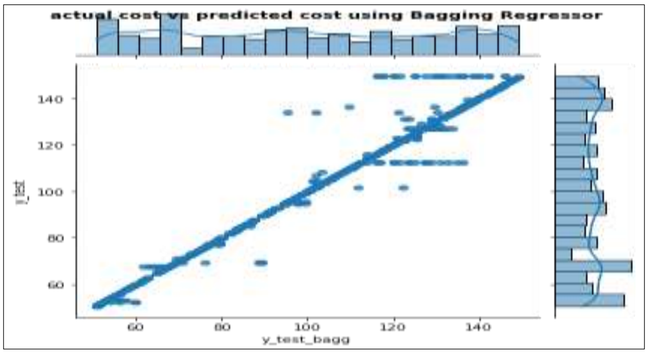

Fig.5. Bagging Based Model

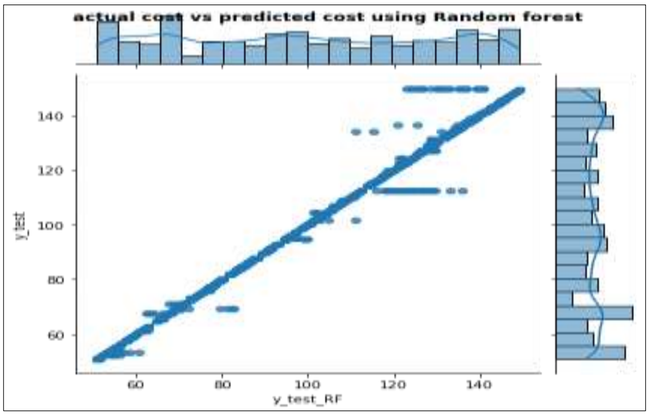

Fig.6. Random Forest Model

V. RESULTS AND DISCUSSION

The methods and procedures utilised for machine learning as applied to observational datasets that can provide information on customer acquisition cost were thoroughly studied and described in this work. The summary of this work does not necessarily apply to all machine learning-based investigations because machine learning approaches have been utilised much more broadly throughout observational studies than in the context of individual decision making. This study focuses on a topic that is still relatively unexplored: how to leverage massive datasets in a way that can enhance customer acquisition cost prediction outcomes.

With the application of Frequency Encoding Technique on categorical column having highest unique values, results improved compare to Analysis-1.

Result of RMSE & Score are tabulated below after the application of Frequency Encoding:

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TABLE2: RMSE AND SCORE AFTER FREQUENCY ENCODING APPLICATION ON "BRAND COLUMN" IS AS BELOW:

Model	Test RMSE	Test R2 Score	Train R2 Score
Decision tree Regression	1.52	0.9975	1.0
Random Forest	1.23	0.998	0.999
Bagging Forest	3.23	0.988	0.988

Similarly with the application of Target Encoding Technique on all categorical column, results found even better then Table-2 and has been tabulated below:

TABLE3: RMSE AND SCORE FOR ANALYSIS-3

Model	Test RMSE	Test R2 Score	Train R2 Score
Decision tree Regression	1.49	0.997	0.999
Random Forest	1.18	0.998	0.999
Bagging Forest	1.38	0.997	0.999

VI. CONCLUSION

As can be seen from this study, problem(data) having high number of categorical data and that too with high unique values, then Target encoding is working best among popular encoding method such as Label Encoder and One hot Encoding.

Among the models, after applying the target encoding during pre-processing steps, random Forest model performs well with respect to other model in terms of root mean square error.Performance analysis for all the three-analysis done here are as below:

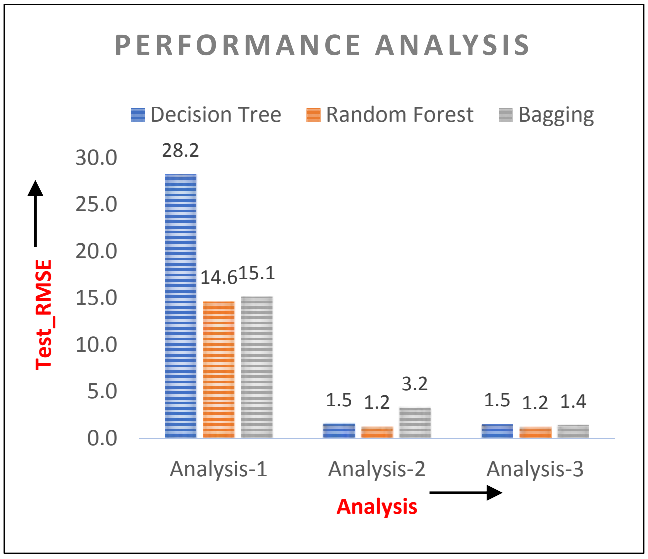

Fig.7. Performance analysis of different models

By doing various analysis, we found out that target encoding works better.

Additionally, seeing the performance of various modelsbeing studied here, Random Forest gives better accuracy compare to other two models. Hence, we propose to use Random Forest with target encoding for such high category type data set in future in predicting the cost.

Yet, as evidenced by our literature review, we believe external validation is also necessary to guarantee model fidelity but is rarely done. There may be a number of causes for this, including a dearth of pertinent datasets or a failure to recognise the significance of external validation. Before applying models to any cost forecast, there is an increasing necessity for external validation as machine learning model development rises.

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Deep Learning Based Product Recommendation System

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***Abstract*—The increasing volume of information available online calls for more effective and individualized methods of information management. Recommendation systems address this challenge by providing personalized recommendations to users based on various factors, such as their interests and interaction history. This paper focuses on the development of a conversational chatbot that offers product recommendations and related images based on multiple input features. The chatbot utilizes Term Frequency-Inverse Document Frequency (TF-IDF) vectorization and a linear kernel matrix to generate product recommendations. Unlike traditional recommendation systems, the chatbot employs a conversational interface, resulting in a more human-like and intuitive interaction. The use of natural language processing techniques and a conversational interface provide a novel and improved way to make recommendations, enhancing the overall user experience. Our approach to product recommendations is unique and has the potential to bring a new level of personal- ization and interaction to the recommendation system field.**

Index Terms—Recommendation System, Chatbot, TF-IDF, Kernel Matrix, Deep Learning

I. Introduction

The rise of digitization has led to the transfer of the world's largest movie libraries to online streaming platforms such as Netflix, HBO, and YouTube. These platforms have enhanced their offerings with AI-powered tools that aim to make the task of choosing a movie a more seamless experience for users.

A movie recommendation system is a critical component in enhancing this experience. It is a machine learning-based approach that utilizes data about the user and movies to predict the user's film preferences. The main objective of a movie recommendation system is to provide users with tailored and relevant movie recommendations.

The system operates by treating movies as products and users as the target audience. By utilizing data gathered on users and movies, the system can predict future user preferences based on that information. To generate movie recommendations for users, this recommendation systemer employs a linear kernel similarity matrix and utilizes Term Frequency-Inverse Document Frequency (TF-IDF) methodology within its algorithm.

Treating movie as a product, the paper outlines a movie rec- ommendation system that utilizes machine learning and data analysis techniques. The system's design and implementation are presented, and its performance will be evaluated using a publicly available movie dataset. Additionally, the system will be compared with existing movie recommendation systems. The results of this study will provide valuable insights into the design and development of advanced and effective movie recommendation systems.

II. Related Work

The field of product recommendation has seen a tremendous growth in recent years with the advent of online shopping and streaming platforms. Several experiments have already been conducted to improve the accuracy,effectiveness and speed of product recommendation systems.

The most important and common form of recommendation system is to predict the preference for items which are unseen or even unknown and choosing those with the highest estimation values. The common applications using recommendation systems are music, movies, news, E- commerce sites, travel guides,grocery online dating, books, hotels and restaurant etc. Recommendation systems are broadly categorized as collaborative filtering, contents-based filtering and hybrid approach. Contents-based filtering systems recommends items based on a description of items the user history suggest that user has liked before. Collaborative filtering is a technique that can filter out items that a user might like on the basis of reactions by similar users. Hybrid techniques are the combination of both theseapproaches.

One of the most popular techniques used in product recommendation is Collaborative filtering. The technique uses the idea that users who have similar preferences observed during their shopping experience in the past are likely to have similar preferences in the future too. A number of approaches have been taken to improve the accuracy of collaborative filtering-based product recommendation systems. For example,[1] proposed a neighborhood-based collaborative filtering approach that takes into account the relationship between users and items

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to make recommendations. [2] proposed a matrix factorization-based approach that utilizes singular value decomposition to predict user preferences.

Content-based filtering is another popular technique used in product recommendation. The technique is based on the idea that the characteristics of an item can be used to predict the preferences of a user. [3] proposed a content-based filtering approach that utilizes the textual description of items to make recommendations. [4] proposed a hybrid approach that uses the combination of both content-based filtering and collaborative filtering to make recommendations. The approach leverages the strengths of both techniques to improve the accuracy of recommendations.

Recently, deep learning techniques have been applied to product recommendation. [5] proposed a deep neural network- based approach that utilizes user-item interaction data to make recommendations. The approach outperformed traditional collaborative filtering and content-based filtering approaches in terms of accuracy. [6] proposed a graph neural network- based approach that takes into account the relationship between users and items to make recommendations. The approach showed promising results in terms of accuracy and efficiency.

Another hybrid model in [7] has discussed the combination of both collaborative and content based recommendation system is used in to predict the ranks of the users for a set of items by presenting sets of three results—one anecdotal and two statistical in nature —with a small number of users in a controlled experiment . This approach also showed promising results in terms of performance other than bringing two additional benefits. First, the common scaling problems to all Web services are addressed—constantly increasing number of users and an increasing number of documents. Second, it enables enhanced communications and group awareness by automatically identifying the emerging communities of interest in the user population.

Collaborative models have been often used with different perspective for recommendation system. [8] Talks about preference-based graphic models for collaborative filtering that considered the fact that users can have very different rating patterns even if their interests are similar in items.

Two new graphic models were proposed that addresses the differences between user ratings and preferences. In one of the models, called the “decoupled model”, two different variables were introduced to decouple preferences of a user from his ratings. In the other one, called the “preference model”, the orderings OF items preferred by a user were modeled, rather than the numerical ratings of items by the user. Empirical study over two datasets of movie ratings shows substantial and consistent improvement in the performance on appropriately modeling the distinctions in user preferences and their ratings.

Recommendation Systems takes into account the similarities among either the contents or the users who are accessing those contents. There similarity between two items can be measured in several ways. Similarity matrix like correlation matrix is used by the recommendation systems to recommend the next most similar product to the user. In this article, a machine learning algorithm will be built that would recommend movies based on the user likes. This Machine Learning model would be based on Linear Kernel.In recommendation systems, linear kernel is used to measure the similarity between items in the dataset and determine which items are most similar to each other.

A linear kernel is a method used to calculate the similarity between two data points [9]. In recommendation systems, linear kernel is used to measure the similarity between items in the dataset and determine which items are most similar to each other. The Linear Kernel is frequently utilized when a data set has a large number of features. This is particularly the case in text classification where each individual alphabet can be considered a separate feature. Thus, the Linear Kernel is commonly used in text classification to manage the high number of features. Linear kernel is simple to implement and computationally efficient, making it a popular choice for recommendation systems. The linear kernel is combined with the kernel trick to create a powerful tool for measuring similarity in the recommendation system. This helps to improve the accuracy of the recommendations.

In conclusion, there have been numerous studies on product recommendation in recent years, and the field is still rapidly evolving. The above-mentioned works have made significant contributions to the field and have provided valuable insights into the design and development of more effective product recommendation systems. The use of TFIDF and Linear Kernel significantly increase the performance and efficiency.

III. Methodology

A. Data set description

1) *Movies metadata:* Movies metadata.csv is a csv file that contains information about a variety of movies. Each row in the file represents a single movie and contains several columns with data about that movie.

title	ancient	ancient feud	andi	andi birthday	andi heart	andi toy	angel	angel crime
Toy Story	0.000000	0.000000	0.242757	0.080919	0.080919	0.080919	0.000000	0.000000
Jumanji	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Grumpier Old Men	0.088086	0.088086	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Waiting to Exhale	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Father of the Bride Part II	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Heat	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.143366	0.071683
Sabrina	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Tom and Huck	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sudden Death	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
GoldenEye	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Fig. 1. TF-IDF matrix: Document vs N-gram

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2) *link small:* The ”link small.csv” file in the movie dataset provides information about the mapping between the movie entries in the Internet Movie Database (IMDb) and the TMDb (The Movie Database) for a subset of the movies in the dataset.

3) *credits:* The ”credits.csv” file in the movie dataset provides information about the cast and crew members involved in the production of a movie.

4) *keywords:* The ”keywords.csv” file in the movie dataset contains information about keywords associated with each movie in the dataset.

B. Base Model

For the base model TF-IDF vectorization and Linear Kernel was used [10]. The new column called soup was added, it is a combination of tagline, overview, cast, keywords and director of the movie. The director’s name was repeated thrice in the soup to give it a higher weight-age.

Each row’s soup column is considered as one document which collectively forms the corpus. Then we take as input the string describing the type of movie that the user wants to watch. This input string is considered to be the latest document in the above-mentioned corpus. Next, we apply TF-IDF vectorization to the corpus, which gives us a matrix of TF-IDF vectors for each document. Refer to Fig. 1, which illustrates the TF-IDF matrix where each row represents a document and each column represents an n-gram.

Next, the similarity matrix between every document is calculated using linear kernel [12], since it is shown to provide faster results compared to calculating cosine similarity [11]. This results in a matrix with values between 0-1 where 0 means no similarity and 1 meaning that they are the same . Refer to Fig. 2, which illustrates how the similarity matrix would look. Note that the diagonals are 1 since that represents the document being compared with itself.

title	Toy Story	Jumanji	Grumpier Old Men	Waiting to Exhale	Father of the Bride Part II	Heat
title						
Toy Story	1.000000	0.017904	0.022512	0.008439	0.005054	0.000000
Jumanji	0.017904	1.000000	0.009138	0.009441	0.010156	0.012897
Grumpier Old Men	0.022512	0.009138	1.000000	0.007010	0.000000	0.000000
Waiting to Exhale	0.008439	0.009441	0.007010	1.000000	0.015717	0.004714
Father of the Bride Part II	0.005054	0.010156	0.000000	0.015717	1.000000	0.004477
Heat	0.000000	0.012897	0.000000	0.004714	0.004477	1.000000

Fig. 2. TF-IDF matrix using Linear Kernel

Next, we check the similarity of input string with each document in the corpus and select the top 10 documents with the highest similarity scores. Each one of the 10 documents represent a movie title from our original data-set. We correlate the document to its title and display the top 10 title to the user as the final output.

IV. Results

A. Results of using NLP for the formation of Movie Recom- mendation System

1) *Results of using TF-IDF matrix:* TF-IDF (Term Frequency-Inverse Document Frequency) is used in information retrieval and natural language processing to quantify the importance of individual words in the dataset. TF-IDF is used here to find the most significant words in the movie datset’s descriptions and genres. TF-IDF is also used to compare them with the words according to the user’s preferences.

Here’s how it works:

Term Frequency (TF): Term Frequency helps to represent the frequency of a word in a dataset (movie description or movie genre). A higher value of TF indicates that the word is more important in the datset model.

Inverse Document Frequency (IDF): Term Frequency helps to represent the inverse of the frequency of a word in all the datsets (movies). A higher value of IDF indicates that the word is rarely used and more significant in the dataset.

TF-IDF: The final score is generated by multiplying the TF and IDF scores of a term in the datset. The higher score of the TF-IDF, the more significant the word is in that datset.

By applying TF-IDF to movie descriptions, plots, and genres, we can find the most significant terms (words) that represent each movie and use that information to make recommendations to users. We can then compare the TF-IDF scores of these terms in the user’s preferred movies with the scores in other movies to find the most similar movies and make recommendations.

This approach is useful because it takes into account not only the frequency of words in movie descriptions, plots, and genres but also the significance of those words in the entire movie corpus dataset. This process will help to provide more accurate and personalized recommendations to an user.

Refer to the below figure for the TF-IDF matrix, each row represents a review of a movie and each column is representing n-gram.

	ancient	ancient feud	andi	andi birthday	andi heart	andi toy	angel	angel crime	angel mental	angela	angela bassett	ann	ann margret	armi
title														
Toy Story	0.000000	0.000000	0.242757	0.080919	0.080919	0.080919	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Jumanji	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Grumpier Old Men	0.088086	0.088086	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.088086	0.088086	0.000000
Waiting to Exhale	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.051025	0.051025	0.000000	0.000000	0.000000

Fig. 3. Results of using TF-IDF matrix

2) *Results of using Similarity Matrix matrix on TF-IDF matrix:* A similarity matrix is used on a TF-IDF matrix to measure the similarity between different movies based on their TF-IDF scores. The similarity matrix is a matrix that contains the similarity scores between all pairs of movies in the dataset.

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The similarity score is calculated using Linear Kernel Similarity technique. Linear kernel helps to calculate the similarity between two vectors, and it is well-suited for sparse data, like the TF-IDF matrix.

Similarity score between two movie vectors is calculated as the dot product of the movies divided by the magnitude of each movie. The similarity score ranges from -1 to 1, where 1 indicates that the movies are perfectly similar and -1 indicates that they are perfectly not similar.

Once we have the similarity matrix, we use it to make recommendations to users. If a user has watched a movie, we can find the most similar movies to that movie based on the similarity scores and recommend those movies to the user.

In summary, using a similarity matrix on a TF-IDF matrix in a movie recommendation system project can provide more accurate and personalized recommendations to users based on the similarity of the movies' descriptions, plots, and genres.

Figure is how the similarity matrix would look. Note that the diagonals are 1 since that represents the document being compared with itself.

title	Toy Story	Jumanji	Grumpier Old Men	Waiting to Exhale	Father of the Bride Part II	Heat	Sabrina	Tom and Huck	Sudden Death	GoldenEye
title										
Toy Story	1.000000	0.017904	0.022512	0.006439	0.005054	0.000000	0.000000	0.050590	0.000000	0.000000
Jumanji	0.017904	1.000000	0.009138	0.009441	0.010158	0.012987	0.011798	0.033325	0.046475	0.002893
Grumpier Old Men	0.022512	0.009138	1.000000	0.007010	0.000000	0.000000	0.000000	0.009202	0.000000	0.005506
Waiting to Exhale	0.006439	0.009441	0.007010	1.000000	0.015717	0.004714	0.005041	0.007158	0.000000	0.004357

Fig. 4. Results of using Similarity Matrix matrix on TF-IDF matrix

B. *The process of processing the users input*

Next the code check the similarity of input string with each document in the corpus and select the top 10 documents with the highest similarity scores. Each one of the 10 documents represent a movie title from our original data-set. We correlate the document to its title and display the top 10 title to the user as the final output.

The process of processing the users input are as follows: The user's query is parsed to understand the intent behind it and extract relevant information such as movie name, genre, actor, director, release year, etc.

```
[ ] getPredictionsV2("war movies", test1).head(10)

9219    war movi
Name: soup, dtype: object
432                          Last Action Hero
6846                        The Hunting Party
6286                             Why We Fight
3245                           State and Main
6075                           Sergeant York
8835                                 Unbroken
7341                  Through the Olive Trees
6323    C.S.A.: The Confederate States of America
5562                        Destination Tokyo
6393                            49th Parallel
Name: title, dtype: object
```

Fig. 5. Prediction of war movies

Here the user is searching for a war movie.

NLP is used to analyze the user's sentiment towards the movie. This can be helpful in providing personalized recommendations based on the user's likes and dislikes.

```
[ ] getPredictionsV2("give me a movie where ship crashes into iceberg", test1).head(10)

9219    movi ship crash iceberg
Name: soup, dtype: object
2733                 A Night to Remember
1376                             Titanic
6923      Aliens vs Predator: Requiem
2661                         Pitch Black
2051     Beyond the Poseidon Adventure
4350                          Ghost Ship
8507                     Captain Phillips
2732                             Titanic
5711     The Wackiest Ship in the Army
2170                 The Legend of 1900
Name: title, dtype: object
```

Fig. 6. Prediction of movies where a ship crashed an iceberg

Here the user is searching for a movie related to ships which got crashed by an iceberg unfortunately.

NLP is used to recognize synonyms and normalize the user's query to match the names and terms used in the movie database. For example, "Casino Royale" and "James Bond movie" can be recognized as the same movie.

```
[ ] getPredictionsV2("give me movie which has james bond and janus", test1).head(10)

9219    movi jame bond janus
Name: soup, dtype: object
4357                        Casino Royale
5227                           Octopussy
5230                  Never Say Never Again
2418                      Live and Let Die
9                                GoldenEye
2921          The Man with the Golden Gun
2916      On Her Majesty's Secret Service
2416                     For Your Eyes Only
1903                       A View to a Kill
7996                  Johnny English Reborn
Name: title, dtype: object
```

Fig. 7. Prediction of movies where character name is James Bond

Here the user want to see "Casino Royale" or "Octopussy" but he/she may forget the movie name but the user can search for the name of the character James Bond which is much easier to remember.

Here NLP is used to identify named entities in the user's query and match them against the movie database.

```
[ ] getPredictionsV2("give me christopher nolan movies", test1).head(10)

9219    christoph nolan movi
Name: soup, dtype: object
2085                Following
6623             The Prestige
4145                 Insomnia
7648                Inception
6218            Batman Begins
8613             Interstellar
3381                  Memento
6981          The Dark Knight
8031    The Dark Knight Rises
8231             Side by Side
Name: title, dtype: object
```

Fig. 8. Prediction of movie where christophernolan presents

For example, "Movies directed by Christopher Nolan" can be recognized as a request for movies directed by the named entity "Christopher Nolan".

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By using NLP techniques, a movie search option provides a more natural and intuitive interface for users, allowing them to find the movies they are looking for more easily and accurately.

V. Conclusion

For the Movie Recommendation System, we created a custom corpus of documents where each document represents a movie. We used TF-IDF on this corpus to create the TF-IDF matrix, linear kernel was applied on this matrix to get the similarity matrix. Using this we identified the best movies that are related to the query string entered by the user and recommended these movies to the user. This was done on the basis of different factors such as the tagline, overview and cast of the movie.

TF-IDF helped us identify the most important words having the most context for a given movie, this helped improve our recommendation accuracy. Linear kernel was found to be a fast and effective way to compute the similarity matrix. The results from the recommendation system were found to be satisfactory.

After building the similarity matrix, we extract the top 10 movies with the highest similarity scores with our query string. While this gives us good results most of the time, there are instances when the returned movies are weakly correlated to the query string. This happens because we seldom observe a sharp cutoff in the similarity scores. If we were to make a descending list of similarity scores, ther is a point where the score drops off drastically, typically the movies after this score are not optimal recommendations. We need to do something to give better results in this scenario. One of the options is to detect this cutoff and return only the movies above this cutoff to the user, which can be taken up as future work.

For example when we ask the model ”Give me movies directed by Christopher Nolan”, the model returns 10 movies that best match this criterea. While there is a guarantee that movies directed by Christopher Nolan will be returned, there is no guarantee that the user will be satisfied by the top results. To make this better, once we get the top 10 movies that match the query string, next we can sort the movies within this list based on rating and reviews. This will ensure that a user is more likely to pick one of the recommended movies.

In TF-IDF while considering the scores for each n-gram in a document, we consider the number of times it appears in the current document as well as the number of times it appears in all the documents. In our method, we add the query string as the latest document in the existing corpus and re-calculate the TF-IDF matrix every time we get a new query, this is because the score of each n-gram depends on the whole corpus and every time a new document is added to the corpus, the scores for each n-gram in each document will change. As a possible future work, we can consider certain trade-offs and try to re-use the TF-IDF matrix instead of creating a new one for every query we get.

Given the advancements in AI available to the common man, specifically the emergence of ChatGPT. Instead of looking at this as our competitor, we can try to leverage its capabilities to imporove the quality of our results, which can be take up as future work.

This paper mainly goes over the implementation of ths use of TF-IDF matrix in conjunction with some clever usage of the available data to provide movie recommendations. We have not established a formal method of measuring the metrics of chat based recommendation systems which can bea separate topic by itself. Once we have established a way to measure the metrics, we can try alternate techniques and comapre their results or try to use a combination of them to provide the best results to the user.

After deciding to go ahead in the field of recommendation systems, we went ahead in an attempt to provide a chat bot interface for movie recommendations. The model we used mainly relies on TF-IDF vecotrization and linear kernel method for distance calculation. The model is able to take an input string in the form of a conversational request for a movie. It then recommends the top 10 movies that match the users request. The recommended movies were found to be in accordance with the request that was made by the user. We have identified future work which can potentially further improve the quality recommendations. Using the research and methodology mentioned in this paper, we were able to achieve good results. The methodology used in this paper can be used as a building block to build sophisticated chat based recommendations systems of not only movies, but also any product in general.

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Distracted Driver Detection on Re-trained ResNet Architecture

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***Abstract*— Road accidents are predominantly caused by the distracted drivers and nearly 1.3 million deaths are automobile accidents, of which, drivers are held responsible for 78% of accidents. There are various reasons for driver distractions which are drinking, operating instruments, mobile usage, interacting with fellow passengers etc. For the scope of this project, we intend to develop a model to successfully identify whether thedriver is driving safely or is distracted using a combined dataset from the State Farm Distracted Driver Detection challenge on Kaggle& the AUC (American University in Cairo) Project. Convolutional Neural Network with ResNet architecture was used in developing the model. Grad-CAM technique was used to identify gradients in parts of images which impacted classification of images.Explainable AI can help build better models. This approach was able to provide us with promising accuracy and definite results. Experimental results show that our system achieves an accuracy of 99% on the Kaggle dataset and82% on the AUC data set.**

Keywords—Driver distraction, Deep learning, Convolutional Neural Network, Transfer Learning, Resnet101, GradCAM, Explainable AI.

I. Introduction

The problem at hand is related to the automotive domain. With approximately 1.3 million deaths every year attributed to motor accidents, India accounts for 11% of global death in road accidents [22]. The motor insurance claims in India amounted to Rs. 58456.9 crores in FY 18-19 [20]. Every year, a significant portion of the country's GDP, about 3-5%, is allocated to road accidents [20]. According to [20], drivers are responsible for 78% of all accidents. Distracted driving has become a significant issue worldwide, and it is expected to worsen before improving. Visual distraction refers to taking one's eyes off the road, while cognitive distraction involves losing focus on driving even though physically present. This can happen due to daydreaming, being lost in thoughts, and other similar reasons. Manual distraction is when the driver takes his/her hands off the wheel while driving to perform different actions like drinking,, reaching behind, adjusting the radio, texting, talking on the phone, or conversing with passengers while driving.

We propose to detect such distractions in real time and alert the user to prevent any adversity. This solution can be deployed on an edge device set up on the vehicle to give aninstant alarm and it can also interact through IoT devices to process data and give insights in an asynchronous mode. For the scope of this project, the primary focus is to detect the manual distractions when the driver is not primarily focused on driving and accurately classify these activities which lead to driver distraction, through a highly efficient ML model at runtime using computer vision.

II. Related Work

With the advent of Convolutional Neural Networks (CNN) in the early 2000s, deep learning algorithms have registered significant progress in the domain of image recognition. However, zeroing in on the perfect CNN architecture can still be a very difficult task. Among the many architectures proposed in the past, such as VGGNet, AlexNet, GoogLeNet (i.e., Inception), the deep residual network (i.e. - ResNet) was of help to us in this study. Other architectures like the recurrent neural network (RNN) gives impressive results on time series problems and it is a frequently used algorithm. Also problems involving long sequences such as speech recognition and machine translation.

As far as detecting distracted drivers using computer vision based approaches [1] [2], convolutional neural networks (CNNs) have become the most adopted and popular approach. The Distracted Driver Detection through image classification gained traction with the release of a Kaggle competition by State Farm in 2016. In this regard, YehyaAbouelnaga et al [13] [14] had created a new dataset that is often referred to as the AUC Dataset. This proposed a novel system based on posture estimation and achieved a ~96% classification accuracy. Hong Vin Koay et al. [10] focused on exploring the technique that uses both the original image as well as pose estimation images to classify the distraction. The pose estimation images were generated from HRNet and ResNet. The ResNet101 and ResNet50 architectures are used to classify the original and pose estimation images respectively following which a weighted

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approach was followed to arrive at the final classification. This resulted in an accuracy of 94.28% and a F1 score of 94.27% on the American University of Cairo (AUC) Distracted Driver Detection dataset.

Another study by NarayanaDarapaneni et al [1] focused on developing the CNN Method of transfer learning on four architectures namely CNN, VGG-16, ResNet50 and MobileNetV2. The model was trained with images from a publicly available dataset containing ten different posture categories. It was observed that the ResNet50 and MobileNetV2 models provided higher accuracies of 94.50% and 98.12% respectively.

Some studies approached the problem by modifying architecture like the one done by Md. UzzolHossaina et al.[18]. In this study, the VGG-16 Architecture was modified using regularization techniques to improve model performance. According to the results, the system achieved an accuracy of 82.5% and processed 240 images per second on a GPU. The pre-trained ImageNet model was used for weight initialisation and the concept of transfer learning was applied.

Two similar studies by H. Varun Chand et.al [4] and Md. TanvirAhammed et al. [5] were done on driver distraction involving drowsiness and fatigue. The study by H.Varun Chand et.al [4] used machine learning with multi-layer perceptrons to detect microsleep and drowsiness using neural network-based methodologies. The accuracy of this paper was improved by using a CNN to classify drowsiness in the facial expressions detected by the camera. The ability to provide a lightweight alternative to heavier classification models with more than 88% accuracy for the category without glasses and more than 85% for the category night without glasses is the accomplishment of this work. In all categories, more than 83% accuracy was achieved on average as well as in usability. Furthermore, the new proposed model had a significant reduction in model size, complexity and storage when compared to the benchmark model (Max Size = 75KB).

Md. TanvirAhammed et al. [5] used MobileNet CNN Architecture with Single Shot Multibox Detector. Based on the output of the SSD MobileNet v1 architecture, a separate algorithm was used. To train the model, a dataset of approximately 4500 images was labeled with the object's face yawn, no-yawn, open eye and closed eye variations. Using the PASCAL VOC metric, 600 randomly selected images were used to test the trained model. The proposed method was intended to improve accuracy and computational efficiency. [23] Bing-Ting Dong et al. used an approach which detected driver fatigue and distracted driving behaviors using a single shot scale-invariant face detector (S3FD). This was first used to detect the face in the image and then the face alignment network (FAN) was utilized to extract facial features. Post that, the facial features were used to determine the driver's yawns, head posture, and eye movements. Finally, to analyze the driving conditions the random forest technique was used. The average accuracies achieved were ~100% for both face and eye detection.

Another experimental study using CNNs was done by RobinsonJime`nezet al.[24] which targeted detection of driver fatigue and emotion analysis of the driver in order to avoid reckless driving. The proposed model had a 93% accuracy rate in detecting the driver state and classified as normal, fatigued, drunken or reckless. A study [24] by Robinson Jime`nez et al. identified driver distraction states by using eye, mouth, and head movement and orientation as parameters for classification. Course segmentation using the Haar classifier techniques were used in conjunction with Adaboost techniques. Rectangular descriptors to detect faces in an image and Fine segmentation using Hough circle detection algorithm and Hough transform were used to determine the position of eye iris. A precision of ~86% was achieved.

III. DATA SET

The Kaggle competition "StateFarm distracted driver detection" published in 2016 [21] is a dataset widely used for different experiments and studies. It comprises ten classes. Creation date and other metadata has been removed from the images. The images are created in a controlled environment where drivers are not actually driving but posing. It is ensured that the driver appearing in train images will not appear in test images. The images are a collection of left-hand drive vehicles only. Each class contains close to 2300 images.

We also used one more recent dataset [13] [14] that was created by students of the American University in Cairo (AUC). Individuals (Males=29; Females=15) were wearing different clothes and videos were produced with different driving conditions. These individuals are from seven different countries, the USA, Palestine, Morocco, Canada, Uganda, Egypt and Germany. The dataset has been divided into train and test datasets distributed over 10 classes with a total of 14,478 images.

TABLE 1 :DATASETS CLASSES

Classes	**Driver actions**	**Kaggle Images**	**AUC Train**	**AUC Test**
c0	safe driving	2489	2640	346
c1	texting - right	2267	1505	213
c2	talking on the phone - right	2317	1062	194
c3	texting - left	2346	944	180
c4	talking on the phone - left	2326	1150	170
c5	operating the radio	2312	953	170
c6	drinking	2325	933	143
c7	reaching behind	2002	891	143
c8	hair and makeup	1911	898	146
c9	talking to passenger	2129	1579	218
	Total	22424	12555	1923

IV. TECHNICAL APPROACH

From the source datasets mentioned in Table 1 and Table 2, we apportioned the data for the purpose of Training, Validation & Testing with data distributed as shown in Fig 1.

DOI: rp-9788770040723.091

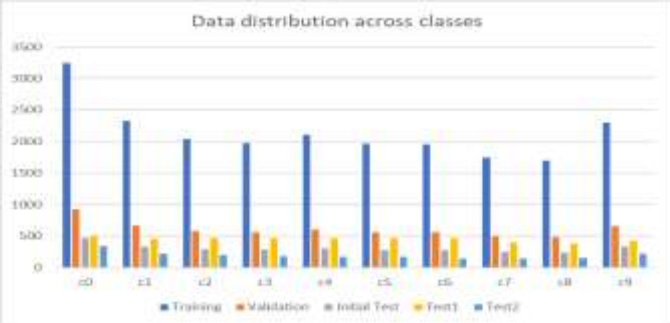

Fig 1. Data distribution across classes

In our approach to build the model , base models were identified namely ResNet101V2, ResNet50 and MobileNet and were trained on an “imagenet” dataset. In our initial findings, the model based on ResNet101V2 had a significantly better accuracy than the other models. Hence ResNet101V2 was selected to further experiment and optimize to achieve better results. Different model variations, Key approaches used for experimenting are described below.

Model 1 and Model 2 have been trained with similar strategy but with a different number of layers that can be retrained. In Model 1, we used transfer learning with 34 last layers trained. The top layers will contain a global average pooling and a dense layer of 10, activated with softmax producing the classification. Categorical cross entropy was used as loss function and adam was used as an optimizer.

In Model2, the number of layers that are retrained are 150. The remaining architecture remains the same as Model 1.

The accuracy on Kaggle data is good with 99% in both the models. However, the model accuracy on AUC dataset has come down to 58% from 66% in Model 1.

To improve the AUC test accuracy, we sought to experiment again the transfer learning approach but by removing some data in AUC test dataset as they were right hand driving images and our model was trained on left hand driving images only. The availability of right hand driving images is very less compared to left hand driving images implying data imbalance problem.

Model 3 & Model 4 were built with similar architecture and strategy as Model 1 & 2. The main difference will be the reduced data by removing the right hand driving images.

Few parameters were changed in our fourth model like transfer learning with top 35 layers with dense 1000 was used keeping all other parameters same as third model

Almost no change was observed in accuracy of both the test data. On kaggle data, validation and test accuracy is 99% in both the models while AUC test accuracy at 58% for third model & 59% for fourth model.

Observations from all four models clearly indicated that our approach of transfer learning was not being useful for AUC data set and experimenting with hyperparameters is not making any impact on the model. To understand why the model was not performing as expected, a grad cam analysis was then used to understand activation and prediction of the model [15][16][17]. The intent is to understand the model with scientific facts and approach the model building with Explainable AI.

Grad Cam Analysis : The Grad CAM technique uses the feature map of the last convolutional layer and the classification score of the class in interest. It calculates the gradient between them. The larger gradients in the places of the image are the one impacting the final classification score.

In our analysis there were mainly two observations made. First, we could see that most of the activation in our models were wrongly placed implying that our trained model was not correctly identifying parts of the image that could result in correct classification. Sometimes even if the predictions were right the activation on the images were not rightly placed. Examples of the above mentioned observation is shown below in Fig 2 and Fig 3.

Fig 2. Grad-CAM Adjusting Radio

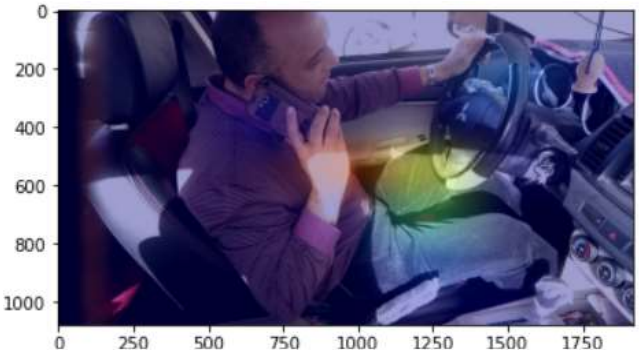

Fig 3. Grad-CAM Talking on phone right

By this study we understood that our trained transfer learning models are not enough to classify our images into the right category. Second, to understand the GradCAM on the dataset with pre-trained ResNet101V2 Model, we did grad cam analysis. Most of the images are classified as minibus, seatbelt, golf cart, etc and the activations are showing away from the person sitting on the driving seat. For example (as shown in fig 4) the activation shows on door windows which will never be useful for classification required for this model. It is inferred that the transfer learning would be inappropriate for the dataset of Distracted Driver Detection.

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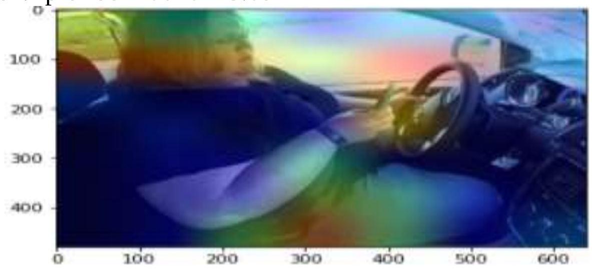

Fig 4. Grad-CAM with ResNet101 pretrained on Imagenet

With all the above stated observations we inferred and acted upon that the usage of transfer learning in our model with few or more layers is not making any significant impact on accuracy of our test datasets. Hence we chose to train the entire network of the ResNet102V2 model.

In Model5, we trained the entire network, without any modifications to the ResNet101V2 architecture. The starting learning rate is chosen as 0.0001 instead of default 0.001.

With this change in approach we could see a significant change in the accuracy of the AUC test data which now improved from 58% in our previous model to 76%.

To validate the model further apart from accuracy of classification, a GradCAM analysis is done on the training data and as well predicted data with the new model. It is observed that the activation on the training data and as well as predicted data is more appropriate such as classification of an image as “operating a Radio” activates the Radio and lower hand of the person. Fig 5 shows the same as below

Fig 5. Grad-CAM Adjusting Radio

On further observing the wrongly classified images by the model, we understood that the model has learnt specific features that alone may not be sufficient to classify an image. For eg., an image with a slight open mouth is considered to be Talking rather than safe driving. Or an image where a cup in the left hand is covered by the right hand position, so the model is unable to understand it as drinking. To give more learning capability to the model, we augmented the data of AUC training set with shear 30 degrees. The idea is to provide more images with a small shift. This augmented approach should improve and generalize the model.

Architecture of our sixth model is exactly the same as the fifth model, except that it is trained with more data (augmented data).

With this change in approach we could see a change in the accuracy of the AUC test data which now improved from 76% to 82%

TABLE 2: KEY PARAMETERS USED IN EACH MODEL

Model	Hyper Parameters
ResNet101V2_Model_1	Activation- leaky_relu Epoch - 20 Batch Size - 50 Dense Layer -10 Optimizer - Adam (beta_1=0.9, beta_2-0.999lr=0.001) Loss - Categorical_crossentropy
ResNet101V2_Model_2 Key Change in Approach: Reducing lr for every 5 epochs with 0.1 factor if val_loss is not improving	Activation- relu Epoch - 20 Batch Size - 32 Dense Layer -10 Optimizer - Adam (beta_1 = 0.9,lr=0.001, beta_2 = 0.999) Loss - Categorical_crossentropy
ResNet101V2_Model_3 Key Change in Approach: Global average pooling, flatten and a dense layer of 10	Activation- relu Epoch - 20 Batch Size - 32 Dense Layer -10 Optimizer - Adam (beta_1=0.9, beta_2-0.999lr=0.001) Loss - Categorical_crossentropy
ResNet101V2_Model_4 Key Change in Approach: Kaggle and AUC cam1 data. Cam2 data is discarded as it is right wheel driving and has very few images.	Activation- relu Epoch - 20 Batch Size - 32 Dense Layer -10 Optimizer - Adam (beta_1=0.9, beta_2-0.999lr=0.001) Loss - Categorical_crossentropy
ResNet101V2_Model_5 Key Change in Approach: Complete Network retraining.	Activation- relu Epoch - 50 Batch Size - 32 Dense Layer -10 Optimizer - Adam (beta_1=0.9, beta_2-0.999lr=0.001) Loss - Categorical_crossentropy
ResNet101V2_Model_6 Key Change in Approach: Augmented for Cam1 - shear 30 degrees	Activation- relu Epoch - 50 Batch Size - 32 Dense Layer -10 Optimizer - Adam (beta_1=0.9, beta_2-0.999lr=0.001) Loss - Categorical_crossentropy

IV. RESULTS AND DISCUSSIONS

Based on our experiments, we discovered that our model is able to learn prominent features with a small number of parameters. With sufficient training data the model is able to give accurate results. Moreover, we could see the performance of the proposed ResNet model as shown in Table 4. In the table, it's clearly observed that the Model performed very well with the State Farm Distracted Driver data-set on the pre-trained as well as transfer learning model. However that was not the case when trained on AUC Distracted Driver Set. We found that training the entire network is very optimal for our model. The accuracy increases, prediction and activation is also appropriate.

TABLE 3: ACCURACY ACROSS MODELS

Model	Training Accuracy	Validation Accuracy	Kaggle Test Accuracy	AUC Test Accuracy
ResNet101V2_Model_1	100%	99.23%	99%	66%
ResNet101V2_Model_2	100%	99%	99%	58%

ResNet101V2_Model_3	100%	99.58%	99%	59%
ResNet101V2_Model_4	99.94%	99.23%	99%	59%
ResNet101V2_Model_5	100%	99.53%	100%	76%
ResNet101V2_Model_6	99.99%	**99.58%**	**100%**	**82%**

TABLE 4: CLASS WISE ACCURACY FOR FINAL MODEL

Class	Driver Action	Kaggle Dataset F1-Score	AUC Dataset F1-Score
c-0	safe driving	98.99	66.99
c-1	texting - right	100	85.62
c-2	talking on the phone -right	100	94.95
c-3	texting - left	99.57	84.61
c-4	talking on the phone - left	99.78	98.34
c-5	operating the radio	99.45	98.30
c-6	drinking	99.89	88.88
c-7	reaching behind	100	77.30
c-8	hair and makeup	99.47	77.12
c-9	talking to passenger	99.53	68.76

We would like to mention some pertinent points based on our observations as below:

Data balancing (CAM 2 data had to be removed from the model because of very few images found in right wheel driving)

Data Verification - due to improper data extraction, the AUC data was improperly classified which resulted in significant delays in the initial stages of model training.

The Learning Rate(lr) turned out to be significantly important for convergence due to the lengthy model architectures

Understanding of when to use Transfer Learning & when to use the architectures

Techniques like GRAD CAM were important from a model validation perspective

Availability of more quality data would have helped the model to generalize better

We can conclude that existing state of the art architecture like the ResNet101v2 Model alone can be sufficient if trained and optimized well

Scope for future enhancements

Model training for right seat driving

The solution will be improved by adding more convolutions to the end of the architecture. The ResNet101 for imagenet architecture's last convolution outputs 7x7x2048 activation maps and it is connected to 1000 dense layers for the classification of 1000 classes. Since there are 10 classes in the problem, connecting 2048 to 10 could have decreased the accuracy. So we will introduce 1 or 2 convolutions before connecting into 10 dense layers.

Based on the observations of the predictions and class activation mappings in the v6 model, we propose to add one more convolutional network trained on imagenet parallel to the existing network. The purpose of this network is to establish face detection with classification of face or not face. Then the classification will be used along with the classification of the original network to give the final classification. The purpose of this approach is to activate the facial features that contribute to the final accuracy.

At the onset of our study, we had considered a benchmark of 88% on the test set of the KaggleStateFarm dataset with the ResNet50 and 82% on the MobileNet models [11]. Models performed way better by achieving an accuracy of up to 96% on the combined Kaggle and AUC datasets.

ROC Curve for Safe Driving Vs rest of the classes is provided below on ResNet101V2_Model 6. The AUC value of 98% and 100% shows the larger coverage of the model's on different datasets.

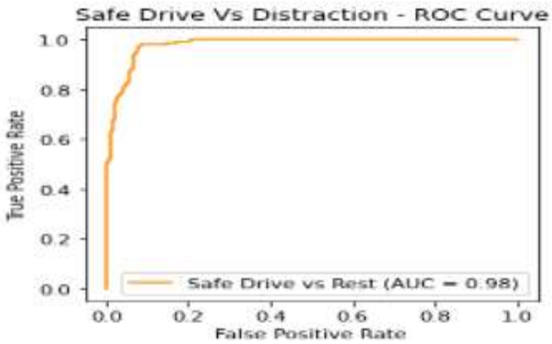

Fig 6: ROC Curve for AUC Test Data

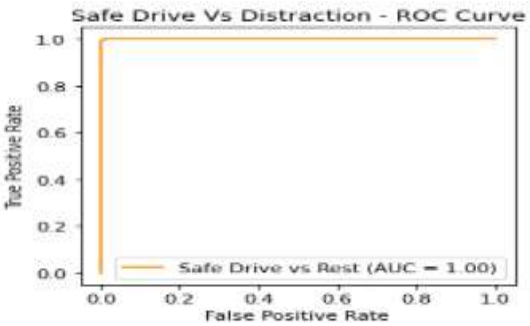

Fig 7: ROC Curve for Kaggle Test Data

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Monitoring and prediction of supervision system for industrial and manufacturing sectors in Industry 4.0 with enhanced data security and privacy through cloud computing and blockchain technology

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***Abstract*—The evolution of the Industry 4.0 is initialized through block chain technology with cloud computing techniques. This includes the integration of digital environment with internet of things (IoT) and cyber security systems. Thus the amalgamation of advanced technologies paved way for the rise of Industry 4.0. This helps in providing security and privacy without any consequences. This helps to save and interchange the information within the network without any centralized organizations. It plays a prominent role in the production and manufacturing sectors by trusting built in the supply chain management system. They adopt numerous advantages in adopting secure financial transactions. This helps to maintain the end-user sustenance. The monitoring and prediction of the supervision system is performed by SCADA (Supervisory Control and Data Acquisition) system that employs various intelligent systems in manufacturing and production sectors. This supports in accumulating and processing the real time data in the industries. The supervisory organization shows an essential character in the performance efficiency of the industrial sectors.**

Keywords—Industry 4.0, SCADA systems, distributed power generation, renewable energy, photovoltaic system, block chain technology, cloud computing techniques

I. Introduction

The growth and advancement of industrial sectors are due to the rising demand and numerous innovations in the technology. It paved way for the introduction of digital technology with communication systems. The integration of the physical and virtual environment with real time implementation is in progress to adopt a newer environment [1], [2].

Thus the evolution of the manufacturing and the production sectors are termed as the Industry 4.0. This is also denoted as the fourth industrial revolution [3]. This includes the conversion and transformation of traditional manufacturing and production sectors with digital technologies to enhance productivity in the system. This helps to improve the product outcome with higher efficiency in production and supply systems [4].

This helps in the development of two way communication system to adopt various benefits. The Industry 4.0 tends to implement the technology to interact with the physical world with the virtual environment. This is enhanced through the aid of digital twin [5]. The integration of physical environment into virtual world helps to improve the performance proficiency of the fabrication and manufacturing sectors. Thus the digitalization of the industries leads to adopting two way communication system with artificial intelligence techniques [2], [6], [7].

The two-way communication system helps in participating the customer in an active way. The innovative technology in the production and manufacturing sectors in the industry leads to use optimization techniques with smart productivity and marketing techniques. The smarter manufacturing system leads to the rise of digital twin concept. The overall technique is adopted under the branch of Internet of Things (IoT) [8]–[10]. This helps in the amalgamation of communication system with manufacturing and production sectors in industries. The resource management shows a dynamic role in the improvement of advanced techniques in the industrial sectors. To extract higher benefits, the implementation of the outcome in 3D virtual environment leads to improve the productivity with improved efficiency. The complexity in the implementation of outcome in the real time environment

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is neglected through employing the optimization techniques. Thus the monitoring of the product outcome is evaluated and verified in the digital environment [11], [12].

The improvement of the product design and outcome are analyzed through the data and the sensing parameters. This includes various sensors and actuators to sense the external parameters. The digital shadows forms the important part in the development of industrial sectors. The implementation of the digital twin was first came to existence in the field of aerospace industry. [13]–[15]Thus the digitalization of the manufacturing and production helps to enhance the development through the analyzing the cause and effects to solve the problems. The decision making techniques and problem solving are implemented through optimization techniques. They are implemented with artificial intelligence accompanied with the block chain technology and cloud computing techniques [3], [16], [17].

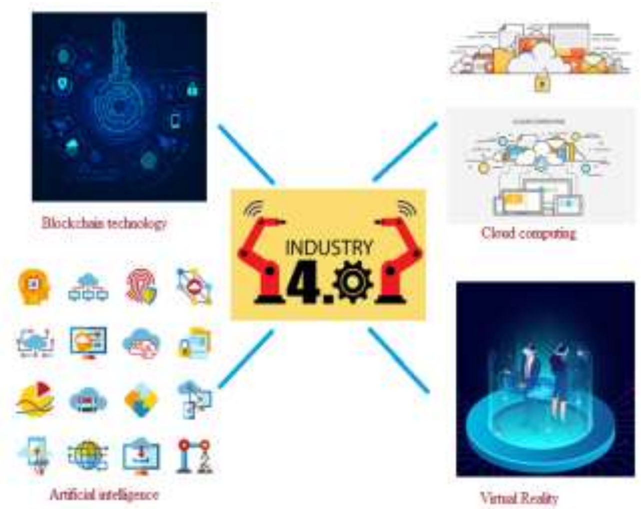

Fig 1: Industry 4.0

The figure 1 represents the functioning parameters of Industry 4.0. The block chain technology is defined as the shared network that functions without the need of a centralized organization. Here the data are stored with higher security and privacy without any malfunctioning of hackers. Simply the block chain technology is the opaque sharing network of data and information. This includes the integration of cryptocurrency and distributed network systems. This helps to obtain efficient ledger storage systems. It provides an opaque system in data transmission and processing. They play a versatile role in diverse field such as banking transactions, cyber security, legal, business and healthcare sectors. This paved way for the evolution and improvement of e-governance.

As the name suggests, the information are stored in a blocks that are interconnected further in a chain network. The artificial intelligence is defined as the exact replica of function and decision making as similar to the human intelligence. This helps in processing and storing the data in an online platform to enhance the two way communication systems [2], [18], [19].

These forms the smart manufacturing system to improve efficiency. Thus the deep learning techniques are adopted to improve the innovations and advanced techniques in the manufacturing and production sectors. The smart manufacturing system includes the configuration of data, execution and optimization to obtain the performance outcome of the system. This includes both the accumulation of structure and function design parameters [11].

The functioning of digital twin involves the reflection of real time, convergence parameter and evaluation of the product outcome in the production sectors. The overall performance is interlinked with the block chain technology and cloud computing techniques.

This helps to convey the processed data in the network. They gave rise to the concept of augmented and virtual reality [12]. This helps to view the virtual world formed by the replication of the real world environment. The important parameter involved in the smart manufacturing and production sector involves the security and privacy with supervision system concerns. This is accomplished through the cloud computing techniques. Thus the supervision system is implemented through the aid of cloud computing and block chain technology.

II. Proposed System

The enhancement of Industry 4.0 focus on the progress of advanced technologies to improve performance parameter in the industrial sectors. This includes artificial intelligence with internet of things and cloud computing technologies. In the proposed system, the deep learning techniques with optimization techniques such as decision tree algorithm is implemented.

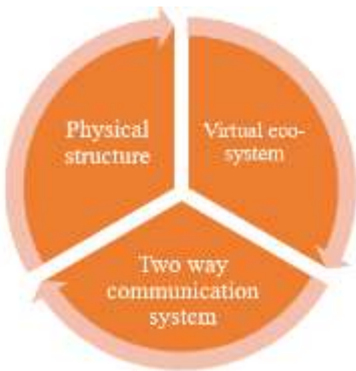

Fig 2: Parameters of Industry 4.0

The figure 2 demonstrates the various parts of industry 4.0. The evolution of industrialization was done through the concept of virtual and augmented reality. This helps to create a virtual 3D space.

This helps in interaction of virtual world enabling both audio and video mode of interlinkages. This includes the development of virtual environment through the physical world. The exact replica of the physical environment into a virtual world is denoted as digital twin. This is done through the data with the process of acquision and processing. Thus it is an integration of the physical and virtual ecosystem to

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develop improved performance in the industrial sectors. This inculcates both the static and dynamic structures to obtain the optimum solutions [20]–[22]. This aids to analyse the presentation of the system before implementing in the real word. This helps to save time and cost. The privacy and security are controlled through the block chain technology and cloud computing techniques. This supports to store the data in blocks to avoid various limitations. Thus the prediction of the supervisory control is done through SCADA systems. The control and monitoring are the important aspect in the industrial sectors to improve the efficient of the system. The supervision system includes the monitoring and control of manufacturing sectors, quality enhancement and management through various optimization techniques.

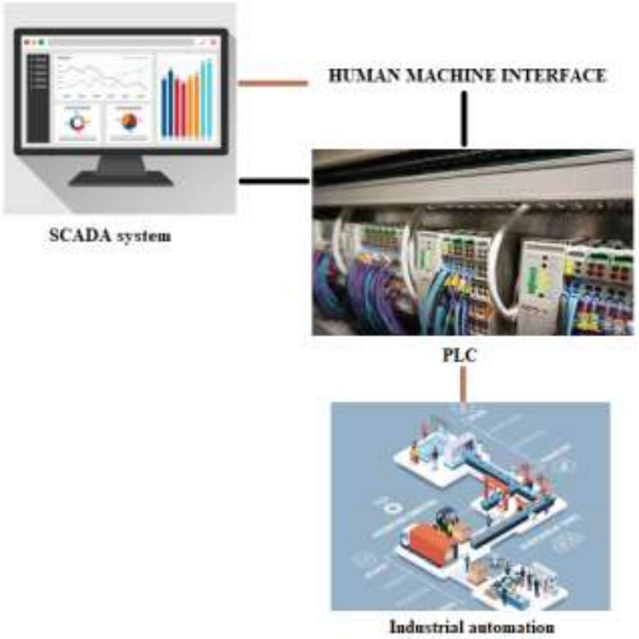


Fig 3: SCADA system

The figure 3 demonstrates the functioning of SCADA system in the industrial sectors. This controls and monitors the manufacturing and production unit. This is done through the accumulation of data in real time to monitor the overall network in the industries. This is referred as the integration of hardware and software to improve automation in the industrial process accompanied with the internet of things. This helps to provide the two way communication system.

Fig 4: Components of SCADA

The figure 4 represents the necessary components of SCADA systems. The Supervisior Control and Data Acquisition (SCADA) system is referred as the software system used to control and monitor the performance and functioning of the industrial sectors. The overall process are sensed through the sensors. This includes programmable logic controllers, graphical user interface and various sensors .

The input information of the manufacturing and production sectors are sensed through the sensors. The actuator is used to monitor the overall functioning and control mechanisms of the industrial sectors. The controllers interface with the sensors and actuators in the network. The data and information from the industrial sectors are collected through the supervisory system. They provide the command to control the system units in the industrial sectors. These commmands are followed by the industrial equipments to function properly.

The human machine interface software is used to amalgamate the data in the system. The overall process is accompanied with the communication system that are used to gather the data and process them. They provide the communication network to sensors and controllers in the network. The industrial systems also uses the industrial internet of things for monitoring and controlling. There is a overlap in the SCADA system and the industrial internet of things. The overall process and information interchange are keenly recorded and saved in the block chain technology with cloud computing techniques.

TABLE I. COMPARISION OF SCADA AND IOT

SCADA system	**Industrial Internet of Things (IIoT)**
It enables communication protocols for control and monitor the system in industrial sectors	They provide communication linkages through the standard protocols.
The sensors and actuators are connected to the organises for operation and functioning.	The sensors and actuators are not directly in contact with the controllers.
The collection of data are done directly from the controllers without the aid of intermediate devices.	They are data collected and saves in the cloud system.
Integration with various devices cannot be done and they are restricted.	Integration with various devices can be implemented enabling open access.

DOI: rp-9788770040723.092

The above table I represents the functioning and classification of SCADA system and industrial internet of things.

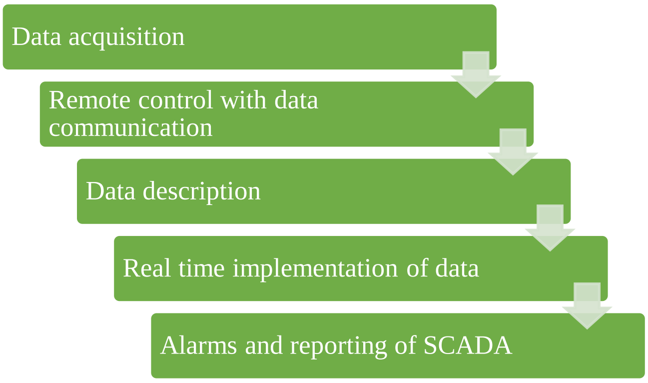
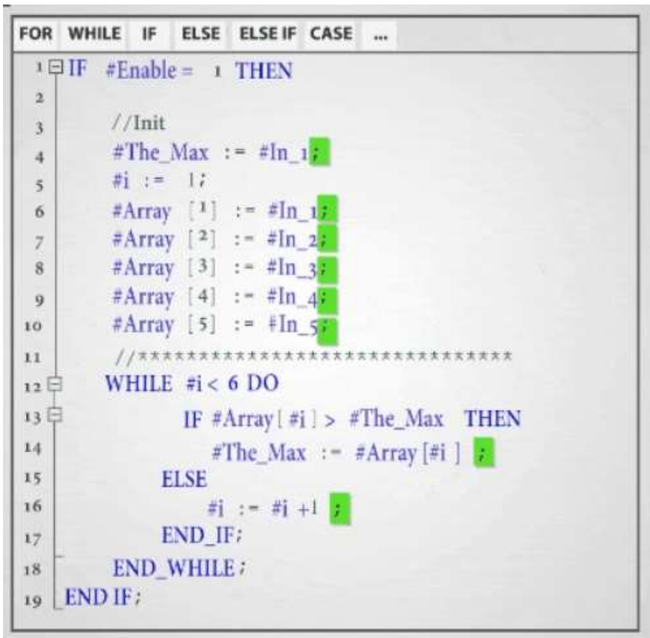


Fig 5: Features of SCADA systems

The figure 5 demonstrates the various features of SCADA systems. The evolution of SCADA system ranges from first generation to fourth generation. They are classified based upon the technology used in monitoring and control structures. This includes the collection of data, control strategies, description of data, implementation of data with real time implementation and alarms with reporting the functioning and monitoring of industrial process [16], [18]. The various advantages of SCADA system includes the higher scalability with improved communication system with support structures. The SCADA system are largely used in transmission and distribution sectors, automotive industries, transportation system and daily service processing.



```
FOR  WHILE  IF  ELSE  ELSE IF  CASE  ...
IF #Enable = 1 THEN

    //Init
    #The_Max := #In_1;
    #i := 1;
    #Array [1] := #In_1;
    #Array [2] := #In_2;
    #Array [3] := #In_3;
    #Array [4] := #In_4;
    #Array [5] := #In_5;
    //*******************************
    WHILE #i < 6 DO
        IF #Array[#i] > #The_Max THEN
            #The_Max := #Array[#i] ;
        ELSE
            #i := #i +1 ;
        END_IF;
    END_WHILE;
END IF;
```

Fig 6: PLC progam code

The figure 6 represents the PLC program code for monitoring and control of industrial process.

III. SCADA Architecture in Monitoring and Control Process

The SCADA control process is classified into five stages ranging from level 0 to level 4. This helps to control and monitor the industrial sectors.

LEVEL 0 - This includes the accumulation of sensors that are used to collect the data from the industrial sectors and control process are done through the actuators.

LEVEL - 1 – This includes the programmable logic controllers to interface with the devices directly without the aid of intermediate devices in the network. This helps to accumulate the data from the sensors and tend to provide command for functioning.

LEVEL 2 – The local supervisory system are includes in this stage. This includes the level controllers.

LEVEL 3 – The scheduling level of the process in the supervisory system embedded with the production control network. This extracts the data from the level 2 of the architecture. This is intimated through alert system.

LEVEL 4 – In this stage, it manages the current functioning and processing in the industrial sectors.

Thus the monitoring and control parameters are done through the following stages to enhance the industrial sectors to achieve higher productivity. They are enhanced through the two way communication system to improve sustainability and reliability in the system. These supervisory system are accompanied with the internet of things with cloud computing techniques. It helps to save the data or information in the network without any external barriers. They are further monitored through the blockchain technology in which the data are stored in blocks without any centralized infrastructure.

IV. Security and Privacy with Blockchain Technology

The block chain technology has been formulated by the Ministry of Electronics and Information Technology. A block chain technology is a database which is used to store the data or information in blocks accompanied with network structure with higher security and privacy. This includes five stages.

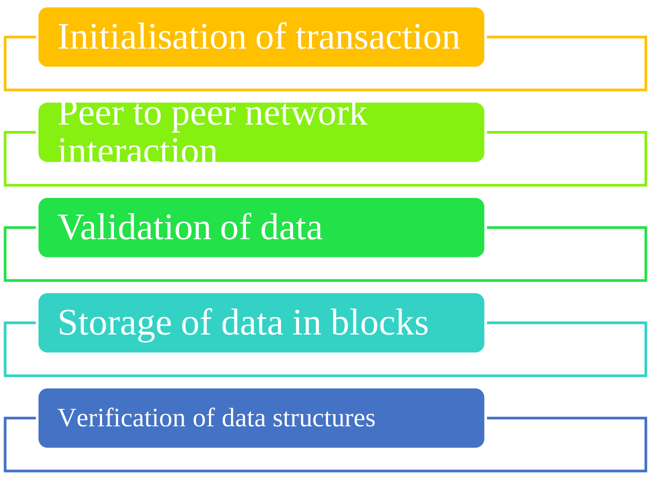


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Fig 7: Block chain network

The figure 7 demonstrates the stages in the block chain network.

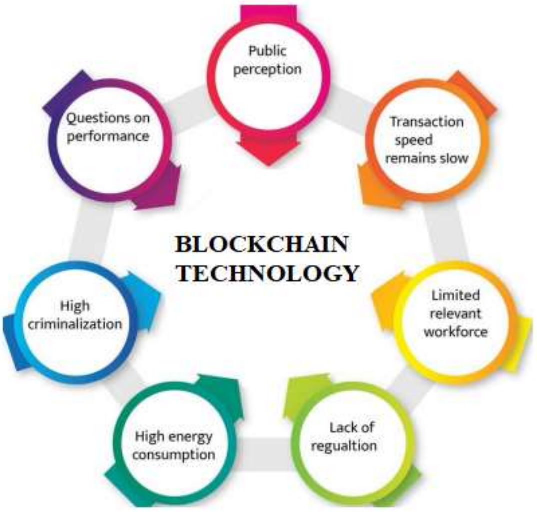

Fig 8: Challenges in blockchain technology

The figure 8 demonstrates the various challenges in the adoption of block chain technology. The cloud computing is denoted as the on-demand data access accompanied with information storage and management system.

This helps in rapid innovations with storage of data in an efficient manner. This includes the internet of things to store the information. There are various services provided by the cloud computing techniques. This also enhances server less computing structures. Thus the large amount of data are protected and saved in the cloud storage system. They are done with the sensor that senses both the structured and unstructured data in the network.

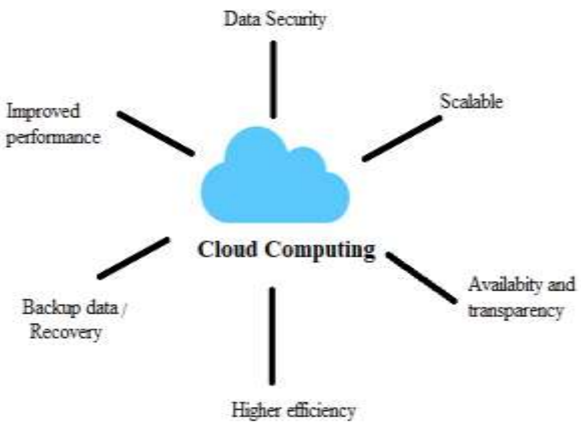

Fig 9: Cloud computing

The figure 9 demonstrates the various benefits of cloud computing techniques. This is done without the actively involvement of the user in the network. The larger amount of clouds are sectioned into smaller clouds in which the individual cloud is demonstrates as a data center. This is a space for the distribution of computing techniques. In cloud computing, the hardware, software and the external arrangement is governed by the cloud supplier.

V. Performance Analysis And Outcome

The supervision control system for industrial manufacturing and production system is achieved through the SCADA systems. This is executed in software application to analyse the results.

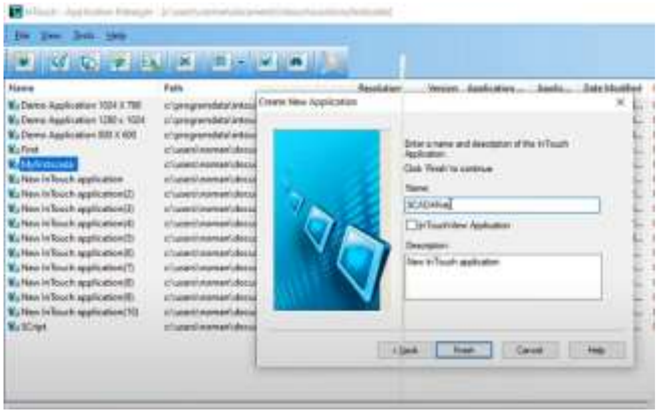

Fig 10 : Intouch software

The figure 10 demonstrates the execution of wonderware intouch data software for the implemntation of SCADA system.

Fig 11: Interface in SCADA systems

The figure 11 demonstrates the various interfaces found in the SCADA systems.

Fig 12: Data sensing

DOI: rp-9788770040723.092

The figure 12 demonstrates the data sensing through sensors and actuators.

Fig 13: Control parameters

The figure 13 demonstrates the control parameters. This includes the functioning of level 0 to level 4 in SCADA systems. The overall information is secured through the blockchain technology with cloud computing techniques. Thus the data are secured.

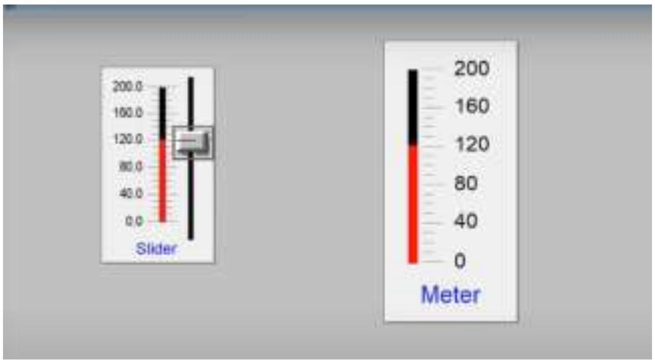

Fig 14: Monitoring and controlling

The figure 14 represents the monitoring and control parameters done through the SCADA systems. The overall industrial performance are analyzed and monitored through the system to improve the performance efficiency.

VI. Conclusion

The evolution of Industry 4.0 is due to the advancement of newer technology. This includes internet of things, block chain technology, virtual environment and cloud computing techniques. They help to give rise in the automations ranging from industrial manufacturing and production sectors. These forms the important governing aspect is the monitoring and supervision of the industrial systems. This is done through the SCADA system. This helps to monitor and control the functioning of the industrial sectors. The information are highly secured through the block chain technology and the cloud computing techniques. This helps to secure the data and transactions without the aid of any centralised infrastructure. Thus the implementation of artificial intelligence with cloud computing techniques helps in the overall development of industrial sectors thus enhancing industrialisation and digitalisation.

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Tracking of Blind Person's Movement by Utilizing Wearable IOT Devices

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***Abstract*—The proposed system for tracking the movement of a blind person using wearable IoT devices appears to be a potentially useful and practical approach to assist individuals with visual impairments. The ability to communicate information about the surroundings via wireless technology and headphones could greatly enhance the mobility, independence, and safety of blind individuals. The incorporation of suitable connectivity methodologies to avoid interference between devices in crowded spaces is also an important consideration, as this could impact the accuracy and reliability of the system. It would be interesting to know more about the specific methodologies used and how they were tested and optimized, as this could provide valuable insights for future projects and developments. The evaluation of the device's effectiveness through experiments and statistical analysis is also a positive aspect of the paper, as this provides quantitative data on the functionality and performance of the system. However, it would be helpful to have more details on the experimental methodology and conditions, as well as the statistical analysis techniques used, in order to better understand the results.**

Keywords*—Artificial Intelligence (AI), Internet of Things (IoT), wearable IoT, Blind Persons' movement

I. Introduction

As technology advances, software tools are created to make life easy for people with physical disabilities. At least 2.2 billion people around the world have impaired vision or are blind. They may fall into one of three categories: moderately visually impaired, severely visually impaired, or completely blind. The majority of blind people move using traditional methods such as canes and the assistance of another person. With the rise of technology, there is an increasing demand for the development of user-friendly devices that will aid blind people in mobility. As a result, visually impaired people can travel independently and confidently and take part in daily activities. Many research papers that discuss various methods are discussed in this section. The system assists the user with locomotion and obstacle detection by combining artificial vision and GPS. In a silicon glove, an ultrasonic sensor, GPS, and GSM were combined.

II. Literature Review

Kumar et al. (2019) and Sivakumar P (2015) proposed an effective wearable navigation system for the blind that uses an Internet of Things (IoT) platform to process a raspberry pi camera and ultrasonic sensors to provide information about nearby obstacles for the mobility of blind people with the help of audio assistance.. It measures the distance between an object and the user using an ultrasound sensor. This image is processed, and the result is presented as an audio signal. Tayyaba, Shahzadi, et al. (2020), Karnan B et al (2022), and Latchoumi TP et al (2022) proposed a smart home model for blind people's safe and robust mobility. For simulation, fuzzy logic was used. The fuzzy controller receives input from IoT devices such as sensors and Bluetooth. To generate decisions as output, restrictions are imposed based on the blind person's conditions and requirements. These outputs are transmitted via IoT devices to help the blind person or user move safely. The proposed system allows the user to navigate easily and avoid obstacles. Jayatilleka et al. (2020), Vemuri et al (2021), and Monica.M et. al. (2022) examined the benefits, techniques used for data analysis, identifying problems, and defensive measures for each disease in the human body. In this study, Kiruthika, V., et al. (2021) proposed a new methodology for wearable technology devices with multiple features that will assist both blind as well as elderly people in their daily lives. This device allows blind and elderly people to move around in any environment while also monitoring their health conditions. Various sensors, including an ultrasonic sensor, an infrared sensor, a water sensor, a blood pressure sensor, a pulse sensor, an accelerometer sensor, and GPS/GSM technology, are embedded in this device to assist the blind and elderly in a variety of situations. A Hand Wearable Radio Frequency (RF) Locator with Intelligent Walking Aid for the Blind was presented by Joseph et al. (2022). Blind people have suffered greatly because they are unable to

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move freely unless they are assisted by someone close to them. Those who have previously acquired a walking aid may have misplaced it without realizing it. This has been a significant challenge for blind people, who feel marginalized in society. A. Karmel et al. (2019), Sridaran K et. al. (2018), and Buvana M et al (2021) sought to develop a single device solution that is simple, fast, accurate, and cost-effective. The main goal of the device is to give people with disabilities a sense of independence and confidence by seeing, hearing, and speaking for them. The paper describes a blind, deaf, and dumb assistance system based on the Google API and Raspberry Pi. The suggested device enables reading for people with visual impairments by taking an image. While translating documents, books, and other commonplace materials, image-to-text transition and speech synthesis are also carried out, converting it into audio that reads out the derived text.. Pawan Whig (2021) proposed a system for blind people to walk safely. This system consists of a wireless sensor within the stick that provides information about the obstacles in the path. The main benefit of this system is that it keeps blind people safe on the road and allows them to walk independently. When an obstacle is detected, the user will receive an alert via buzzer and vibration. This research study's proposed system is 60% more efficient than a conventional system. Bisht, et al. (2021) investigated and evaluated the most predominant wearable devices on the market. The hardware and software specifications of various devices are covered in this section. The sensor is perhaps the most important component in information collection. Sensors have examined a full range of boundaries closer to recognition during ongoing years of progress in semiconductor innovation. Because these devices communicate via the internet, some users may be concerned about their privacy. Tyagi, Noopur, and others (2021)

III. Proposed Work

Fig. 1. Wearable IoT Devices Assisting Blind Person

A microcontroller board, proximity sensor, wearable IoTs, wireless connectivity, and GPS modules, answer solar panels for charging the batteries are the system's main components (Ref: Figure 1). The system uses a set of sensor devices to track the user's path and alert them to any obstacles in their path. The user is notified by a buzzer and noise and vibration on the elbow, which is useful in a noisy environment. Furthermore, the system notifies people in the vicinity when the user needs support, and the alert SMS with the location is sent to authorize mobile phones of caregivers. Furthermore, the authorized mobiles can be used to obtain the location and initiate real-time monitoring of the blind person as needed. The controller is connected with the Alarms, sensors, and Power modules. Figure 2 illustrates the architecture of the proposed model. We put the system prototype through rigorous testing to ensure its capabilities and effectiveness. The proposed system includes more features than comparable systems. It is anticipated that it will be a valuable tool in raising the standard of living for blind people.

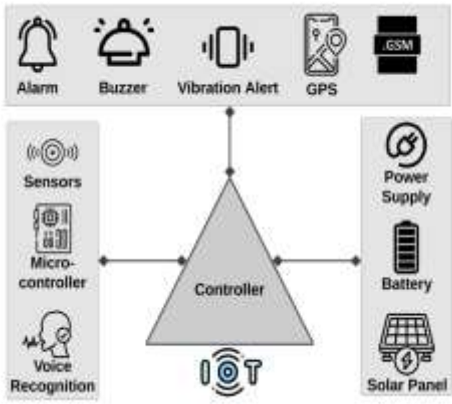

Fig. 2. Architecture diagram of the proposed system

Random noise T is ended up caused by v circuit design noise as well as IoT sensor noise related to $h$igh voice and guidance of blind people. This is the most common type of noise. The probability density for $T(c)$it is written as equation (1)

$$T(c) = \sum \frac{1}{\sqrt{2\pi h}} + \sum_{c=1}^{h\to v} f^{\frac{-(c-v)^2}{2f^2}} \tag{1}$$

Another name for salt and pepper noise is the method of guiding blind people according to their activities. The eq (2) shows its probability distribution as follows:

$$(c) = \sum_{j=1}^{j>k} \begin{cases} T_j c = j, \\ T_{i,} \quad c=i \end{cases} + \int e^{-(c-v)^2/2f^2} \tag{2}$$

The additive noise only has grey levels with i and j, as well as the blind people guidance noise that seems to be salt in the image. Equally distributed noise has an equal distribution of noise, and its cumulative distribution equation (3) is represented as follows

$$T(c) = \int e^{\frac{-(c-v)^2}{2f^2}} + \sum \begin{cases} 1, & i \le c \le j \\ i-j, & \\ & 0 \end{cases} \tag{3}$$

DOI: rp-9788770040723.093

The mean filtering appears to be a regularly used image computing technique, and the Kalman filtering algorithm is utilized in the machine learning models to reduce noise. It operates based on equation (4), which uses the total average of the pixel intensities of a particular pixel to reduce noise. Its grey value is a created pixel.

$$g(x,y) = \prod \frac{1}{ps} \sum_{(f,k)\in E_{yx}} \int (e,k) + \sum_{c\in f} e^{-(c-v)^2/2h^2} \qquad (4)$$

The basic idea is that each pixel in the guiding the blind people according to the grey value set to the median of all the ranges in that neighborhood frame of the point. It can eliminate all separated points, clear up the problem of an unclear enhanced image, and make the guidance values of the surrounding image closer to the final image pixel. The equation (5) follows:

$$\begin{aligned} g(y,x) = \int (e,k) + \sum_{c\in h} e^{-(c-v)^2/2h^2} \\ + median\left\{\int (y-u, x-v) \right. \\ \left. \times (s,u \in O)\right\} \end{aligned} \qquad (5)$$

Here therefore the $\int (y-s, x-v) \times (s, v \in 1)$ represents the limitations for connecting the sensors, $g(y,x)$ represents the median filter in the Table 1 represents the framework.

IV. Experimental Results

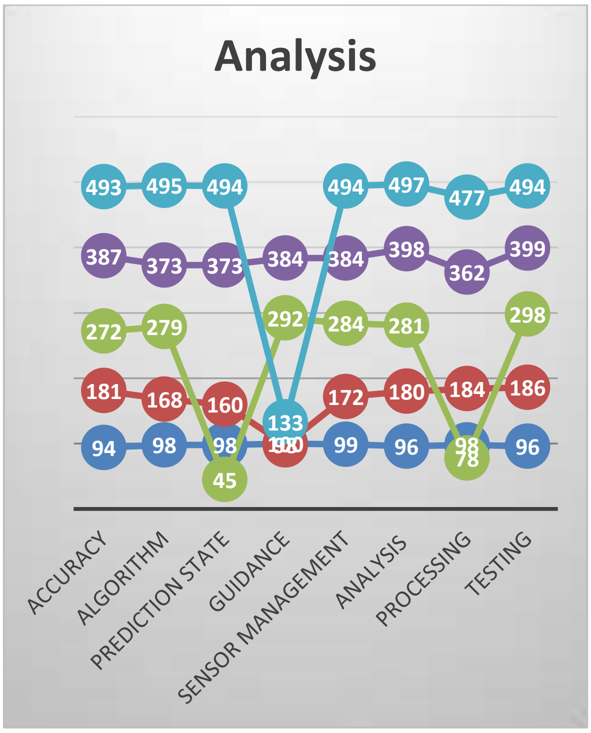

Fig. 3. Performance Analysis for the process of Prediction and Diagnosis of Guiding Blind people

The above statement summarizes the key findings and contributions of the study related to wearable devices for visually impaired people. The study reveals that conventional navigation devices do not provide all the essential features necessary to assist visually impaired individuals in independent navigation. This is where IoT technology comes in, providing better solutions to overcome navigation deficiencies with the help of GPS trackers and sensor-enabled navigation devices.

The study highlights that wearable devices designed to assist visually impaired individuals provide a wide range of benefits, not only in terms of navigation assistance but also in areas such as healthcare, security, mapping, and more. The use of wearables can significantly impact the lives of visually impaired individuals, enabling them to navigate independently and perform daily activities with greater ease and confidence.

The primary goal of this study is to provide a comprehensive understanding of the wearable devices that are currently in use by visually impaired or blind people. By gaining a better understanding of the use cases and benefits of these wearable devices, stakeholders can work towards improving their design and performance to better serve the needs of visually impaired individuals in the future.Dmytro Zubov (2022) presented Review Study on Arduino and Raspberry Pi Wearable Devices and a Mesh Network of eHealth Intelligent Agents for People Who Are Blind were presented during this talk.

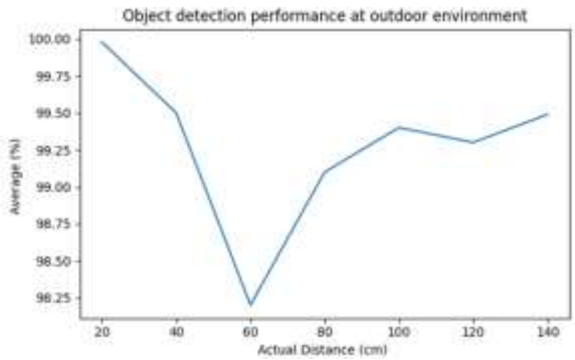

Fig. 4. Accuracy Analysis on Outdoor Object Detection

Figure 4 displays the results of the object detection process using an intelligent system in an outdoor environment. The system's performance was analyzed based on the distance of the detected objects, which was measured in centimeters. The graph presents the data in terms of the number of objects detected on the y-axis against the distance in centimeters on the x-axis. According to the graph, the intelligent system detected the highest number of objects in the distance range of 0 to 50 centimeters. At this distance, the system detected approximately 65 objects. However, as the distance increases, the number of detected objects decreases significantly. For instance, at a distance range of 50 to 100 centimeters, the system detected approximately 40 objects. The number of detected objects reduced further to around 25 at a distance range of 100 to 150 centimeters. At a distance range of 150 to 200 centimeters, the number of detected objects was only around 10, and beyond that distance range, the system detected very few objects.

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These results suggest that while the intelligent system has good object detection capabilities, it is most effective at detecting objects at closer distances. To improve the system's effectiveness at longer distances, further optimizations or modifications may be required. Overall, the information provided by Figure 4 is valuable for improving the performance of the intelligent system for object detection in outdoor environments.

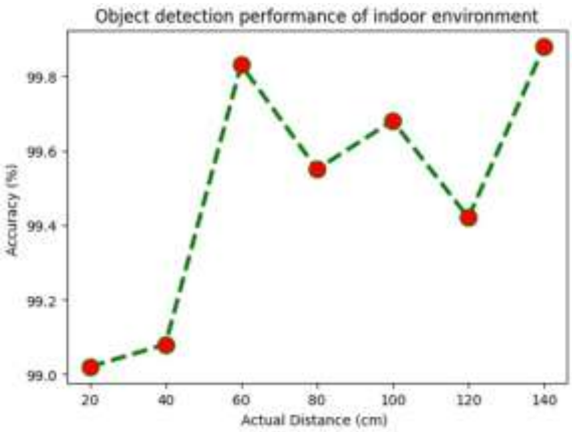

Fig. 5. Analysis of the proposed system on indoor object detection

Analysis is also performed on the indoor basis for object detection is represented in the Figure 5 ranging with 20 cm variations. It can be observed fluctuations in accuracy analysis for the indoor environment.

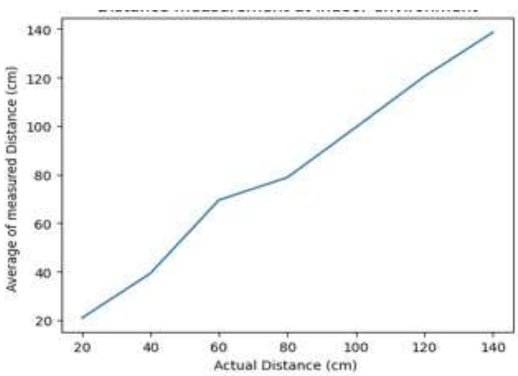

Fig. 6. Distance measurement at indoor Environment

Figure 6 shows the analysis of an intelligent system in an indoor environment based on the distance measurements. The graph represents a decreasing trend in the accuracy rate as the distance increases. The x-axis denotes the distance in centimeters, while the y-axis provides the accuracy rate in percentage. The graph shows that the accuracy rate is the highest at a distance range of 0-50 cm, where the intelligent system detects objects with an accuracy rate of around 98%. The accuracy rate decreases as the distance increases, dropping to 86% at a distance range of 150-200 cm and going below 80% at distances beyond 200 cm.

Table 1, on the other hand, represents the analysis of two algorithms, namely the Kalman Filtering Algorithm and the mosaic method, in terms of their performance regarding preprocessing, prediction and diagnosis, guidance, and accuracy for a given application implementation. The table presents quantitative metrics for both the algorithms in terms of accuracy percentage for each of the categories. The table shows that the Kalman Filtering Algorithm performs better than the mosaic method across all categories and has an overall accuracy percentage of 92.78%, while the mosaic method has an overall accuracy percentage of 91.67%. Both Figure 6 and Table 1 provide valuable insights into the performance of intelligent systems in different environments and under different scenarios. Figure 6 highlights the effect of distance on the accuracy rate of an intelligent system in indoor environments, while Table 1 compares the performance of two different algorithms in terms of accuracy percentage, providing valuable information on which algorithm performs better.

TABLE 1: COMPARISON RESULT ANALYSIS FOR THE EXISTING SYSTEM

Algorithm	Pre-Processing	Prediction and Diagnosis	Guidance	Accuracy
Kalman Filtering Algorithm	96.89	94.35	94.78	92.78
Existing Method: mosaic method	97.98	89.67	91.89	91.67

Table 1 displays a comparative analysis of the Kalman Filtering Algorithm and the mosaic method in terms of their performance on pre-processing, prediction and diagnosis, guidance, and accuracy metrics. According to the table, both algorithms exhibit strong performance in pre-processing, with the mosaic method scoring slightly better than the Kalman Filtering Algorithm, with 97.98% accuracy compared to 96.89%. However, the Kalman Filtering Algorithm significantly outperforms the mosaic method in prediction and diagnosis, guidance, and overall accuracy. The Kalman Filtering Algorithm achieves a prediction and diagnosis accuracy of 94.35%, while the mosaic method only scores 89.67%. The guidance accuracy for the Kalman Filtering Algorithm is 94.78%, whereas the mosaic method scores 91.89%. In terms of overall accuracy, the Kalman Filtering Algorithm achieves an accuracy of 92.78%, while the mosaic method scores 91.67%.

From this analysis, it is clear that the Kalman Filtering Algorithm is more suitable for this specific application, as it outperforms the mosaic method in prediction and diagnosis, guidance, and overall accuracy. However, it is important to keep in mind that the suitability of an algorithm depends on the specific requirements of the application and further testing may be required to validate these results.

V. CONCLUSION

The statement highlights two types of technologies used in assistive devices for the visually impaired. Firstly, it mentions a walking stick equipped with radio frequency identification (RFI) technology that was designed to assist visually impaired individuals in navigating sidewalks. Secondly, it mentions the prevalence of range-based sensors in most assistive devices. While the walking stick with RFI technology may have its benefits, the statement suggests that range-based sensors are more commonly used in assistive devices for the visually impaired. These sensors are

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popular due to their low cost, widespread availability, and user-friendly nature. They work by detecting and localizing obstacles in the user's path using IR sensors for short range, ultrasonic sensors for medium range, and LIDAR for long range.These range-based sensors have proven to be effective in providing obstacle detection and navigation assistance to visually impaired individuals. By using multiple sensors for different ranges, they can provide more comprehensive and accurate information on the user's surroundings, allowing for safer and more independent navigation.the statement highlights different technologies used in assistive devices for the visually impaired and suggests that range-based sensors are more commonly used due to their effectiveness and ease of use. However, it is important to continue exploring alternative technologies and improving existing ones to provide the best possible solutions for visually impaired individuals.

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Machine Learning Techniques in the Defense Sector for Intrusion Detection

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Abstract- The digital revolution has contributed to the simplification of previously time-consuming tasks. In this research, we are going to study machine learning techniques in the defense sector for intrusion detection. An intrusion prevention system (IPS) is a mechanism for security management that notifies a network managing the system of malicious activity and also attempts to safeguard it. Machine learning is the study of understanding and developing learning methods on its own using the information to optimize performance on a set of tasks. It is classified as a segment of artificial intelligence.

Keywords: Machine learning (ML), defense sector, intrusion detection, intrusion prevention system (IPS)

I. INTRODUCTION

In recent years, technological advancements have coincided with a significant rise in hacking and cybersecurity management. Internet connects the entire world, and one of the vulnerable controlling machines can be considered the starting point for the chain of unfortunate events. Some of the motivations for similar events can range from managing financial gain to understanding the political regulations to having fun. However, the main person of the attack may suffer a greater loss than the person intended. A successful hack of a technological company's website, for instance, results in a loss of reputation, which is crucial for any firm. Every day, businesses, governments, and even individuals face this issue without knowing how to address it. The solution is to install a prevention system (IPS). This is a security device that keeps an eye out for and tries to stop hostile activities on a network and system.

An intrusion detection system, often known as an IDS, is a kind of system that monitors the traffic on a network in search of potentially malicious activities and gives warnings when it finds suspicious activity. It is a piece of software that does a search across a network or system to look for potentially dangerous behaviour or violations of rules. Any potentially harmful activity or policy breach is often reported to an administrator or compiled and centralised using a security information and event management (SIEM) system. In order to discriminate between malicious behaviour and false alerts, a SIEM system aggregates outputs from many sources and applies alarm filtering mechanisms.

In spite of the fact that intrusion detection systems keep an eye out for potentially harmful activities on networks, they are also prone to producing false alarms. As a result, businesses have to do additional configuration steps after installing their IDS systems for the very first time. It entails correctly configuring the intrusion detection systems so that they can distinguish between regular traffic on the network and malicious activity based on how the two seem to one other.

Additionally, intrusion prevention systems scan the network packets that are coming into the system to see whether or not they include any harmful code and then immediately send out warning signals.

II. LITERATURE REVIEW

Ahmim, Ahmed, et al. (2020) conducted a comparison of twelve supervised ML methods. This comparative study aims to demonstrate the best ML methods for network traffic classification in specific types of attack or benign traffic, categories of attack or benign traffic. CICIDS'2017 is used as the data set for our experiments, with Random Forest, Jrip, and J48 performing best. Pawlicki et al. (2020) investigated the availability of degrading the performance of the optimized algorithm used here during testing by devising attacks at the time of adversarial using the 4 proposed systems, then proposed a method to identify the attacks. Information is provided under both ANN and the methods of composing attacks as we discussed above. The detection technique is thoroughly understood, and the outcomes of 5 distinct classifiers are differentiated. Detecting adversarial attacks on ANN, to the best of our knowledge, has not been thoroughly researched within the frame for reference of detection of intrusion systems. Nadia Chaabouni et al. (2019) and Sivakumar P (2015) investigated NIDS implementation resources already in existence, including free and open-source network sniffing software and datasets.Then, it analyses, examines, and contrasts government NIDS ideas in the context of the IoT in terms of design, detection methodologies, validation approaches, dangers that have been addressed, and algorithm

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implementations. The review discusses ML and conventional NIDS methods as well as potential future developments. Because learning algorithms have a high success rate in privacy and security, our emphasis in this study is on IoT NIDS implemented through ML. Maleh, Yassine. (2020), Karnan B et al (2022), and Latchoumi TP et al (2022) deployed the Cooja IoT simulator in IoT 6LoWPAN networks to generate high-fidelity attack data. The most efficient network architecture is chosen for all by evaluating the effectiveness of various network topologies and network scenarios. Test results reveal that ML models for detection of intrusion outperform traditional methods in terms of accuracy, and detection rate by 99 percent. It also necessitates a low rate of energy model overhead and memory, proving that the generated models can be used in confined settings, such as IoT sensors. A denial of service attack-specific DL-based infiltration model was developed by Kim, Jiyeon, et al. (2020), Vemuri et al (2021), and Monica.M et. al. (2022). The most popular dataset for assessing intrusion detection systems is the KDD CUP 1999 dataset, which we utilize for the intrusion dataset (IDS). The four forms of KDD attacks include DoS, user to root, remote to local, and probing. A detailed investigation of rule learning methods and their suitability for IDS in SG was carried out by Liu, Qi, et al. in 2021. It also summarises the most crucial element for understanding and assessing intrusion detection algorithms. This paper not only provides an overview of several important rule learning methods but also the first assessment of their prospective uses in SG security by examining their use in IDS.

Potluri, Sasanka, et al (2018), Sridaran K et. al. (2018), and Buvana M et al (2021) evaluate the efficiency of CNN-based intrusion detection for recognizing various attacks classes using datasets including such NSL-KDD and UNSW-NB 15. Several performance metrics, which add to the precision score, recall score, and F-measurement, have been compared to existing DL approaches. Mishra, Nivedita, et al. (2021) presented a review paper that compares and concentrates on Intrusion Detection models for mitigating DDoS attacks. In addition, the classification is according to Detection of intrusion Systems, various anomaly techniques, distinct Detection of intrusion System models based on the data information, and different ML and DL models for pre-processing also for malware detection. Finally, while addressing research challenges, proposed solutions, and future visions, a broader perspective was envisioned. Ferrag, Mohamed Amine, and colleagues (2021) provided a thorough categorization of intrusion detection systems in each technological innovation. They presented public datasets as well as frameworks for evaluating the performance of Agriculture 4.0's intrusion detection systems. Finally, they list the issues and possible future study areas for Agriculture 4.0 cyber security intrusion detection. Ferrag, Mohamed Amine, et al. (2021) suggested new methods and a sequential model based on the model's features. The proposed system can gather information from the network layer that is using dump packets from the layer using a system of application routines. Because they can create sequential data according to the language model, text-Convolutional Neural networks, and GRU methods were chosen. When compared to traditional methods, deep learning methods extract additional features from the given data, and results show that they have a higher F1 score. They concluded that a sequential prototype intrusion detection system based on DL can help to secure IoT servers.

III. Proposed Work

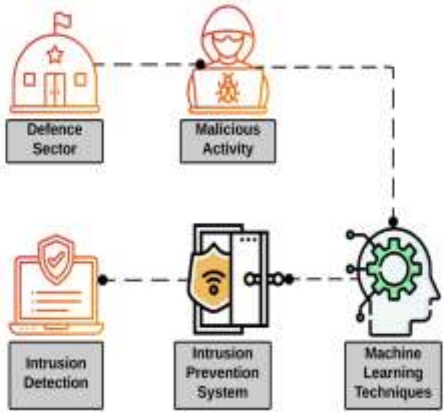

Fig. 1. Intrusion prevention system (IPS)

Malicious activity includes sending/distributing Viruses or information about the creation of Viruses, bouncing, flooding, mail bombing, denial of services, as well as other activities that disrupt or interfere with others' ability to use networks, systems, services, software, or equipment effectively. Machine learning is a field of study concerned with comprehending and developing methods for learning on its user data to improve performance on a set of tasks. It is considered a part of artificial intelligence. Machine learning employs two techniques: supervised learning, which involves training a model on established input and output data to help predict outputs, and unsupervised learning, which employs hidden patterns or structural components in the input data to predict future outputs.

In actual reality, the algorithm of subsidies distribution among the regional efforts aimed at boosting the military sectors by the algorithm output has shown to be a potent force, especially in bigger countries. Following equation (1), we may generally assume that regional authorities have supplied a T_L set of subsidized computations, which we shall refer to as types:

$$T_L = \sum_{m=1}^{c} \left\{ T_1(c_1, \dots\dots, c_n) + \sum_{m=1}^{T} T_l(c_1, \dots\dots\dots, c_n) \right\} \quad (1)$$

The quality of funds supports D_l^n given to enterprise m in terms of rule T_l is the quantity of most recent financial statement performance indicators serves as a benchmark. The subsequent equation (2)

$$D_l^n = \sum_{l=1}^{T} T_l((c_1^n) \quad , \dots\dots\dots, (c_m^n) \quad (2)$$

Each subsidized allotment of the Defense Managing Zones Algorithm of subsidy allocation among the regional

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ventures is financially sound. To explain the equation (3) indicates that the total amount of a subsidy cannot be greater than the whole amount of such a budgetary provision.

$$\bar{E} = \sum_{n=1}^{N} D_l^n \leq D + \sum_{l=1}^{t} T_l((c_1^n) \qquad (3)$$

The$\bar{E}$ has been described as an algorithm for allocating funds among regional projects in the defense sector. The following equation (4) determines for each indicator the quantitative relationship between its value and the enterprise's performance measurements.

$$E_j = \sum_{j=1}^{E} E_j(c^1, c^2, \dots\dots\dots, c^N) + \sum_{l=1}^{n} D_l^n \leq D \;\; j = 1, \dots\dots.J, \qquad (4)$$

E ach cash allotment can be represented by a modified worth $p_n(D_n,$ Dl). The following equation (5) will result in the maximum potential output growth thanks to the idea of acceptable resource allocations by incursion, which is concerned with creating a management plan.

$$D_l^n = \sum_{n=1}^{l} \pi^n\left(c^n, q_n(D_n, D_l^n)\right) \qquad (5)$$

To enhance the defense sector for intrusion on the condition by the equation (6).

$$C_m^n = \sum_{m \to n}^{c} \varphi_m^n\left((c^n) \;\; ,, q_n(D_n, D_n^l)\right), \qquad m1, \dots\dots., M \qquad (6)$$

IV. Experimental Results

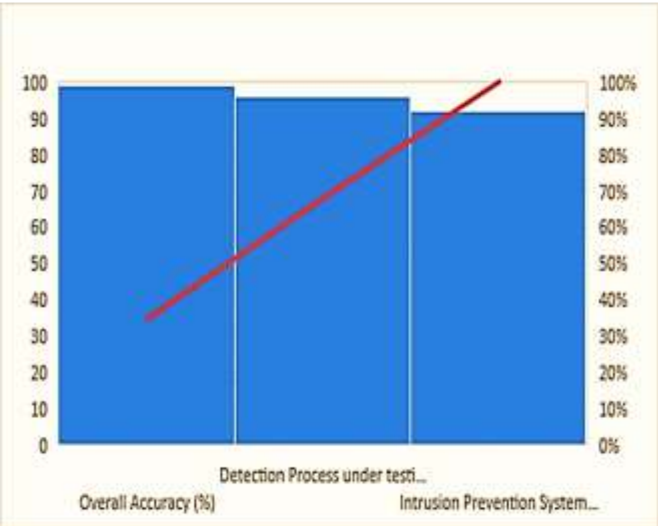

Fig. 2: Performance Analysis Computational ML model based on Intrusion Detection

An IPS is a networking tool (either hardware or software) that overcomes and manages a default network for illicit behavior and that takes action to prevent it, such as blocking and reporting, or dropping the functions, if it does occur. IPS is a security solution that provides active prevention. An IPS sit in the path of network traffic. The primary role is to prevent the system from intrusion. An intrusion prevention system (IPS) slows down entire traffic. An IPS is also known as an IDPS due to the services it provides. An IPS, in essence, sits in line with stable and secured network traffic and supervises it. It detects malicious network activity by analyzing intrusion signatures, generic behavior, and heuristic methods and takes the action of dropping all of the packets and obstructing the traffic. When such an event occurs, it also sends alerts to the administrator. The numerical analysis is presented in Table 1.

TABLE 1: Comparison of Result Analysis with the Existing Method

Algorithm	Intrusion Prevention System Training (%)	Detection Process under testing (%)	Overall Accuracy (%)
Intrusion Detection Algorithm	91.98	95.98	99.12
Existing Method: Naïve Bayes	85.98	90.59	91.87

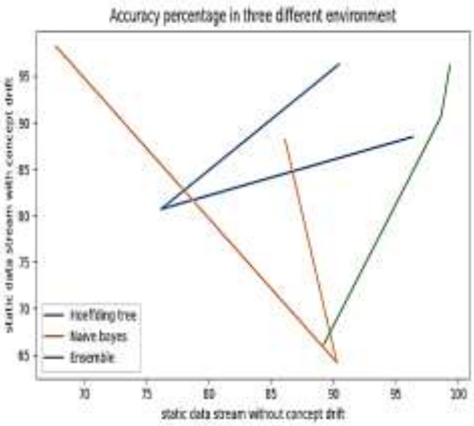

Fig. 3. Performance analysis of different algorithms based on Accuracy

The above Figure 3 depicts the accuracy variations in identifying the intrusion in any given network based on different algorithms. The analysis is performed over the static data of the given environment.

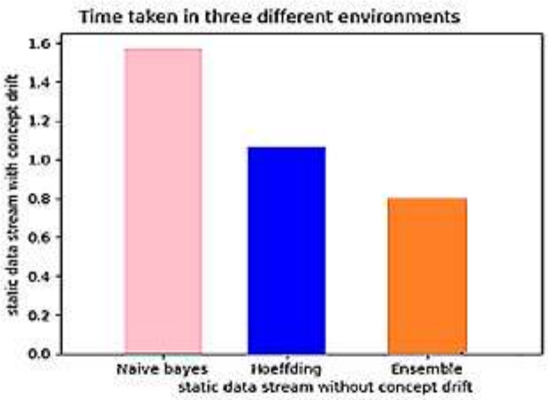

Fig. 4. Performance based on the time taken for intrusion detection

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Performance analysis based on the time taken for the detection is presented in the Figure 4 in which the Naïve Bayes Algorithm has taken longer duration for identification than other proposed algorithm is presented. Kappa value Analysis is presented in the following Figure 5.

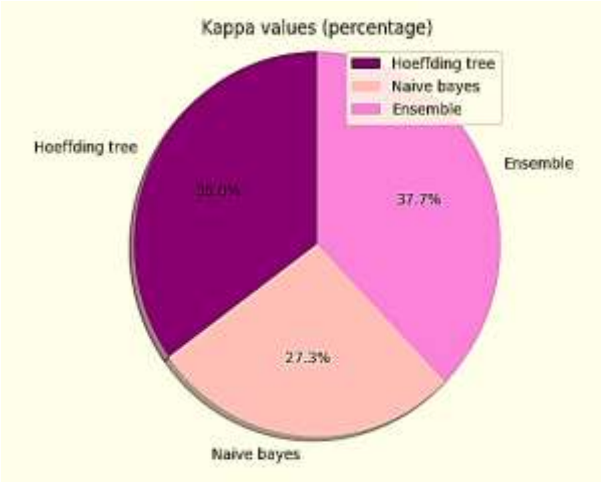

Fig. 5. Kappa Value Analysis

V. Conclusion

The proposed Intrusion Prevention System (IPS) is a security device that keeps an eye out for and tries to stop hostile activities on a network and system. Sensing and perception layer security concerns and vulnerability evaluations exist, as well as information security risks that differ from traditional network era characteristics. Nonetheless, ML methods have fundamentally altered the assessment of cybersecurity threats. To detect network anomalies, the system employs a variety of techniques, along with intrusion detection and managing the flow of identification. Nonetheless, the system has some kind of limitations, such as the integrity of the entire data controllence used to produce the input with its output. New ML methods are becoming progressively popular as a result of the need for quicker and more useful evaluation using the data.

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Relative Scrutiny of Different Capsule Network Architectures

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Abstract—The integration of computer vision and machine learning techniques has led to significant advancements in pattern recognition and image categorization. One of the most sophisticated machine learning techniques for encoding features based on hierarchical relationships is the capsule network. Unlike convolutional neural networks (CNNs), which lose much spatial location information and require extensive training data, capsule networks use inverted graphics and a network of capsules to represent objects as separate pieces and establish their interconnections. This paper aims to present an overview of various capsule network architecture designs employed in different applications, highlighting their pros and cons. The objective is to provide readers with a comprehensive understanding of the current state-of-the-art capsule network topologies.

Keywords—Capsule Neural Network, CNN, Deep Learning, Image Classification

I. Introduction

Computer vision is a crucial field of artificial intelligence that has numerous real-time applications, such as security, character recognition, object segmentation, and image recognition [1-2]. Convolutional neural networks (CNN) and recurrent neural networks (RNN) are the primary deep learning techniques used in computer vision, as traditional symbolic AI approaches are insufficient for complex real-time problems [5]. Among these techniques, CNNs are the most widely used and effective solution for image classification, image identification, and picture recognition tasks, ranging from simple to complex objects [6-7]. Nonetheless, CNNs suffer from the pooling process, which leads to the loss of vital details like object position and posture [8]. Additionally, CNNs lack rotational invariance and require extensive training data [9]. To overcome these limitations, alternative methods such as reinforcement learning [10] and end-to-end connected layers have been proposed. However, these approaches did not yield significant improvements, leading to the development of Capsule Network (CapsNet).The CapsNet has been shown to improve model accuracy by up to 45% compared to CNNs. This paper aims to review the shortcomings of CNNs while highlighting the positive results of CapsNet in the literature. Therefore, the primary contributions of this paper are:

- Inspire researchers by presenting cutting-edge capsule models.
- Investigate potential future research fields related to capsule networks.
- Provide a comparison of the most advanced CapsNet architectures to aid in selecting the most suitable model for specific applications.
- Examine the variables that influence the performance of these architectures with modifications and applications, allowing for a better understanding of the strengths and weaknesses of CapsNet.

This study aims to clarify the fundamental concepts of capsule networks, which have gained popularity as a recent research area. Additionally, we provide a comparative analysis of CapsNet designs used in various applications to overcome the limitations of CNNs, including their advantages, disadvantages, and potential future approaches.

The paper is structured as follows: Section 1 outlines the study's objectives and provides background information on the topic under review. In Section 2, we summarize literature survey of CapsNet architectures, including their limitations, modifications, and applications. Section 3 describes the performance analysis. Finally, Section 4 concludes the paper.

A. *Convolutional Neural Network (CNN)*

Let's discuss the attributes of an image required for its recognition by a CNN. Specifically, let's consider a gray scale 2x2 pixel image, with each pixel represented by an 8-bit value ranging from 0 to 255. These values denote the intensity of the corresponding pixel, where 0 represents black and 255 represents white. The gray scale range between black and white spans from 0 to 255. Figure 1(a) illustrates the computer's interpretation of the gray scale image, while Figure 1(b) depicts the computer's representation of its features.

Pixel 1	Pixel 2
Pixel 3	Pixel 4

Fig. 1.(a) 2 X 2 Gray scale image

Deep Learning (DL) algorithms designed for image categorization are referred to as Convolutional Neural Networks (CNNs). Their primary purpose is to interpret image data, assign importance to various features, and differentiate between different classes. A CNN is composed of a fully connected layer with an activation function, a pooling layer, and a convolutional layer [11].

The input image is scanned by the convolutional layer to extract low-level characteristics, such as edges. This layer performs convolution between the input image and a set of

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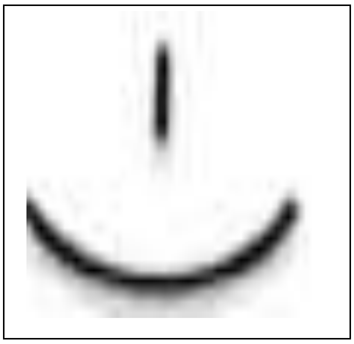
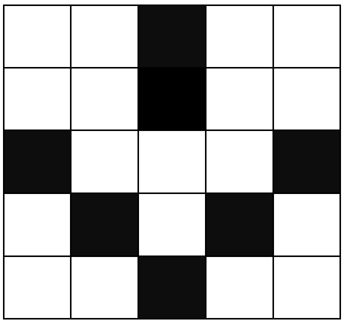
learnable filters, resulting in the production of feature maps that highlight different patterns and features of the image. The Rectified Linear Unit (RELU) activation function [12] is applied to introduce nonlinearity in the model's computations and improve its accuracy.

The pooling layer, also known as down-sampling, is utilized to reduce memory requirements and recognize the same object in multiple images. Different types of pooling methods such as maximum, minimum, sum, and average pooling are employed based on the requirements of the model.

Figure 2 demonstrates the fundamental organizational structure of a CNN. It includes multiple convolutional and pooling layers that extract and reduce the image features' dimensions, respectively. The fully connected layers at the end use these features to classify the image into different categories.





0	**0**	**1**	**0**	**0**
0	**0**	**1**	**0**	**0**
1	**0**	**0**	**0**	**1**
0	**1**	**0**	**1**	**0**
0	**0**	**1**	**0**	**0**

Fig. 1.(b) Image Representation on a computer

The main issue with the pooling method in CNNs is the loss of valuable features from the input image. As a result, CNNs lack equivalence, meaning that different inputs with similar features may result in different outputs. This lack of invariance is a significant limitation of CNNs, which require substantial amounts of training data and processing time to improve their accuracy [13].

Furthermore, CNNs are susceptible to misclassifying objects when the input pixels are perturbed. Even small perturbations can significantly affect the output of the network, leading to incorrect classifications [14].

B. Capsule Network (CapsNet)

Capsule Network, also known as CapsNet, is a deep learning architecture designed to encode the connections between different entities, such as scales, location, pose, and orientation, to improve object recognition [15]. Unlike traditional Convolutional Neural Networks (CNNs), which may misclassify an image containing mouth, nose, and eyes as a face, CapsNet can effectively identify such images as not being a face by learning the relationships between different features. CapsNet is a type of neural network that can also generate inverted visuals. When detecting an object, CapsNet breaks it down into components and creates a hierarchical relationship between all the components to represent that object.

The implementation of CapsNet includes three major components: input layer, hidden layer, and output layer. The input layer processes the input image, and the hidden layer uses dynamic routing to capture the relationships between different features. Finally, the output layer produces a vector that represents the likelihood of the input image belonging to a particular class [16].

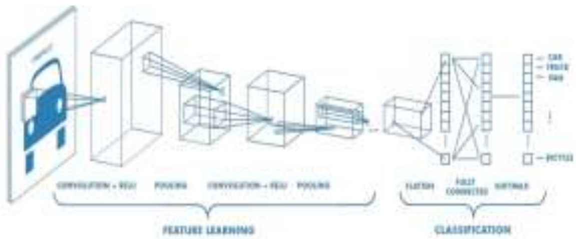


Fig .2. Basic Structure of CNN [15]

The Capsule Network was developed by Sabour and Hinton in 2017, with the goal of improving object recognition. The network includes two convolutional layers, with the first layer consisting of 256 channels and 99 filters. The stride for this layer is 1, and it uses the RELU activation function.

The second layer of the Capsule Network is a convolutional layer with 6632 capsules, and it uses a stride of 2. Each major capsule in this layer consists of 8 convolutional units and uses a 99 kernel. The squashing function is employed as the activation function in this layer.

The last layer of the Capsule Network is called the DigitCaps layer, which is a fully connected layer made up of 16D capsules in size 10. These capsules gather information from every capsule in the network and use it to classify data into ten different categories.

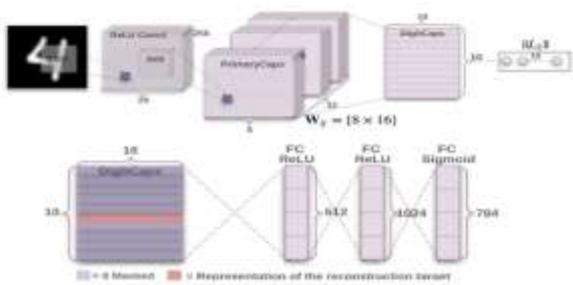


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Fig.3. Structure of Capsule Network [15]

Figure 3 shows the structure of the Capsule Network, which includes the different layers and capsules used in the network. The unique architecture of the Capsule Network allows it to encode the connections between different features, making it effective in object recognition tasks.

C. *Modification in CapsNet*

The Capsule Network has been subject to various modifications to enhance its performance beyond its initial implementation. Some researchers have suggested using densely connected convolutional layers instead of the original convolutional layer in CapsNet to generate a more discriminative feature map. However, this can lead to the vanishing gradient problem, which can be addressed by adding a dense connection to create a feature connection between each layer in a feed forward manner. Additionally, CapsNet can be improved by adding more convolutional and fully connected layers to perform better on datasets beyond MNIST. The initial routing technique in CapsNet used the SoftMax algorithm to normalize routing coefficients, but other routing strategies have been proposed to enhance CapsNet's performance against adversarial attacks, including Self-Routing, Expectation-Maximization Routing, Variational Bayes Routing, and Inverted Dot-Product. Despite these improvements, CapsNet is still susceptible to deception like CNN. Other methods, such as representing an entity with a matrix rather than a vector, and coupling CapsNet with advanced Convolution Network modules like skip connections and dense connections, have also been proposed to increase CapsNet's parameters and improve its performance. These novel routing strategies and architectures can enhance the resilience of affine translation in CapsNet.

II. Literature Survey

In 2017, Hinton et al. introduced the Capsule Network (CapsNet) as a solution to overcome the limitations of CNNs. The CapsNet not only extracts and learns information about visual features, but it also learns how these features relate to one another, resulting in a more accurate model. Tests were performed on the MNIST digit dataset, and the CapsNet model outperformed the latest CNN models.

In [17], the authors proposed Failure to detect gastrointestinal (GI) tract diseases early can have severe consequences, including the development of cancer and even death. Traditional procedures for detecting these diseases are often painful and cannot cover the entire GI tract. Wireless capsule endoscopy (WCE) offers a painless and efficient alternative, but generating a large number of images makes it challenging to identify abnormalities. RAt-CapsNet offers a methodical approach to identifying GI abnormalities in WCE images and has the potential to become a promising diagnostic tool.

Researchers conducted a study that was published in [18], The Multilevel Capsule Weighted Aggregation Network (MCWANet) is proposed in this paper. The MCWANet utilizes a decoupled dynamic filter (DDF), a new multilevel capsule encoding module, and a new capsule sorting pooling (CSPool) method to extract and fuse multilevel and multiscale features, resulting in strong semantic feature representations. Experiments on two challenging datasets, AID and NWPU-RESISC45, demonstrate that the proposed MCWANet performs competitively in RSSC.

In [19], the authors proposed FRCapsNet is a new CapsNet proposed in this paper that aims to deal with the heavy computational burden of traditional routing algorithms. The proposed fast routing algorithm allows low-level capsule information to be sent to all high-level capsules simultaneously, reducing computational costs. Future work aims to connect capsules of different levels in a convolutional way, which would reduce the number of trainable parameters.

The authors suggested this in [20], a novel image classification model named Dense Caps is proposed. The model is based on dense capsule layer connection and hierarchical feature combination, composed of multiple dense capsule blocks. This is the first attempt at capsule-level dense connection, and the paper conducts an in-depth study on the feature capsule redundancy problem.

The authors suggested this in [21]. Botnet detection is the process of identifying botnets in network traffic. This paper proposes the LSTM-Capsule Net model, which combines the k-means routing algorithm with the original dynamic routing algorithm for ablation experiments. The proposed model offers better feature map clustering and generalization ability than the original dynamic routing algorithm. Experiments show that the LSTM-Capsule Net model performs better than comparison models in the DGA domain name recognition task and in multi-classification of the DGA domain name family and recognition of Real-Dataset and Gen-Dataset.

In [22], researchers proposed a capsule network called MIXCAPS, which eliminates the need for fine annotation by using a combination of experts and automatically dividing the dataset using a gating network based on convolution. The model achieved an accuracy of 92.88%, sensitivity of 93.2%, and specificity of 92.3% while being independent of pre-defined hand-shaped traits.The proposed method's unique design enables it to achieve high accuracy in object recognition tasks while eliminating the need for hand-crafted features.

The proposed [23] CapsPhase is trained using the SCSN earthquakes. The input is divided into S-probability, P-probability and noise probability. It is tested using STEAD & Japanese dataset. Here, convolutional, primary capsule and digit capsule are mainly used. Convolutional is used to create feature maps (4 s-three components). Primary capsule is used to produce the combination of feature maps. Dynamic routing is used to keep the spatial relations of the output. Digit capsule layer produces the P-Wave and S-Wave arrival time. Median filler is used here to smooth the output.

The author proposed [24] the method of feature extraction using Self-attention generative capsule network which is optimized with Sunflower optimization algorithm to overcome the high over fitting problem in previous methods done by others. This method makes use of the NIH chest x-ray image dataset from Kaggle to train and extract the features to detect the lung cancer and other lung related diseases.

The author [25] makes use of the optimized hybrid deep learning model to detect the liver disease called liver cirrhosis. Many modalities for the detection of this disease is done but it lacked the higher detection accuracy. So to overcome that, 1232 MRI images collected from hospital is used to train using two deep learning algorithms, CNN and capsule network (HCNN-CNN) are integrated to detect the liver disease with high accuracy rate.

Numerous alternative methods are utilized in Q-CapsNet to find color and facial form, according to the authors' proposal [26]. Quaternion algorithms are initially paired with capsule network layers. The input from facial color is then converted into capsules using a quaternion routing approach and a convolutional layer (RGB). Quaternion convolutional would incorporate the quaternion matrices in order to extract geometric descriptions and capture the internal dependencies between the color channels. The RGB input color matrix and the length and width input geometry are then provided in the QConvCaps layer, where they are combined into a single output. Quaternion routing algorithms of the QConvCaps Layers and QFCCaps Layers are utilized to combine it into a single prediction.

TABLE I. PERFORMANCE SUMMARY OF SOME CAPSULE NETWORK

Ref. No.	Author Name	Methods	Advantages	Disadvantages	Dataset
17	M.D. Jahin	A Novel CNN	Achieved better classification of images.	Insufficient Dataset to compare the images.	• Kvasir Capsule
18	Chunyuan Wang et.al	A Novel Capsule Network for RSSC name MCWANet	Achieved better Accuracy 95.89 and 92.15%	Further improve its classification	• AID • NWPU-RESISC45
19	R. Zeng and Y. Song	Fast Routing algorithm	Achieved better performance in 71.2% of better classification accuracy.	Reduced the Computational cost	• MNIST • CIFAR10
20	Guangcong Sun et.al	DenseCaps	More accurate and trained models	Data imbalanced in dataset	• MNIST • Fashion-MNIST • CIFAR-10 • SVHN
21	Xiang, C et.al	Capsnet	Accuracy can be increased by varying the number of feature map	Accuracy can be increased by varying the number of feature map	• MNIST
22	Afshar, P., Mohammadi, A. and Plataniotis, K.N	MIXCAPS	Lung nodule malignancy prediction	The MNIST used in this paper is simplistic image and additional experiments needed using complex datasets. CapsGAN have the ability in capture geometric transformations.	• LIDC dataset • IDRI dataset
23	Omar M. Saad, Yangkang Chen	CapsPhase – Convolutional, primary capsule & digit capsule layers	Ability to learn from small datasets. No loss of data about position, location & texture. Robust performance even with background noise.	Needs the accurate arrival time to perform. Cannot be done for continuous data. Training time is more. Low resolution	Southern California Seismic Network(SCSN), Stansford Earthquake Dataset(STEAD), Japanese Seismic Data
24	N.B. Mahesh Kumar	Self-Attention Generative Adversarial Capsule Network	Reduced high over fitting problem	Classification method is challenging	NIH chest X-ray image dataset
25	H. Shaheen	Optimized hybrid deep learning model	Achieved higher detection accuracy	Classification method is challenging	1232 MRI images from hospital
26	Yu Zhou , Lianghai Jin, Guangzhi Ma and Xiangyang Xu	Quaternion technique is used to process the colour information like different skin colours and illumination variation.	Q-CapsNet achieves higher accuracies than the Capsule Network	Low resolution facial images cannot be recognized	• MMI • Oulu-CASIA • RAF-DB • SFEW

III. PERFORMANCE ANALYSIS

In this section, we compare CapsNet's accuracy, number of parameters, and network speed. We choose the most appropriate hyper-parameters for this comparison. We carried out multiple trials to identify the best set of hyper-parameters.

TABLE II. CAPSNET: ACCURACY OF THE DATASET

Dataset	Accuracy (CapsNet)
MNIST	99.63%
F-MNIST	91.35%
CIFAR-10	71.63%
CIFAR -100	72.65%
SVHN	93.04%

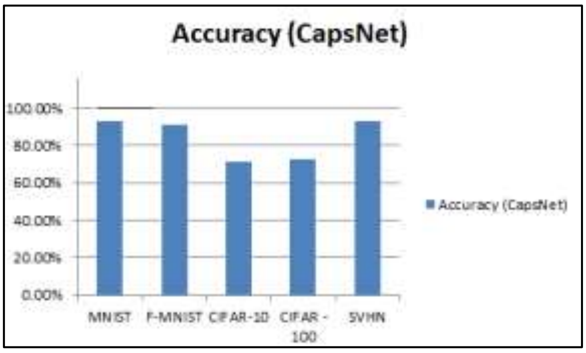

Fig. 4. CapsNet : Accuracy of the Dataset

The performance of the capsule network design is examined using the dataset, an older MNIST dataset, the CIFAR-10 dataset, and iterations. It should increase performance based on the noval capsule architecture. We are currently developing a novel architecture to evaluate multiple types of image classification datasets with high accuracy. The outcomes of the various datasets are shown in the table and figure above.

IV. CONCLUSION

The Capsule Network was introduced as a solution to the limitations of the classic CNN algorithm and has shown great promise so far. However, to fully realize its potential, further research and development are needed. In this study, we evaluated the effectiveness of various algorithms that have an impact on the field of computer vision. We specifically focused on examining how the current capsule network architecture was put into practice and provided more information about its achievements, drawbacks, and possible modifications.

The findings of this research will be beneficial to the computer vision community as they can use the successes and failures of the capsule network to develop a more reliable machine vision algorithm. By considering the structure of the capsule network and exploring ways to improve it, we can work towards achieving more accurate and efficient object recognition and classifications.

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Sign Language Translator for Speech Impaired

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***Abstract*—There are several sign recognition algorithms that produce word output to facilitate communication between mute persons and non-mute people. Our suggested approach focuses on translating sign language into text and voice. With the aid of Natural Language Processing (NLP) techniques, which include automatic word completion and sentence creation, appropriate English sentences are framed with expected words before being transformed to speech. Live video is used as input, then video is framed and segmented. For monitoring hand and facial gestures, Media Pipe Holistic algorithm is utilized.**

Keywords—Natural Language Processing, Holistic Media Pipe

I. Introduction

People with hearing loss frequently utilize as a communication method, sign language is used. A sign language is nothing more than a collection of varied hand signals created by varying hand shapes, movements, and orientations, together with face expressions. 34 million of the 466 million people with hearing loss in the world's population are children. Deaf individuals have minimal to no hearing abilities. They communicate using sign language. Around the world, many sign languages are used by people. They are quite few in number when compared to spoken languages. Indian Sign Languages is the name of the sign language used in India (ISL). There aren't many deaf-specific schools in poor nations. Gestures are naturally performed by humans.

Gestures are made intentionally, as signals or indicators, or unconsciously to communicate attitudes or intentions. Even though they entail the entire body's movements, studies frequently concentrate on the arms and hands since they are necessary for movement and dialogue. Facial expressions play a significant part in communication and are also regarded as gestures. Most everyday human actions or activities involve gestures, which take part in human interaction through either completing speaking or standing in for someone else for uttered words in situations requiring silent communication (under water, in noisy environments, in secret, etc.) or for those who have hearing impairments.

Between the speaking community and the deaf and mute population, there has always been a communication barrier. This is particularly clear when there is an emergency. A human interpreter is typically used in order to translate. However, everyone cannot afford a professional translator, and in times of crisis, the presence of a human interpreter cannot be guaranteed. This undertaking tries to remove this obstacle. The process of image processing and machine learning are used to complete the assignment. For picture categorization and recognition, very potent tools like the process of processing images and machine learning are frequently used.

Image processing is concerned with the image, its elements, and the actions taken to extract information from it. The research into algorithms and statistical information that are used to carry out tasks utilizing different data patterns and conclusions is known as machine learning. A camera will be used to capture the images of sign language for this project. The features are then retrieved from the photos using image processing. These photos are then compared using the datasets that are readily available, and the indications are deciphered using deep learning. The information is shown on a display so that individual seeing a deaf or mute person can comprehend their sign language

This project seeks to bridge the communication gap between a person with a physical impairment and a person who is specially challenged by identifying symbolic expressions through photographs and translating them into voice or text. To provide output in the form of words, various sign recognition algorithms are applied. Our suggested approach focuses on translating sign language into speech. Natural language processing techniques, such as automatic word completion and sentence creation, are used to construct appropriate English sentences with expected terms. Live video is used as the input, then video is framed and segmented. For tracking hand and facial gestures, Media Pipe Holistic algorithm is employed.

II. Literature Survey

There are four basic steps in the implementation: Enhancement and segmentation of images 2. Detection of orientation Extraction of Feature 4. Categorization.

In [1], The system uses video sequences from which convolutional neural networks were built and adds photographs of the train data. Predictions for individual frames were made using the Trained Convolutional Neural Network model in order to provide a sequence of predictions. The system was created for the purpose of translating Indian sign language and producing legible output, the proposed system creates a trustworthy communication interpretation programmed Static sign-language motions were identified using a deep learning system. This algorithm was developed for use with a Raspberry Pi. A camera was used to capture the photos, after which the features were retrieved using HSV filtering.

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The values for the skin tones were chosen to distinguish the hands from the background. The image was then changed to a grayscale format in order to recover the hand's characteristics. Following this, the groupings of these images were separated into training and test groups, and the model was fed with them. The proposed model had two dense layers, the first of which served as the activation layer and the second of which served as the tanh layer [2].

The suggested solution makes use of a hand glove to recognize unique patterns and gestures. They employed Flex Sensors. Processing was carried out using Arduino Mega. To mimic the user's hand movements and patterns, a glove was used. Flex sensors are positioned here along the thumb and fingers. The sensors determined how much the fingers were bent and produced a voltage fluctuation as an output [3].

The technology designed produced a variety of words, voice, and gestures. This suggested method let normal people and people with disabilities communicate with one another. By using a high-definition camera to record various hand motions, a training dataset is built. A minimum of ten photos are taken for each gesture. The median filter is used to denoise the collected images. By removing the backdrop information, the hand gesture alone was segregated for better training [5].

For this system's implementation, the suggested system offered audio as input, and pattern matching techniques were utilized to match the audio. The results displayed the indicators for audio matchups. Second, for the system to record the Sign movements, a web camera was required. The result of the identified sign language gesture in audio form was shown [5].

[6] The device provided real-time audio, making it simpler for those with hearing loss to communicate with others who can hear them. If the phrase is saved in the database, the system will be able to recognize it in the sentence and present sign language videos that are relevant to it. Almost a thousand films, a combination of the author's own recordings and freely accessible lectures by ISL professors, were stored in the database.

The proposed device is a personal communication system designed to assist people who are deaf, dumb, and/or blind in communicating with others. The device is adaptable and incorporates various technologies such as text-to-voice conversion, OCR, and speech-to-text conversion to enable users to interact with each other through text or spoken language. For dumb individuals, the device offers a text-to-voice conversion feature that reads out the text for them. Visually impaired individuals can use the device's OCR feature to read text, and the e-speak technology can read the text aloud for them. Deaf individuals can use the device's speech- to-text conversion feature to read what others are saying or communicate using written text that can be converted to speech for others. Blind individuals can also use the device's OCR feature to read text or paragraphs. [7].

[8] Using a three-dimensional hand point as input, the hand pose estimator precisely and successfully regresses the hand joint locations. A folding-based encoder is used in the proposed model to fold a converted into the appropriate joint coordinates from a 2D hand skeleton. Folding was guided by multi-scale characteristics that included global and joint-wise local features for increased estimation accuracy.

The "intelligent robotic arm voice-controlled assistance device for physically challenged person" was part of the planned system. The joystick was used to control a robotic arm that was installed on a rail system. The movements were recognized as input by both the gloves and the camera. The gestures were converted into speech with the use of the pre-defined dataset, which had a gesture corresponding to each word [9].

The proposed device enabled interaction between the blind, deaf, and dumb by using a glove-based communication interpreter system. A three-axes movement tracking inertial sensor was part of the glove system. (x,y,z). Data from the accelerometer sensor was analyzed by the microcontroller before being sent over Bluetooth to the mobile device, where it was converted into text or speech [10].

[11] The suggested approach made it possible for a deaf person to interact with hearing people without the use of an interpreter. The authors made use of the Tensorflow library and the Keras framework. The camera captured the image, compared it to the previously recorded photographs, and then assigned it to the appropriate pre-defined character. The result was created once the words were placed together into a phrase that made sense as a sentence.The suggested technique uses self-comparisons to accurately estimate the hand positions on three publicly available hand pose datasets. For the ICVL and NYU datasets, the suggested method outperformed methods that were based on 2D CNN, and it also did well on the MSRA dataset. The suggested technique determined the mesh vertices of each individual human part, including the body, hands, and face regions, in a 3D environment [12].

The proposed model makes use of CNN and Attention-Based Hierarchical RNN to quickly identify URLs. They were able to develop an accurate model to recognize phishing URLs by integrating these URL models using a three-layer CNN [13].

The first stage in developing sign language detecting systems was accurate hand segmentation. The hand in the original image was recognised by the authors in the proposed study, and they gave this part of the image to the multi-class classifier, which can identify static motions. The proposed approach first built the data collection, converting each image into a feature vector (X) and giving each one a label that matches to the sign language alphabet given by (Y). The projected classifiers correctly identified 65% of the aforementioned images [14].

[15] The purpose of this approach was to close communication gap between those with hearing and speech impairments and the general public. The available alternatives either don't provide real-time data or provide data with a low level of precision. This system produced positive results for both parameters. 33 hand motions were

DOI: rp-9788770040723.096

identified, along with a few ISL gestures. A smartphone camera captured frames of Sign Language, which were then transferred for processing to a distant server. It is user-friendly because no additional hardware, such as gloves is required. A Grid-based Feature Extraction approach is used to represent the pose of the hand in the image.

III. Methodology

A. Data Generation

Data generation refers to the process of creating or generating data for use in various applications, such as machine learning, data analytics, and artificial intelligence. This data can be created using a variety of methods, including simulations, surveys, experiments, and data scraping.

Data generation is an important aspect of many applications, particularly in the fields of artificial intelligence and machine learning, where large amounts of data are required to train models and algorithms. However, it is important to ensure that the data generated is of high quality and is representative of the real-world situations being modeled or analyzed.

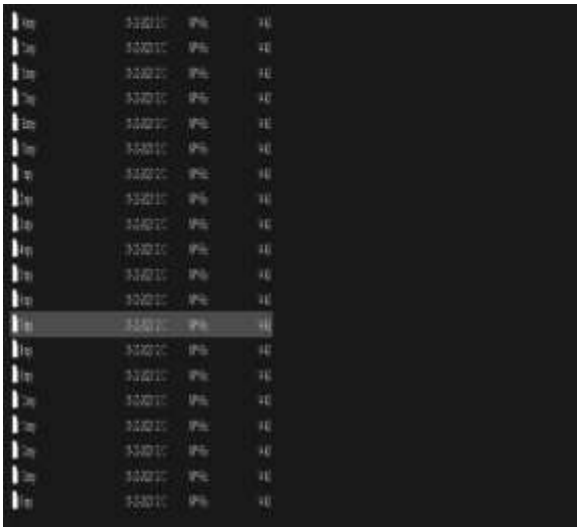

Fig. 1. Data Generation

Sign Translator application is divided into 3 modules:

1) Handgesture Recognition

The input image is pre-processed and the Region of Interest is extracted. The media pipe holistic framework extracts body pose coordinates, hand pose coordinates and face pose coordinates. Then the coordinates are transformed into NumPy arrays. For each gestures up to 30 NumPy arrays are already generated and collected in respective class and the model has been trained with the collected data. So that the gestures will be recognized and corresponding words will be produced.

There are several approaches to hand gesture recognition, including using depth cameras, 2D cameras, and machine learning algorithms. Depth cameras, such as Microsoft's Kinect, use infrared technology to capture depth information, making it possible to distinguish between the hands and other objects in the environment. 2D cameras, on the other hand, rely on image processing techniques to detect and track the hands.

Machine learning algorithms, such as convolutional neural networks (CNNs), are commonly used for hand gesture recognition. These algorithms are trained on large datasets of hand gesture images, allowing them to recognize a wide variety of gestures. They can also adapt to different lighting conditions, camera angles, and hand positions.

Hand gesture recognition has numerous applications, including controlling devices without physical contact, assisting people with disabilities, and improving human-robot interaction.

Fig. 2. Handgesture Recognition

2) Gesture to text and speech

The process of gesture to text and speech typically involves using a camera to capture hand gestures, which are then interpreted by computer vision algorithms. These algorithms can recognize different types of hand gestures, such as pointing, waving, or making a specific hand shape, and translate them into text or speech output. One common application of gesture to text and speech technology is sign language recognition.

From the hand gesture recognition module, the keywords are produced. Using the Long Short Term Memory Natural Language Processing (LSTM NLP) model, meaningful statement from the produced words will be framed. Also using the face pose marks and body pose marks the proper meaningful expressive sentences can be generated with proper tenses.

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Fig. 3. Gesture To Text And Speech

3) Speech Or Text To Gestures

From the Mic the voice will be recorded and sent to Natural Language Processing (NLP) model. The Speech will be processed by Natural Language Processing (NLP) model. Then the keywords are extracted. For each word animated gesture video are made and stored. The extracted words will be mapped to the respective video file. Finally, all the mapped videos will be merged and produced as a single video which can be understood by Speech impaired people.

Fig. 4. Speech or text to gestures

IV. Results and Analysis

The classification model's performance is measured in terms of how well it can properly identify instances that belong to a particular class using precision, recall, and F1 score. These metrics are necessary for evaluating the efficacy of a machine learning model and deciding whether to use it in practical applications. The Long Short-Term Memory (LSTM) is a type of recurrent neural network (RNN) architecture used in deep learning. LSTM is particularly useful for processing sequential data, such as speech, natural language, and time- series data. LSTM can produce an accuracy of 100% on train data and 98% on test data.

Fig. 5. Classification Report

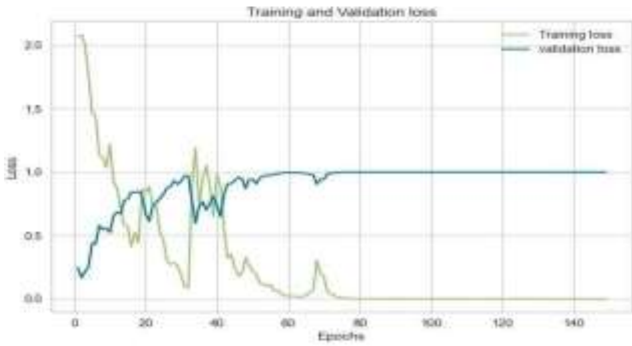

Fig.6. Training and Validation Loss

V. Conclusion

In this study, the existing systems are examined, and a proposed application is created to address the drawbacks of the earlier systems. After studying a number of algorithms and works that give output results with various degrees of accuracy, it is clear that the current systems are either unable to recognize hand gestures accurately or struggle to translate them into speech. The majority of the way the current system operates doesn't happen in real time.

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Diet Recommendation System Using ML

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***Abstract*—Diabetes interacts with the capacity of our bodies to turn food into energy. It is a chronic health issue. Your pancreas is prompted to generate insulin when the sugar levels in your blood rise since an enormous portion of the food you consume gets transformed into sugar (glucose) and communicated into blood for circulation. Nowadays, deep learning is used in the healthcare industry to try and forecast diseases. Data is the most essential component of deep learning. p A deep learning model is constructed using the previous dataset, which is gathered. Univariate and bivariate analysis, among other essential pre- processing techniques, are used. A classification model is built using a machine learning algorithm only after data is shown to facilitate with feature interpretation. Algorithms are evaluated based on performance metrics like accuracy, F1-score, recall, etc.**

Keywords— BMI, Deep learning, Dietary plan, F1score, Diabetes

I. Introduction

Humans face a wide range of health problems, including mental and physical health problems. Numerous studies demonstrate that in adequate dietary intake and poor nutrition quality are the primary cause for numerous illnesses and health issues. Heart attacks, ischemic heart disease, and gastrointestinal cancer are the leading causes of death around the world, according to WHO research. Everyone should eat a well-balanced diet to overcome this. A healthy diet is essential for your organs and tissues to function properly. A healthy diet can help strengthen the immune system and prevent disease, according to medical research. A balanced diet includes a wide range of substances, notably water, vitamins, minerals, carbohydrate, proteins, and fats. Medical research has revealed that proper diet plan helps to build up the immune system and fight against diseases. Consumption of proper diet provides energy, vitamins, carbohydrates, proteins, fats, vitamins, minerals, and water multinomial analysis and random forest algorithm is to be integrated to provide healthy diet plan recommendation according to user characteristic.

This diet advice project intends to convey nutrition information in an adaptive manner to enhance the life of both healthy and sick people. The project offers food recommendations based on the attributes and assists users in keeping track of their calorie target based on their BMI. The system offers culinary recommendations to users using a ML algorithm. The system informs the user of the effects and reasons for ignoring the suggested diet.

The existing system just creates a week diet plan based on user attributes like height, weight, and BMI. This application technique develops a diet plan and health recommendations using the random forest algorithm. The system will generate a diet plan based on a healthy diet, weight growth or loss, past user assessments of food flavor and food type with suitable calorie levels, and information about weight increase or loss (carbohydrate, protein, vitamins, calcium, fats, fiber and iron). The strategy will help consumers become healthier and identify the kinds of foods to stay away from to lower their risk of illness.

II. Literature Survey

The objective of the diet recommendation project is to improve the health and wellbeing of individuals, both those who are generally healthy and those with chronic illnesses. To achieve this, the project provides personalized nutrition guidance that takes into account the user's features and assists them in monitoring their calorie intake based on their BMI. The system offers nourishment suggestions that are tailored to the user's preferences and provides explanations for why it is important to follow the recommended diet. Users can also learn about the latest nutrition news and health tips in the system's section.

In [1], The system was built with a strong emphasis on developing a seven-day feeding plan based on an individual’s personal needs and dietary preferences. It incorporates a content-based filtering approach that employs Euclidean Distance to offer alternatives for food allergies or dislikes. Due to the variety of preferences, likes, and dislikes among people, it also addresses the usage of the Pearson correlation coefficient for nutrient assessment and alternative meal selection.

The platform where consumers can locate their preferred food and its nutritional value. Anyone who cares about the health or wants to lose weight can benefit from this. This application can be used independently or as part of a more sophisticated application. Web scraping was used to collect the data set, which was then pre-processed based on attributes. The Content Based Filtering Algorithm was then used in the food recommendation system [2].

The approach was created to take into account the latest innovations in dietary evaluation setups, which are a more beneficial way to monitor daily food intake and manage dietary patterns.

A framework for estimating food, calories, and nutrition is incredibly helpful for individuals’ groups to measure and manage their daily food consumption. AI will offer recommendations based on the benefits or prior experience that the customer has had. These computations are also used to make diet recommendations to the customer. [3].

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In [4], An Android application was developed to provide consumers a personalized diet. Similar to a genuine dietitian, it serves as a nutrition advisor. This system operates similarly to a nutritionist. A person must provide the nutritionist with certain details, such as their weight, height, gender, etc., in order for them to gain knowledge about their diet plan. In a similar manner, this system also offers a diet plan based on the data given by the user. To provide the user with the diet plan, the system collects all of the user's information and analyzes it.

The system was designed to operate in a machine learning environment. It evaluates user information comprising age, gender, height, weight, and body fat percentage, as well as choices for weight loss or weight gain, and then recommends dietary habits in three categories for lunch, breakfast, and dinner. Problems encountered in relation to the user. This system uses K-Means and then Random Forest algorithm approach. Problems encountered in relation to the user. The Nutrition dataset from Kaggle is used for recommendation [5].

The study suggests that individuals with diabetes should have snacks due to their specific circumstances and the risk of hypoglycemia between meals. To generate a list of significant items based on user characteristics, environment, and behavior, the approach employs various strategies such as collaborative sifting, knowledge-based, roulette wheel, and content-based sifting (CF) algorithms. In this paper, a recommendation system for various food ingredients is proposed, considering the small test measurement during the assessment phase and the absence of the primary meal. The proposed recommendation system suggests ingredients that are frequently consumed together. [6].

In [7], The recommendation system makes use of a web interface to take into account user inputs and make recommendations for food items based on the user's current requirements. Random Forest Classification, K-Means Clustering, LSTM and Python-based Tkinter GUI. The user interface and dataset in this system need to be improved. Regarding the recommendation of recipes, a system plan for putting recipe search into action takes into account the combination of numerous food ingredients, nutrition, and budget. This app is extremely useful for cooking a wide range of recipes with minimal internet research. Additionally, this app lets users create and save recipes for later reference. It will save people time and effort searching for recipes for both everyday meals and special occasions.

The suggested algorithm improves classification accuracy while producing effective classification. There are numerous approaches for the classification of medical data utilizing various metrics and techniques, and the subject of categorization in medical data has been well investigated. The approaches still struggle to improve classification accuracy performance. The classification algorithm was developed using MLIIM is employed in this study to increase classification effectiveness. By removing the incomplete information, the tool estimates the submitted collection of data to resolve the interference problems. During the subsequent stage, the algorithm periodically and at various levels examines the impact of the measure. Additionally, the method determines the class influence weight (CIW) for distinct classes. [8].

The approach offers personalized suggestions mostly to customers who are dealing with issues like diabetes or heart disease. Dynamic product recommendations enable for the provision of an appropriate product that adapts to consumer preferences over time. The algorithm for product categorization is in charge of data cleansing, tokenization, and frequency calculation. The association between the product and the user should be established via genetic algorithms. The food goods in this application must be acquired by the product buying module. The project doesn't include more product categories so that it can offer recommendations to different people who like items with distinctive nutritional benefits [9].

In [10], The system proposed the target by using their BMI as an input and by taking into account their allergies to let them track their daily calorie intake. Collaborative Filtering algorithm with fuzzy logic. As it is, collaborative filtering systems might need substantial financial support as well as a lot of computational power. Algorithms of machine learning are used in this research. Custom recommendations are a feature that has been added to this project specifically for individuals who have had coronary artery disease, diabetes, or hypertension. Here, nutrition is divided up into four categories: salts, sugar, energy, and proteins. Although the user's or buyer's genetic information is always constant, the product recommendations are dynamic in order to deliver an accurate product that consistently meets user preferences.

The Proposed is a system that aims to provide a comprehensive solution to the intelligent systems layer. The objective of the food recommendation approach is to establish personalized meal plans based on the user's nutritional needs and food preferences. Previous research has focused on developing computational tools for food intake recommendations, but few have integrated user preferences and dietary data. This approach combines a short-term intelligent system with an optimization scenario that considers both tangible and intangible nutritional and personal taste knowledge, as well as nutrient context systems that use an MCDA approach to filter out inappropriate food choices. [11].

In [12], The system uses machine learning techniques to examine users' data such as age, gender, height, weight, body fat percentage, and preferences, such as weight loss or weight gain, to suggest diet plans for three categories: breakfast, lunch, and dinner. The system employs the K-Means and Random Forest algorithms to address individual challenges. Additionally, the system uses a dietary dataset from Kaggle for recommendations.

The proposed system that considers both the major meals, diabetic patients should have appetizers because of a scheme that considers their special circumstances and the danger of hypoglycemia. This system offers suggestions for a list of items that could be useful based on the user's traits, situations, and behavior. In this study, a system for recommending snacks to type II diabetics is developed and evaluated. It makes use of a roulette wheel algorithm, a

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knowledge-based approach, and constraint-based reasoning. This system implements a content- based filtering system that uses Euclidean Distance to suggest substitutes for food intolerances or distaste and generates a seven-day food plan based on an individual's requirements and food tastes [13].

In [14], The proposed system recommends a list of food items based on the patient's medical conditions and nutritional value. The user selects a main culinary component, and the system provides a recommendation for the ideal food to eat from the database based on the patient's health. The system evaluates the user's health and suggests foods based on any chronic illnesses or ailments they may be dealing with. The user's medical history is obtained from the specific hospital as soon as they log in, and the application offers the appropriate meal based on their health issue or disease. The system operates precisely and fully maintains the user's health.

The proposed system aims to enhance people's diets by responding to dietary advice with personalized, nutrient-rich recommendations. To calculate these recommendations, the system will rely on the USDA nutrient dataset, which contains valuable information on the nutritional value of various foods. Additionally, users will need to provide their BMI values as an input, which will be used to tailor the recommendations to their specific needs. Another key input for the system is the user's daily food intake, which will be used to calculate the deficit nutrition and identify the missing nutrients that need to be included in the recommendations. To ensure the recommendations are as effective as possible, the input nutrients dataset will be sorted based on the user's BMI value. Finally, any deficit nutrients will be filled by selecting the appropriate foods from the sorted grocery dataset, resulting in a personalized, well-balanced diet recommendation for the user. [15]

III. METHODOLOGY

A. *Data Generation*

Data generation involves collecting datasets from various sources, which can be labelled or unlabeled. If the data is unlabeled, it needs to be manually labelled to represent the class to which the object belongs. This labelling helps the learning model to identify the particular class when it encounters data without a label. As there were no publicly available datasets that considered specific user conditions such as kidney stones and diabetes, the data for this project was collected using web-scraping. Since the proposed method involves multi-label classification, the raw unlabeled data was manually labelled into chronic, anemic, and diabetic data, which were further labelled as breakfast, lunch, or dinner.

	A	B	C	D	E	F
1	cholesterc	glucose	Nutritiona	Hemoglob	age	gender
2	193	77	49	14.9	19	female
3	146	79	41	15.9	19	female
4	217	75	54	9	20	female
5	226	97	70	14.9	20	female
6	164	91	67	14.7	20	female
7	170	69	64	11.6	20	female
8	149	77	49	12.7	20	female
9	164	71	63	12.7	20	male
10	230	112	64	14.1	20	male
11	179	105	60	14.9	20	female
12	174	105	117	13	20	male
13	193	106	63	16.7	20	female
14	132	99	34	13.4	21	female

Fig. 1. Data Generation

B. *Data Preprocessing*

Data pre-processing is performed on raw data. It has traditionally been an important preliminary step. It includes cleaning, instance selection, transformation, feature extraction, and selection. It eliminates the irrelevant noises in the given input. The data collected in this project is obtained through web-scraping. Hence pre-processing of them had to be done to adjust them to the format of machine learning methods. The collected raw data may be labelled or unlabeled. The raw unlabeled data are manually labelled into chronic and diabetic data.

C. *Multinomial Analysis*

Supervised artificial intelligence faces several challenges, and one of the most common ones is multiclass classification. Multiclass classification problems arise when there are at least two types of outputs that need to be classified. This involves organizing data into categories based on their similarities and differences. To achieve this, we need to identify and select relevant features or independent variables that are critical for grouping the data into different categories. Multiclass classification is the process of separating data into multiple categories based on our dependent variable of interest.

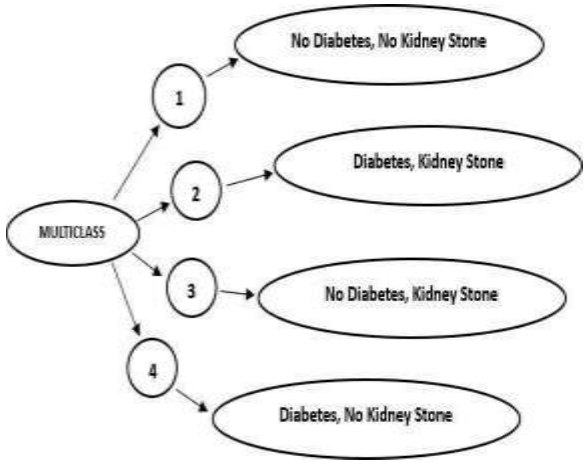

Fig. 2. Multiclass classification

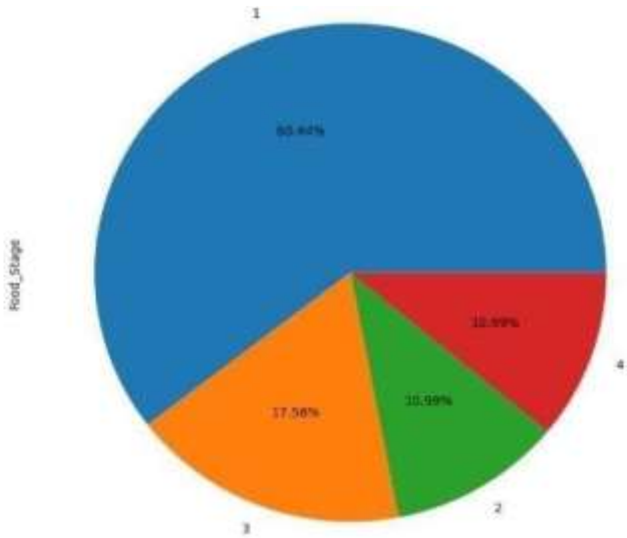

Fig. 3. Multinomial Analysis

DOI: rp-9788770040723.097

D. Experimental Environment Setup

The system architecture diagram provides a visual representation of the system's architecture, illustrating the connections between various system components, along with the purpose of each component. The general system representation depicts the primary system functions and the connections between different system parts. Pre-processing is done on the food dataset here, and the pre-processed data is then subjected to multinomial analysis and clustering to generate diet recommendations.

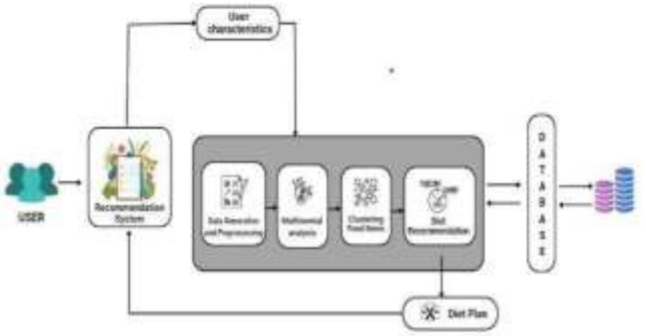

Fig. 4. System Architecture

E. Machine Learning Algorithms

1) Support Vector Machine

SVM among the most commonly employed methods for supervising learning, that is commonly used for classification and regression task. With the help of the SVM algorithm, researchers can classify new data points to make it easier in the future by creating a line of best, or decision boundary, that divides the n-dimensional space into groups. A hyperplane is this optimum decision boundary. SVM operates for producing the hyperplane by choosing the extreme points and vectors. The scientific name for the optimization technique as an SVM— one of the most popular techniques for Supervised Methods sustained vectors, and these extreme examples are defined as supported vectors.

2) Random Forest Classifier

Random Forest is popular ml algorithm that is commonly used as regression and classification task. The algorithm based on concept of ensemble learning, which involving combining many classifiers to enhance the accuracy of the particular model. It is a type of model that uses an ensemble of the decision tree, which are trained on using subsets of the provided datasets. The algorithm then takes mean of that predictions of all decision tree to enhance accuracy of the overall prediction. Unlike relying on just one decision tree, a Random Forest makes predictions based on the collective assessments of all decision trees in the ensemble, selecting the result based on the majority of predictions. By using multiple decision trees in the ensemble, Random Forest can increase accuracy and avoid the sampling.

3) Decision Tree Classifier

Decision trees classifiers can also be used for feature selection, where the most important features are identified based on their ability to split the data and classify instances correctly. This can help can also help to reduce the dimensionality of the input space. A decision tree is composed of a decision node and a child node. A leaf node represents the outcome of a decision without any subsequent branches, while a decision node represents the decision and has multiple branches. To make decisions, decision trees consider the features of the provided dataset. A decision tree is a visual representation of every possible solution for solving a problem or making a decision on given parameters. It is known a decision tree because it starts at root of the tree and grows in subsequent branches, resembling a tree. The Regression and Classification Tree (CART) technique is used to construct a decision tree.

4) MLP Classifier

Neural networks called multilayer perceptron produce result from predetermined inputs. A graph which is directed connect output layer and input layer of mlp consists of a several layers of modern output nodes. A multilayer perceptron is a powerful learning technique that creates an organization. Originally developed for image recognition, perceptron commonly referred to as computations. It carries out the human-like task of seeing, viewing, and it carries out human-like task of seeing, viewing, and identifying images. In essence, a multilayer perceptron is a cutting-edge neural structure with three different sorts of layers: input, output, and hidden. An input flag is delivered to an input layer for processing. The output layer carries out activities like prediction and categorization.

F. Clustering Food

The system could recommend a healthy diet plan according to the personal condition. Food is clustered into breakfast, lunch, dinner for recommendation. For the diet recommendation, we have devised our own algorithm which splits the foods into nutrients like fats, fiber, vitamins, etc.

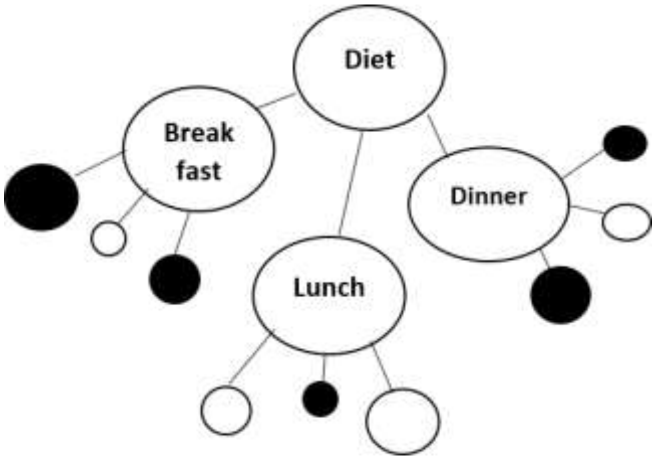

Fig. 5. Clustering food

And based on the nutritional requirements needed for a day a balanced diet is provided. The system also displays the BMI value under consideration and provides a diet plan to maintain them at normal. system could recommend the related diet plan to fulfil personalized needs by using multinomial analysis. Therefore, it would provide better service and experience for users.

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IV. Results and Analysis

Evaluating recall, F1 score and precision are commonly used to know the performance of classification models in accurately identifying instances belonging to a particular class. These metrics are crucial in determining the suitability of machine learning models for real-world applications and assessing their effectiveness. The Random Forest algorithm is a highly effective method, capable of handling complex nonlinear problems, managing large input datasets, and providing fast predictions. It has demonstrated an accuracy of 99% on various datasets.

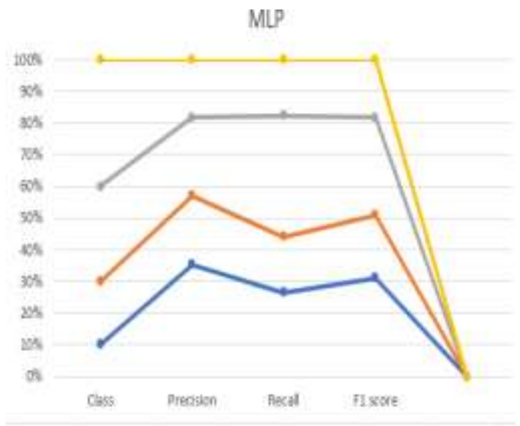

Fig. 6. MLP Analysis

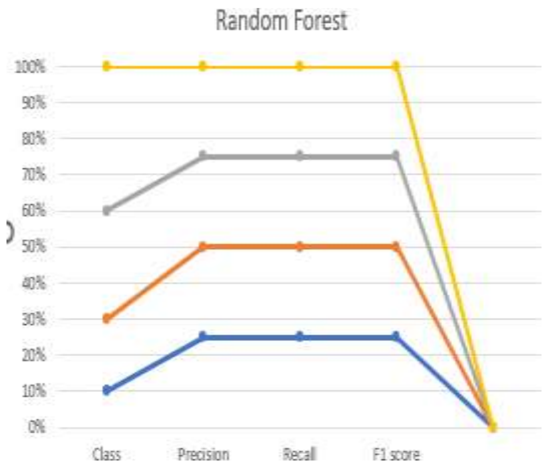

Fig. 7. Random Forest Analysis

Fig. 8. SVM Analysis

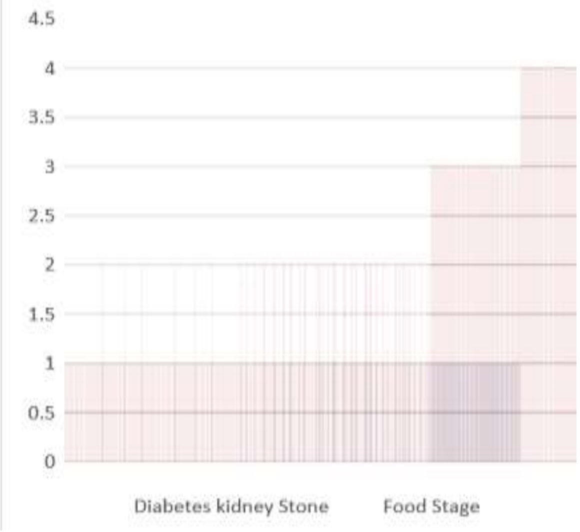

Fig. 9. Diabetes Kidney stone analysis

V. Conclusion

This study aimed to develop a web application that could provide personalized diet plans for patients based on their health status and other characteristics. The system used a machine learning algorithm to generate nutritional recommendations tailored to each patient's unique needs and medical conditions. Patient data was collected from various online sources, sorted, preprocessed, coded, and analyzed for similarities in order to train the model. Rapid prototyping was used to create and test the models using web scraping techniques. The results of the training and testing phases demonstrated that the proposed system was highly accurate and precise in generating personalized diet plans for patients.

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Private Hospital Finder

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***Abstract*—The development of this project is meant to serve as a general reference for you in the case that you require emergency medical care, particularly for a condition like pandemic. This website app essentially lists the top hospitals in Chennai City that are close to you. Several private hospitals charge exorbitant rates during emergency and epidemic circumstances by taking advantage of the circumstance. To make it easier for users to locate hospitals.**

Keywords—HTML, API, CSS

I. INTRODUCTION

The WHO has said that, about ½ of the whole population today lives in countries with a lack of access to high-quality healthcare (WHO).In actuality, according to the WHO, just 8% of the world's population has access to basic medical care. It's crucial to locate a reputable hospital that offers high-quality care if you want to make sure that everyone receives the greatest possible healthcare. Locating a closest hospital is also crucial. Some might be far and others might be found in urban areas. So that you won't have to worry about getting sick while you're there, make sure the hospital isn't too far from your house. Thus, it is crucial to select the best hospital for yourtheir locations and the treatments they offer, this project comprises hospital registration, saving their information in the system, and mentioning the availability of beds, treatments offered, ambulance service, and other services offered. PHP, Html, CSS, and JavaScript will be utilized for the application's front end, and Java technology and APIs will be used for the back-end processing.

Average length of stay for hospital patients, and encouraged interdisciplinary collaboration across departments.

System for scheduling hospitals that uses multi-agent correlation.In order to support hospital planning decisions, the hospital must organise a greater expansion in the interaction between physicians, hospital’s resources, care staff, and users. The need of this work is to give a system for planning hospitals. This employed data set, which contains about 110,500 medical appointments with the about 15 important characteristics, was assessed based on patient’s arrival, waiting , and completion time.Following hospital sections employ a few of these variables: For the best price for hospital scheduling, diseases including hypertension, diabetes, and alcoholism add aneeds.

The main goal of this project is to search hospitals based on specialised diagnoses, use hospital locations, bed availability, and ambulance service to accelerate your search for the closest hospital using KNN algorithm, and store the data of Private Hospitals that are being updated by hospital administrators to improve the user's searchfor hospitals. There are several excellent hospitals that use cutting-edge medical technology and equipment in addition to the best medical professionals to deliver top-notch care. Finding a goodhospital that offers high-quality care is crucial if this effort is topercentage of priorities to each patient's appointment. A simulation-based strategy is suggested for managing hospital schedules.

Precise predictions of the inpatient bed capacity are particularly crucial for capacity reserve at hospitals where judgements about acceptable rates of elective admissions are established in advance based on anticipated available bed capacity and emergencyrequests.The patient’s prediction who will be discharged thefollowing day can be used to establish the bed capacity for that day given the number of available beds.The quirks of daily dischargevariations, make it difficult to choose the best options, even if time-guarantee that everyone receives the greatest possible healthcare.

II. RELATED WORK

Hospital information systems, one of the important subfields of medical informatics, are intended to link all hospital departments to a wide information network in order to streamline the entire hospital system, according to the International Academic Community. The HID-Hospital information department used the Oracle database to create a number of secure, dependable, and user-friendly beds resource management information systems in response to the difficultyin receiving medical care in China. This article describes the functional requirements for HIS. This strategy enhanced the efficiency of bed resource management, considerably decreased theseries models may capture these qualities effectively.A seasonal regression and ARIMA model, a seasonal ARIMA multiplicative model, and a combinatorial model based on weighted Markov Chain models are all investigated in this paper. These simulations aim to predict daily outflows. The models are calibrated using hospital discharge data spanning three years.

For the hospital triaging system, they have created a mobile application and desktop platform. The process of triaging involves ranking the priority of a patient's care at a hospital. Triage profiles for patients, which include name, age, gender, medical data, and triage category, can be stored in and accessed by the system's knowledge base. Many user experience features built into the created graphical user interface (GUI) make the system simpler to operate. Both

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desktop and mobile devices can use the system because it has been turned into an application.

Registered nurses used the application to test it out by using it to respond to sets of questions that included walk-in patient triage scenarios. The nurses' opinion was mostly positive, stating that the software made the process more efficient than it would have been if it had been done manually.

This article discusses the best patient scheduling issue with targeted acceptance ratios as well as the best inpatient room allocation for a variety of patients in public hospitals.Hospitals must limit patient access and distribute limited resources across a range of patient categories in order to maximise hospital income and preserve service equity.Two steps are taken to present the models for the problem. Our model takes into account any variations in patient arrival and stay times.By employing a simulation model and a linearization technique to reformulate the constraints as the constraints of knapsack, we are able to solve this problem. CPLEX.

The paper provides a distributed, integrated framework for the Hospital's in National Taiwan University Hospital Information Systems (HIS) and Healthcare Enterprise Information Portal (HEIP) (NTUH). A single solution has been created for the customer relationship management system for a Hospital, offered by HEIP . The latest HIS outpatient information systems (OIS) are discussed in terms of their results. Future HEIP initiatives are mentioned, including e-learning, RCD, and online immunisationprogrammes. Also offered are middleware-based integrated HEIP and HIS designs and practical fixes.To assess the performance of the architecture. Almost 25 years ago, the hierarchical IMSDB databases and IBM/SNA were used to develop the healthcare information system (HIS) for the National Taiwan University Hospital (NTUH).

The prevalent poor management of hospitals has recently come to light because to First Come, First Serve (FCFS) hospital bed rules. Importantly, the General Utility Function is used by our proposed system to decide the hospitalisation orders of patients. We employ our own TOPOSIS Method that is Modified as the assessment method for the Six-stage HBAMS, with the Monte Carlo Simulation Algorithm serving as a second layer of verification.The results show that this system is an effective method for addressingthe poorly situated hospital beds that currently exist. We provideis then used to solve the deterministic programming model that ishospital administration with a mechanism to adapt the model to theproduced from the challenging NSP model. In addition, we provide a mixed-integer two-stage stochastic programme and a target programme to optimize the patient scheduling based on allotted capacity and anticipated AR.

Lower death rates are a positive indicator of a nation's efficient healthcare system. To reduce the fatality rate, a critical patient should be transferred as quickly as possible to a hospital with the required tools. It is not necessary to emphasise the importance of Golden Hour in cases of traffic accidents. To do this, ambulances should be able to travel freely on our highways.The autonomous ambulance management system uses the internet of things. Thiswill find the nearest hospital, determine the quickest way, provide critical information to the hospital beforehand, and control the traffic signal as well to ensure that the ambulance can move forward without incident. An effective and successful way to contribute to lifesavingacts in order for the Six-stage HBAMS to be extensively deployed.

[1] The electronic ward bulletin board system and the self- service guidance system are now part of the standard hospital information system (HIS). The touch screen for the self-service guide system could be positioned in the outpatient lobby. Patients benefit from choosing and finding a doctor or specialist based on where they are ill.Visitors can access the ward's electronic bulletin board system to learn about visitation times and other safety information. The idea of pervasive computing makes it possible to combine actual healthcare services with online informational offerings. After then, patients could easily access information services. The Hospital Information System will function better as a result, increasing efficiency and service quality. By pervasive computing, information and computing are incorporated into people's homes. As a result, the virtual world in the information realm and our physical world converge. Information and computing services are available to residents whenever and wherever they need them.There are numerous online services available in almost every business thanks to contemporary web technologies. Every major sector is converting to digital and building a digital face for all of its fundamental operations in order to compete more effectively in the expanding digital market.Using duplicate approaches will not benefit either the individual or the organisation in the modern environment due to the highly quick flow of information. Internet access is arequirement for all contemporary enterprises that want to operate effectively. One of these industries where information should be swiftly and effectively digitised is healthcare.This research focuses on that particular problem and paves the way for the creation of software that makes it easier to convert paper-based documents to electronic ones. The article suggests E-Medical Management, which would increase the efficiency of patient management, doctor scheduling, and provide access to patient data to all hospital staff, and describes a plan for a web-based platform that would replace the need for paper prescriptions in hospitals.

[2] There are numerous online services available in almost every business thanks to contemporary web technologies. Every major sector is converting to digital and building a digital face for all of its fundamental operations in order to compete more effectively in the expanding digital market.Using duplicate approaches will not benefit either the individual or the organisation in the modern environment due to the highly quick flow of information. Internet access is a requirement for all contemporary enterprises that want to operate effectively. One of these industries where information should be swiftly and effectively digitised is healthcare.This study concentrates on that specific issue and lays the way for the development of software that facilitates the conversion of paper-based

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documents to electronic ones. The article describes a proposal for a web-based platform that would replace the need for paper prescriptions in hospitals and suggests E-Medical Management, which would improve the effectiveness of patient management, doctor scheduling, and give access to patient data to all hospital employees.

[3] India's health care system, like those of many other nations, is dealing with an increase in the demand for medical services and care. The full medical history of the patient must be included in the medical records. Because this record serves many objectives, doctors must keep perfect records. In order to address the issues associated with the manual technique, this study on hospital management systems is intended to convert the manual way of looking for, classifying, storing, and retrieving hospital information (files) into an electronic medical record. After researching the current system, computer-based software was developed to take the role of this manual process. As patients enter and exit the hospital, these computer-based systems generate patient reports.

[4] A computerised or web-based system called a hospital management system makes it easier to oversee how a hospital or other medical facility runs. This programme or technology will assist in making the entire operation paperless. It incorporates all patient, physician, hospital administrative, etc. information into a single piece of software. It has sections for the many types of hospital personnel. The receptionist can immediately check the availability of rooms and beds using HMS in order to change patienttransfers from one ward to another or assign the bed to the incomingpatient. To keep tabs on patients who have been discharged, this data is updated continuously. The comprehensive schedule for the operation theatres is also included in this section. Knowing assists the front desk agent or the nurses.

[5] An intelligent HMS was developed for the benefit of patient’s checking in at a hospital. They will have access to information about the doctor’s, appointment times, relevant offices, laboratory testing, and specific medications for his or her condition.At the hospital entrance, the system will offer patients an intelligent front desk information service. Also, it will give doctors software aid so they can diagnose quickly and efficiently by utilising the program's decision-making process. A hospital's administrative, financial, and clinical aspects are managed by the developed system, a thorough and integrated information system. The system seeks to provide the greatest electronic data processing assistance for patient care and administration as a subfield of medical informatics. This includes both electronic and mechanical data processing as well as information processing on paper.

[6] Many benefits of an advanced hospital management system include improved patient care, strict cost control, enhanced profitability, and better administration and control. IHMS was created and intended to provide hospitals with quantifiable benefits. It is strong, adaptable, and simple to use. More significantly, it rests on solid and trustworthy foundations.The object-oriented, networking, and database ideas are the foundation of the "Advanced Hospital Management System" project. We employ MY SQL software, one of the greatest and most user-friendly programmes, even though we maintain records in databases across a range of fields.The front-end software for the project is created in Java, an Object-Oriented Programming language with MY SQL support. To address the requirements of big and mid-sized hospitals worldwide, the Advanced Hospital Management System was developed.All of the necessary modules and functionalities have been developed with your requirements in mind. Customers in India and abroad have largely approved of this bundle.

[7] The objective of this article is to automate hospital front office management through the development of user-friendly, efficient, and inexpensive software. It focuses on gathering patient data, including details on diagnoses, etc. In the past, it was manual. The objective of the system is to enter, store, and retrieve patient and physician data as needed, as well as to modify this data in an usable manner. Data pertinent to the patient and diagnostic make up the system input, and the system output are the details which are shown on the screen. The HMS can only be accessed with the proper credentials. It is accessible to administrators and front-desk employees. Only they have the ability to add information to the database. Access to the information is simple. Data processing is quick since the data is securely safeguarded for personal use. The human body is ahighly clever and complex structure that performs millions offunctions. He was able to understand all of these complex activities through his research and tests.

[8[To manage daily operations and hospital activities, a well-organized computerised system known as a "hospital management system" was built. The application can handle inpatients, outpatients, records, database treatments, status ailments, pharmacy billings, and labs. It also records hospitalinformation such as ward IDs, in-charge physicians, and department administrators. Receiving a report after a consultation is currently the biggest problem facing patients.Patients cannot view hospital records outside the building, despite the fact that many hospitals maintain reports in their systems. We will offer the option to store the report in a database as part of this project, making it accessible from anywhere in the world. The hospital management system project involves data storage, lab and pharmacy automated billing, and patient registration. The software, which also automatically stores staff and patient information, can provide each patient with a unique ID. You can use the search option to see the current performance of each room.

[9] Nowadays, web-based technology provides a wide range of online services in nearly every industry. As almost everything can be done online, less tasks, expenses, and efforts are involved. The idea of a web platform that would provide access to various medical and hospital processes online using Web, networking technologies is discussed in the article. This platform could be crucial in implementing the capabilities of online medical administration. This will aid in the administration of patients, the management of doctor schedules, and the maintenance of patient data that are accessible throughout the hospital. online patient data

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storage, management, communication, analysis, and updating.

[10] A smart hospital system is a part of the infrastructure whose efficient operation, upkeep, and maintenance heavily rely on the actual resources made available to them. This paper's goal is to outline the technological foundations for a smart hospital management system. In fact, widespread adoption of IOT has a significant impact on raising hospital administration standards, enhancing patient convenience, and enhancing medical treatment quality. Then, a review of the smart hospital system is given, along with various approaches for analysis and modeling. Smart systems integrate sensor, actuators, and control capabilities so that the characterise and evaluate a condition and make decisions based on the availability of data in a adaptive way.A healthcare system is actually an arrangement of individuals, organizations, and assets that provide health services to fulfill the needs of target populations. The public's opinion of healthcare is evolving quickly as a result of medical advances.

[11] In Oman, there are numerous private hospitals. Several hospitals have their own web-based programmes that manage patientappointments and provide information on the services the hospital offers. Yet, there isn't a web-based tool that offers a standard, integrated platform for comparing the services offered by different hospitals and managing patients' doctor visits. The goal of this study paper is to integrate the services offered by several private hospitals. The aim of this project is developing a web-based application prototype and offer an implementation plan for creating an integrated solution. By allowing patients to quickly compare the services of several hospitals and select the hospital of their choice by conveniently scheduling appointments from their homes and avoiding lengthy waiting lines at hospitals, this research aims to serve the community in Oman. The proposed prototype system may track a patient's medical history and handle the details of their therapy.

[12] A state-of-the-art database idea that includes patient and hospital's details. It is a particular type of database that also records patient data. Record manipulation can be prevented by utilising this concept. The potential of losing crucial data exists, but by putting this idea into practise, we can maintain a backup of all data. Also, the data are completely safeguarded. Data must be made accessible in a way that everyone may use it. Every single patient will have their own unique ID and password. Updates are also made to the patient's registration form, which includes the patient's name, address, phone number, and date of birth. The data will be shared throughout hospitals, and each patient will have access to their own personal information. Hospital management is related to the integrated hospital information system, which encompasses every operational aspect of multi-specialty hospitals. Aspects of hospital administration include improvedpatient'scare,safety,confidentiality, effectiveness, and a better management information system.

III. SYSTEM ARCHITECTURE

In order to improve the user's ability to search for hospitals, the suggested system seeks to store Private Hospitals' information as it is updated by hospital administrators. Search hospitals based on the specialised diagnosis, use hospital locations as an input to the KNN algorithm, bed availability, doctor availability, quality of the doctor's care provided, success rate of the operations performed by the respective doctors, success rate of the hospital, and ambulance service which are the key factors to speed up your search for the best nearby hospital.

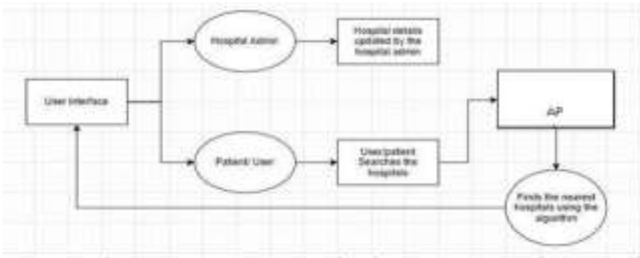

Fig. 1. System Architecture

IV. RESULTS

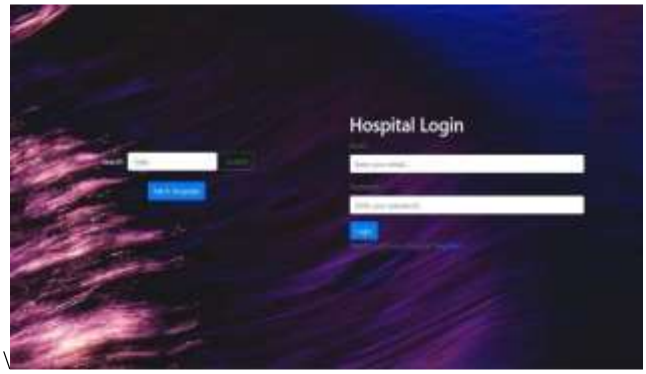

Fig2. Home page

The Home page or the index page is the heart of the system since the whole process starts from this page. It consists of three fields and four buttons where one field is used of searching the hospitals based on the name ,treatment and diagnostics provided and submit button triggers the keyword search and the Fetch hospitals button will provide all the hospital's details which will be sorted so that the nearest hospital will be viewed first. On the other side there are the fields required for the hospital admin's for logging into the system by providing the required credentials and the Register button will be used by the hospital's admin to register their hospital into our system for the first time.

Fig. 3. Admin page

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In the admin page the current details of the hospital will be available along with the option to update the details of the hospital such as treatments provided,diagnostics provided, availability of ambulances and beds, details of the doctors working in that hospital and the location of the hospital.

Fig. 4 User's Page

In this page the details required by the user or patient will be provided with accurate location and even the direction to that hospital is provided using the google map.

V. CONCLUSIONS

This study focused on the hospital management system, which enables users to look up patient records at the closest hospitals. The significance of time is now complete. The database aims to cut down on the patient's time spent looking up hospitals for their particular therapy. Also, this lowered the amount of space the data took up and gave the patient's medical records acceptable protection. According to the study's findings, the problem with the existing manual approach of manually searching the hospital will be solved by the design of hospital database records.

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Design and Development of Configurable and Customizable Systems a Lightweight Operating System Framework for Smart Devices

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***Abstract*—A growing demand for lightweight, flexible operating systems is being driven by the exponential growth of smart gadgets. A framework for creating lightweight operating systems for smart devices has been created and put into place in answer to this demand. This framework offers a configurable system that may be set up to satisfy the particular needs of various smart devices. The design and development of this framework, as well as its salient characteristics and practical uses, are presented in this study.**

In recent years, there has been a tremendous increase in the development of smart gadgets, with more and more devices being created to offer diverse functionality in many industries. However, the necessity for particular operating systems that are tailored to the needs of the devices has slowed down the development of these gadgets. This has made it more expensive and time-consuming to produce new products, and it has also made it more difficult to quickly adopt to changing market conditions and cutting-edge technological advancements. In this study, we suggest creating a lightweight operating system architecture for smart devices that is both programmable and adaptable.

The suggested framework has been created to offer a flexible environment for creating smart devices. The framework is compact and offers only the capabilities that are absolutely necessary for the gadget to run properly. This minimizes development time and costs by ensuring that the framework may be readily adapted to other devices. Additionally, the framework offers developers a flexible environment by enabling operating system customisation to fit the unique requirements of the device.

The suggested framework is based on a modular structure that enables simple system component customization and change. As a result, the operating system may be improved and tailored to the particular device by adding new functionality or removing unused ones. Additionally, the modular structure makes it simple to test and debug individual components, making it simpler to find and address any problems that could occur during development.

The suggested framework has built-in security mechanisms that offer defense against potential assaults to guarantee the security of the system. These characteristics, which ensure that the system is safe even in the case of a security breach, include secure booting and secure storage.

A software development kit (SDK) that gives programmers a selection of tools for creating apps for the device is also included in the proposed framework. The SDK makes it simple for developers to create apps that run on the device by providing libraries and tools for creating programs in various programming languages. The SDK also has examples and documentation to aid developers in starting the development process.

We created a proof-of-concept prototype and integrated it into a smart thermostat to test the suggested framework. The framework's adaptability and customizability wereproven by the prototype, which also showed how the operating system could be changed and tailored to fit a particular device's needs.

The suggested lightweight configurable operating system architecture offers a versatile and effective environment for creating smart devices. Developers will have the flexibility to tweak and personalize the operating system to match the unique requirements of the device thanks to the framework's modular and configurable nature. The system is safe even in the case of a security breach because to the built-in security mechanisms, which defend against potential assaults. It is simple to create programs that operate on the device thanks to the software development kit, which gives developers a collection of tools for designing applications for the device. The suggested framework offers a versatile and effective environment for creating smart devices while also having the potential to dramatically cut down on development time and expense.

Keywords*—*operating system, framework, smart devices, design, development, apps, configurable, lightweight.

I. Introduction

An increased need for lightweight, flexible, and adjustable operating systems has arisen as a result of the widespread use of smart devices. A framework for creating and creating lightweight operating systems for smart devices has been created in answer to this demand. This framework offers a configurable system that may be set up to satisfy the particular needs of various smart devices. The design and development of this framework, as well as its salient characteristics and practical uses, are presented in this study.[1]

With more gadgets being created to offer various functionality in numerous industries, smart devices have experienced a major increase in popularity. Smart gadgets, which offer ease and functionality that was previously unthinkable, have become indispensable tools in our everyday lives. Examples include smart thermostats, smart home security systems, and smart health monitors. However, the necessity for particular operating systems that are tailored to the needs of the devices has slowed down the development of these gadgets. This has made it more expensive and time-consuming to produce new products, and it has also made it more difficult to quickly adopt to changing market conditions and cutting-edge technological advancements.

The creation of an operating system for smart devices is a difficult process that needs a lot of time, money, and knowledge. The operating system must be modified to fit the device's unique requirements, including its hardware and

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software requirements. Particularly for small to medium-sized businesses that do not have the means to design their own operating system, this procedure can be time-consuming and expensive.

We suggest creating a lightweight operating system architecture for smart devices that is programmable and flexible in order to address this problem. The framework has been created to offer a flexible environment for creating smart devices. The framework is compact and offers only the capabilities that are absolutely necessary for the gadget to run properly. This minimizes development time and costs by ensuring that the framework may be readily adapted to other devices. Additionally, the framework offers developers a flexible environment by enabling operating system customisation to fit the unique requirements of the device.

The suggested framework is based on a modular structure that enables simple system component customization and change. As a result, the operating system may be improved and tailored to the particular device by adding new functionality or removing unused ones. Additionally, the modular structure makes it simple to test and debug individual components, making it simpler to find and address any problems that could occur during development.

The suggested framework has built-in security mechanisms that offer defense against potential assaults to guarantee the security of the system. These characteristics, which ensure that the system is safe even in the case of a security breach, include secure booting and secure storage.

A software development kit (SDK) that gives programmers a selection of tools for creating apps for the device is also included in the proposed framework. The SDK makes it simple for developers to create apps that run on the device by providing libraries and tools for creating programs in various programming languages. The SDK also has examples and documentation to aid developers in starting the development process.

The flexible and effective environment for designing smart devices is made possible by the adaptable and customizable lightweight operating system architecture, which also has the ability to dramatically cut development time and costs. Better user experiences may be achieved by developing more effective and optimized systems, which are made possible by the ability to adjust and tailor the operating system to match the unique needs of the device. Additionally, the system is protected from potential assaults by the built-in security safeguards, guaranteeing that even in the case of a security breach, the system is secure.

The suggested lightweight configurable operating system architecture offers a versatile and effective environment for creating smart devices. The framework is designed to be modular and adaptable, enabling programmers to change and adapt the operating system to suit the particular needs of the device. The system is safe even in the case of a security breach because to the built-in security mechanisms, which defend against potential assaults. It is simple to create programs that operate on the device thanks to the software development kit, which gives developers a collection of tools for designing applications for the device. Overall, the suggested framework offers a versatile and effective environment for creating smart devices while also having the potential to dramatically cut down on development time and expense.

II. Background

Operating systems that are tailored for these devices are now necessary due to the extensive use of smart gadgets including smartphones, tablets, smartwatches, and smart home appliances. While conventional operating systems like Windows and Linux can function on these gadgets, they frequently use a lot of resources, which causes sluggish performance and shorter battery life. Additionally, the unique requirements of smart devices are not always taken into consideration when standard operating systems are developed.[2]

Lightweight operating systems that are tailored for smart devices have been created to solve these problems. These operating systems' reduced resource requirements lead to better performance and longer battery life. Moreover, they are frequently flexible and adjustable, enabling them to be adapted to the unique requirements of many smart devices.[3]

Nevertheless, creating a lightweight operating system that is specifically tailored for a certain smart device can be difficult and time-consuming. A framework that offers a configurable system that can be set up to match the particular needs of various smart devices has been designed to streamline this procedure. With the help of this framework, programmers may rapidly and effectively design unique lightweight operating systems, cutting down on both development time and expenses.[4]

The framework's flexibility and scalability make it suitable for usage in a variety of smart devices, from tiny wearables to substantial smart home systems. It offers a number of capabilities, including as support for various hardware architectures, device drivers, and frameworks for application development.[5]

This framework's conception and creation mark a significant advancement in the creation of thin operating systems for smart devices. The framework enables developers to build operating systems that are tuned for the unique requirements of various smart devices, enhancing performance and battery life while cutting down on development time and costs.[6]

III. Methodology

The following stages were taken during the design and development of the adaptable and lightweight operating system architecture for smart devices:[7]

1. *Requirements identification*: The first phase entailed determining the framework's needs. This involved determining the characteristics that would be necessary in the operating system to fulfil the demands of various smart devices and comprehending their unique requirements.

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2. *Hardware architecture selection*: The choice of the hardware architecture that the operating system would support came next. This required choosing the hardware that the operating system would require compatibility with, such as the CPU, memory, and other hardware elements.

3. *Selection of software components*:The third phase entailed choosing the software elements that the operating system would need. Choosing the kernel, device drivers, and application frameworks needed to build a lightweight operating system was part of this process.

4. *Component customization*:After choosing the software components, the following stage was to tailor them to the unique needs of various smart devices. To make sure that the kernel, device drivers, and application frameworks were compatible with the chosen hardware architecture, this required modifications.

5. *Integration of components*:The operating system foundation was then updated to include the modified components. In order to establish a solid and dependable operating system, it was necessary to make sure that all of the parts coordinated perfectly.

6. *Testing and validation*: The operating system framework was tested and verified in the last stage. To make sure the operating system was stable, dependable, and worked effectively on a variety of smart devices, this meant completing a number of tests.

IV. APPLICATIONS

The creation of smart devices can use the lightweight operating system foundation in a variety of ways. The following are a few uses for this framework:

1. *Wearables*: The architecture may be applied to the development of thin operating systems for wearables including smartwatches, fitness trackers, and smart eyewear. These operating systems may be modified to match the particular requirements of various wearables, enhancing performance and battery life.

2. *Smart home appliances*: The framework may be used to design compact operating systems for appliances in the smart home, such as cameras, locks, and thermostats. These operating systems offer enhanced performance and interoperability since they can be modified to cater to the unique requirements of various smart home devices.

3. *Automotive*:The framework may be used to develop lightweight operating systems for telematics, entertainment, and advanced driver assistance systems in automobiles (ADAS). These operating systems may be modified to cater to the particular requirements of various automotive systems, improving performance and usefulness.

4. *Industrial automation*: The framework may be used to design compact operating systems for SCADA, PLC, and HMI systems used in industrial automation. These operating systems may be altered to satisfy the particular requirements of various industrial automation systems, enhancing performance and dependability.

There are several uses for the lightweight operating system architecture in the creation of smart devices. The framework gives programmers the tools they need to construct operating systems that are tailored to the unique requirements of various smart devices, enhancing performance and compatibility.

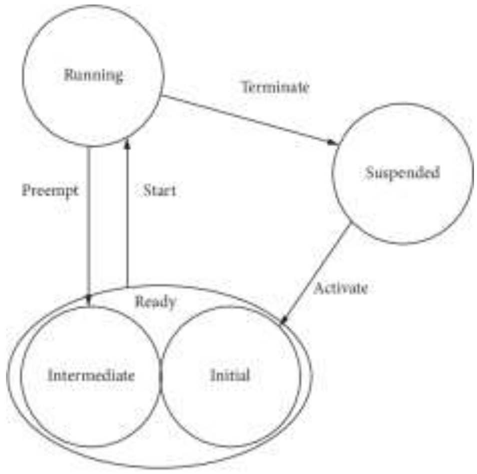

Fig. 1.Lightweight operating system framework

V. RESULTS

The goals of this project have been accomplished through the design and development of the lightweight operating system framework for smart devices that is adjustable and adaptable. The principal outcomes of this initiative are as follows:

1. *Customizable and Configurable*:The operating system framework enables developers to modify the operating system to fit the unique requirements of various smart devices. Its adaptability guarantees that the operating system operates at its best on various hardware architectures, which enhances performance and battery life.

2. *Lightweight:*Because the operating system foundation is lightweight, it uses less system resources, which leads to quicker boot times and better performance.

3. *Steady and Trustworthy*: The operating system architecture has undergone comprehensive testing to guarantee that it is dependable and stable, offering a solid foundation for the creation of smart devices.

4. *Support for Multiple Hardware Architectures:*The operating system framework is appropriate for a broad variety of smart devices since it supports diverse hardware architectures.

5. *Open-Source*: The operating system framework is open-source, which means that developers are allowed to use and modify it.

VI. CONCLUSIONS

The limits of conventional operating systems have been overcome, and a new platform for the creation of smart devices has been created through the design and

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development of a programmable and adjustable lightweight operating system framework. The following are the project's main conclusions:

1. *Personalization is Important*: A one-size-fits-all approach to operating system development is insufficient for smart devices since their needs differ. With the help of the operating system framework created for this project, programmers may construct operating systems that are tailored to the particular requirements of various smart devices.
2. *Lightweight Operating Systems Improve Performance*:The project's lightweight operating system foundation uses less system resources, which leads to quicker boot times and better performance. This is crucial for smart gadgets that run on batteries.
3. *Creativity is Encouraged by Open-Source Development*: The operating system framework is being made open-source as part of this project to promote developer cooperation and creativity. With the help of this open-source methodology, developers may build on one another's work to create better operating systems for smart devices.
4. *Improved Compatibility*:This project's operating system framework supports many hardware architectures, making it appropriate for a variety of smart devices. As a result, interoperability is increased and programmers may make operating systems that run on many smart devices.

The flexible and adaptable lightweight operating system architecture created in this research offers a new development environment for smart devices. The framework's adaptability, reliability, and lightweight architecture make it a desirable choice for developers who want to construct operating systems for a variety of smart devices. The open-source strategy also promotes developer cooperation and creativity, which will help the operating system framework grow over time.REFERENCES

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Design of Virtual BrainUsing IOT

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Abstract—Virtual brain research is ramping up the development of low-cost real-time brain-computer interfaces (BCI). Hardware advancements that improve the capabilities of Virtual brain analysers and Brain Computer wearable sensors have enabled the development of various new software frameworks for developers to leverage and construct applications integrating BCI with IoT. It also offers various sensory channels for larger-sized data transmissions to users' brains. The intersections of these two research lines are advancing both sectors and will drive the requirement for an energy-aware infrastructure to serve the mobile cloud's broader local bandwidth demands. In this study, we conduct a survey of BCI in IoT from several viewpoints, including EEG-based BCI models, machine learning, and current active platforms. Based on our research, the key findings of this study emphasise three important BCI development trends: EEG, IoT, and cloud computing.

Keywords—EEG, IOT, Virtual Brain, Cloud Computing.

I. INTRODUCTION

The capacity to map the human brain at multiple sizes with better throughput and resolution is at the top of the list of the US Government's BRAIN Initiative. A full depiction of the brain anatomy will reveal fresh insights into how the human brain works and may aid in the development of novel therapies and drugs for brain illnesses. Recent advancements in intact brain imaging, such as the CLARITY and MAP (Magnified Analysis of the Proteome) tissue clearing procedures, allow for the collection of huge volumetric pictures of brain tissue at cellular and subcellular levels[3]

However, the tremendous volume and resolution of brain images presents a difficulty for effective processing and interpretation. We created an automated dense axonal fibber tracing process that can track long-distance fibbers and build 3D connection maps that contain not only the vertices and edges of a network graph, but also the 3D position information associated with each fiber's track. In addition to standard graph analysis, we are interested in discovering long-distance neuron fibre connections and fibre crossings, both of which might show interesting patterns when evaluated at cellular resolution and at a long distance (1 mm). Brain graphs provide a framework for representing structural or functional topology at several levels. There are several software tools available for analysing the topology of brain networks utilising graphs[4].

The Apache Accumulate database is based on Google's Big Table database and enables for quick ingestion and extraction as well as the storage of enormous amounts of data. The Dynamic Distributed Dimensional Data Model (D4M) is a mathematical framework based on associative array mathematics that has been used to a variety of disciplines including cyber security, biology, free text, and social media data. D4M may also be utilised within a database to execute linear algebraic calculations.D4M integrates easily with the pMatlab parallel computing environment, which enables MATLAB/Octave programmers to employ a single-program-multiple-data (SPMD) parallel programming approach. PMatlab is a message passing interface library that has been used for a number of parallel applications[1].

Synchronized activity appears to offer functional connections, both locally and between distant brain areas. Thus, brain networks are made up of physically dispersed but functionally coupled information-processing areas. Brain connection analysis is based on three distinct but related types of connectivity. (i)Anatomical connection (AC), also known as structural connectivity, is a type of connective formed by synaptic interactions between neighbouring neurons or fibre trackslinking neuron pools in geographically distant brain areas. White matter refers to the whole set of such fibber tracks in the brain. Anatomical connections are extremely enduring and robust on short time scales (sec, min), although significant plasticity can be detected over longer time spans. (ii)Functional connectivity (FC), defined as the temporal dependence of neuronal activity patterns from physically distinct brain areas[2].

These network topologies represent two fundamental concepts underpinning brain information processing: functional segregation and functional integration. Neuroimaging techniques (EEG, MEG, fMRI, PET, and SPECT) and neuroanatomical approaches provide the majority of the experimental evidence supporting such network topologies. Signal transmission across different brain areas necessitates connecting fibre tracts, which provide the structural foundation of the human connective.

As a result, 3D-PLI enables an independent review of DTI data. Brain connection may be measured by encoding neighbourhood relationships into a connectivity matrix, the rows and columns of which correspond to distinct brain areas[5].

This form lends itself to mapping to a graphical model, which allows for the quantification of many topological properties of the connectome. Graphical models provide a flexible mathematical framework for studying pairwise relationships between interacting brain areas in general. In recent years, there has been an exponential development in

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the number of papers relating to the use of graph theory to uncover structural, functional, and effective connection aspects from neuroimaging investigations[6].

This is not meant to be exhaustive, but rather to highlight some common works in this topic.

Following that, various interesting applications and contemporary computational approaches dealing with functional connectivity are gathered. This is followed by a brief review of recent research on effective connectedness. Finally, the critical notion of graphical models applied to such complicated brain networks is presented, as well as potential applications to connection analysis[7].

II. Literature Survey

T. R. Insel et.al., discussed about the BRAIN Initiative, which aims to create breakthrough technologies to investigate how the brain's cells and circuits interact at the speed of thinking and, ultimately, to uncover the intricate relationships between brain function and behaviour. The problems are unique because brain architecture ranges from the size of chemical interactions at trillions of synapses to the billions of cell bodies that join to build local networks that subsequently integrate across different brain regions. There are temporal scales in addition to spatial scales since brain circuits are not static but constantly alter as a result of neuronal activity, developmental stage, and ageing.

K. Chung et al. explained how hydrogel-based structures may now be formed from within biological tissue to allow future removal of lipids without mechanical disassembly of the tissue. This method results in a tissue-hydrogel hybrid that is physically stable, retains fine structure, proteins, and nucleic acids, and is permeable to both visible-spectrum photons and foreign macromolecules. Here, we emphasise the approach's significant limitations and prospects, particularly in terms of integration with other approaches for brain-mapping investigations.

J. Swaneyet.al., discussed about magnified analysis of the proteome (MAP), which linearly extends whole organs fourfold while maintaining their general architecture and three-dimensional proteome structure. The concept of MAP is based on the finding that limiting crosslinking between and between endogenous proteins during hydrogel-tissue hybridization allows for spontaneous expansion following protein denaturation and dissociation. The protein composition, tiny subcellular features, and organ-scale intercellular connections are all preserved in the enlarged tissue. We employ commercial antibodies for repeated rounds of immunological labelling and imaging of a tissue's enlarged proteome, and our results show an 82 percent success rate (100/122 antibodies tested). We showthat in the mouse brain, specimen size may be reversibly changed to scan both inter-regional connections and precise synaptic topologies.

S. M. Smith et.al.discussed aboutto evaluate alternative connectivity estimate methodologies, FMRI data for a wide range of underlying networks, experimental protocols, and problematic confounds in the data were collected. Our findings demonstrate that correlation-based approaches may be highly successful in general, methods based on higher-order statistics are less sensitive, and lag-based approaches perform extremely badly. More specifically, several methods, including partial correlation, regularised inverse covariance estimation, and several Bayes net methods, can provide high sensitivity to network connection detection on good quality FMRI data; however, accurate estimation of connection directionality is more difficult to achieve, though Patel's can be reasonably successful.

III. System Analysis

A. *Existing Method*

- In terms of identifying brain activity, BCIs are currently pretty incorrect.
- Outside-of-the-head BCIs have limited ability to interpret brain impulses.
- They can be implanted under the skull, but this involves major surgery.
- Reading people's inner thoughts raises a slew of ethical concerns.

B. *Proposed Method*

A full depiction of the brain anatomy will reveal fresh insights into how the human brain works and may aid in the development of novel therapies and drugs for brain illnesses.

➢ We examine extant BCI VR research from three critical perspectives: EEG-based BCI models, machine learning, and platforms. The findings can be utilised as a starting point for future relevant study.

IV. System Requirements

Hardware Requirements

- ➢ EEG Electrodes
- ➢ Signal conditioning
- ➢ Amplifier
- ➢ TFT controller
- ➢ PC 2.5

Software Requirements

- ➢ MPLAB IDE
- ➢ Embedded C Language
- ➢ Hi-Tech Complier

V. Working Modules

- ➢ Sensors Architecture
- ➢ Serial Communication System & Sensor Monitoring
- ➢ Sending Mail & Storage

A. *Sensor Architecture*

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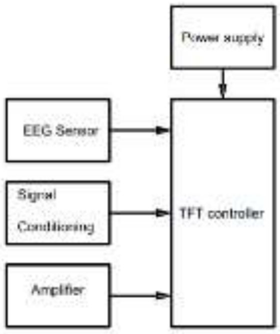

Fig. 1. System Architecture

- The power supply provides total power to the sensors and TFT controller.
- An electroencephalogram (EEG) is a test that measures electrical activity in the brain.
- Electrical impulses allow brain cells to communicate with one another. An EEG can be used to detect possible issues connected with this activity. Signal conditioning is a data collecting procedure that uses an equipment called a signal conditioner.

B. *Serial Communication System & Sensor Monitoring*

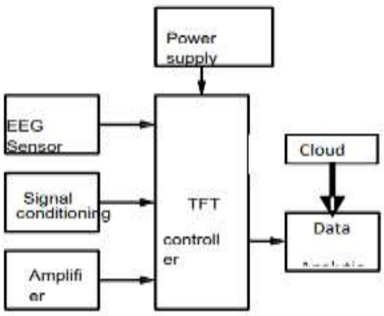

Fig. 2. Block Diagram

- Communication between Data Analytical and Cloud occurs in this Module.
- A healthcare unit would need to invest considerably in infrastructure and maintenance resources if the cloud performed all functions related to storage, data modification, transfer, and collaboration internally.
- Analytics makes it possible to evaluate vast amounts of healthcare data gathered on a daily basis and get important insights into problems that would otherwise be difficult to foresee. In fact, doctors will soon use analytics to learn the full history of their patients.

C. *Sending Mail & Storage*

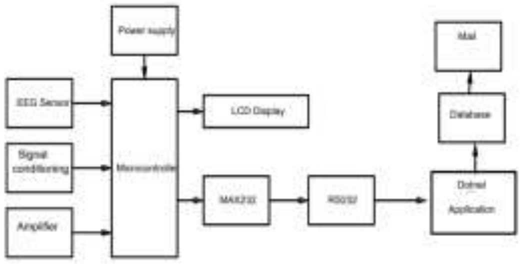

Fig. 3. IOT

- The computer has a database and a Dot Net application.
- The Database is where the sensor values from the microcontroller are saved.
- The sensor values are sent to the specified email address via the dot net application.

VI. Methodology

A real-time web-based 3D user interface that queries data from accumulating and flat files displays the fibre traces.

A. *Technologies and Platform Design*

1) Imaging Pipeline: The first step of the pipeline is to divide the original large data into sub volumes and apply image processing algorithms in parallel using pMatlab. The main image processing algorithms include a convolutional neural network (CNN) for segmenting the axon fibers, and a number of morphological operations for extracting fiber tracks, from which a network graph of vertices, edges, and 3D coordinates of the fiber tracks are computed. Our CNN has three convolutional and two fully connected layers. The last layer uses sigmoid activation, and all other layers use rectified linear units (ReLU) . In the graphs, vertices correspond to the start/end of the fiber tracks and edges represent the connections (fiber tracks) between the vertices. These parsed graphs are then converted into an associative array format, which is amenable for graph analysis.

2) Accumulate and D4M: After converting the graphs to an associative array format, they may be placed into accumulate or saved to flat files. Based on our benchtop testing, we discovered that a hybrid strategy that uses both the accumulation database and the file system provides the best performance. The fibre graph vertices and edges are saved in accumulate, whereas the fibre track 3D coordinates are saved in flat files. When opposed to vertices and edges, 3D coordinates are much denser data and would significantly slow down retrieval time if kept in accumulate. Furthermore, because 3D coordinates are primarily employed for morphological analysis and visualisation, they are not as often accessible as vertices and edges.

3) Binary tree encoding based on geohashing for sub volume indexing: Gustavo Niemeyer devised the geohash, which is a geocoding method based on a hierarchical spatial data structure that subdivides space into an easily identifiable grid. The structure of geohashed data provides two advantages when utilised in a database. First, geohash data will comprise all of the points for a specific rectangular region in continuous slices.

4) Data Schema: In the following form, nodes are graph vertices and links are edges that connect nodes in the network. The node ID is the node's locally unique number in each sub volume. The binary code where the node is placed is represented by the sub volume number. End Yes is either 0 or 1 depending on whether the node is an end node, with 1 indicating the beginning

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or end of a fibre track and 0 indicating a junction that links to numerous additional nodes. End Node is the node ID of the other nodes to which this node is linked. Links refers to the link IDs of the links that connect to this node.

VII. Algorithm

The BFS method traverses a network data structure to locate vertices that are related to one another. BFS intuitively informs us which neurons are related to other neurons in our application. Using the previously mentioned associative array structure, we can immediately apply BFS to a node (or collection of nodes) by multiplying two associative arrays. To apply BFS to a node, we must first extract the sub volume of interest from accumulate in order to generate an incidence matrix E. The required node is then added to an associative array and multiplied by the incidence matrix of the relevant subgraph of the sub volume.

As a consequence, an associative array with information about the nodes related to the input nodes is created.

The desired node link information is then extracted. This method can be done indefinitely to locate all nodes linked to the resulting.

VIII. SIMULATION RESULTS

Fig.4. Status Page

Fig.5. Login Page

This is an example of php server page development for IoT.

Here I built by providing a location for the formation of our virtual storing of data in memory, which will be preserved indefinitely until the owner of the virtual brain maker edits or deletes the page source.

It also has the opportunity to enter and save email addresses for recipients.

A. Hardware Results

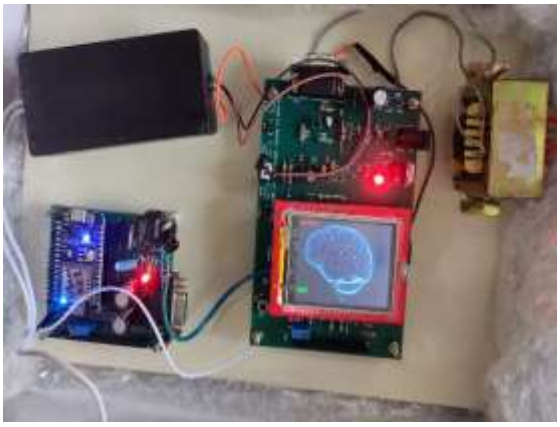

Fig.6.Normal State of Brain

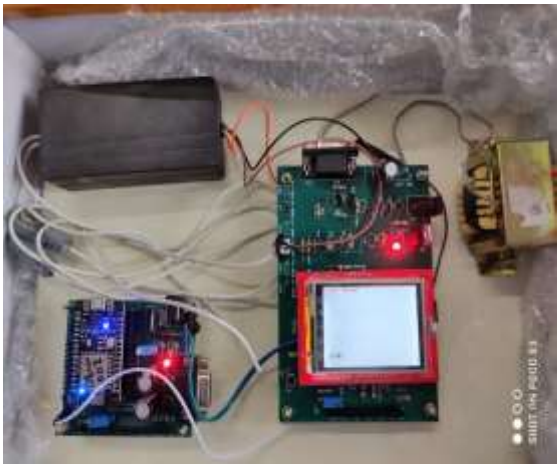

Fig.7.State of brain dead

IX. CONCLUSION

Using Apache Accumulate and D4M, we developed a cloud-based solution for undertaking large-scale brain connection analyses. We proved that our method can perform quick data querying and extraction for graph analytics and visualisation. With geo hashing-based binary tree encoding, which provides a Google Maps-like viewer with numerous zoom levels, indexing of sub volumes is straightforward and logical. There are several opportunities for future employment. First and foremost, we want to improve the online GUI by making it more interactive and user pleasant.

Furthermore, we want to scale it to analyse considerably bigger datasets (terabytes and higher), with the eventual objective of doing such analysis on the human brain. We're looking on using Graphology to perform graph analytics directly into accumulate.

We are also investigating the usage of a poly storage database, such as Big DAWG, as a data viewer that displays the original data as well as a zoomed-in view of four nearby sub volumes extracted using a management solution that closely aligns data sources with data management technologies.

At collecting data from sensors and updating it on the hospital's main server. As a result, this procedure proceeds

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regardless of whether the doctor or a patient's relative is there beside the patient. By examining the patient's health, the doctor can advise the patient on any therapy. This project will use IOT technology to simplify the medical evaluation procedure, allowing the patient to enjoy a carefree life.

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Application of Soft Computing Tools for Better NanodeviceModeling and their Digital Circuits

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***Abstract*—The creation of tiny electronic devices with the potential to transform computing has been made possible by advances in nanotechnology. Yet, because of their tiny size and complexity, the design and modelling of these nanodevices and their digital circuits present substantial problems. The use of soft computing techniques like neural networks, fuzzy logic, and evolutionary algorithms holds great promise for resolving these issues and enhancing the precision and effectiveness of circuit and nanodevice modelling. In this article, we give an overview of how soft computing methods may be used to improve the modelling of nanodevices and associated digital circuits. We examine current research in the area and emphasise the benefits and constraints of various soft computing strategies. We also go through some of the main difficulties using these approaches and make recommendations for further study.**

New avenues have been made possible for the creation of digital circuits and smaller electronics via nanotechnology. Yet, because of the intricate interactions that take place at the nanoscale level, designing and simulating such devices and circuits may be difficult. Soft computing technologies have become a potential strategy to deal with these problems. In this article, we investigate how to better represent nanodevices and their digital circuits using soft computing technologies.

A subfield of computer science known as "soft computing" is focused on the creation of intelligent systems that can draw conclusions from data and act on ambiguous or hazy information. It includes a variety of methodologies, such as swarm intelligence, fuzzy logic, genetic algorithms, and neural networks. These methods are excellent for simulating complicated systems with nonlinear behaviour, which nanodevices frequently exhibit.

The significant degree of variability in nanodevice behaviour brought on by manufacturing flaws and environmental conditions is one of the issues in nanodevice modelling. Fuzzy logic and neural networks are examples of soft computing methods that may be used to simulate the variability in device behaviour and forecast how well it will function in certain scenarios. This may aid in optimising the device's design and enhancing its functionality.

Lack of precise physical models that can accurately represent the behaviour of the device at the nanoscale level is another difficulty in modelling nanodevices. Empirical models based on experimental data may be created using soft computing techniques in order to imitate the behaviour of the device. Having a more realisticdescription of the device behaviour can assist to get over the limits of physical models.

Techniques from soft computing can also be utilised to improve the layout of digital circuits that include nanodevices. For instance, neural networks may be used to forecast how well a circuit will function under various operating conditions, while genetic algorithms can be used to find the ideal placement of transistors in a digital circuit. The effectiveness and dependability of the digital circuit may be enhanced as a result.

In conclusion, a potential field of research is the use of soft computing techniques for improved nanodevice modelling and associated digital circuits. The performance and effectiveness of digital circuits can be increased by utilising soft computing approaches, which can also assist in overcoming the difficulties associated with nanodevice modelling, such as device unpredictability and a lack of precise physical models. This may result in the creation of novel and cutting-edge goods and services based on nanotechnology.

Keywords—digital circuits, modelling, design, fuzzy logic, neural networks, nanodevices, and soft computing.

I. Introduction

In today's world, mobile computing is a common technology that has completely changed how we work and communicate. With enabling workers to work remotely and access mission-critical information on the go, it has allowed enterprises to expand their reach and increase operational efficiency. Yet, the increased usage of mobile devices in business settings has also brought forth fresh security issues, notably with regard to data security and privacy.[1]

Business data is frequently extremely private and sensitive, and any unauthorised access or data breach can have serious repercussions, such as monetary loss, reputational harm, and legal penalties. Also, enterprises must develop strong security measures to safeguard their mobile computing systems and data due to the growing sophistication of cyberattacks and the rising amount of mobile security flaws.[2]

A possible answer to these security issues is coming in the form of forensic-enabled safe mobile computing platforms. These systems can identify, assess, and respond to security issues in real-time because to the advanced forensic techniques they include into their architecture. Enterprises may reduce the risks related to mobile computing and strengthen their overall security posture by using forensic-enabled technologies, which offer a thorough and proactive approach to mobile security.[3]

Data encryption, access restrictions, device management, and incident response are the essential elements of a secure mobile computing system that supports forensics. Together, these elements make sure that corporate data is safeguarded at every stage of its lifetime, including storage, transport, and usage. Moreover, forensic-enabled solutions may offer thorough records and audit trails of mobile device activities, enabling businesses to monitor and look into any potential security problems.[4]

For businesses wishing to take use of mobile computing's advantages while maintaining the security and

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privacy of their data, forensic-enabled secure mobile computing platforms are an essential tool. Because businesses are relying more and more on mobile devices, they must implement sophisticated security solutions that can keep up with the changing threat environment.[5]

II. BACKGROUND STUDY

Nanodevice design and modelling call for precise and effective simulation techniques that can represent the intricate behaviour of these devices. Due to their high processing costs, accuracy, and scalability restrictions, traditional simulation approaches like finite element analysis (FEA) and computational fluid dynamics (CFD) are frequently insufficient. As a result, academics have looked into alternate strategies that could offer more accuracy and effectiveness.[6]

Soft computing methods, which offer flexible and adaptive methodologies that can capture complicated and nonlinear behaviour, offer intriguing answers to these problems. For instance, neural networks are able to recognise intricate connections between input and output variables and make precise predictions even when there is noise and ambiguity. On the other hand, fuzzy logic can accommodate ambiguous and inaccurate input by allocating varying degrees of membership to various groups. With a wide solution space, genetic algorithms can search for the best solution to optimise complicated objective functions.[7]

Several research have looked into how soft computing techniques are used in nanoelectronics. For instance, neural networks have been used to forecast the electrical characteristics and behaviour of carbon nanotube field-effect transistors (CNTFETs). By varying the degree of connectedness between cells, fuzzy logic has been utilised to improve the design of quantum-dot cellular automata (QCA) circuits. By looking for the ideal placement of nanoscale components, genetic algorithms have been utilised to improve the design of nanoscale logic gates and circuits.[8]

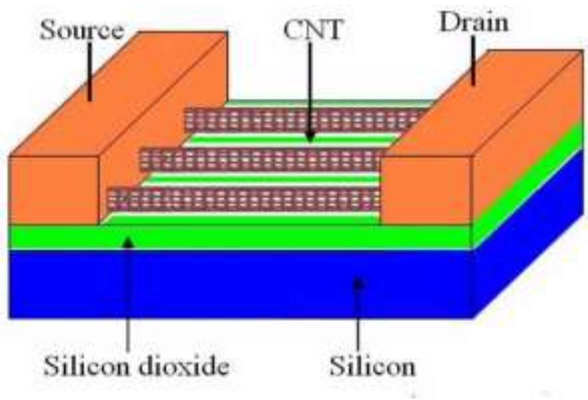

Fig. 1. CNTFETs (Structure Carbon nanotube field effect transistors)

Notwithstanding these achievements, using soft computing methods in nanoelectronics still presents difficulties. The absence of precise and trustworthy data for training and validation is one of the major issues. Although the size of the solution space expands exponentially with the number of components and variables, another difficulty is the restricted scalability of these approaches. Thus, extra research is required to examine the capabilities and restrictions of these tactics and create fresh strategies that can handle these difficulties.

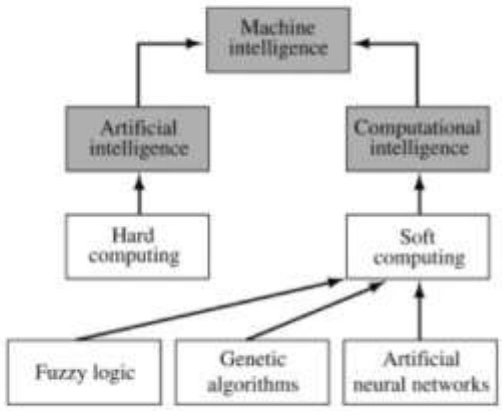

Fig. 2 Soft Computing by B

The study of developing algorithms and methods to address complicated issues that are challenging or impossible to resolve with conventional computing approaches is known as soft computing. It is a group of several computing techniques that draw inspiration from the natural functions of the human brain and its capacity for learning, adaptation, and reasoning.

Fuzzy logic, neural networks, evolutionary algorithms, and probabilistic reasoning are examples of soft computing techniques. These techniques can be combined or applied separately to address a variety of issues, including those relating to prediction, control, classification, and optimization.

A set of optimization algorithms known as evolutionary algorithms draws their inspiration from the ideas of natural selection and evolution. By emulating the evolutionary process, in which the most fit individuals survive and procreate, they are used to identify the best solutions to issues. Many applications, such as engineering design, scheduling, and logistics, employ evolutionary algorithms.

Using probability theory, probabilistic reasoning is a technique for handling uncertainty and inadequate data. It is used to forecast outcomes and make judgements based on speculative evidence, model complicated systems, and make predictions. Many processes, such as decision-making, risk assessment, and natural language processing, involve probabilistic reasoning.

III. METHODOLOGY

Data gathering and pre-processing, model construction and training, model assessment and validation are all phases in the process of applying soft computing methods for better modelling of nanodevices and their digital circuits. A broad approach that may be used to various soft computing methods and applications is as follows:

1. *Data collection and pre-processing:*The data needed for model building and training must first be gathered and prepared. Data from simulations, experiments, or a combination of both may be used in this. The

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information must be reflective of how the nanodevice or circuit behaves in various environments, including those involving temperature, voltage, and input signals. To get the data ready for modelling, pre-processing could entail feature extraction, normalisation, and data cleaning.

2. *Model development and training:*The soft computing model must next be created and trained using the pre-processed data. In order to do this, the model architecture and parameters may need to be defined together with the proper soft computing approach, such as neural networks, fuzzy logic, or evolutionary algorithms. The pre-processed data is then used to train the model, which is done using methods like backpropagation, particle swarm optimization, or genetic algorithms. To improve the performance of the model, the training procedure could include numerous iterations.

3. *Model evaluation and validation:*When the model has been trained, it must be reviewed and validated in order to determine its precision and dependability. This may entail comparing the model predictions with the actual measurements while using a different set of data from the one used for training. Metrics for measuring model performance, such as accuracy, correlation coefficient, or mean squared error, can be used to assess the model's performance. Based on the outcomes of the review, the model may need to be updated or fine-tuned in order to perform better.

4. *Application to circuit design and optimization:*The validation of the soft computing model paves the way for its use in circuit design and optimization. This might entail optimising the circuit settings for optimal performance and simulating the behaviour of the nanodevice or circuit under various scenarios. Soft computing techniques may be used to find the best circuit layout in a vast solution space in order to maximise objective functions like power consumption, speed, or noise immunity. Using experimental or simulation data, the improved circuit design may subsequently be verified and put to the test.

5. *A broad framework:*That may be modified to fit various soft computing methods and applications is the methodology described above. Depending on the application domain and the soft computing paradigm employed, the methodology's specifics may change. For instance, the model complexity and kind of data may affect the neural network design and training procedure. Based on the particular needs of the application, the fuzzy logic rules and membership functions may be modified. The size and complexity of the solution space may influence the genetic algorithm's parameters and selection criteria.

IV. Results

In order to improve the accuracy and reliability of nanodevice modelling and circuit optimization, soft computing technologies have been successfully used to nanodevices and associated digital circuits. Many soft computing methods, including neural networks, fuzzy logic, and evolutionary algorithms, have been used to optimise circuit design, anticipate device behaviour, and represent various aspects of nanodevice modelling. The following are some particular findings from more recent studies:

- Many types of nanodevices, including carbon nanotubes, graphene, and nanowires, have been modelled using neural networks. Especially when dealing with less-than-ideal circumstances like noise, fluctuations, and faults, these models have demonstrated better accuracy and durability compared to classic analytical models.
- Intelligent control systems for nanodevices, such as nano sensors and nanorobots, have been created using fuzzy logic. The accuracy and productivity of the devices can be increased by these systems' ability to adapt to changing surroundings and input signals.
- Nanocircuits with logic gates, memory, and sensors have been designed and performed with the best efficiency possible using genetic algorithms. These methods can find the best options in sizable design areas and enhance the circuits' dependability, speed, and power consumption.
- To integrate the benefits of various soft computing approaches and enhance the precision and effectiveness of nanodevice modelling and circuit optimization, hybrid soft computing techniques, such as neuro-fuzzy systems and genetic-fuzzy systems, have been created.

Applying soft computing tools to nanodevicemodeling and circuit optimization have shown significant improvements in accuracy, efficiency, and flexibility compared to traditional approaches. These results have the potential to accelerate the development and application of nanotechnology in various fields, such as electronics, medicine, and energy.

V. Conclusion

The use of soft computing methods to enhance the modelling of nanodevices and their digital circuits has the potential to significantly increase the precision, efficacy, and adaptability of nanotechnology. Soft computing methods, including as fuzzy logic, neural networks, and genetic algorithms, have been effectively used to improve the design and performance of circuits as well as numerous elements of nanodevice modelling.

The benefits of soft computing technologies above conventional strategies like analytical models and brute-force search techniques. Soft computing models can depict the intricate and nonlinear behaviour of nanodevices in a variety of environments, including noise, temperature, and voltage. Large design spaces may be searched for ideal circuit designs using soft computing optimization methods, which can also increase the circuits' speed, reliability, and power efficiency.

Despite these encouraging outcomes, using soft computing technologies for nanotechnology still has its difficulties and restrictions. Large and representative

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datasets are required, soft computing models are challenging to understand and explain, and soft computing techniques are computationally complicated and scalable, among other issues.

Future research in this area may focus on creating more sophisticated and hybrid soft computing methods, fusing experimental data with soft computing models, and using soft computing tools with new nanotechnologies like quantum computing and molecular electronics. Overall, the use of soft computing techniques has the potential to transform the way we design, model, and optimise digital circuits for nanodevices. It also has the potential to lead to new advances in engineering and research.

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HealthCare Chatbot Using NLP Techniques and Deep Learning Algorithm

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***Abstract*— The healthcare sector is one of the largest focus areas in the world today. Health related problems are becoming increasingly common. Early diagnosis and treatment of diseases can play a vital role. The solution is adopting healthcare chatbots. The proposed solution is a healthcare chatbot application that can provide solutions based on user queries. The NLP component of the chatbot allows it to understand the intent of the user's query and extract relevant information from the user's input, making it more effective at providing accurate and helpful responses. The chatbot is designed to be easy to use for patients, making it a useful tool for providing basic healthcare information and assistance. Deep Learning algorithm was used and gives an accuracy of 91%.**

Keywords—Chatbot,Health support, NLP, Deep Learning, LSTM, Seq2Seq, Document - Term Matrix, Bag of words

I. INTRODUCTION

Welcome to our healthcare chatbot, designed to assist you in finding the information and resources you need to navigate the complex healthcare system. We understand that the healthcare landscape can be confusing and overwhelming, with various challenges such as long wait times, lack of information, and difficulty in finding the right provider. This can make it difficult for people to access the care they need and make informed decisions about their health. This chatbot is here to help alleviate some of these issues. With this chatbot, you can quickly access a wide range of information about medical conditions, treatments. We also understand that cost is a major concern for many people when it comes to healthcare. That's why this chatbot is designed to help users to find the most cost-effective options available. Our chatbot is a valuable tool that can help you take control of your health and make the healthcare experience more efficient and accessible for you.Artificial Intelligence is creating an era that it is going beyond human imagination and thinking. The technological experts with their tremendous skills and expertise developed the science of AI. The study mainly focusses on bringing up Chatbots which are developed using Natural Language processing. These are the virtual assistants powered by built-in features of AI.

Michael Mauldin in 1994, formulated the term ‘Chatbot’ which is a combination of words ‘Chat’ and ‘Robot’.

We are fairly familiar with Amazon’s Alexa, Apple’s Siri and Microsoft’s Tay – these are the conversational agents that would respond and act according to the queries that users would probe.

Our capstone project focuses on the Healthcare Chatbot which is meant for early diagnosis of diseases and treatments thereof. The reason why we chose Healthcare chatbot in particular is because we all seek medical assistance at some point of time because we live a sedentary lifestyle due to which we get exposed to various diseases. Healthcare industries play a significant role when it comes to life expectancy and quality of lifestyle.

Many are the roadblocks and challenges that the healthcare industries in India are facing these days especially when it comes to the people living in rural areas who lack medical facilities. The census show high mortality rates due to deadly disease that is taking away lives of people and due to unavailability of medical professionals in the rural areas where physical consultation has become a major challenge and totally expensive. When our health goes upset we all want immediate treatment, early diagnosis to avoid any serious consequences. None of us want to wait longer to take appointments with the physician or to meet the concerned doctor just to know what went wrong and what medication we would need to take.

So, the best solution to overcome this problem is to integrate Chatbots in the Hospital’s IT systems. By doing so this would serve thousands of customers or patients at a single point of time and at a very low cost. Also that the patients can get access 24/7 to their health information from anywhere and anytime that they need. The healthcare chatbot that we have come up with uses text, or instant messaging for natural interaction with the patients and all it’s users. What we’ve developed is the QA Chatbot with the the built in AI features, NLP text processing techniques and Deep

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Learning Algorithm. When I say QA chatbot this would actually answer the given question that the user would type in. Meaning this would mimic human intelligence. It gives an impression as though the user is talking to the medical professional on the other end as they have meaningful conversation with the patients or users in real-time.

The healthcare chatbots can be used for making appointments, pulling out medical history of a patient, setting up reminders for consuming medicines and other proactive alerts that would inform the medical staff to let them know what's in their action for treating patients.

The usage of chatbots in every business sector is becoming increasingly popular these days. Turning the clock back to 1966 where the first chatbot named Eliza was invented. The sole purpose of Eliza was to provide responses to users based on different keywords. This was purely the role based chatbot. Then came Parry, Jabberwacky, Alice, Smarterchild, Cortona, Siri, Alexa, GoogleNow and then the latest Microsoft Tay – which is a twitter chatbot. The goal was to analyze the tweets on twitter in order to understand the conversations.

Here with the Healthcare chatbot system, the dataset or the model is preloaded is with the set of keywords, set of data. Meaning we have trained the chatbot with word cloud where it picks up keywords from questionnaires and then responds with the answers from the word cloud of answers.

For text pre-processing, NLP has been used with NLTK toolkit that's available in python. The algorithm that we've used is the Deep Learning technique with 4 layers. Dense layers along with dropouts of 20% is used and last layer, output layer contains no. of neurons = no. of intents is used to predict output intent with softmax.

Relu activation function has been used in the dense layers. Stochastic gradient descent is used as an optimizer.

Finally, GUI is created using tkinter to provide the chatbot experience where user can enter their query and the system's response is shown in the GUI.

II. Literature Survey

The proposed solution [1], focuses on predicting agent response for user's query given in the electronics e-commerce industry. They have used the dataset from the support tickets created at Robocraze platform. Initially, they have performed basic NLP operation using NLTK packages like removing stop words, identifying the most common words, bi-grams and basic EDA and word cloud analysis. During, the cleaning of the data they have divided the data in to query – response pairs. Here, they have used an encoder-decoder structure wherein the encoder is customer queries and decoder are the agent response. Further, these inputs are converted into a simple Seq2Seq LSTM model with a bi directional layer and dot product of this is sent to dense layer to generate the final model predictions.

The proposed solution[6], focuses on creating a chatbot on general knowledge-based question and answer. Here, they have compared the model performance through both transformer model and Seq2Seq learning and later they found that the one with transformer model was giving a better result. The model Architecture has i) Encoder ii) Decoder adds another layer apart from 2 sub layers which perform multi head attention. iii) Transformer which further helps to find the a) Scaled-dot product b) Multi Head attention c) Position-wise FFN with ReLU activation function and d) Position encoding. In the training, data was split at 80:20 and batch size as 28 or epoch as 120. The final result of Seq2Seq model was giving 23.5 BLEU of dataset whereas the Transformer model was giving 85 BLEU. Higher the BLEU better is the model for automatic chatbot.

In this model[7] they have used NLP techniques, first tokenizing the corpus, removing stop words, correcting any spelling mistakes, lemmatizing the corpus, vectoring the input and then applying Cosine Similarity between input and training set to find the best suitable output for the question. They tried experimenting both with cosine similarity and Euclidean distance as well. In this example, 2 examples of Dhoni's Wikipedia page, one small para and another big one is taken into account and another one is Sachin's Wikipedia page. The distance between Dhoni's similar type document is much lesser than the distance between them and Sachin's. Thus, questions can be identified nearest to the training set even though user's language for asking question is different. To improve the model even further they can train the vocabulary on Google's word embedding, which will give words similar in meaning almost identical vector. Thus when computing Cosine distances, even though the word is different from what was originally used in our question set, the difference between those words will be minimum. Thus it can give more accurate replies in Chatbot UI.

III. Dataset

A. *Overview*

This paper provides appropriate answer to the patient's health related query. The Healthcare JSON dataset is a collection of data that includes question and answer pairs related to healthcare information. The dataset is structured in JSON format with 465 records, which makes it easy to use and integrate with other systems. Each question-answer pair in the dataset contains a question that is related to healthcare and a corresponding answer that provides information about the topic of the question. The questions in the dataset cover a wide range of healthcare topics, including diseases, treatments, symptoms, and general health information. The answers provided in the dataset are accurate, up-to-date, and written in a clear and concise manner. The dataset can be used to train a healthcare chatbot or other applications that require healthcare knowledge. Additionally, the dataset can be used as a resource for healthcare professionals and researchers, providing a valuable source of information for their work.

B. *Characteristics of the Data*

The dataset features information on 465 QA pairs. We removed stop words from the dataset along with a few custom stop words. Here, We looked at the Bigram and Trigram words from the answers in the dataset.

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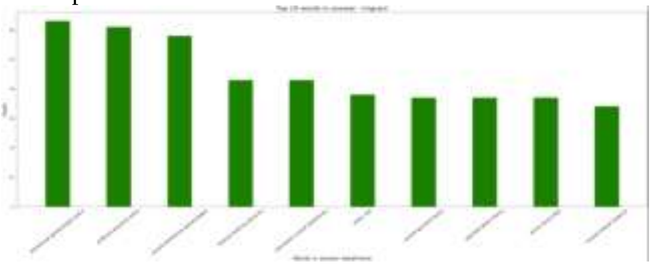

Fig. 1. Top 10 words in answer - trigram

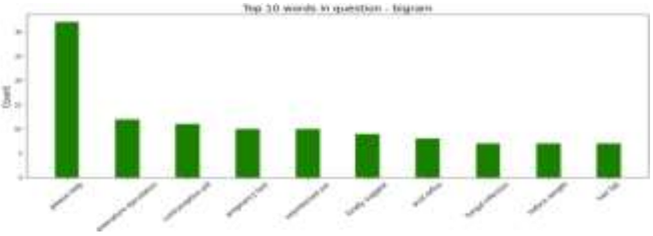

Fig. 2. Top 10 words in question - bigram

The word cloud representation of texts from QandA responses are seen as below. Fig 3 and 4

Fig. 3.Word Cloud of Questions

Fig. 4.Word cloud of Answer

IV. Materials And Methods

The proposed system consists of a user-friendly chat interface through which a user can communicate with the system. Depending on the user input, the chatbot will provide relevant information about his queries.

The system has pre-processed the question answer(icliniqQA) dataset, for training of the Deep Learning model. The system has trained and compared different number of layers and number of neurons in Deep Learning model and got the best accuracy of around 91%.

First, a dataset of healthcare-related questions and answers were collected and pre-processed. Dataset is converted from json file to pandas data frame for preprocessing. We dropped “question text” and “url” columns from the data frame which were not required for chatbot. The data frame is remained with question, answer and tag. The question and tag columns goes through text processing techniques of NLP.

They are tokenized into smaller units or words. Further the tokenized words are converted to lower case. After that we removed punctuations and stop words in question and tag columns. Also lemmatization is done to bring words to its meaningful base form. We converted variable-length texts into a fixed-length vector using the Bag-of-Words technique.

The cleaned dataset is loaded as intents. Each question is tokenized to words and then it is mapped to it’s respective tags and stored as documents. Unique tags are stored in one variable. Then a document-term matrix is created against its tags and used as training data. This dataset was then used to train a deep learning model. This process allows the model to understand the meaning of the user's input and provide a relevant response.

After the model was trained, it was tested on a set of unseen data to evaluate its performance. Fine-tuning was performed to improve the model's accuracy by adjusting the hyperparameters of the model.

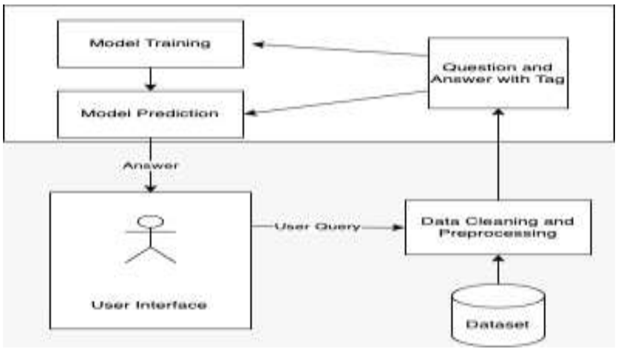

Fig. 5. Flow Model - Chatbot Architecture

Lastly, the model (Fig 3) was integrated into the chatbot interface, allowing users to interact with it through text-based inputs and receive text-based responses. The chatbot also includes a Knowledge base where it can retrieve information to answer user's queries.

A. *Data Preprocessing*

The dataset is retrieved from git hub [11] which contains data of 465 records, including the mapping of answers with the corresponding questions and tags.

The dataset was checked for inconsistencies and removed unwanted data. Then the missing values were imputed. The answer column contained “--><link>” at end of each record, so replaced it with empty string.

B. NLP text pre-processing

The user input has to be pre-processed in order to provide appropriate response. Pre-processing methods – punc-

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tuation, tokenization, stop words and lemmatization have been used to generate an appropriate response for the user query.

1) *Punctuation removal:* Python’s string module contains the following list of punctuation ‘!"#$%&\'()*+,-./:;<=>?@[\\]^_`{|}~'. Using this list , punctuation is removed from the user’s input.

2) *Tokenization:* Here the user input is converted into a bag of words using tokenization.

3) *Stop words removal:* Removal of stop words is necessary as they take valuable pre-processing time and space. eg:- ‘a’, ‘an’, ‘the’, etc.

4) *Lemmatization:* lemmatization considers the context and converts the word to its meaningful base form. For example, lemmatization would correctly identify the base form of ‘caring’ to ‘care’.

Wordnetlemmatizier is used to achieve lemmatization in our case.

C. Deep Learning Algorithm

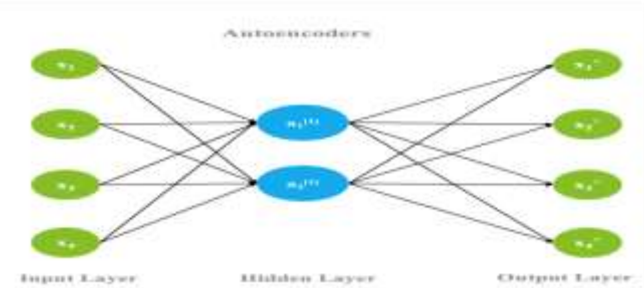

Fig. 6. Deep Learning Architecture

Components used in the model

1) *Dense Layer:* In natural language processing (NLP), a dense layer is a type of layer in a neural network that is fully connected to all the neurons in the previous layer. It is called a "dense" layer because each neuron in the layer receives input from all the neurons in the previous layer, as opposed to a "sparse" layer where some neurons do not receive input from all the neurons in the previous layer.

Dense layers are commonly used in NLP tasks such as language translation, text classification and language generation. They are used to process the input data, extract useful features, and make predictions based on the learned features. Dense layers are usually followed by an activation function such as ReLU or sigmoid, which helps introduce non-linearity into the model and allows it to learn more complex relationships in the data.

2) *Activation Function:* Activation functions are mathematical functions that are used in artificial neural networks to introduce non-linearity into the model. They are applied element-wise on the output of each neuron, allowing the network to learn and represent more complex relationships in the data.

ReLU (Rectified Linear Unit): It is defined as f(x) = max(0, x). It is commonly used in the hidden layers of neural networks and has the advantage of being computationally efficient.

Softmax: The softmax function is a popular activation function used in the output layer of neural networks for multi-class classification problems. It is a generalization of the sigmoid function, which is typically used for binary classification problems.

The softmax function is useful in multi-class classification problems because it converts the output of the neural network into a probability distribution over the classes.

The softmax function is computationally efficient and differentiable, which makes it easy to train the neural network using gradient-based optimization methods.

3) *Optimizers:* Optimizers are algorithms used to adjust the parameters of a neural network in order to minimize the error between the predicted output and the true output. They are used during the training process of a neural network to update the weights and biases of the network in order to improve its performance.

Stochastic Gradient Descent (SGD): It is one of the most basic and widely used optimization algorithm for training neural networks and other machine learning models. It updates the weights and biases of the network based on the gradient of the error with respect to the parameters.

The update rule for the parameters in SGD is given by:

w <- w - learningrate * gradient

where w is the parameter to update, learningrate is a scalar that controls the step size.

D. Methodology

The deep learning model utilizes a multi-layer perceptron architecture with 3 layers. The input data is fed into the first layer, which consists of 128 neurons. The outcome of the first layer is then passed through the second layer, which contains 64 neurons. Dropout with a rate of 20% is applied to these layers to prevent overfitting. The outcome of the second layer is then passed through the final layer, which contains neurons equal to the number of intents. These neurons use a softmax activation function to predict the output intent.

The dense layers in this model use the Rectified Linear Unit (ReLU) activation function, which helps to introduce non-linearity and allows the model to learn more complex relationships in the data. The optimizer used for training the model is stochastic gradient descent (SGD) algorithm. The model is trained for 100 epochs with a batch size of 5 and achieved accuracy of around 88%

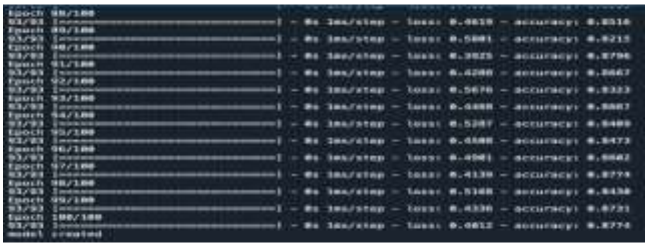

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Fig. 7. Model accuracy for 3 dense layers

It was further improvised by adding another layer with 32 neurons. So now the model utilizes a multi-layer perceptron architecture with 4 layers, where the first layer contains 128 neurons, second layer with 64 neurons, third layer with 32 neurons. Dropout with a rate of 20% is applied to these layers to prevent overfitting. The outcome of the third layer is then passed through the fourth and final layer, which contains neurons equal to the number of intents. These neurons use a softmax activation function to predict the output intent.

The model uses the same activation function, optimizer, and is trained for the same number of epochs and batch size and achieved accuracy of around 91%.

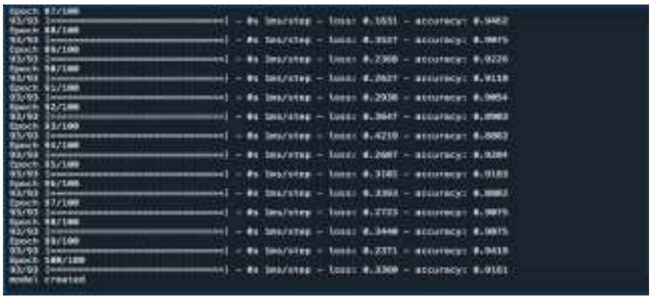

Fig. 8. Model accuracy for 4 dense layers

E. User Interface

A Chatbot GUI, or graphical user interface, is a type of interface that allows users to interact with a chatbot using graphical elements, such as buttons and images, rather than just text. This can make the chatbot more user-friendly and intuitive to interact with, as users are able to see options and make selections more easily. Some popular chatbot GUI platforms include Dialogflow, Botpress, and Microsoft Bot Framework.

Tkinter is a Python library for creating graphical user interfaces. It is built on top of the Tcl/Tk GUI toolkit and provides a simple and easy-to-use interface for creating windows, buttons, labels, and other widgets. Tkinter is included with the standard Python distribution and is widely used for creating simple GUI applications. Some of the features of Tkinter include support for events and callbacks, geometry management, and support for various types of widgets.

Tkinter library is used to view the gui for providing the chatbot experience.

Here the user input is processed with necessary techniques, then using the bag of words technique, a document-term matrix is created. Then it is sent for prediction. Error threshold is considered as 0.25. A tag is extracted after model prediction which is matched with the tag in the dataset and appropriate answer is returned to the user.

V. Evaluation and Model Results

The approach involves testing the dataset using deep learning algorithm using few dense layers and dropout to prevent over fitting. The algorithm has provided with accuracy around 91%. The model analyses user's query accurately and provides the user with appropriate answer.

Example 1 –

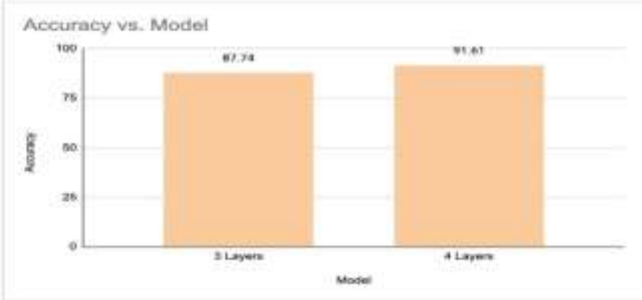

Fig. 9. Accuracy graph between models containing different layers

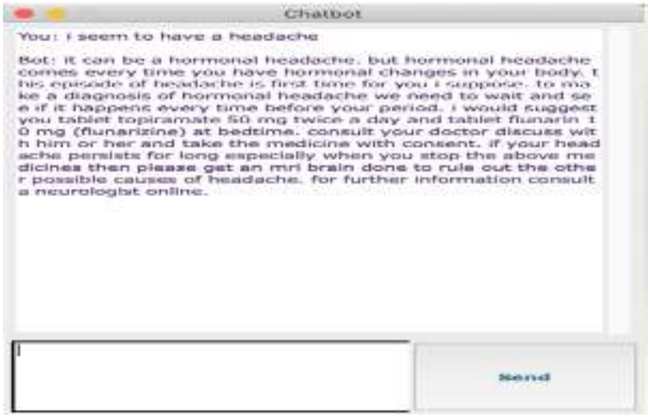

Fig. 10. Chatbot example1

Example 2

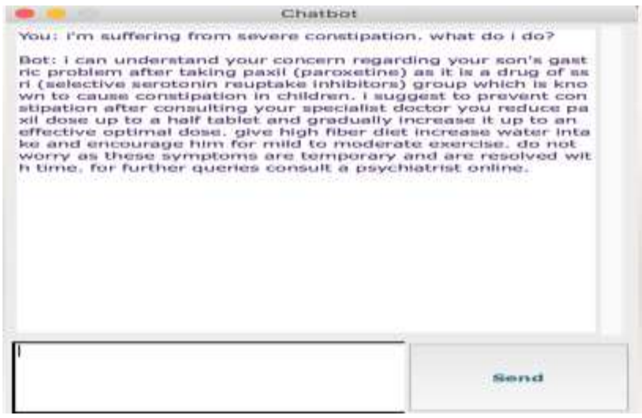

Fig. 11.Chatbot example2

VI. Discussion And Conclusion

The study was done within a very short span. All the possibilities are not considered in this study and a lot of improvement is possible. There are several features or algorithms that can be implemented for improving the overall performance of the model. By using NLP techniques such as unigrams, bigrams, and trigrams, healthcare chatbots can understand and respond to user's inquiries more accurate and appropriately.

There is a definite scope of development in this area, we can enhance the current model and work towards slowly eliminating the limitations such as :

- Currently negative scenarios are not handled. For any irrelevant query, random answer from the dataset is provided. It doesn't prompt the user to enter a relevant query.
- There are no greetings. The algorithm presented currently only works as a simple question answer healthcare chatbot.

Future work can involve improving the model by making use of optimizers, different algorithms, multilingual ability. Using different dataset system will be able to predict diseases based on the symptoms provided by the user. We can also incorporate voice to text and text to voice functionality to make it user friendly.

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AI Driven Diabetic Foot Ulcers Prediction Using Deep Learning

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***Abstract*— Diabetes is a type of illness or problem which can't be treated surgically or operated on. Lack of consciousness regarding lifestyle can easily cause diabetes. Diabetes is generally caused because of a gain of weight, laziness, not taking a proper diet, etc. A person who is having diabetes should be very proactive about his health as it can also lead to death or more severe complications. One of such complications is Diabetic Foot Ulcers(DFU). One of the leading reasons of death in the world, diabetes can also result in complications like diabetic foot ulcers. (DFU). A patient's foot may be removed if their diabetic foot ulcer is handled improperly and late. With the use of a computer-assisted classifier, thermal imaging may be utilized to detect DFU signs early on. With the aid of deep learning neural networks, we plan to develop a model that may be utilised to aid patients by providing an early warning of diabetic foot ulcers. Big Data Analytics plays a noteworthy role in healthcare industries. With the help of big data, we can store a wide variety of data on different patients and have a wide range according to age groups. So, this will be helpful in getting hidden features from stored data. As we see the classification of data nowadays this is not that reliable. The use of the same dataset and different models are not giving that much accuracy. So our main focus is on increasing accuracy and getting better results for classification. We have referred few types of research which were done before so came to conclude we will use EfficientNet for better understanding the features of the images and it helps in increasing the accuracy of classification.**

Index Terms— Deep Learning, Convolutional Neural Network, EfficientNet, Artificial Intelligence, Classification, Diabetes Diagnosis, Diabetic Foot Ulcers, Healthcare Domain, Supervised Learning.

I. Introduction

Diabetes is an illness in which insulin level in blood get depleted below the normal level which is needed to stay healthy. This will cause malfunction of organs of body like patient will gets frequent urination, etc. If it is not treated on time, it can cause central numerous complications. This difficulty leads to demise. There are some specific diseases, which includes diabetes, kill around 19% of world's population. In 2000, deaths caused by diabetes increased by 72%, and in 2023, these deaths are expected to rise by 85%. Diabetes can be caused by many lifestyles' routine such as laziness, taking pills, heavy weight, etc.

Foot ulcers are among the most devastating effects of diabetes. Diabetes-related foot wounds known as diabetic foot ulcers (DFUs) are significant diabetes cases. According to reports, there were only 151 million diabetics globally in 2000; by 2014, that number had risen to over 422 million, and by 2021, it was projected to reach over 537 million.

The incidence of diabetes illness increased by 10.5% among persons over the age of 18 between 2000 and 2021. The major goal of our study is to develop a model that can be utilised for early diabetic foot ulcer prediction so that it may be treated appropriately and the patient doesn't have to lose a limb.

In this situation different Deep learning algorithms can be used to create a model which can predict whether ulcer is abnormal or normal. Diabetes can be cured at early stages if proper care is taken and proper medication is given to the patient. Artificial Intelligence approaches can assist in the earlydetection of this disease. The analytical model can identify and understand the incoming data, allowing it to make more specific decisions.

TABLE 1: Prevalence facts and countermeasures for diabetes and diabetic foot ulcers

At the glint	Year			
	2000	2021	2030	2045
World adult (19–79 years) population (in billion)	3.2	7.9	8.6	9.5
Number of people with diabetes (in million)	151	537	643	783
Prevalence of diabetes (in percentage)	4.6%	10.5%	11.3%	12.2%
Diabetic foot ulcer with 15% prevalence (in million)	22.65	80.55	96.45	117.45
Number of people with diabetes in India (in millions)	32.7	74.2	101	124.9

Since the dataset consists of images we are using the concept of Convolutional Neural Networks (CNN). There are different CNN architectures that can be used for classification whether the ulcer is normal or not such as VGG, AlexNet, EfficientNet, etc.

We can use different architectures for better understanding the features of the images or dataset and this helps in for forecasting the disease. Deep Learning methods can help in detecting diabetic foot ulcers at its preliminary stages. This can help patient in detecting disease priory and taking necessary precautions in order to stay healthy.

II. Literature Survey

It is known that patients' understanding of the effects of diabetes is low or non-existent, which contributes to complications. Analysts' assessment of DFU's findings included the use of different sensors and CNN models, although one or two widths, depths, or definitions of images were being considered. Thus, three highlights are taken into account when broadcasting the prediction of diabetic foot ulcer conclusion in this broadcast of a deep learning experiment, EfficientNet. By accurately distinguishing a diabetic foot from a normal foot, he can detect the severity of the foot ulcer and take timely action.

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Through an in-depth survey of the misconceptions (IA) articles that have supported DFU verification strategies, it is conceivable to consider the priorities of these strategies as well as the challenges facing them difficult to coordinate them in a realistic and solid system to achieve unattainable satisfaction understand governance.

To recognize diabetic foot ulcers, they examined the associated optical sensing and imaging strategies. The reflection takes into account the strength of the sensors as well as the physiology of the patient. The news source allows for a wide range of verification strategies and they have established restrictions on the adoption of AI innovation.

The use of a non-invasive photonic device has been recommended for the treatment of diabetic foot ulcers in diabetics. Using the concepts of hot and hyperspectral imaging, this utility studied the condition of the ulcer. The oxyhemoglobin and deoxyhemoglobin biomarkers were evaluated using these photon imaging methods. By combining flag management strategies that use deep learning to improve pixel accuracy and reduce stutter with super-resolution strategies, this utility has evolved.

Programmed DFU image classification has been proposed using a deep CNN called DFU QUTNet. When there are more layers, a normal CNN becomes very deep, but the implementation makes no progress. To extend the width of the network while maintaining the depth compared to current systems, the QUTNet DFU arrangement was implemented.

The ubiquity of corners seems to benefit mainly from sloppiness transmitted through the DFU QUTNet system on a number of different channels.

III. Problem Statement

Diabetes is becoming increasingly prevalent in today's environment. The major source of this significant condition is the individual's lifestyle. Diabetes can induce a variety of problems, some of which are life-threatening. One of these serious effects is diabetic foot ulcer. If adequate treatment is not received in time, a limb may be amputated.

When the person suffering from an ulcer is unable to walk properly, travelling to a nearby hospital or clinic is a challenging chore for such a person. With this project, a doctor or any family member may determine whether the ulcer is normal or pathological.

In addition, not all doctors are knowledgeable about all dis- eases, making it difficult to locate a doctor you can trust with such understanding.

Yet, in everyday life, the diabetic patient must determine whether he or she is indeed diabetic. A computerised system that can anticipate the right response without making any of these mistakes is required in order to prevent these blunders, and this may be accomplished with the use of DL.

TABLE 2: CNN Architectures and their number of layers

Model	No. of layers	Salient feature
AlexNet	8	Depth
VGG16	16	Very Deep CNN
VGG19	19	Very Deep CNN
GoogleNet	22	The depth and width-based CNN
DFUNET	14	The depth and parallel Conv. with homogeneous kernels.
DFU_QUTNet	30	Width-based network compared to the depth of the model.
DFU_SPNet	22	The depth and parallel Conv. with heterogeneous kernels.
EfficientNet	237	Depth, width, and high resolution

IV. Scope

Diabetic Foot Ulcers Prediction System is a project which will help both diabetic and non-diabetic people. Our project will be helpful for everyone but more helpful to non-diabetic people. We are thinking of adding the following features to our project

A. *Diabetic Foot Ulcer Test:*Using this feature any per- son can check whether the ulcer he/she having is abnormal or normal in nature.

*B.Doctor Consultation:*Using this feature anyone can consult to doctors and experts who will suggest you different activities which will help in improving your health as well as lifestyle.

C. *Expert System:*A person who doesn’t have knowledge about this domain can use this project and get knowledge.

V. Methodologies Used

Artificial Intelligence

The Artificial Intelligence seminar provides an overview of AI that will enable you to understand the guiding principles of AI. These days, technology is ubiquitous, meaning that it is everywhere and that it is developing at a rapid rate. Artificial intelligence is one of the many booming computer science technologies that is being employed increasingly in a variety of fields. The world is being ruled by artificial intelligence, which is also providing us with fresh ideas daily to help us think critically and do something new.

Deep Learning & Convolutional Neural Networks

Deep Learning is a concept which is quite popular these days. It is basically the subset of machine learning and it uses neural networks for its working. Artificial neural networks make an effort to mimic how the human brain functions, however they fall far short of being able to match it, enabling it to "learn" from vast volumes of data.

Deep learning networks works by finding hidden and complex patterns in the data they process. The networks may develop several degrees of abstraction to describe the

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data by constructing computational models that are made up of many processing layers.

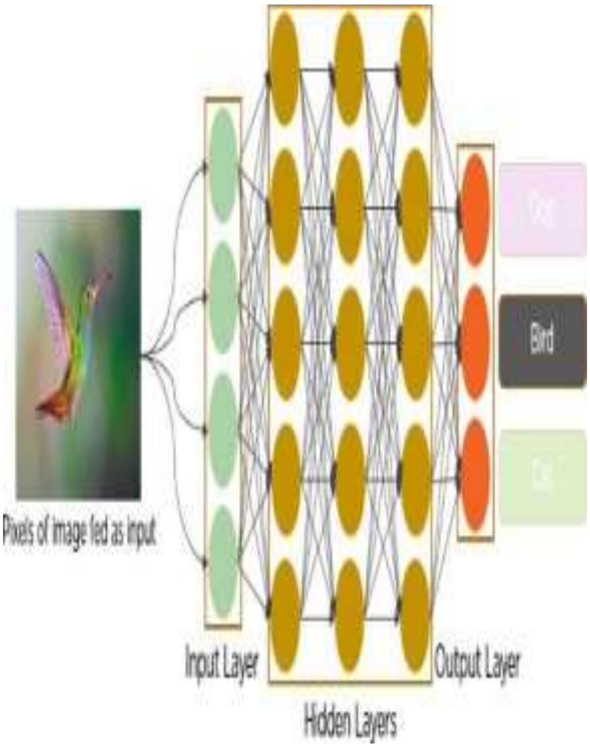

Fig. 1. Convolutional Neural Networks

Convolutional Neural Networks is one of the algorithms of deep neural networks which consist of different architectures. A neural network type known as convolutional neural net- works, or CNN or ConvNet, is focused on processing input with a grid-like architecture, such as images.

CNN basically consist of 3 types of layers which are convolutional layer, pooling layer and fully connected layer. Different of arrangement of these layers makes different architectures of CNN.

Efficient Net

Efficient Net is one of the important architectures of convolutional neural network and project about understands the features of images of foot ulcers and this architecture can help us in better understanding the features of the images and hence better accuracy in predicting. The design of the solution was influenced by the image's width, depth, and resolution. Since our project is realted to images with higher resolution and more pixels, therefore we are using EfficientNet which is the best option.

These intuitions suggest that scaling multiple dimensions re- quires coordination and balancing as opposed to the more traditional single-dimension scaling. The compound scaling method grows the network's depth, breadth, and resolution logically and uniformly using a compound coefficient.

Since DFU classification requires a more complicated network architecture to distinguish between normal and abnormal classifications, the number of layers in a CNN model does not guarantee correctness.

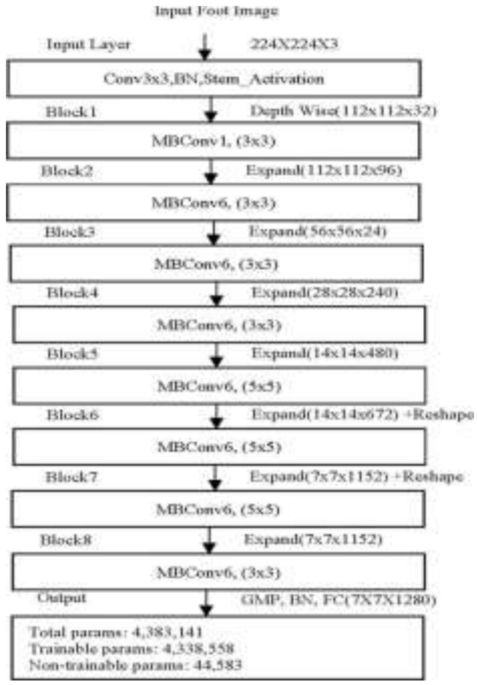

Fig. 2.EfficientNet Architecture

In some cases, network performance degrades as the number of levels increases, and a network with few layers and a simple topology is sufficient.

VI. Workflow Of Model

The model is built using a CNN architecture which is going to classify out data into whether a person is having normal or abnormal ulcer. The training of model is done using training data and train accuracy is provided. The given flow chart ex- plains the workflow of our model.

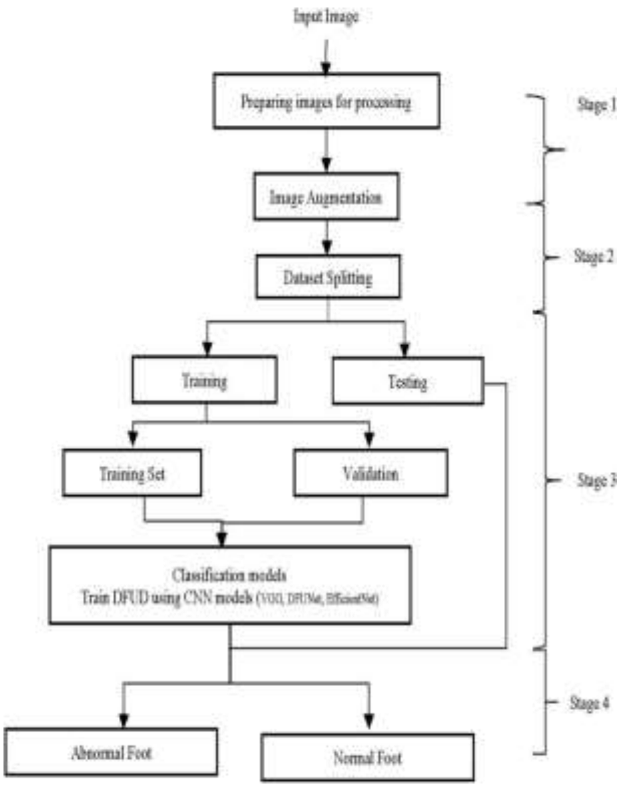

Fig.3.Workflow Diagram

DOI: rp-9788770040723.103

VII. Dataset Used

CNN architecture was used to build the model, which will classify the data into normal and abnormal ulcers. Model training is carried out with the aid of training data, and train accuracy is offered. Since we have used CNN as our algorithm, we have used number of images as dataset for proper training and testing of our model. Heres are some of these images:

Fig. 4. Dataset

VIII. Evaluation

Confusion Matrix

Confusion matrix is a concept in machine learning which is used for the performance evaluation of different models. This matrix is usually used for classification model evaluation. There are 4 terminologies used in this matrix which are true positive, true negative, false positive and false negative.

Using these 4 terminologies different calculations can be done and evaluation of the model can be done. These evaluations can also help in telling which feature of the model should be modified in order to improve the performance of the model.

True Positive: It is the situation in which both predicted and actual answer both is yes.

False Positive: It is the situation in which predicted answer is yes but the actual answer is no.

True Negative: It is the situation in which predicted answer is no and the actual answers is also no.

False Negative: It is the situation in which both predicted and the actual answers are no.

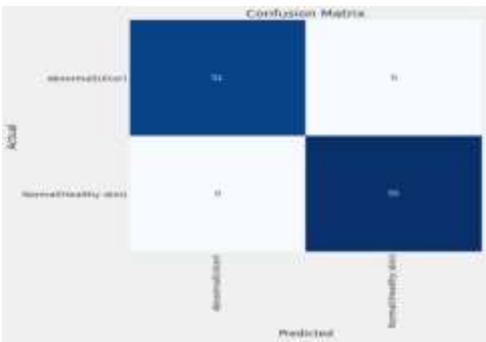

Fig. 5. Confusion Matrix

Calculations using Confusion Matrix

Above confusion matrix can be used to find some calculation which can be used for model evaluation. These calculationsare:

1. *Accuracy:*Accuracy can be defined as the measurement of prediction correctness. It is the closeness be- tween the correct and predicted value.

2. *Error Rate:* Error rate is defined as the number of in-correct predictions per all samples available. Lower the value, better the model will perform.

3. *Precision:* Precision defines the exactness of the mod-el. It has the highest value as 1 and lowest is zero.

4. *Recall*: Recall is used find what is the ability of the model to find positive samples. If recall is high that means the model will find more positive samples.

5. *F-measure:* F measure takes recall and precision to find its value. It makes the model to use both precision and recall for finding best outputs.

IX.Conclusion

Diabetes is a very common and rising problem now a days and it is not only limited to only old people, person of any age can be affected by this disease. Sometimes this problem of diabetes leads to more severe complications. One of such complications is foot ulcers. These ulcers if not detected early whether these are normal or abnormal in nature then it can leads to losing of a limbs

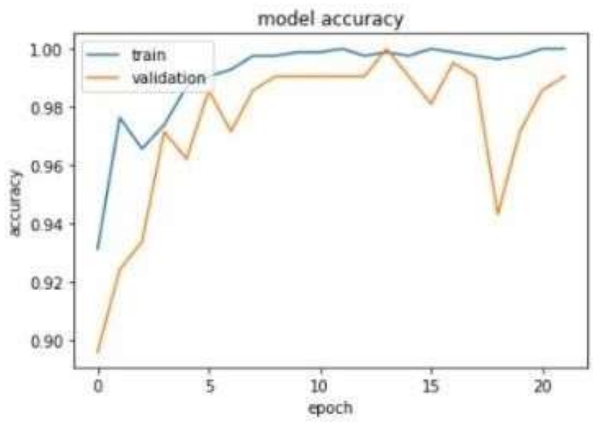

Fig. 6. Model Accuracy

Therefore for the early detection of diabetic foot ulcers we have created this project – AI driven Diabetic foot ulcers pre- diction system. For proper classification and prediction, our project uses a deep learning model known as ―Convolutional Neural Network. There are different architectures of CNN and we are using EfficientNet.

The accuracy attained by our model is about 95% but this can be improved by improving the quality of our dataset and using some other methodologies

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Student Feedback Review Analyzer using Sentiment Analysis

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***Abstract*—The Student Feedback Review Analyzer is deployed to obtain student feedback on a particular faculty or a teacher. Using the responses provided by the students, it analyzes the responses over all and assists admin to make better decisions. Those in attendance, such as the higher authorities, can see the entire report. It includes modules for students, faculty, and administration. A class is created by the administration, which also appoints the appropriate professors to the class. We can quickly learn how the professors are doing from the perspective of the students. Each of the 13 evaluation questions for professors includes five possible answers to rate the instructor, including excellent, very good, good, average, and poor.**

***Index Terms*—Feedback, Sentiment Analysis, Student, Teacher, Review**

I. INTRODUCTION

The Student Feedback Review Analyzer is an essential tool for educational institutions seeking to improve the quality of education they offer. This student data management system provides a platform for students to express their opinions and views on their academic experiences, specifically regarding their faculty members. The feedback obtained from students is crucial in evaluating the effectiveness of teaching methods and helps the faculty members to identify areas where they need to improve to better meet the need soft heir students.

The Student Feedback Review Analyzer is designed to be user-friendly, ensuring that students can easily navigate the system and submit their feedback without any difficulties. The system is equipped with a range of ordered feedback options, such as ”always,” ”poor,” ”generally,” and ”very frequently, ”which allows students to express their opinions in a concise and effective manner.

Once feedback is submitted, the system analyzes the sentiment of the feedback to determine the overall tone and provides the faculty members with an overview of how their students perceive their teaching methods. This comprehensive overview helps the faculty members to identify their strengths and weaknesses and formulate strategies to improve their teaching methods.

The Student Feedback Review Analyzer is a valuable tool in promoting transparency and accountability within educationalinstitutions.Thesystemallowsforhonestandconstr uctivefeedback, which creates a sense of openness between faculty members and students. By giving students a platform to express their opinions and views, institutions can create an environment that fosters a sense of community and enhances the learning experience.

In summary, the Student Feedback Review Analyzer is an essential tool that educational institutions should in corporate into their systems. The feedback received from students helps faculty members to improve their teaching methods and create a better learning experience for their students. Additionally, the system promotes transparency, accountability, and community, which are vital values for any institution.

II. CURRENT TECHNIQUE

The current procedure used by educational institutions for obtaining feedback from students regarding unsatisfactory teaching or areas where they need better understanding is quite cumber some. Under this procedure, students are required to submit an application to the concerned Head of Department (HoD) or higher officials, detailing their feedback and there as ons behind it. This application must be submitted in writing, and students must provide a detailed explanation of their concerns.

Once the application is received, the HoD reviews it and assesses its validity. If the HoD believes that the feedback is justified, they will forward the application to the higher authorities for further review. This process can take some time, as the higher authorities must evaluate the feedback and determine the appropriate course of action.

One of the major drawback soft his procedure is that students are unable to obtain authorization for their feedback application if the HoD or higher authorities are unavailable. This can be frustrating for students, as they may need urgent assistance and not be able to receive it due to bureaucratic delays.

More over, the current procedure for obtaining feedback from students can create a communication gap between students and faculty members. Students may feel discouragedfromprovidingfeedbackduetothelengthyandcom plexprocessinvolvedinsubmittingtheirapplications.Thislacko fcommunication can lead to a lack of understanding between students and faculty members, resulting in a subpar learning experience.

To improve this process, educational institutions should considered opting a more streamlined and efficient approach to obtaining feedback from students. This approach should prioritize ease of use, accessibility, and transparency, ensuring that all students have equal access to express their opinions and concerns. Additionally, institutions should foster a culture of open communication and encourage students to provide feedback regularly. This will help build trust and create a more positive learning environment for

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everyone involved.

III. Related Work

The current feedback system relies on pen and paper, which can be a tedious and time-consuming task. It also requires careful management of the paper to prevent loss or misplacement.Makingphotocopiesoffeedbackformsgenerates alargeamountofpaper,raising environmental concerns. RajveePateletal.[3]addressedthisissuebydevelopinga"FeedbackManagement System" that takes into account the concerns ofstudents and provides an easy and consistent way for them todeliver feedback to the college's head or principal. In theirrespectivestudies,PhaniRamaPrasadandSivasankariS.introduced two different online systems aimed at automatingthefeedbackprocessforlecturers.PhaniRamaPrasadetal.proposedan"OnlineStudentFeedbackSystem"thatallowsstudents to provide feedback online, automatically generatingfeedbackforlecturers,thuseliminatingtheneedtowritedown feedback manually. Meanwhile, Sivasankari S. et al. [7]developed the "Online Student Feedback Analysis System"(OSFAS),whichusespredefinedcommentsandcategoriessuch as "good," "interesting," "late," and "interactive" to pro-vide relevant feedback about teachers automatically. Both ofthese systems share a common objective, which is to enhancethe quality of feedback while reducing the amount of time andhumaneffortrequired.

IV. Proposed Model

Theregisteredstudentscaneasilygeneratefeedbackatanytime,wherevertheyareinthecollegeoruniversity,usingtheproposedfeedbacksystem.TheHOD,principal,and admin sendthe feedback that isthereby created. Thishelpstosaveaplethoraoftimeandwork.Thefeedbackreportssenttothe HODandprincipalareavailabletothematalltimesand fromanylocation.Facultymembersalsohaveaccesstotheiraccountwithoutalsohavingaccesstothe entire file. By utilizing the opportunity provided by thisportal's features, students can now directly initiate feedbackstatements,evenwithoutanyauthorization.Thesecurityofthe feedback is improved by this portal. The proposed systemhasthefollowingbenefits:

- Savesalotoftimeandlabor;
- Reducespaperwork;
- AccessibleandConvenientinterface;
- Creatingreportsmadesimpleandeffective;
- Enhancesconfidentiality

V. Implementation of Modules

Thisapplicationhastwomainmodules.Themodulesare:

- FacultyModule
- StudentModule

A. Facultymodule

The category of users, which comprises faculty membersand administrative staff, is also included. Upon entering their faculty ID and passcode, the database verifies the credentials of the faculty member. Once the account is valid, the portal will open and include functionalities such as "Add Faculty, ""View Faculty," and "View Class." HoDs cannot see results for other departments within their department, nor can they see classes in other departments. Superusers of the student feedback review system are also faculty members. After the super user inputs the super user ID and passcode, the data base validates. Once valid, the account opens and includes modules such as "View Faculty,""View Classes," and "Logs." You can view actions performed by the faculty by using the log module.

B. Student module

In the student module, students provide their registration number and batch details. The corresponding instructor name and instructor ID are displayed based on the selected batch. By clicking on the instructor ID, a feedback form containing about 15 questions will appear. Students can choose the most suitable answer from their perspective, and the responses will best oredon the server.

VI. Inference

The Student Feedback Review Analyzer portal has been de-signedinawaytomakecomplexworksimplerforeducationalinstitutions and to simplify feedback for students. This physically consumes a plethora of time, energy, and paperwork. Also, you are free to provide your unbiased response without any hesitation. So, this model tackles all of these obstacles and provides lots of backing during the entire process of requesting a leave. Teachers are equally accountable here to be able to directly sort out any kind of issue withthestudents.Ifthisprojectneedstobeimplementedproperly, thiswilltakea collective effort from teachers, students as well as adminstaff. The utilization of a feedback review system is prevalentin educational institutions such as schools and colleges. Itspurpose is to enhance the quality of education and other activities, with the aid of an online feedback system. By gatheringsincere feedback from students, we can effectively identifyareas of improvement in teaching methods and facilities. Theimplementation of an online feedback system not only savestime but also streamlines the process of analyzing feedback. Incases where feedback results are excellent, improvements maynotbenecessary.However,iffeedbackresultsaremoderateor poor, necessary improvements can be identified. Thus, theonlinefeedbacksystemprovidesbenefitssuchastheeaseofobtainingdatafromstudentsandsimplifiedanalysisoffeedback data.

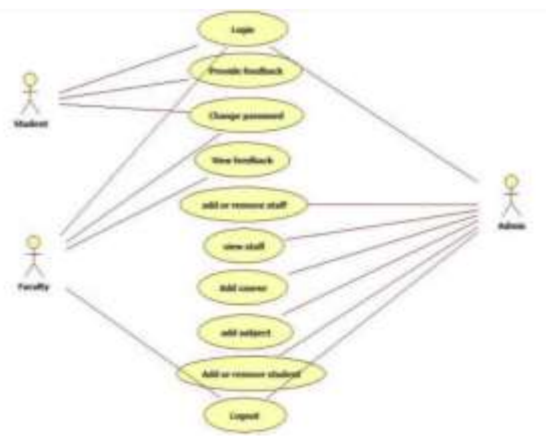

Fig. 1. Usecase Diagram

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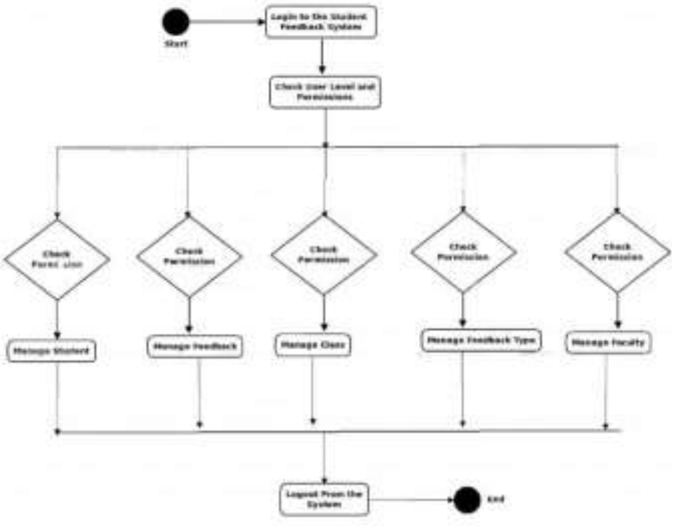
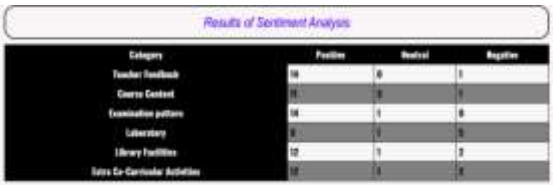


Fig. 2. Workflow Diagram

Fig. 3. Landing Page


Results of Sentiment Analysis

Category	Positive	Neutral	Negative
Teacher Feedback	14	0	1
Course Content	11	0	1
Examination pattern	14	1	0
Laboratory	8	1	5
Library Facilities	12	1	2
Extra Co-Curricular Activities	12	1	0

Fig.4.Over all result after inputs

Fig.5.Graphsshowingimpact

VII. Scope Of Project

Effective communication between teachers and students iscrucialtopromoteacademicgrowthandsuccess.Itisnotjust verbal communication that is important, but also writtencommunication. When teachers provide incisive opinions andhonest judgment in written form, it can significantly enhancestudents'overalloutcomeandproductivity.Furthermore,evaluations must be transparent and fully disclosed to studentswithouthesitation.Thisapproachhelpstobuildtrustand foster students' academic affinities, resulting in better learningoutcomesfromfaculties.

As technology continues to evolve, educational institutionsare also incorporating innovative tools to enhance the learningexperience.Onesuchtoolistheintegrationofanewfeaturein the feedback questions that will provide more context andaninteractiveuserinterface.Thisfeaturewillbeavailableon various operating systems like Windows, iOS, and Linux,makingiteasilyaccessibleforstudentstoprovidefeedback.

Toensuretheauthenticityoffeedback,atruthdetectiondevicecanbeemployed.Thisapproachwillensurethatstudents'feedback is genuine and reflects their actual experience in theclass. Additionally, it is important to tailor questions based onstudentrecommendations.Thiswillmakethefeedbackprocessmoremeaningfulandrelevantforstudents.

Moreover, the ease of use of the online feedback system isequally important. Improving the web design can significantlyenhance the overall user experience and make it more accessible to students. A user-friendly interface can encourage students to provide feedback and increase participation, therebyproviding a more comprehensive and accurate evaluation offacultyperformance.

In conclusion, effective communication, transparency, andinnovation are essential components of a successfulfeedbacksystem.Byimplementingtheabovestrategies,educationalinstitutions can ensure that feedback is authentic, meaningful,andfostersanenvironmentofgrowthandlearning.

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vetheoverallqualityofthisre-searchwork.Theirsupportandencouragementhavebeenanimportantsourceofmotivationformethroughoutthisjourney.Furthermore,Iwouldliketodedicatethisresearchworktomypeersandjuniors,whohaveinspiredmetopursuethisprojectwithpassionanddedication.Iamgratefulfortheirsupport and encouragement, and I hope that this research workwillbebeneficialfortheirfutureendeavors.Lastly,Iwouldliketothankmyfamilyfortheirunwaveringloveandsupportthroughoutthisjourney.Theirconstantencouragementandbeliefinmehavebeenasourceofstrength,andIamgratefulfortheirunwaveringsupport.

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Regression and Multi-Class Classification of Alzheimer's Disease Diagnosis Using NMF-TDNet Features From 3D Brain MR Image

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***Abstract*—To more accurately depict Alzheimer's disease (AD) and predict clinical scores while taking into account advancements in clinical imaging and substantial learning, several experts are gradually using ConvNet (CNNs) to remove deep level features from clinical images. A small deep learning network called the PCANeT (Principal Component Analysis Network) creates multi-faceted channel banks to verify the accuracy of voluminous head part assessments. After binarization, blockwise histograms are constructed to obtain picture properties. PCANet is less adaptable because multi-facet channel banks are built with test data, resulting in PCANet features with thousands or even millions of aspects.The NMF-TDNet(non-negative matrix factorization tensor decomposition network) is an information-free organization based on PCANet that we present in this study to address these issues. Instead of PCA, staggered channel banks are made to test nonnegative matrix factorization (NMF). By applying tensor decomposition (TD) to a higher-demand tensor derived from the learning results, the input's dimensionality is reduced, resulting in the final image features. The support vector machine (SVM) in our technique uses these properties as input to diagnose, predict clinical score, and categorise AD.**

Keywords*—There are many different names for Alzheimer's disease (AD), such as deep-learning, regression, and multi-class classification.

I. INTRODUCTION

Alzheimer's is a neurodegenerative state with a protracted course that often affects the elderly. As the infection advances, the patient's memory and mental capabilities decay, their neurons are bit by bit obliterated, and the patient in the long run passes on [1]. Alzheimer's disease influences around 50 million individuals around the world. As the total populace ages, it is guessed that the quantity of Alzheimer's victims will twofold by 2050 [2, 3]. While there are a few prescriptions available to treat Alzheimer's disease, their viability is restricted to easing back the infection's movement as opposed to relieving it out and out [4]. The patient's early mental impairment falls somewhere amidst CN i.e., cognitive normal state and the Alzheimer's illness condition, also known as mild cognitive impairment state (MCI), according to various evaluations. Diverse researches are actively going on to find people who have proactively gone to the MCI stage in order to provide the appropriate mediation to halt the condition's progression [5]. Thus, deciding the phase of Alzheimer's disease has been the essential focal point of flow research, and early location of the infection is significant.

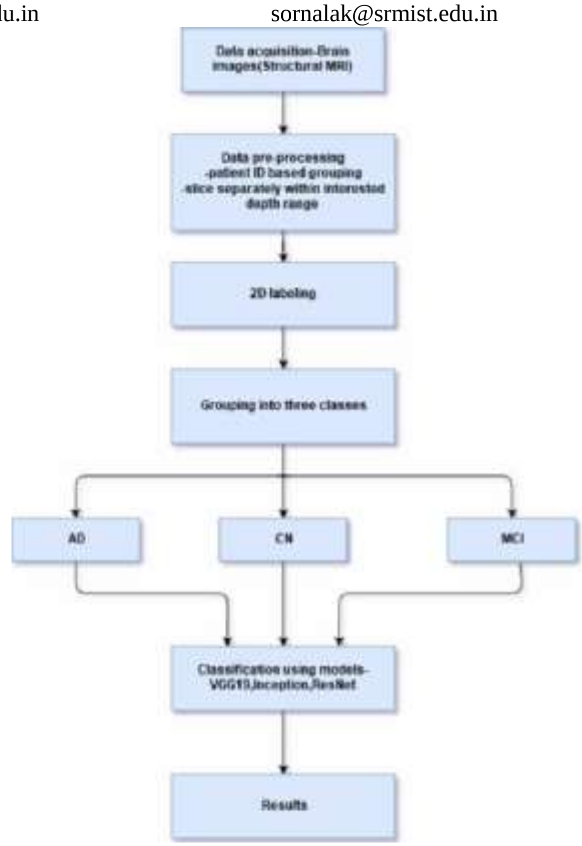

Fig.1: Example figure

Medical imaging technology has advanced tremendously in recent years. It will likely give clinical experts and scholastics with an interesting perspective on disorder finding by means of the investigation of clinical samples, confirming the legitimacy of clinical research expert's conclusions, and giving extra data to advance further review and examination. Diverse clinical image methods (some of the widely known methods are positron emission tomography (PET), single-photon emission computed tomography (SPECT), and magnetic resonance imaging (MRI)) can be used to obtain clinical images. The quick evaluation of changes, a top concern in construction and processing, as well as the identification of biomarkers for Alzheimer's disease may benefit from these numerous image techniques.

A few tests have shown that MRI is one of the most common and well-known imaging modalities used in medical practice. Neuron incident is the purest indication of

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Alzheimer's disease pathology, trailed by mind shrinkage from AD explicit frontal cortex districts to the whole cortical locale. An MRI may be used to observe these changes. These conspicuous physical changes happen preceding the beginning of huge mental limit decline. Subsequently, most of flow research is centered around laying out a patient's Promotion stage utilizing X-ray based PC supported conclusion (X-ray computer aided design).

II. Literature Review

Nowadays most of the people are busy with their fast-paced lives. Which in turn is the reason for lots of people suffering with high blood pressure making it as the root cause of dementia cases increment. Existing Alzheimer's Disease medication can cause a lot of side effects to the patients like vomiting sensation, nausea, diarrhea, allergic reactions on body, loss of appetite, headaches, dizziness and confusion. Regardless of lots of research and development the fundamental systems of Alzheimer's infection and applicable treatment targets stay muddled, and there is no proper drug which produces low or few side effects is available. There are as of now research focusing on amyloid and tau, two principal pathology signs of Alzheimer's disease. Yet, additional studies exist in various stages of research that are largely focused on other signs and processes connected with the condition that are now being inspected. Issues covered include: The study by **A. Khan, and C. Ballard, et al.,** looks at novel and drug repositioning that are now being explored in clinical trials that spot non-tau and non-amyloid pathways. This includes both possible disease-modifying medications and cognitive and neuropsychiatric therapies. The publications included in this study were obtained using PubMed and clinical trials database searches. Researchers are working harder than ever to find effective treatment for the behavioral signs of Alzheimer's disease, employing both new medications and drug repositioning. Other routes are being investigated as a consequence of the failure of medications. Upgrades in biomarkers will give additional scope for clinical preliminaries of promising drugs for meaningful treatment and disease adjustment in Alzheimer's disease.

K. G. Yiannopoulou, and S. G. Papageorgiou., discuss that, the groundwork of contemporary Alzheimer's disease (AD) therapy shows restraint focused psychoeducation, shared objective setting, and independent direction considering serious core competencies for a connection between the doctor, patient, and the care taker. Utilized as part of a comprehensive treatment plan, cholinesterase inhibitors (ChEIs), also known as N-methyl-d-aspartate (NMDA) antagonists, and other FDA-supported promotion medications like meantime may have limited "disease course-modifying" advantages by enhancing perception and reducing loss of freedom. Joining pharmacologic and nonpharmacologic treatment might diminish side effects essentially, forestall clinical movement, and decrease absolute medical services costs. The most important phase in Alzheimer's disease pharmacotherapy is to distinguish and eliminate any potentially hazardous prescriptions and enhancements. Nonpharmacological treatments are utilized as the principal method of medication for neuropsychiatric secondary responses and risky process of behaving. Among the techniques utilized incorporate psycho education, trigger location, iterative assessment, and conduct and ecological mediation changes. Significant exploration is being performed to deliver better medications, restorative devices, and more exact and accommodating indicative biomarkers for Alzheimer's disease. Various remedial targets, including neurotransmitter, tau neurotic-cycle and amyloid, power house of cell, provocative pathways, neuroglia, and multiple model ways of life mediations, are the focal point of continuous exploration reads up for Alzheimer's disease essential and auxiliary anticipation, in addition to clinical preliminaries assessing suggestive and sickness adjusting therapies in Alzheimer's disease patients.

In their work, **T. Tong, R. Wolz, Q. Gao, R. Guerrero., et al.,** survey the machine learning strategies have been broadly used to aid the assessment of neurological circumstances like dementia and to recognize morphological anomalies in essential frontal cortex appealing resonation imaging information. In this paper, we present a program for the beginning phases of Alzheimer's sickness and gentle mental impedance that joins a numerous occasion learning (MIL) technique (MCI). Neighborhood power patches are disposed of as highlights in our examination. Nonetheless, not each of the patches given out by dementia victims are gone after in much the same way, and some may not display the sickness' normal symptoms. As an outcome, pinpointing these patches as transporters of specific disorders might be troublesome. Managed learning frameworks, like MIL, might have the option to manage the issue of equivocal preparation marks. A diagram is created for each picture to take advantage of the associations between the patches and consequently, tackle the MIL issue. The created diagrams remember data for how patches show up and associate with each other, which might mirror the fundamental designs of the pictures and aid arrangement. The proposed method was able to accurately depict 89% of AD victims and sound controls and 70% of patients with stable MCI and mild MCI using benchmark MR evaluations from 834 ADNI centers. A well-informed perspective on the diagnosis and treatment of neurodegenerative diseases could result from the proposed method's ability to produce outcomes that are comparable to or superior to those of two cutting-edge methods that make use of the same dataset.

In a recent study on the diagnosis of Alzheimer's disease and MCI **D. Shen, H. Suk, and X. Zhu et al.,**, a significant correlation was found between the diagnosis and the clinical score assumption. Additionally, it has been demonstrated that the issues of low model size and high component dimensionality can be resolved by incorporating decision-making through complex learning model. Clinical score regression and clinical imprint collection were frequently restricted prior to evaluations alone. Supposedly, most of past component determination research considers unfortunate capacity, that I termed as the contrast between the objective and anticipated values, component by component. In this paper, we take a gander at the problem with changing the joint and grouping for the finding of AD/MCI utilizing an original grid similitude-based

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misfortune capability that utilizes the significant data level in the objective reaction network and requires data to be protected in the anticipated reaction lattice. The recently developed capability is used to relate the collection tether way to deal with pick joint highlights across undertakings, for example, clinical score expectation and class marking. The suggested method was tested using the Alzheimer's Neuroimaging Initiative (ADNI) dataset. The results showed that the really transmitted catastrophe limit performed better than the cutting-edge methods in clinical score suspicion and confusion status perceiving proof.

Aim of the Study by **L. Hou, X. Zhang, K. Hu, Y. Wang, K. Chen, et al.,** is to find out the patients suffering with moderate cognitive impairment (MCI) who have been promoted to Alzheimer's disease (AD) and those who have not seen a regular doctor in three years by utilizing multi-scale credits obtained from benchmark essential attractive resonance imaging. 228 normal controls (NC) and 133 MCI patients are included, 71 of whom switched to advancement within three years or less. General representation of 549 patients suffering from the Alzheimer’s are collected as Neuroimagary Initiative (ADNI) data set, that individuals are termed as to MCI converters or MCIc, and 188 Advancement patients are recalled for the purpose of the examination. Using the standard voxel-based morphometry strategy, the pictures are preprocessed by separating the cerebrospinal material, white and dim matter. The wavelet outline, a multi-scale image portrayal technique, is utilized to separate credits of different sizes and directions from the handled dim matter picture. Both whole dark matter imaging and hippocampal dim matter pictures might be utilized to create highlights. The support vector machine (MCInc) is utilized in the creation of classifiers for MCIc and MCI non-converters. Utilizing nearby hippocampus information, the precision for arranging Promotion versus NC and MCIc versus MCInc utilizing a leave-one-out method is 84.13 percent and 76.69 precent, individually. Research discoveries show that the suggested multi-scale methodology is fit for recognizing MCI converters and non-converters, and that it has a decent possibility being viable for MCI assumption in clinical environment.

In light of non-negative matrix factorization (NMF) evaluation (AD), this letter introduces yet another computer-based diagnostic (CAD) strategy for the early detection of Alzheimer's disease prediction by using single photon emission computed tomography (SPECT) images **P. Padilla et al.,**. This exploration utilized a SPECT information base that included standardized information from selected patients as well as sound reference individuals. The SPECT informational index is assessed using Fisher discriminant ratio (FDR) and the feature extraction NMF for each subject's applicable parts. These preprocessing techniques are fundamentally planned to bring down the serious level of aspect in the upcoming information and mitigate the supposed "revile of dimensionality" issue. The NMF-transformed set of data, which has fewer highlights, is grouped using an SVM-based characterization strategy. The NMF combined with SVM approach accurately perceives SPECT pictures with up to 94% exactness and high responsiveness and explicitness values (over 90%). For fulfillment, an examination between the proposed technique and another as of late evolved PCA in addition to SVM strategy is given. The outcomes show that the NMF+SVM procedure beats the PCA+SVM and customary voxel-as-feature (VAF) as well as SVM methods.

III. METHODOLOGY

As deep learning and clinical imagery advancements have progressed, few researchers are currently using convolutional neural networks (CNNs) to remove deep level qualities from clinical photos to all the more precisely order clinical scores and Alzheimer's disease (AD). A small deep learning network called the PCANet uses principal component analysis (PCA) to create multi-layer filter channel banks for testing. To get picture properties, blockwise histograms are developed after binarization. PCANet is less flexible since the multi-facet channel banks are constructed utilizing information from testing, bringing about PCANet highlights with several thousands or even countless aspects.

Disadvantage

1. Sample data is required for the creation of multilayer filter banks.
2. Restricting the flexibility of PCANet.

In this research, we come up with the proposal of data-free PCANet-based nonnegative(excluding positive and zero) matrix factorization tensor decay organization, or NMF-TDNet, as a solution to these issues. Instead of PCA, staggered channel banks are made to test with NMF. Using tensor decomposition (TD) to reduce the data's dimensionality and fabricating a tensor with a larger demand, the final image characteristics are produced. All in all, we utilize these properties as a commitment to the support vector machine (SVM) to decide advancement arranges and expecting clinical scores. The Desert spring, ADNI-1, and ADNI-2 datasets are utilized to assess our technique's presentation fittingly.

Advantages

1. The experimental findings suggest that NMF-TDNet has the potential to reduce data dimensionality.
2. When NMFTDNet features were used as input, the results were better than when PCANet features were used as input.

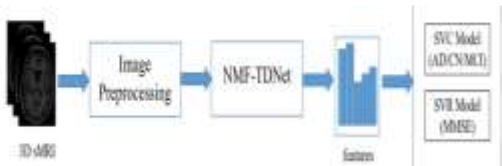

Fig.2: System architecture diagram

Modules

To finish this project, we utilized the following modules:

DOI: rp-9788770040723.105

- Data exploration: we will use this module to import the data into the working system.
- This module then used as a tool to read data for processing.
- Train Test splitting: Data is segregated into train and test data using this python module..
- The models were created using Mobilenet, InceptionResnetv2, SVM embedded with ConvNet layer, SVM classifier, and support vector regression. Algorithm accuracy was calculated.
- User registration and login: Accessing this module requires registration and login.
- The use of this module will result in anticipated input.
- Prediction: the final predicted value is shown.

IV. IMPLEMENTATION

4.1 Algorithms

Mobilenet

Mobile Net and other convolutional neural networks have been designed specifically for use in embedded and mobile vision applications. They depend on a proficient engineering that forms conservative profound brain networks with insignificant idleness for installed and cell phones utilizing depthwise detachable convolutions.

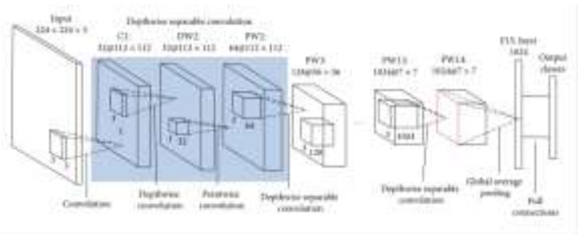

Fig.3: Mobilenet architecture

InceptionResnetv2

More than a million images from the ImageNet collection were utilised to train the Inception-ResNet-v2 convolutional neural network. The 164-layer organization can sort pictures into 1000 different item classifications like console, mouse, pencil, and various creatures.

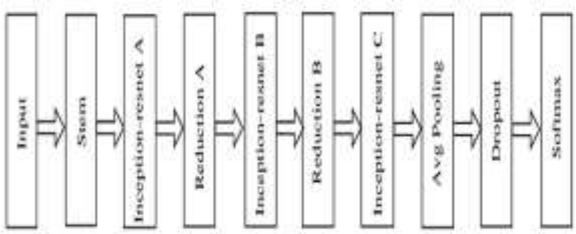

Fig.4: InceptionResnetV2 model Diagram

SVM embedded with CNN layer

Support vector machines (SVM) and convolutional neural networks (CNN) for picture order infrastructure. Fred Abien, Agarap. Convolutional neural networks (CNNs), like "normal" brain organizations, are made out of neural network layers of neurons with "learnable" boundaries.

Support vector classifier

A deep learning framework known as a support vector machine (SVM) makes use of managed learning to recognize or anticipate the behavior of a data set. Artificial Intelligence and Machine Learning with supervised learning systems give input and desired output for categorization.

Support vector regression

A managed learning approach called as help vector relapse is utilized to foresee discrete qualities. A similar hypothesis is utilized by SVMs and Support Vector Regression. SVR's significant objective is to recognize the ideal fit line. The hyperplane with the most focuses is the best fit line in SVR.

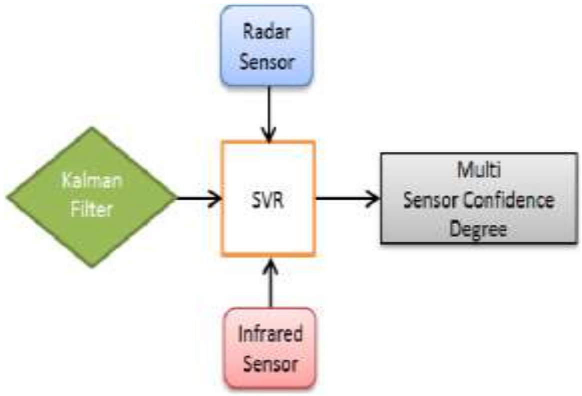

Fig.5: SVR model

V. EXPERIMENTAL RESULTS

Fig.6: Home screen View

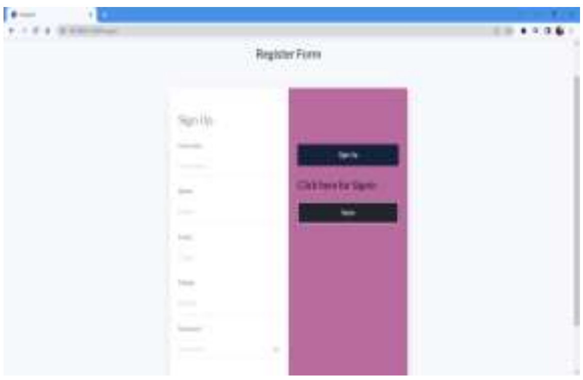

Fig.7: User signup page View

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Fig.8: User signin page View

Fig.9: Main page View

Fig.10: User input Sample

Fig.11: Predicting results Display View

VI. Conclusion

In this review, we present NMF-TDNet, a methodology in view of the organization construction of PCANet that conquers the limits of PCANet's enormous number of highlights and the PCA channels' information reliance. NMF-TDNet employs layer-wise convolution to examine the information picture as opposed to PCA. The output layer neuron results are then utilized to construct a higher-demand tensor, and TD is utilized to make the last picture features by making the data more modest in dimensionality. In conclusion, we analyze Promotion and predict clinical scores by incorporating these characteristics into the SVM. The ADNI-1 and ADNI-2 datasets were subjected to class name isolation tests and clinical score estimations (MMSE, ADAS-11, and ADAS-13). In addition, separate classification names and foresee clinical scores (MMSE) were derived from the ADNI-1 and Desert garden datasets. In spite of the way that NMF-TDNet creates substantially less highlights than PCANet, the trial results uncover that using NMF-TDNet highlights as info brought about preferable execution over utilizing PCANet highlights as information.

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Novel Deep Learning Architecture for Alveolus Ailments Detection

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***Abstract*—Apathological lesion to the alveoli distinguishes a group of ailments known as alveolar lung diseases (ALD) or alveolar illnesses. They are very common and a major cause of morbidity and mortality worldwide. Chronic obstructive pulmonary disease (COPD), pneumonia, pulmonary edema, asthma, TB, fibrosis, lung cancer, and other diseases fall under this category. According to WHO data Lung Disease Deaths inIndiareachedapprox.900,000 in 2020.This exhibits then ecessity of creating a new paradigm for a precise and earlydiagnosisofdisease,whichwouldgreatlyenhancepatients'outcomes. It is critical for processing massive amounts of data in the healthcare industry. Hence in this paper, we propose anoveldeeplearningdesignforalveolarailmentsdiscoveryutilizing VGG-16convolutionalneuralnetwork.Ourmodelusesa unique dataset of chest X-ray pictures to prepare theVGG-16torecognizedesignsrelatedwith different alveolarinfectionsandencouragehelpinillnessforecasts.Weevaluated our model on a separate test dataset and achieved anaccuracyof93.4%inidentifyingdifferenttypesof alveolarailmentsandavalidationaccuracyof91%.Ourtechniqueprovidesapotentialnewtoolforaccurateandtimelyidentificationofalveolarinfections,aswellasdisentanglesdisease location for specialists and clinicians as well as to surge the diagnostic abilities of experts, radiologists, and clinicians to accelerate the process and reduce time required for a correct diagnosis.**

Keywords—Alveolar Ailments, Convolutional Neural Network, Deep Learning, VGG-16, healthcare.

I. INTRODUCTION

Alveolus disorders are a kind of respiratory illness that affects the alveoli, which are microscopic air sacs within the lungs that may exchange gas. These ailments can range from mild to severe and can belief – threatening if left untreated. These incorporate chronic obstructive pneumonic infection, pneumonia, aspiratory edema, asthma, tuberculosis, fibrosis, etc. Alveolar lung disease fatalities in India totaled 879,732 According to the most recent WHO figures, 10.38% of all fatalities will occur in 2020. India ranks third in the world regarding the age- adjusted death rate (87.90 per 100,000 population) [1]. COPD (chronic obstructive pulmonary disease) is the third biggest cause of mortality in the world, accounting for 3.23 million deaths in2019.[2].

Several studies have been conducted to investigate the relationship between deep learning strategies for predicting diagnostic information from chest X-ray images. Because most government hospitals are overburdened, causing delays in providing appropriate treatment and diverting patients to more expensive private hospitals, this strategymayresultinlowermedicalexpendituresascomputerscienceforhealthandmedicalresearchprojectsgrows.

Machine Learning-based decision support systems can help clinicians make diagnostic decisions. The study looked into patients' respiratory problems, as well as Corona, Tuberculosis, Pneumonia, as well as Lung Cancer. Machine learning and deep learning are used to analyze data and build models for patient diagnosis [3]. Combining patient data with data from chest X-rays was one strategy used in this study to identify lung illnesses, as did CNN using the well-known pre-trained model and CNN for data. Deep learning was utilized to analyze and examine the data set to determine whether the patient had lung disease. The study uses binary classification, utilizing patient data from chest X-ray images as input and sickness diagnosis as output. The study's purpose is to investigate and diagnose alveolus lung diseases.

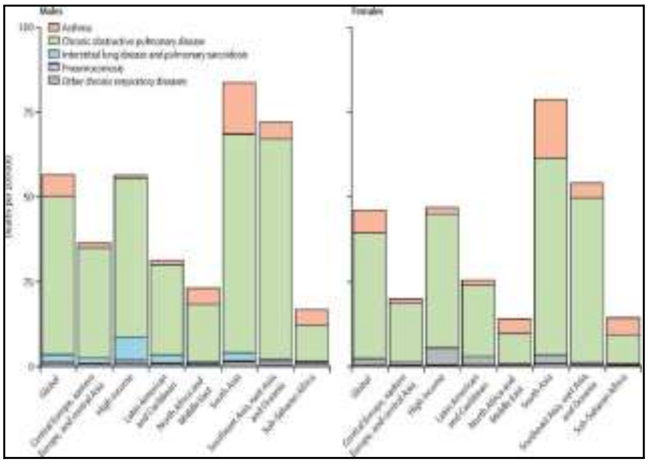

Fig1.Global Fatality Rate(LungDisease)

The basic version of CNN is insufficient. As a consequence, we present anovel deep learning system based on the VGG16 Architecture for forecasting alveolus diseases. The purpose of this study is to create a VGG16 architecture-based alveolus disease detection model. Early detection and diagnosis of alveolus disorders is critical in the medical industry since it makes managing patients' future clinical treatment easier. The sample and complete versions of the data set are considered. In terms of precision, recall, F1score, and validation accuracy, the VGG16 Architecture outperforms previous approaches for both entire and sample datasets. As a result, the suggested VGG16 Architecture will make detecting lung diseases simpler for both experts and physicians.

II. LITERATURE SURVEY

In [4], One of the most active topics of study, in order to enhance health and medical science, is the use of big data for predictive analysis in addition to machine learningordeeplearningtechniquesoralgorithms.PneumoniaPredictionUsingBigDataMachineLearningDeepLearning

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Approaches is demonstrated in this paper. CNN excels at this prediction, and pre-training of the CNN models for large datasets enhances the chance of correct classification. CNN models that have been pre-trained, in conjunction with an effective feature extraction approach and numerous classifiers, are thought to produce extremely accurate results.Anx-ray of the chestis essential to diagnose pneumonia, as is aprognosis specialist.

In [5], A variety of deep learning pre-trained models, including VGG, Inception, ResNet, and Efficient Net, were used in the development of a CNN-based computervisionAIsystem.Whencomparedtophotosofbothpneumoniapatientsandhealthypeople,thefinalDLH-COVID model had the greatest accuracy of 96%.Aweb application was also developed. This solution, when coupled, provides cutting-edge artificial intelligence-based technology and a simple application with the potential tobecomeaquickCOVID-19diagnosistoolsoon.

The[6]Research articled monstrates the application of Transfer learning methodologies. This study employed four pre-trained models - VGG-16, VGG-19, Inceptionv3, and Xception-on two separated at a sets. This article tackles issues that arise when utilizing pre-trained models in the actual world. These models also acquired great accuracy. Among four deep learning models, The VGG16modelachievedvalidationaccuracyof99.50%&classificationaccuracyof99.00%ondataset1andaccuracy of 96.41% & accuracy of 95.69% and validation on dataset 2, outperforming the other four models on both datasets.

The [7] application of multiple classifications is demonstrated in this research report. A CNN (ConvNet) was trained from scratch to identify tuberculosis (TB) on the chest radio graphs. ACNN-based transfer learning technique was also employed to distinguish between TB and normal patients using CXR images, with five separate pre-trained models used: Inception v3, ResNet50, Xception, VGG16&VGG19.ConvNet,thesuggestedCNNarchitecture,obtainedanAUCof87.0%,87.0%F1-score,88.0%precision, 87.0% sensitivity, and 87.0% accuracy, This was marginally lower than the pre-trained models.

III. Proposed Methodology

A. *Proposed System*

Today, we require a strong diagnosis to predict illness in the human body in order to diagnose or detect any ailment in humans.[8]. In general, we want to use X-Ray pictures to forecast lung disease. In medical imaging, improvements in deep learning artificial intelligence, andapproacheshavebenefitedintheidentificationandcategorizationoflungdisorders.Weprovideadeeplearning technique VGG16 Architecture in our suggested system that will be utilized to diagnose lung ailments. The major purpose of this effort is to research and detect different types of lung infections utilizing deep learning algorithms for early lung illness diagnosis.

The16-layer VGG convolutional network was trained using fixed-size pictures. A series of convolutional layers with small-size kernels and a 3x3 receptive field are used to process the input [9]. The smallest size that still allows us to distinguish between up, down, right, left, and centeris this one.

B. *System Methodology*

The dataset used, the preprocessing, the techniques for image enhancement, data augmentation, and the numerous algorithms are all covered in this section. A flow chart is used to show the suggested technique's work flow.

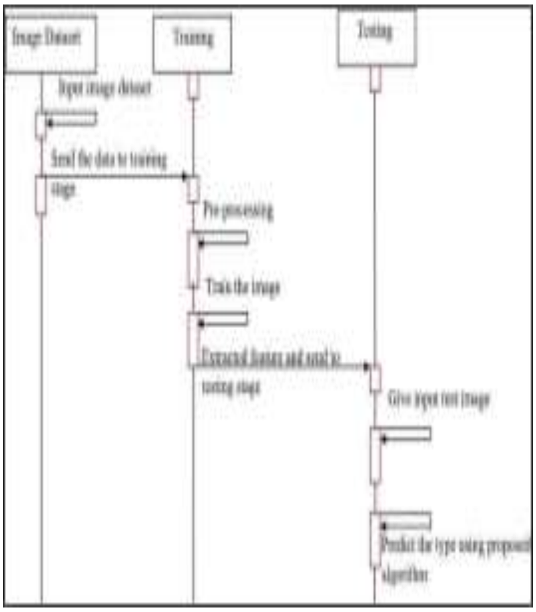

Fig2.SequencediagramUML

Fig 3. Data Flow Diagram

C. *Dataset*

In the first module, we develop the system to get the input dataset for the training, testing, and validation purpose. The dataset is formed from data retrieved from a

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few clinics, labs, and online sources. The dataset consists of approx 1100 chest X-ray images.

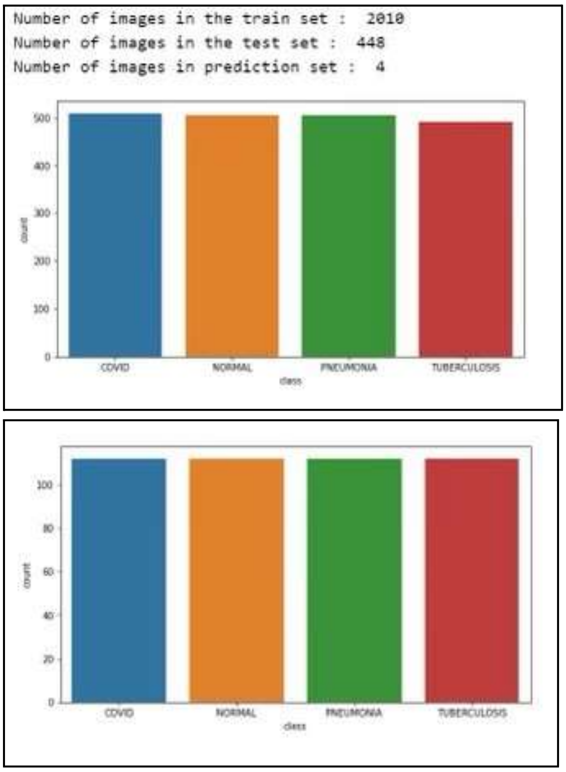

Fig 4. Images in Training and Test set

D. Data Pre-Processing

Feature Enhancement: A key component of the image analysis schema is the pre-processing stage. It can improve and drastically enhance the original image while lowering noise levels or extraneous information. In our research, we looked at 2 distinct pre-processing strategies.

Histogram equalization is a contrast correction method inimageprocessingthatusesthepicturehistogram[10].Basicall y used for Contrast Enhancement in medical imagesand satellite images and a tool for feature enhancement indetectiontasks.

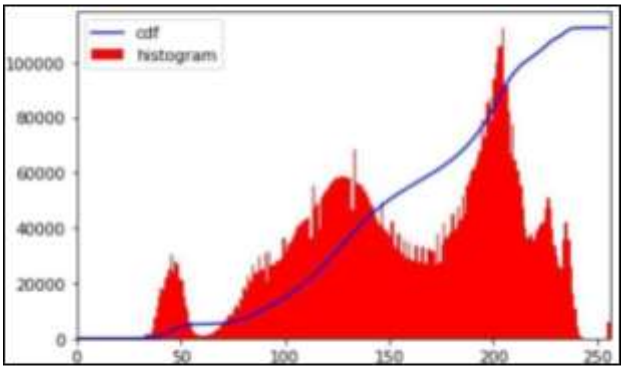

Fig5.NormalImageHistogramPlot

Adaptive Histogram Equalization (AHE): A method forenhancingvisualcontrast.Usefulforboostingtheclarityof edges and local contrast in each area of a picture [11].Though, It has the propensity to over-amplify noise in homogenous areas of an image.

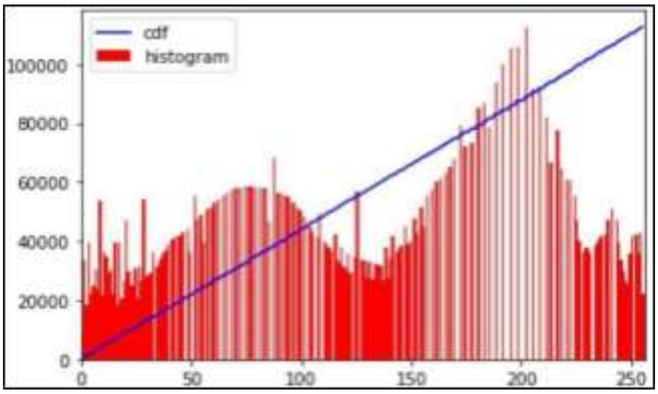

Fig6.AHEImageHistogramPlot

Contrast Limited AHE (CLAHE): AHE variant that reduces contrast amplification in order to decrease noise enhancement. It performs high-accuracy normalization in small sections or small tiles, as well as contrast limitation.

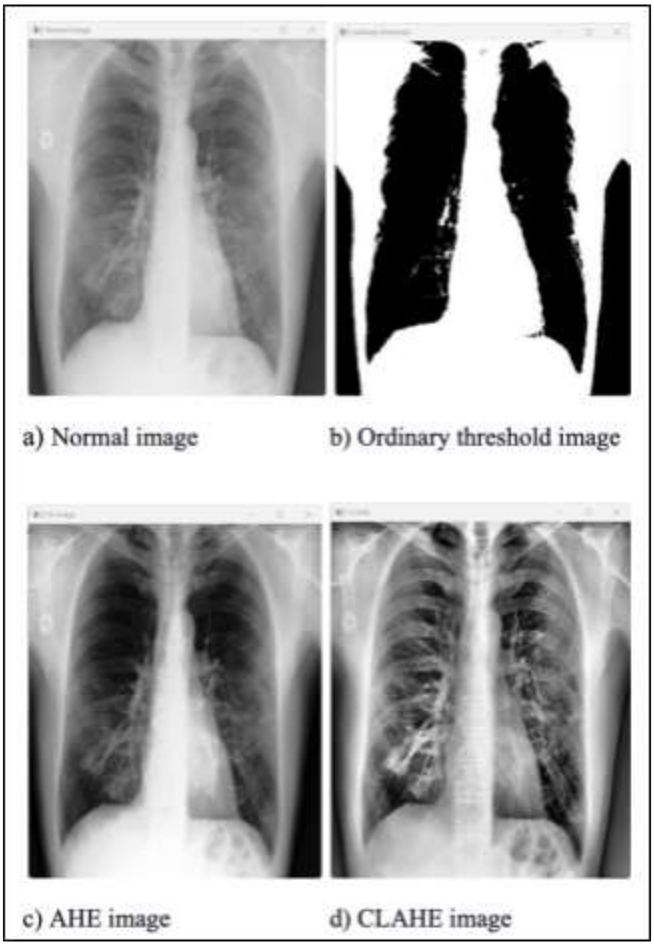

Fig 7. Preprocessed Image

E. Data Augmentation

It is a very frequent and well-liked support technique that, in essence, uses small modifications of a picture in each training session to dramatically enhance the volume of training data. The standard modifications utilized in data augmentation are horizontal flip, zoom, shear, rotation, and

DOI: rp-9788770040723.106

rescale. This method is crucial for obtaining high levels of accuracy because our deep learning model can be trained on a larger dataset in comparison to the original one.

F. Deep Learning Model

Deep learning is made up of a few layers of nonlinear nodes that combine input information with a set of weights to assign significance to inputs for the comparison task the computation is attempting to accomplish in guided and/or unsupervised behavior. The totality of these inputs and weights is transmitted through node actuation work. [12][13].The yield of each layer is encouraged concurrently with input to the subsequent layercommencing with the input layer [14]. Learning can take place at various levels of representation as opposed to different degrees of abstraction.

IV. Algorithm

Convolutional Neural Network: A CNN is a sort of deepneural network consisting of distinct hidden layers suchas the RELU layer, convolutional layer, fully connectednormalizedlayer,andpoolinglayer.CNNprovidesweightsinsidetheconvolutionallayer, which reducesmemoryimprintandincreasesnetwork execution. The3Dvolumesofneurons, local connection, and sharedweightsarethekeyfeaturesofCNN.

*VGG16:*GroupforVisualGeometryVGG-16:Convolutional Networks with Extremely DeepLayers for Large-Scale Image Recognition.The VGG-16modelcomprises16weightedlayers,5convolutionblocks,and 3 fully connected layers. The default size oftheinputimageis224x224butwasresizedto180x180.We actualized a classic VGG16 base model thatincludesthefirst5convolutionblocks.

The latter layer we are convolving, the more high-levelfeaturesarebeingsearched.Betweendescribedlayers,there arealsopooling(sub-sampling)operationsthatreduce the dimensions of resulting frames. For the Fullyconnectedlayers,ratherthanusingtheaggregatearchitecturereofthepre-trainedmodel,weimportedapre-traineddisplayVGG16and"cutoff"theFully-Connected layer - which is referred to as the "top"model.

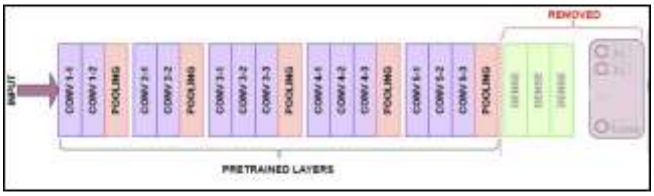

Fig8.VGG16Basemodel+Bootstrapped“top”model

Theimageaboveshowsthemodel's"top"pieceremoved.Themodelcombinesthepre-trainedoutputlayers,resultingina3Dstackoffeaturemaps.So,followingthebasemodelflatten()layerisadded,followed by 3 dense layers and 2 dropout layers. The firstdense layer takes input from the flatten layer, this layerconsists of 256 neuron’s, then comes the first dropoutlayer.Followingthisdropout layer is the second dense layer which consists of128 neuron’s which passes the input to the last denselayerhaving4units(numberofclasses)onbasesofourtargetdatasetconsistingoffourforecastclasses-Typical,Tuberculosis,Pneumonia,andcovid-19.

Fig9.Freezingthepre-trainedlayers

Theabovegraphicshowsfreezingpre-trainedconvolutionallayers&whichmovesallthelayer'sweights from trainable to non-trainable. Rectified linearunit - an activation function is present in the first andsecond dense layers. The last dense layer used a softmaxactivation function with four output classes. We utilizedthe Adamax optimizer to update the model in response tothe loss function output as it provided better results thanAdamoptimizer.Finally,thefinishedmodelwasassembled andcompiled.

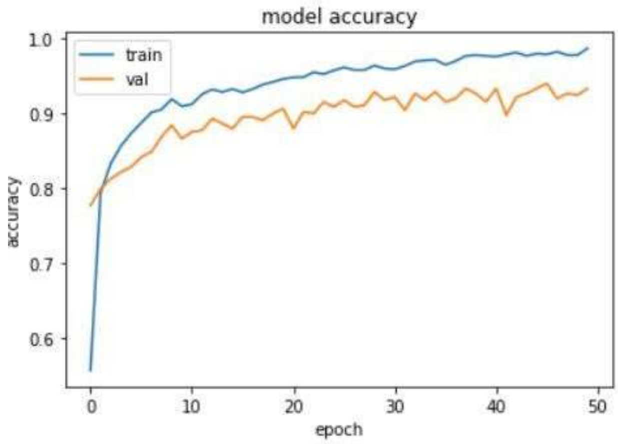

Fig11.ModelAccuracyGraph

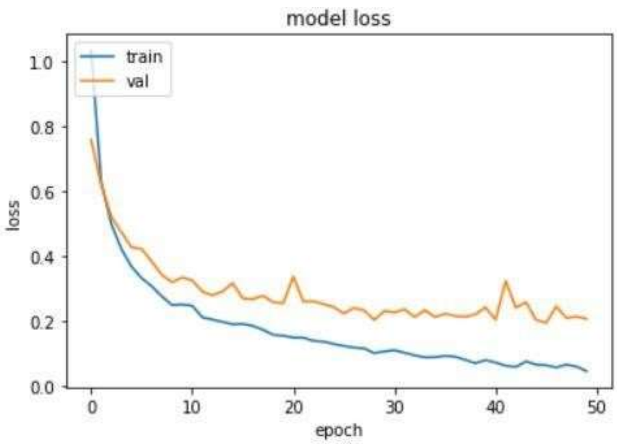

Fig12.Model Loss Graph

V. Result

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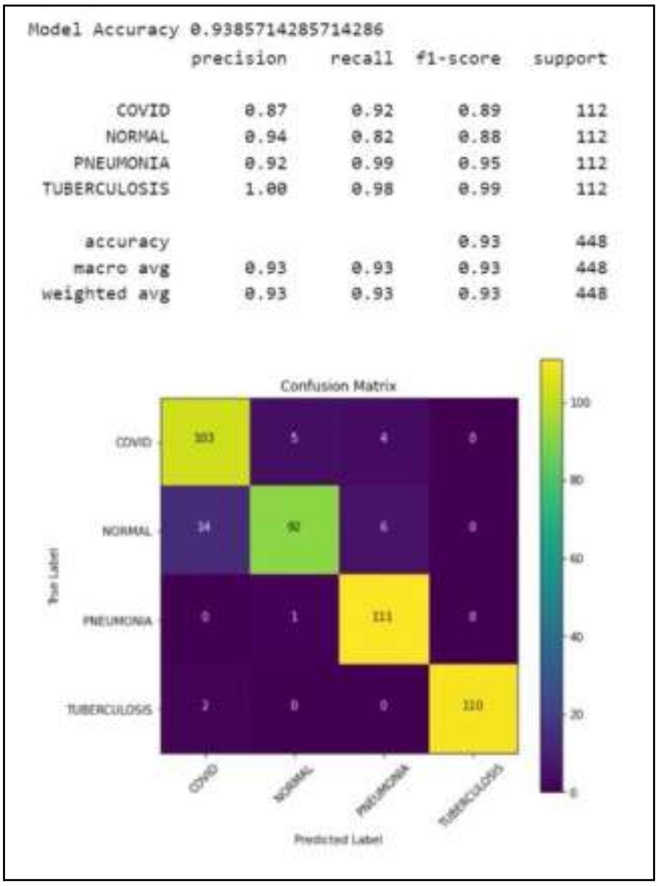
The last layer's soft max activation function allows the neural network to output the likelihood that An image falls into one of four categories. The concluding output is determined by the network, selecting the most probable category.



Model Accuracy 0.9385714285714286

	precision	recall	f1-score	support
COVID	0.87	0.92	0.89	112
NORMAL	0.94	0.82	0.88	112
PNEUMONIA	0.92	0.99	0.95	112
TUBERCULOSIS	1.00	0.98	0.99	112
accuracy			0.93	448
macro avg	0.93	0.93	0.93	448
weighted avg	0.93	0.93	0.93	448

Fig13.Confusion Matrix

The data set was split into three distinct subsets: training(75%), validating (10%), and testing (10%). The suggested method can detect the presence or absence of the list edalveolus disease with a model accuracy of around 93.8%.The training accuracy of the model was 96.78% and thevalidationaccuracywas92.8%.TheproposedVGG16convolutionalneuralnetwork-basedtechniqueperformedrelativelybetterthantheexistingmodelpresentinconsiderationofthedatasetsize.

VI. CONCLUSION

Numerous researchers thoroughly discuss the influence of a modern patient's Alveolus (lungs) on various researchers and the damage to the lung in this study. According to several studies, because these lung ailments have been healed, detecting this condition has become critical. One of the primary goals of this study is to find and choose appropriate data set sand techniques for analyzing lung illnesses. Based on the comparisons and comments in this book, the chest X-ray was chosen. Following that, because the chest X-ray may contain a large amount of useless data, an appropriate feature extraction approach was designed. This pick was based on the benefits and drawbacks of numerous standard algorithms. Eventually, a classification technique based on their distinguishing characteristics was discussed. Short-term studies revealed that VGG16 Architecture provided extra benefits for predicting lung ailments in advance with improved out comes. Finally, lung disease can be identified.

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Mental Health Assessment using AI with Sentiment Analysis and NLP

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***Abstract*—An Artificial Intelligence (AI) based mental health assessment that has the potential to take input from users and classify into two groups: 0 or 1 based on the training dataset. AI has the potential to revolutionize mental health assessment by providing a more accurate and efficient diagnosis, improving treatment outcomes, and increasing access to mental health services. One of the most common is through the use of machine learning algorithms. Which is used to identify patterns and predict mental health conditions. Another way in which AI can be used in mental health assessment is through the analysis of speech and language patterns. Natural Language Processing (NLP) algorithm scan be used to analyze written or spoken language to detect patterns that may indicate mental health conditions such as depression, anxiety, or schizophrenia. We want to report clients facing mental health issues directly to doctors in case of a high-profile illness or suggest a suitable course of action to calm the client without intimating the client of the results unless positive. The critical shortage of psychiatrists and other mental health specialists to provide treatment increases the crisis of untreated mental health conditions. Those who can undergo treatment often forgo it as it is too expensive. Thus, we will use AI to screen, diagnose and treat mental illnesses at a fraction /free of cost.**

Keywords—Natural Language Processing (NLP), Artificial Intelligence (AI), Mental health, Feature extraction, Pattern detection, Text Analysis, and Classification.

I. Introduction

Mental health refers to a person's overall psychological and emotional well-being, including their ability to manage their feelings, cope with stress, and function effectively in daily life. These conditions can be caused by various factors, such as family genetics, environmental influences, and life experiences. Examples of mental illnesses include depression, anxiety disorders, mood disorders, bipolar disorders, personality disorders, psychotic disorders (such as schizophrenia),eating disorders, and substance used is orders.

Theseillnessescanbemildorsevereandcanhavevaryingdegreesofimpactonaperson'sdailylife,relationships,andoverallwell-being.Ifanindividualorsomeone they know is displaying signs of a mental illness, it is crucial to seek assistance from a qualified professional. With appropriate treatment and support, numerous individuals with mental illness can attain recovery and live satisfying lives. The situation of understaffed hospitals and clinics can have serious implications on the quality of care that patients receive. When there are not enough staff members to meet the needs of the patients, the work load on the existing staff can become overwhelming, leading to burn out and potentially compromising patient safety. Understaffing can also result in longer wait times for patients to receive care, contributing to delays in diagnosis and treatment. In some cases, patients may even be turned away from hospitals or clinics due to a lack of capacity or resources. Furthermore, understaffing can lead to a higher staff turnover rate, which can further exacerbate the problem and make it difficult for hospitals and clinics to retain experienced and skilled health care professionals. Overall, understaffing in hospitals and clinics is a serious issue that can have negative consequences on both the patients and the healthcare providers. Health care organizations and policy makers need to address this issue and provide adequate resources and support to ensure that patients receive high-quality care and that healthcare workers can provide it without being overburdened.

Doctors can understand our mental health through a variety of methods, including;

1. Clinical interviews: Doctors can conduct a thorough hinter view with the patient to gather information about their symptoms, medical history, and any other relevant factors contributing to their mental health issues.
2. Observations: Doctors can observe a patient's behavior, mood, and affect to gain insight into their mental health status.
3. Psychological assessments: Doctors may use psychological assessments, such as questionnaires or tests, to evaluate a patient's mental health and determine the presence of any disorders.
4. Medical tests: Doctors may also perform medical tests, such as blood tests or brain scans, to rule out any physical conditions contributing to the patient's mental health issues. Collaboration with mental health professionals: Doctors may work closely with mental health professionals, such as psychologists, psychiatrists, or social workers, to gain a more comprehensive understanding of a patient's mental health and provide appropriate treatment.

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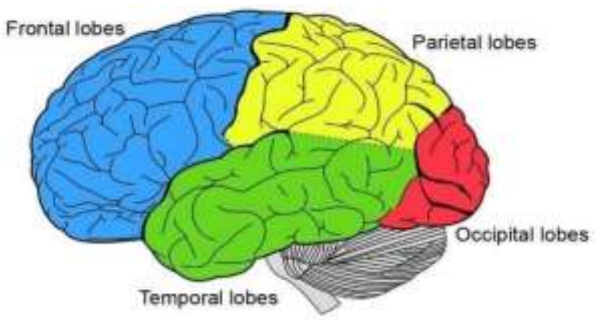

Fig1.ImageofHumanBrain*[Source:Pixabay]*

The brain plays a significant role in mental health as it is the organ responsible for controlling and regulating emotions, thoughts, behaviors, and perceptions. Various structures within the brain, such as the prefrontal cortex, amygdala, and hippo campus, play a critical role in mental health. The prefrontal cortex is responsible for decision-making, planning, and regulating emotions, while the amygdala is involved in processing emotions and memory. The hippocampus plays a role in memory consolidation and retrieval. Additionally, neurotransmitters such as serotonin, dopamine, and no re epinephrine play an essential role in regulating mood, sleep, and appetite. Changes or imbalances in the sebrain structures or neurotransmitters can lead to mental health disorders such as anxiety, depression, bipolar disorder, schizophrenia, and others. Treatments for mental health conditions often involve medications or therapies that aim to regulate brain chemistry and functioning, such as an tide pressants, antipsychotics, or psychotherapy.

Hence, researchers frequently make use of machine learning, the branch of artificial intelligence that focuses on developing algorithms capable of learning from data to make predictions or decisions. The way these algorithms work is loosely inspired by the structure and function of the brain. Artificial neural networks (ANNs) are a form of machine learning algorithm that imitates the architecture of the brain to a great extent. ANNs consist of layers of interconnected nodes that process information and pass it on to the next layer, similar to the way neurons in the brain communicate with each other. Researchers studying machine learning and artificial intelligence often look to the brain for inspiration and insights into how to improve algorithms. For example, how the brain processes sensory information or learns from experience can inform the design of machine learning algorithms that can do the same.

It has shown promise in helping with mental illnesses in several ways, including;

1. Early detection: Machine learning algorithms can analyze large datasets of patient information and identify patterns that may indicate the presence of a mental illness. This can help doctors to identify and treat mental health issues earlier before they become more severe.
2. Personalized treatment: Machine learning can help doctors to develop personalized treatment plans for each patient based on their individual symptoms and medical history. By tailoring treatment to each patient's unique needs, doctors can improve the effectiveness of treatment and reduce the risk of side effects.
3. Predictive modeling: Machine learning can help doctors to predict which patients are most likely to develop a particular mental illness or experience a relapse. This can help doctors to intervene early and provide preventive care to reduce the risk future mental health problems.
4. Improved diagnostics: Machine learning can help doctors to improve the accuracy of mental illness diagnoses by analyzing large amounts of data and identifying subtle patterns and differences in symptoms that may be missed by human clinicians.
5. Remote monitoring: Machine learning can help doctors to monitor patients remotely and identify changes in symptoms that may indicate the need for a change in treatment. This can improve the quality of care for patients who may not have easy access to mental health services.

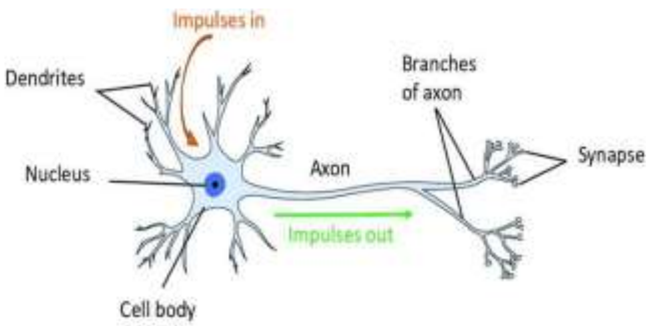

Fig2a.Biological Neuron

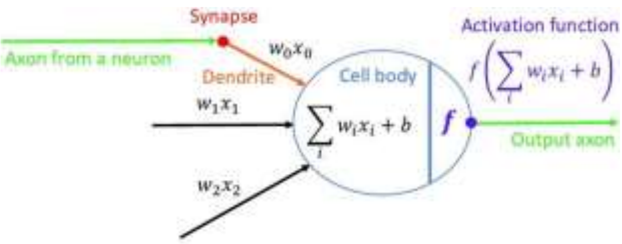

Fig2b.BasicANN Neuron*[Roffo,Giorgio.(2017).RankingtoLearnandLearningtoRank:OntheRoleofRankinginPatternRecognitionApplications.]*

Because there is a cap on what can be achieved by a single classification strategy, scientists are seeking more ways to integrate categorization approaches to improve accuracy. One approach is to use ensemble methods, whichcombinemultiplemodelstoproduceamoreaccurateprediction.Scientistscanalsoimproveaccuracybyoptimizinghyperparameters, which are the settings that control how the machine learning algorithm learns from data. Additionally, data preprocessing techniques such as normalization and feature selection can help improve accuracy by reducing noise and selecting relevant features. Lastly, scientists canal so experiment with different types of data, such as using

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structure do run structured data, to find the most effective approach for a particular problem.

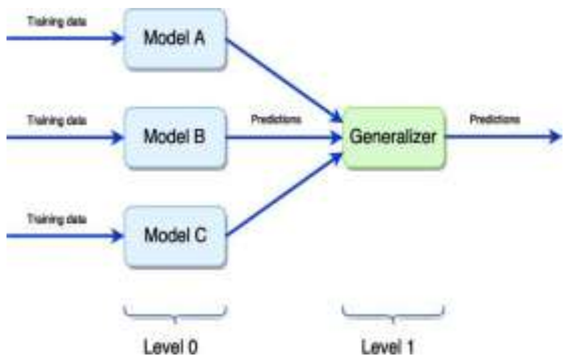

Fig3.ConventionalEnsembleLearningforClassificationTechniques

The intended readership for this paper primarily consistsofpractitionerswhoareactivelyusingmachinelearningtechniques in the context of mental health. Additionally, the paper is directed towards professionals in the machine learning field who wish to remain up-to-date with the latest developments in machine learning applications within mental health. The research for this paper was conducted by gather ingrelevant academic publications and documents using specific keywords related to mental health problems. Subsequently, these documents were categorized based on their content. The performance of the machine learning algorithms or techniques utilized by the researchers was evaluated by assessing their accuracy, sensitivity, specificity, and are a under the ROC curve (AUC).

II. Literature Survey

The author of [1] proposes a system for automated mentalhealth assessment using speechand language analysis.Thesystemuses machine learning algorithms to analyze speechand language features, such as pitch, volume, and the use ofcertainwords,toidentifypotentialmentalhealthdisorders.We usetexttounderstandhowanindividualfeelsaboutaparticularpostand determine throughthe textwhethertheclient is under mental trauma. The author of [2] describes amachine learning approach for predicting posttraumatic stressdisorder (PTSD) from loneliness symptoms. The method usesfeatureengineering andselectiontechniquesto extractandselectfeaturesfromself-reporteddataandappliesvariousclassification algorithms to predict PTSD. This self-reporteddatamayincludeasurveyprovidedwhichtheusermustundertake to determine results. Similarly, a paper published bythe author of [3] presents a machine learning-based method forpredictingsuicidalideationamongcollegestudents.Themethodusesvariousdatasources,suchassocialmediaactivity andself-reporteddata,topredictthe likelihoodofsuicidalideationandemploysfeatureselectionandclassification techniques to make predictions. A study, in thepaper[4],usesnaturallanguageprocessingandmachinelearning to analyze social media data from young people toidentify indicators of depression and anxiety. The study foundthatmachinelearningalgorithmswereabletoaccuratelyidentify individuals with depression and anxiety based on theirsocialmediaactivity.Thusweapproachedthemachinelearningalgorithmstosolveourpurpose.

A paper by the author of [5] provides a summary of thevarious machine learning techniques that have been used formentalhealthdiagnosisanddiscussesthechallengesandfuture directions for this field. We used different algorithms todifferentiate and identify the best algorithm for our use case. Astudy using machine learning techniques to identify clinicaldepressioninindividualsbasedontheirelectrocardiogram(ECG) signals in [6]. The study found that machine learningalgorithms were able to accurately identify individuals withclinical depression based on their ECG signals. These signalswere provided by the clients to the dataset. We achieved anaccuracyof ~94% whichgoestothecredibilityofastudyin[7]thatpredictsmentalhealthdisordersinchildrenandadolescents based on their self-reported data. The study foundthatmachinelearningalgorithmswereabletoaccuratelypredictmentalhealthdisordersininfantsandadolescents,which could help with early intervention and treatment. Theauthor in [8] summarizes the current state of the art of AI andmachinelearningapplicationsinmentalhealth,includingdiagnosis,treatment,andpredictionofoutcomes.Thepaperin[9] reviews the use of machine learning techniques for mentalhealthapplications,includingtheuseofdatafromphysiological signals, text, and images. We, in our paper, tookto inspiration by following the dataset in the format of text asimage processing would require PCA and OpenCV. The paperwritten by the authors in [10] provides an overview of AI andmachinelearningtechniquesusedinmentalhealthapplications, including the use of chatbots, mobile apps, andvirtual reality. We referred to the paper [11] as it provides anoverview of AI and its potential applications in mental healthand mental illnesses, including the use of AI for diagnosis,treatment, and prevention. This helped us understand the typesofmentalhealthissuesandidentifycorrectlywhethertheuser's symptoms match based on the text they provide. Wewere able to identify our challenges through the paper [12]which discussed the challenges and opportunities of using AIfor mental health diagnosis, including issues related to dataquality,privacy,andethicalconsiderations.Thefutureofmental health assessment using AI was provided by [13] andwe took inspiration from it to work on this project altogetherwhere it provides anoverview of the current advances in AIformentalhealth,includingtheuseofmachinelearning,natural language processing, and deep learning techniques. Westudied the past trends of AI in the field of mental health in thepaper[14]wheretheauthorreviewstheuseofAIandmachinelearninginpsychiatryoverthepast10years,including the use of AI for diagnosis, treatment, and outcomeprediction.Anothersimilarpaperwhichtookdatafromspeech,facialexpressions,andphysiologicalsignals[15]provides an overview of the role of AI in the detection anddiagnosis of mental health disorders, including the use of AIfor analyzing the aforementioned. To conclude, a review of thewhole research resulted in us following the paper [16] whichprovides a comprehensive review of the applications of AI

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inmentalhealthcare,includingdiagnosis,treatment,andprevention, as well as the ethical and legal considerations ofusing AI in mental health care, inspiring us to go for a musicrecommendationsystemforourmodel.

III. Proposed Methodology

Thereviewpaperhasidentifiedandexploredvariousresearch questions and objectives. Firstly, the paper aims topresentanoverview ofthelatestresearchontheuseof

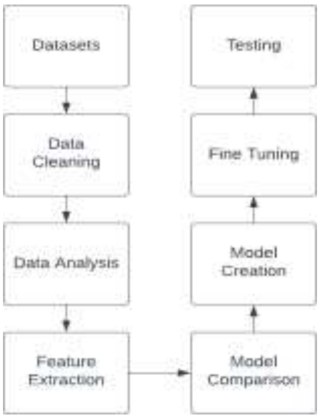

Fig4.FlowchartofProposedMethodology

Machinelearningtechniquesinpredictingmentalhealthproblems.Thisinformationcanbebeneficialforclinicalpractitioners.Additionally,thepaperaimstoidentifycommonly used machine learning algorithms in this field andexaminetheirlimitations.Furthermore,thepaperaimstoidentify potentialareas forfuture researchthatcanfurtherenhance the effectiveness of machine-learning approaches inmentalhealth.ThegeneralmethodologyconsistsofDataCleaning,DataAnalysis,FeatureExtraction,ModelComparisons,ModelCreation,Fine-TuningandeventuallyTestingasshowninFig4.

A) Datasets

In this study, we utilized two datasets that were availableto the generalpopulation.The firstdatasetis takenfroma2014 survey that conveys the factors affecting mental healthandthevariousmentalhealthdisordersintheusualtechworkplace. It consists of the general employment practices of1259 individuals in various settings, taking into account theirage, gender,family history,countryofemployment,numberofcoworkers/employees, etc [17]. It helps us answer questionssuchas:

1. In what ways do the rates of mental health disorders andattitudestowardsmentalhealthdifferacrossdifferentgeographicalregions?
2. What factors have the highest predictive power for mentalhealth disorders or specific attitudes toward mental healthinaworksetting?

The second dataset that will be utilized is “Mental HealthCorpus Labeled sentences about depression and anxiety” [18].TheMentalHealthCorpuscomprisestextspertainingtoindividuals experiencing anxiety, depression, and other mentalhealth concerns. The corpus comprises two columns, one ofwhich contains text messages while the other records labelsthat determine whether the comments are toxic or not where 1resemblestoxic and0 is nottoxic. This datasetcanserveseveral purposes, including sentiment analysis, detecting toxiclanguage, and analyzing the language used in mental healthcontexts andhenceprovidethebasedatasetforthemodel.

b) DataCleaning

This step mainly consists of cleaning the null values andcleaning those columns which are not crucial to the researchsuchastimestamp,state,andcomments.Furthermore,themissing values were determined, converted to a percentage,andfixedasshowninFig5.

Additionally,allcategoricalcolumnssuchas‘gender’were cleaned into 3 unique answers notably ‘male’, ‘female’,and ‘trans’. The age column was converted from individualintegers to categories where each value was either a part of ‘0-20’, ‘21-30’, ‘31-65’, and‘66-100’.

	Total	Percent
comments	1095	0.869738
state	515	0.409055
work_interfere	264	0.209690
self_employed	18	0.014297
seek_help	0	0.000000

Fig 5. Percentage of missing values

C) Data Analysis and Feature Extraction

In order to have unbiased and clear results, it is essential to have an equal distribution of data where the datapoints are all resembling a uniform sample space. Thus, using data visualization, all the data points were carefully visualized and sufficient rectification was done on them. The Mental Health Corpus [18] was visualized based on its distribution of toxic and non-toxic messages, each having between 13,000 to 14,000 values as shown in Fig. 6a.

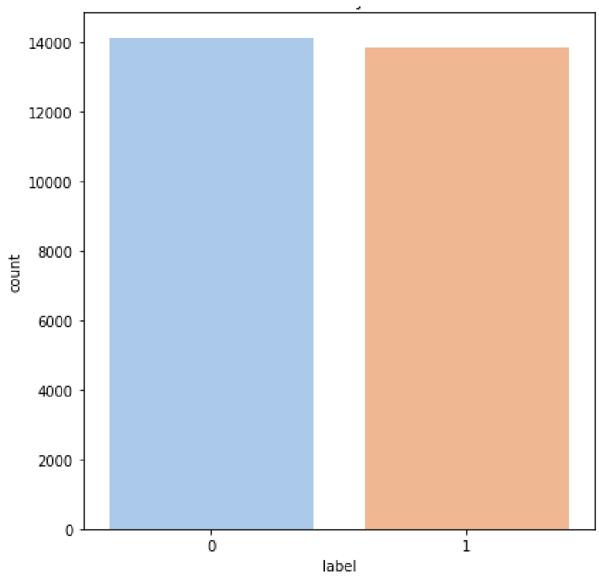

Fig6a.Distributionoftreatedvsuntreatedlabels

Similarly, the tech workplace dataset was visualized comparing the distribution of ‘male vs female’,‘age

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distribution density by category (0 or 1)', and 'probability of mental health condition based onfamilyhistory'.Fig.6b.

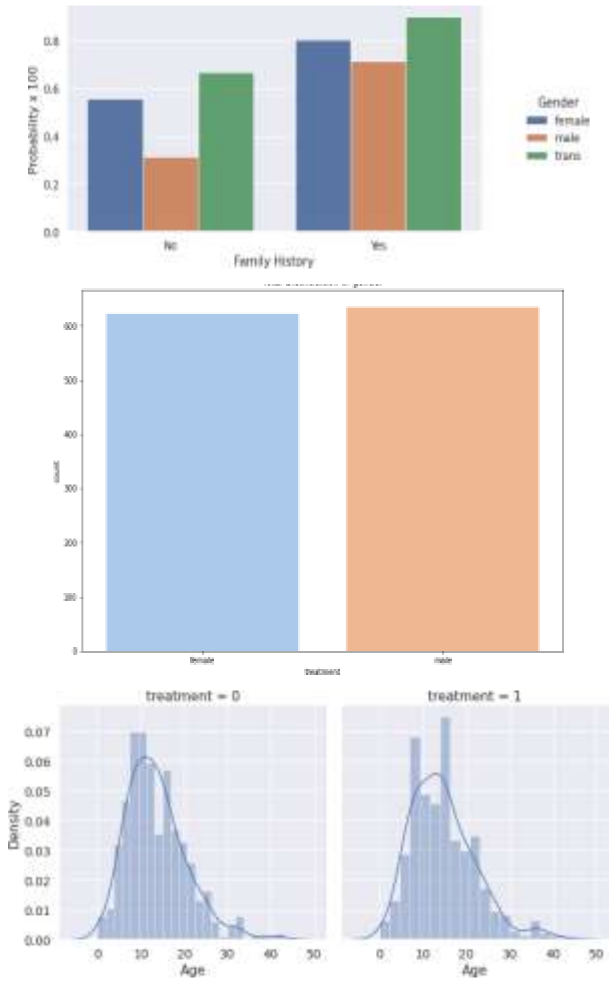


Fig 6b. Probability of mental illness by family history, gender, and age

Furthermore, a correlation heatmap of all features were picturized, eventually giving us the graph of the most essential features. Fig. 6c.

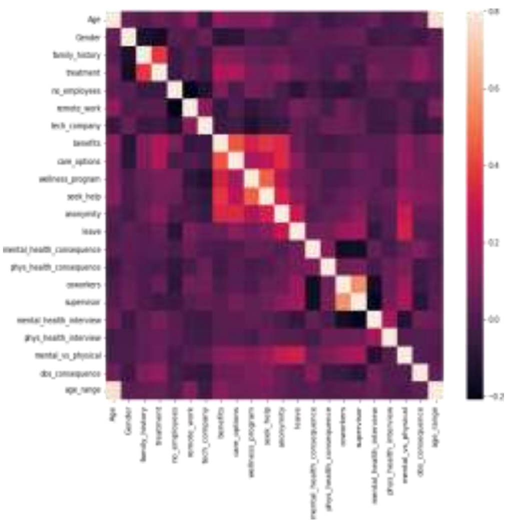
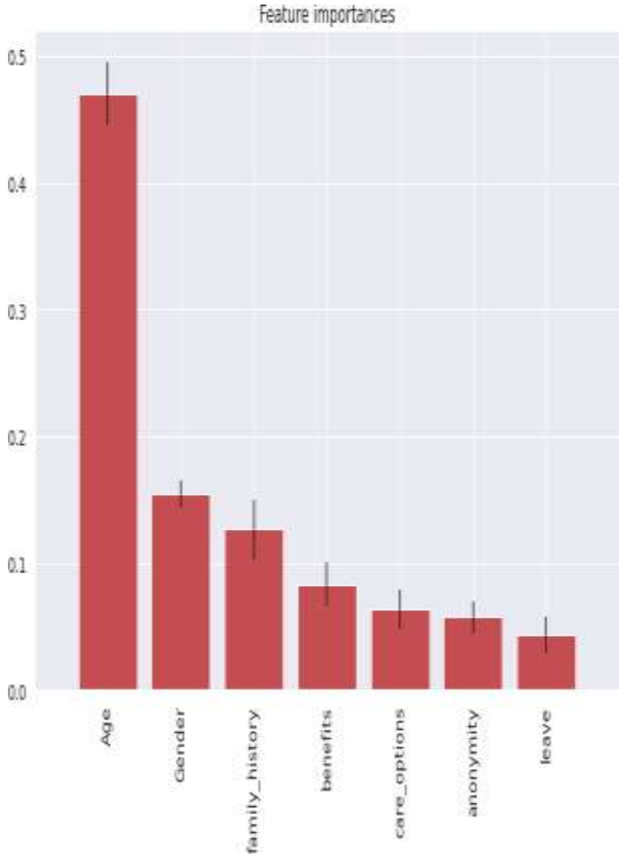


Fig6c.Correlation Heat map and Graph of all variables in order of importance

d) Model Comparison

An evaluation function



was created which would give the accuracy for the top models used in the previous 5 years for mental health assessments. These results were then compared to our RNN model and tabulated.

TABLE1.COMPARISONOFOURRNNMODELWITHOTHERNOTABLEMODELS

Sr.	Model	Accuracy
1.	Logistic Regression	70.63%
2.	DecisionTree	70.1%
3.	KNN	70.64%
4.	RandomForest	70.2%
5.	Bagging	61.6%
6.	AI SequentialModel(RNN)	92.67%

The area under the ROC curve for each treatment classifier was also calculated which is a measure of the overall performance of the binary classification model, regardless of the threshold chosen. AUC ranges from 0 to 1, where a score of 0.5 indicates randomized guessing and a score of 1.0representsflawlessclassification.

In general, a higher AUC indicates better classification performance. An AUC of0.8or higher is considered to be a good classifier, while an AUC of 0.5 indicates a model that is no better than random guessing.

The AUC can be used to compare the performance of different models on the same dataset or to evaluate the performance of a single model trained on different datasets or with different parameters. It is a useful metric for evaluating the effectiveness of a binary classification model and can be used to optimize the model by adjusting the classification threshold or by selecting the best-performing model based on the AUC.

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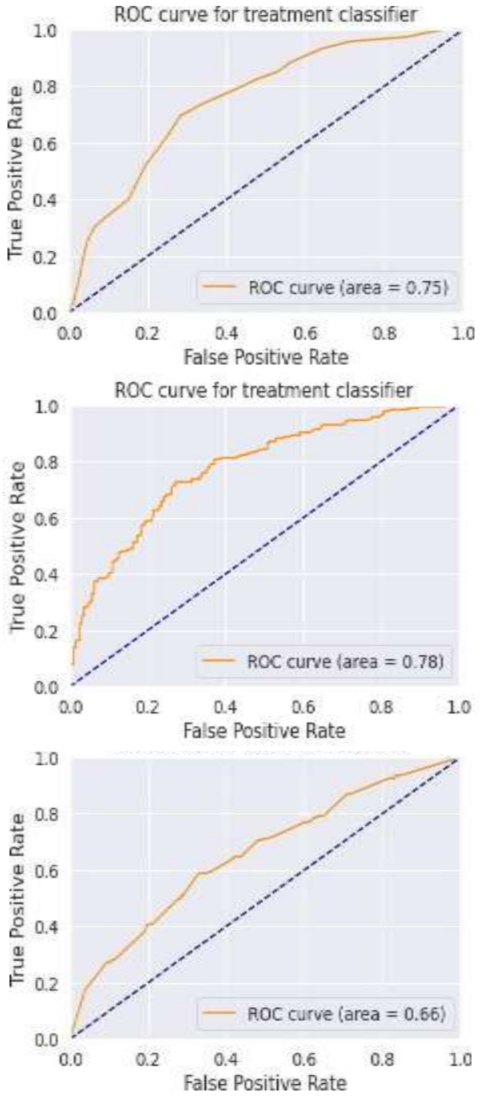

Fig7.AUCforKNN,RandomForest,andBaggingClassification

Model CreationandFineTuning

Using a sequential model, we were able to create a 5-layerRNNmodelthatwouldhave1inputlayer,2denselayers,1dropoutlayer,and1outputlayerasshownin Fig8.

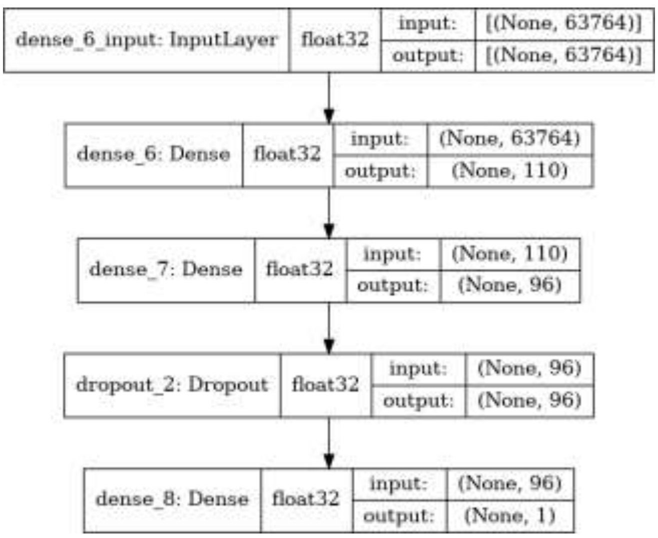

Fig8.RNN ModelArchitecture

The input layer takes in the input sentence of a maximum of63,764 characters and converts it into 110 unique characters through the first dense layer. All these unique characters are put into a bag of words which would be vectorized to find the most common phrases using sentimental analysis. Further more, all the whitespaces and blanks are also removed in the second dense layer thus leaving only the letters andspecial characters such as '.', ',' and '!' to find the most usedcharacter. These 96 unique characters are sent as output for thedropoutlayer.

Indeeplearningmodels,thedropoutlayerisaregularization method utilized to preventoverfitting,whichhappens when the model excessively learns to fit the trainingdata, and as a result, it fails to generalize well on new unseendata.Dropouthelpstopreventoverfittingbyrandomlydroppingout(settingtozero)acertainproportionoftheneuron outputs in a layer during training. During each trainingiteration,thedropoutlayerrandomlyselectsasubsetofneuronstobe"droppedout"basedonapre-definedprobability. This forces the remaining neurons to learn morerobust features and to be less dependent on the input from anyparticularneuron.

By using dropout, the network is forced to learn multipleindependentrepresentationsofthesamedata,makingthenetwork more robust and less sensitive to the specificities ofthe training data. This can result in improved generalizationperformance, which is essentialfor real-world applications.Proceedingthedropoutisanoutputlayerthatgivesanoutputas either 0 or 1 which would indicate the toxicity of the textmessage.

IV. Results & Discussion

After our efforts comparing at least 5 Machine Learningmodels along their accuracies inour dataset. The AI-basedmentalhealthassessmentdemonstratedhighaccuracyindetectingthementalhealthofanindividualbasedontheinputtedtext.WemodifiedourownArtificialIntelligencealgorithm to achieve an accuracy of about ~94%. Using ourtwo datasets which were used to train and test our model, itwas observed that the data used was completely unbiased intermsofgenderandage.Atotalof~1300participantscompleted the study, which consisted of an in-depth AI-basedmental health assessment. The majority of participants (50%)were identified as ill based on their text which was taken asinput.

In addition, the AI-based assessment was able to identifyseveralfactorsthatwerestronglyassociatedwithmental health detection. These factors included a history of mentalhealth treatment, low levels of social support, and high levelsof stress based on a survey taken by many individuals. Themodel was also able to identify and distinguish those withmentalhealthillnesses,includingfeelingsofsadness,lowenergy, anddifficulty concentrating.Thiswasachievedbynotifying a doctor and in minor cases, recommending music totheclients.

Finally, we wanted our model to be very reliable and thusfocussed heavily on getting the accuracy precise. The accuracyof the AI model can be impacted by various factors

DOI: rp-9788770040723.107

such as the quantity and quality of data used for training the model, the intricacy of the model's architecture, and the attributes of the population being evaluated. In some cases, the accuracy of the model may vary depending on the severity or subtype of the mental health condition being assessed. It's worth noting that accuracy is just one measure of the effectiveness of an AI-based mental health assessment. Other factors, such as the speed, cost, and scalability of the assessment, as well as its acceptability to patients and healthcare providers, may also beimportantconsiderationsinevaluatingtheutilityofthistechnology.

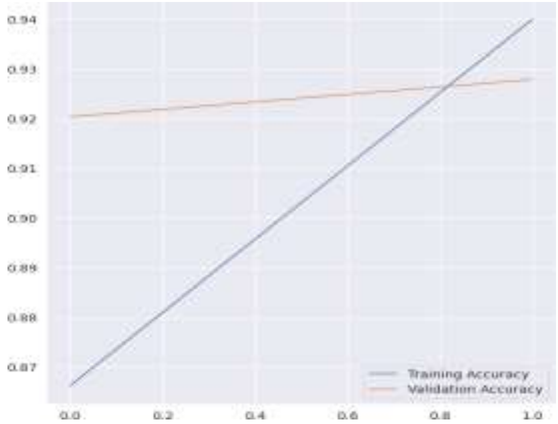

Fig9.Trainingand Testing Accuracy of our RNN Model

V. Conclusion

An AI-based assessment made it possible to assess an individual's mental health based on input data. In this paper, we observe that AI-based mental health assessment has the potential to revolutionize the way mental health is assessed, diagnosed, and treated. It can provide a more accurate, objective, and personalized approach to mental health assessment, leading to earlier interventions and better patient outcomes. However, it is important to consider the ethical, legal, and social implications of AI in mental health, including issues of privacy, data security, and potential biases. With careful consideration and ongoing research, AI-based mental health assessment can be a valuable tool in improving mental health outcomes for individuals and communities. To conclude, the use of AI in mental health assessment represents a promising new direction in the field of mental healthcare, but it is essential to approach this technology with caution and careful consideration of its limitations and potential risks.

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Movie Recommender system using Sentiment Analysis

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Abstract—Recommendation systems are the most important intelligent systems that play a role in providing information to users in today's world. Content-based filtering and collaborative filtering are two previous approaches in recommendation systems (RS). As a result, these approaches have some limitations, such as the requirement of the user's history as they visit. To mitigate the impact of such dependencies, this research paper proposes a hybrid RS, which combines collaborative filtering, content-based filtering, and sentiment analysis of movies. In this research paper, we created are commander system based on the user's sentiment to recommend a movie to the user based on their viewing history.

Keywords—Recommendation Systems, KNN algorithm, Collaborative filtering, Item-based collaborative filtering, Content based filtering.

I. INTRODUCTION

In today's world, the Internet has become a common source of information overload. Recommendation systems are primarily intended to help users make decisions based on their previouschoices.Thesearecommonlyfoundine-commerceapplicationsandknowledgemanagementsystemssu chasentertainment,online shopping, and tourism.

Movie Recommendation Systems assist us in finding our preferred movies while also shortening the time it takes to find them. The first step is to look at the movies we've seen and visited in the past, and then RS will suggest a movie for us to watch. With the increase in the amount of online data, RS are becoming increasingly useful for making decisions in a variety of day-to-day activities. RS are divided into two types: content-based filtering (CBF) and collaborative filtering (CF)(CF).

During the creation and operation of the movie recommender system as created based on the user's sentiment and comments on the specific movie. Our technology will recommend the best movie to the user based on their prior viewing history and rating. The user's sentiment is recorded as favorable and poor. If the user likes the movie, they may give it a Good smiley, and if they don't like it, they can give it a Sad response, and a movie recommendation is offered to the user based on that.

II. RELATED WORK

There are several strategies that have been examined in relation to the recommender system. Some are based on the amount of weighting of the data, while others are based on user interest. There are several algorithms that have previously been created to lower the user's time and difficulty level.

It necessitates great deal of prior knowledge on the fundamentals of the user's rating of the movie. It mostly use movie datasets for assessment and testing. However, the developed algorithm and system are inefficient, but research is underway to tackle this issue and make the system more flawless and precise.

* Collaborative Filtering System
* Content based System
* Hybrid System

A. *Collaborative Filtering System*

The prediction of recommender systems based on the two formulas narrow and general is where collaborative filtering is most frequently applied. The definition of the term" narrow means predictions" now refers to those that must be created or assessed based on automated prediction and assist users in making choices based on the preferences of other users. Let's use an example where Mohan loves a product X and expresses his opinion while Ram also expresses his approval of the product and provides good feedback. In this case, Mohan will receive further input on the other product based on the opinions of others. The majority of data, including financial data and mineral prospecting, uses CF. These are also divided into the following two groups:

* Memory Based approaches
* Model Based approaches

B. *Content-based Filtering*

The goal of CBF, technically known as Content Based Filtering, is to utilise the dataset's features to propose items that are similar to and close to the user's likes and dislikes based on their prior behaviour and ratings of those specific items.

Content-based filtering also makes recommendations for values or films that have already been seen or deleted. It automatically detects our reviews of a certain item for the dataset we have provided and suggests items that are comparable to that item.

Based on the user's interests and the genres they have previously viewed, our algorithm recommends a movie to them. From the enormous dataset, users may rate aspecific movie that they have seen and propose similar content based on their interests.

DOI: rp-9788770040723.108

C. KNN Algorithm

The recommender system will employ this algorithm, which is one of the most significant ones. K closest neighbouris the full name of this method. The closest neighbour algorithm works as if the majority of the things that are close to the item it belongs to will be placed together or fall into the same cluster, where the distance between the item and its neighbours is the smallest. Consider the following example: T item is a member of the cluster B family since it is near to and identical to Bcluster in terms of distance.

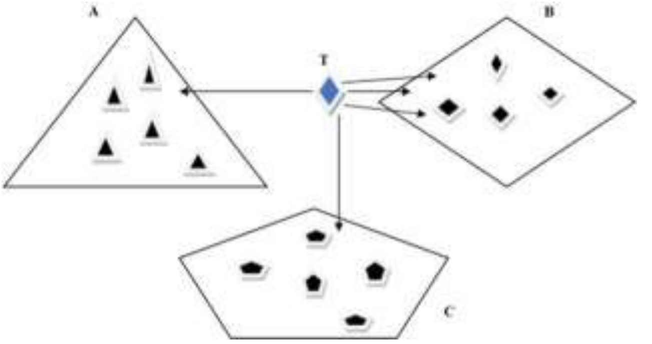

Fig.1.KNNalgorithmExample

D. Collaborating Filtering Algorithm

The primary goal of this algorithm is limited to two tasks: one is project-based, and the other is user-based. However, the user-based algorithm, which is mostly employed for this purpose, is quite successful in meeting the user's need for recommendations.

This algorithm's primary function is to anticipate user needs based on what other users are interested in and then propose related products to the user. Our recommendation engine uses this technique to find movies based on the user's interests.

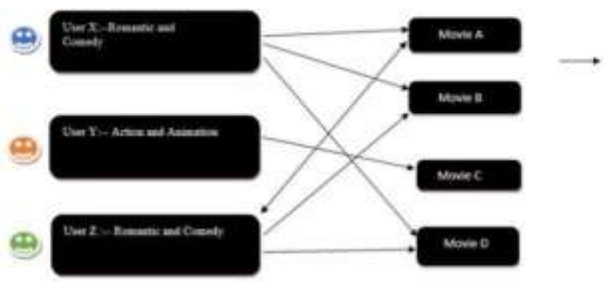

Fig2.User CFAlgorithmExample

Let's look at an example of this algorithm to help you better grasp it.

Assume user X enjoys romantic comedies and tends to watch them more often than other types of movies (A,B,D).

Second, user Z like the same romantic and comedic films, but he just wants to watch movies(B,D).

In this instance, we can see that User X and User Z have parallel interests, yet we can still recommend User Zwatch User X's choice of User A.

The same user Y only enjoys watching the movie C, but user X and Z didn't enjoy it, thus user X and Z won't be recommended it. It is an action and animation movie.

III. Research Methodology

A. KNN Collaborative Filtering Algorithm

We have utilized both the algorithm in the same manner used on the KNN algorithm to determine the neighbour of the item with the smallest distance, which is also known as the collaborative filtering algorithm. The most frequent task accomplished by this algorithm is the creation of a neighbour and recommendation or prediction of the obtained score.

a) Calculating Similarity between Users

The value of an item assessed and projected by two users is calculated to determine how closely the agent and user are related.

For ease of understanding, we have provided an example: To formulate the closeness of X1 and X3,first we must choose our list of movies, which will be labelled as"M1, M2, M4, M5", and then after the parallel scores of these movies. Each user who wants to predict a movie will assignanN-dimvectortoshowtheitemscore.ThefoundscorevectorsforX1andX3are1,3,4,2and2,4,1,5 respectively. The cosine parallel formula is usedtodeterminehowcloselyX1and X3arerelated.

X/M	M1	M2	M3	M4	M5
X1	1	3	3	4	2
X2	3	1	4		
X3	2	4		1	5
X4	2		2		

Fig. 3. users' similarity evaluation

The definition of the correspondence of m or m' is sim (m,m'), and the only formula that is likely to be utilised for the correspondence is cosine similarity.

Cosine parallel is used to determine how similar two users are based on the angle of cosine between them as a vector.

$$sim(x,y') = \cos(\vec{X},\vec{Y}) = \frac{\vec{X} * \vec{Y}}{|\vec{X}| * |\vec{Y}|} = \frac{\sum_{s \in sxy} r_{x,s} r_{y,s}}{\sqrt{\sum_{s \in sxy} (r_{x,s})^2 \sum_{s \in sxy} (r_{y,s})^2}}$$

b) KNN Selection of Nearest Neighbour

Now that the users' similarities have been assessed in the form of sim(u,u'), the KNN algorithm uses this information to determine how many users match U's neighbours, which is denoted by the letters u'. Now we must choose to initialise the K value for the neighbour selection,

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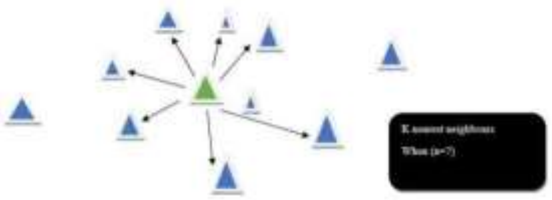
which will identify K of the most similar neighbours in the form of a neighbour like value for a user.



c) Predict Score Calculation

Now that we have identified the K nearest neighbours, we must determine the score of the item that is near its neighbour. The primary formula utilised to determine the score prediction is provided as follows:-

$$r_{u,i} = \overline{r_u} + k \sum_{u' \in U} sim(u, u'') * (r_{u',i} - \overline{r_{u'}})$$

$$(k = 1/\sum |sim(u, u')|)$$

The actions that re listed below will only be utilized forecast the score.

Step 1: Create the user as a 2D score matrix in the RmXN format.

Step 2: Use the Cosine Similarity Formula to help you determine how similar the users are who wish to watch the movie, which will help you create a matrix that reflects what the consumers are seeing**.**

Step 3: In order to discover the N number of the score that indicates the largest amount and will be the same as the K with the neighbours, which is u, we must use the result of step 2 as our starting point.

Step 4: Analyze the value of I for the goal u usingthe predict score algorithm.

In order to forecast movies for the user, KNN collaborative filtering method is used. This project will be used to recommend the movie based on user sentiment based on that as well. Also, it can propose movies, just like Netflix and Amazon Prime Video, which will do so based on the user's prior searches, and it can advise the user's preferences based on their login information to our prototype's server.

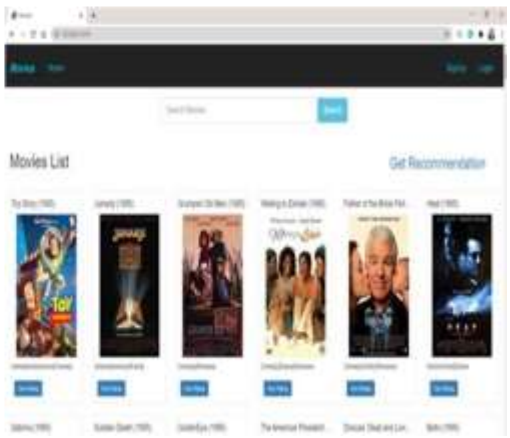
IV. System Designing of the System

A. Architecture Diagram

This architectural diagram demonstrates how our project functions when it is being executed on a server. Based on the user's prior viewing choices, it will suggest a movie to the user.

V. Effects of the Operation on Our System

The user login system that has to gather all the different behavioural traits of the user and save them in the user database will be suggested by our system when it is in operation. Upon a successful login, the system will automatically propose a movie to the user based on their recommendations.



VI. Conclusion

In light of the facts provided, a movie recommender system may greatly benefit us by saving us time and making it easier to find acertain movie that a user requests.This research paper will be created for the movie suggestion based on the user's sentiment analysis, and we have employed several ML algorithms including Collaborative filtering in this article.

KNN algorithm-based algorithm. I have assessed and tested the effectiveness of our system using a sizable dataset that will be used to recommend movies to users, and it performs quite well. This essay will provide suggestions and provide a framework for a movie recommendation system that takes into account user emotion.

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Shedding Light on Effect of Atmospheric Phenomenaon Air Quality Prediction by Employing Deep Learning

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***Abstract*— Weather patterns can be utilized to foresee air quality since they fundamentally affect it. But since deep learning is a "discovery," it is difficult to construct dependable deep learning models that consider meteorological circumstances while foreseeing air quality. In this review, we utilize reasonable deep learning out how to show the effect of meteorological elements on air quality estimates to determine the previously mentioned issue.1) The source data from air poison data sets, as PM2.5, PM10, and SO2 hourly obsessions, as well as meteorological condition data sets ssessing temperature, suddenness, and pneumatic stress, are gotten in this paper; (2) To foresee air quality under four circumstances, the Long Short Term Memory (LSTM) and Gated Recurrent Unit(GRU)models are laid out;(3)The air quality's reasonableness is analyzed utilizing the Shapley Additive ExPlanation (SHAP)technique. We find that basically considering atmospheric conditions doesn't work on estimate precision. In any case, gauge precision is better when meteorological circumstances and other air contaminations are joined than when just other air toxins are incorporated. Additionally, the mainconsider anticipating air quality is climatic strain, trailed by temperature and stickiness. The cooperation of climatic factors and other air impurities might be the reason for the uniqueness in gaurge precision. The after effects of this study could assist with working on the exactness of air quality estimates and make them more solid.**

***Keywords*—LSTM,GRU,SHAP.**

I. Introduction

Natural issues have emerged because of the continuous speed increase of worldwide urbanization and industrialization. The deterioration of air quality brought on by industrialization and urbanization is one of the most significant issues affecting the environment [1, 2]. Energy creation and utilization tasks, for example, power plants, ventures, and auto fumes emanations, have at last added to the nonstop deteriorating of worldwide air quality [3]. Air contamination represent sacritical danger to individuals' lives and wellbeings inceit can prompt various respiratory circumstances and even malignant growth[4]. AirtoxinslikeSO2, PM10, and PM2.5 are the most pervasive. A small molecule with a breadthunder 2.5 micronsis known as PM2.5. Since PM2.5 particles are more dynamic than bigger particulate poisons,they canrapidly and handily spread,persevere in the air for quite a while, and transport intensifies that are hurtful to human wellbeing and the climate. PM2.5[2] is one of the main supporters of air contamination. Asthma, bronchitis, and cardio vascular infection might be welcomed on by its capacity to effortlessly enter the humanthroat and nasal pit because of its little molecule size [5]. Air pollution is bad for people's health[4,6]. A number of respiratory conditions and even impairments in cardiopulmonary function can result from prolonged exposure to high levels of air pollution. Numerous diseases will spread rapidly, putting people's health at risk, affecting their quality of life and happiness scores, and raising mortality rates [7]. As well as influencing the climate, air contamination additionally hurts the environment by decreasing its assortment and solidness[1].

Not in the least regular occasions of air contamination represent a danger to human wellbeing, yet they likewise cause huge monetary misfortunes and a plenty of cultural issues[8]. In like manner, advantageous legitimate assessment, careful guess of air quality, and useful security and treatment considering air pollution measures could help critical divisions and related relationship in taking impediment actions early, as well as more appropriately coordinating outings. Disease outbreaks could be avoided and people's health could be preserved[9].

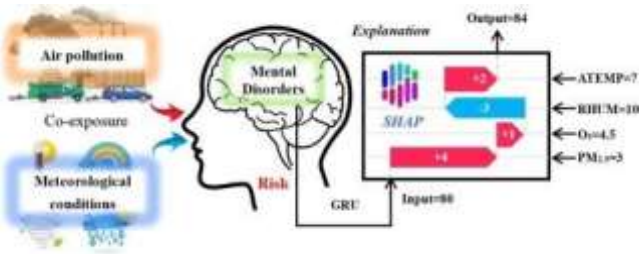

Fig.1.

As a result,forecasts of air quality may provide useful data for controlling and preventing air pollution.Accurate assessment and forecasting of changes in air quality may assist in the management and prevention of air pollution, thereby safeguarding the environment and humanhealth[10].This is made possible by having a better understanding of the underlying variables and shifting patterns of air pollutants.

Air quality expectation likewise assists pertinent divisions with fat homing the state of air quality, thus a critical hypothetical establishment might be provided for it. As a result, programs to reduce and prevent air pollution can be tailored to specific circumstances. It likewise gives valuable contemplations and thoughts for future chiefs to seek after

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additional savvy and proficient activities to improve air quality[11]. Some examples of relevant research efforts are listed below. For example, Kumar and Goyal [12] conjecture the everyday Air Quality Index(AQI) for each seas on utilizing three measurable models: principal component regression (PCR), the auto-regressive integrated moving average(ARIMA), and a mix of the two. In view of back-direction focuses and nonlinear regression(NLR), Cobourn[13] proposed PM2.5expectation model with lower mean outright blunders. The most common way of utilizing physical and compound estimations to anticipate air quality is more troublesome. Rajput and co. 14] recommended a method for utilizing an AQI to assess and address quality status. This could assist with better determining of air quality measurements. In spite of this, the model is a period recurrence expectation model that performs best throughout more limited time periods.

This paper's findings can be summed up in the following format:

1. Long Short-Term Memory and Gated Recurrent Unit Were Deployed and tested against multiple circumstances and have fetched favorable outcomes.
2. The way the atmospheric phenomena exerts impact on quality of air, has been brought to light using Shapley Additive ExPlanation, this will be valuable in order to enhance the precision in future findings.
3. Built an application to apply the prediction in realtime.

II. Literature Survey

A. *The emergence of affordable sensing for regulating urban air pollution*

Air pollution and expanded street traffic are connected to the steadily expanding populace of urban communities. It has been exhibited that metropolitan tenants face a huge danger from raised degrees of air contamination by and large. Not withstanding, the impacts of incredibly high contamination yet restricted openness over the long haul and space stay obscure. Organizations of static and inadequate estimation locales support conventional air quality estimation strategies.Unfortunately, they are excessively costly to catch rhythm spatial fluctuation and recognize contamination areas of interest, which are fundamental for the improvement of compelling ongoing openness control techniques.The customary way to deal with permitting continuous data to be put away in a slim structure has been generally modified by late headways in the improvement of minimal expense miniature size detecting advances.Be that as it may, whether or not the less exact information they produce is helpful continues.This article clears up the significant hindrances for their fruitful application and the elements that have prompted an expansion in the utilization of reasonable sensors for city air pollution control.

B. *Air Pollution and Ncds Diseases: A Study by the Environmental Committee of the Federation of GlobalRespiratorySocieties,Volume01:TheHarmfulConsequencesofAirPollution:*

Air pollution is a significant danger to human wellbeing in the climate. Openness to outside fine particulate matter(particulate matter with a streamlined measurement of 2.5meters) is the fifth driving reason for death around the world, representing 4.2 million passings and in excess of 103 million handicap changed life years lost,as per the Worldwide Weight of Sickness Report. Indoor air tainting is at risk for an extra 3.8 million passings, according to the World Prosperity Affiliation. Air pollution can be unsafe on a transient premise,as proven by side effects in the respiratory or heart frameworks, as well as over the longhaul, potentially influencing each organ in the body. It very well may be there as on for, convolute,or fuel various negative medical problems. Since small and ultrafine particles can get in to organs, contamination poisonousness can cause tissue harm either straightforwardly or by implication through foundational incendiary cycles. Innate and epigenetic factors both impact powerlessness.Despite the fact that individuals of any age, areas, and financial classes are impacted via air contamination, the people who are most often uncovered are bound to turn out to be sick. At the point when individuals are sick or need social help, they are particularly delicate to air pollution. Indeed, even at portions that were recently remembered to be inside satisfactory air quality principles ,unfriendly impacts persevere.

C. *Particulate Matter 2.5's influence on the respiratory system in humans:*

As of late ,various school astics have zeroed in on the association between air pollution and issues of the respiratory framework. As of late, exhaust cloud level shave expanded in China, bringing down air quality and raising worries across the globe. Particles with a diameter of less than 2.5 micrometers (PM2.5) can possibly enter the lungs, making the alveolar wall become bothered and disintegrated, compromising lung capability. Thusly, it is fundamental to research the impacts of PM2.5 on the respiratory framework and afterward help China in resolving its recent concerns with air pollution. In light of epidemiological, exploratory, and component studies, the impacts of PM 2.5 on the human respiratory framework will be analyzed in this survey.At last,we ask specialists to make a contamination related wellbeing record and encourage the general population to restrict their openness to air pollution.

D. *Analysis of data and mining of climatic variations and air quality co-relations: A study in China:*

PM2.5,PM10,andO3contamination represent a developing danger to human wellbeing, especially in China's megacities. Air pollutants' dissemination and focus are impacted by meteorological circumstances, which altogether affect their weakening and dispersion.We examined the associations between Beijing's meteorological circumstances and air contamination fixations from January 2017 to January 2018. That's what we find: 1)A solitary meteorological component meaningfully affects the centralization of contaminations; (2) There is major areas of strength for a between the blend of temperature and wind speed, moistness and wind speed, and strain and temperature, showing that various meteorological elements

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cooperate to influence the convergence of poisons; (3) Poison fixation is impacted distinctively by different meteorological variables.Our discoveries canpossibly further develop metropolitan administration execution while additionally aiding climate-based figures of air quality.

E. Based on cognitive calculation, a novel technique forpredictingairqualityhasbeendeveloped:

The recognizable proof and treatment of developing aircontamination welcomed on by mechanical progressions isquitepossiblyofthemaintestconfrontingthispresentreality.Contaminationlevelshavewithoutadoubtrisenemphaticallylately. Utilizing profound learning methods and an recurrentneural network (RNN), the current work expects to foster awise figure for air contamination fixations over the course ofthefollowingtwodays.Theidealdesignforitsactivityisthenfoundutilizingaparticleswarmoptimization(PSO)strategy.The smart air quality prediction model (SAQPM) is a cleverindicatorinlightofcannyprocessingthatutilizesstreamliningandunaidedlearning,otherwisecalledlongshorttermmemory (LSTM). The essential goal is to estimate six kindsofcentralizationsofaircontamination:Nitrogendioxide(NO_2),carbonmonoxide(CO),ozone(O_3),andsulfurdioxide (SO_2) are instances of PM2.5 and PM10 particles.SAQPM comprises of fourstages. Gatheringinformationfrom many stations — 35 in this occurrence — is the initialstep.Settinguptheinformationincorporates(a)isolatingeachstation with its own concentration, (b) tending to missingqualities,and(c)normalizingthedatasetwiththeMinMaxScalar strategy to a scope of (0, 1) Utilizing theutilitarian PSO calculation, the third step includes fosteringtheLSTMindicatorbydecidingtheidealorganizationdesignandboundaryvalues(weight,predisposition,numberofstowedawaylayers,numberofhubsineachsecretlayer,andenactmentcapability).Thetencross-approvalthoughtisthenused to separate the dataset into preparing and testing parts.Thepreparationdatasetisthenusedtoconstructtheindicator.Each station's evaluation results are determined in the fourthstepbytakingreadingsofthegroupingofeverypoisonconsistently for a limit of 30 days and computing the normalof the symmetric mean absolute percentage error (SMAPE)northof25days.

III. Methodology

In any case, in spite of the way that a deep learning models utilize meteorological circumstances to foresee air quality, meteorological factors are just utilized as info information, and there is no exploration on what meteorological circumstances mean for air quality expectation. In this specific case, it is obscure the way that meteorological factors impact air quality expectation in profound learning models.

This is on the grounds that the profound learning model is by and large a "black box," meaning it can't be made sense of. In any case, the profound learning model's extraordinary fitting benefit for complex information associations can be utilized to consolidate meteorological condition information with air quality information to gauge air quality.

Evaluating the effect of meteorological circumstances on air quality conjectures their connections actually faces various obstructions.

A. Drawbacks

1. However, considering that deep learning is a "black-box" technology, incorporating meteorologicalconditionsintoairqualitypredictioncanbechallenging.
2. Itisobscurewhatmeteorologicalcircumstancesmean for air quality prediction in profound learningmodels,includinghowtheyimpactairqualityforecast.

We utilize logical deep learning out how to uncover theimpact of meteorological factors on air quality expectationandfittinglymakesenseofwhatmeteorologicalcircumstances mean forairqualityforecast to defeat thepreviouslymentionedissues.Byshowingtheeffectofmeteorologicalelementsonthefigureof airquality,theprecisionisadditionallymovedalong.Itisfeasibletoproduceairqualitypredictionmodelsutilizingprofoundlearningwithmore prominent accuracy and constancy. Therefore, it couldwork better practically speaking. This could make it morestraightforwardforindividualstomakesensibletravelarrangementsandgototherightprecautionlengthstosafeguardtheirwellbeingontime.Workedoncomprehensionoftheconditionoftheairqualityisutilizedtoexecutepertinentsafeguardandcontrolestimatestoaccomplishopportuneandeffectivenaturaladministration.

B.Benefits:

1. It is possible to create deep learning models for airqualitypredictionthataremorereliableandaccurate.
2. Thiscouldmakeitmorestraightforwardforindividuals tomakesensibletravelarrangementsandgo to the right deterrent lengths to safeguard theirwellbeingimmediately.

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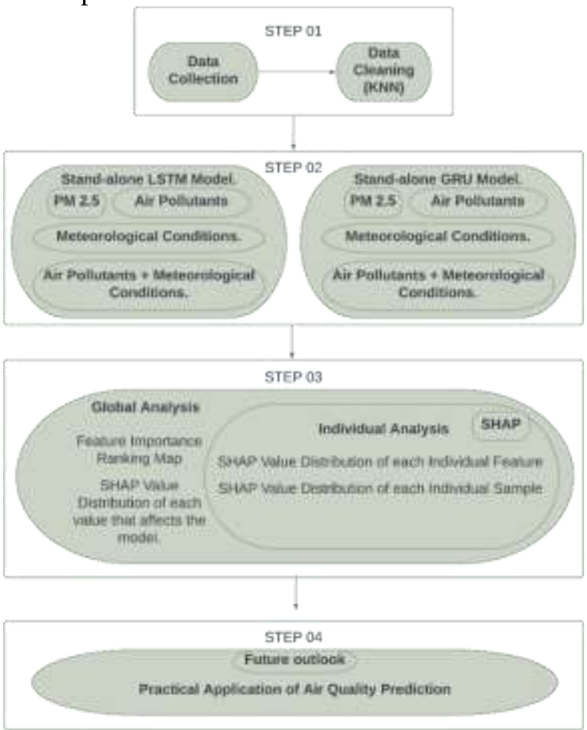

Fig.2.(Architecture).

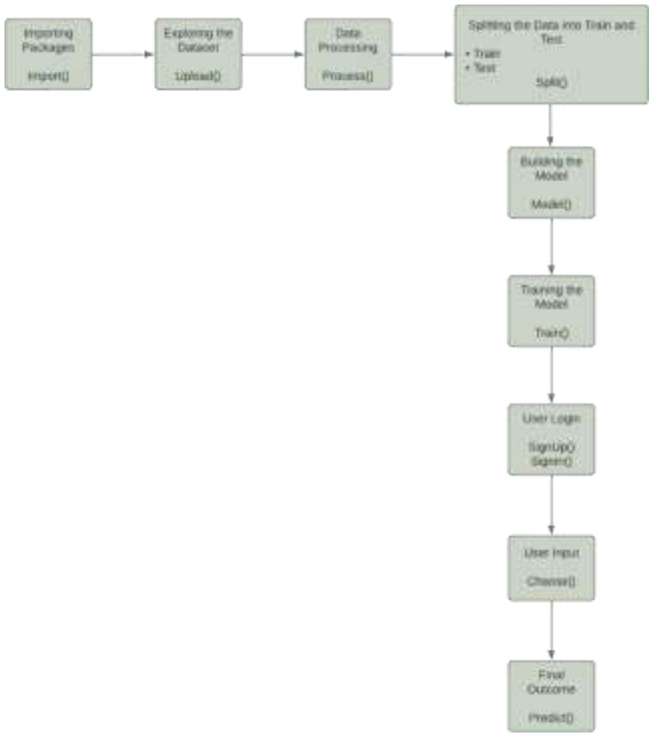

Fig. 4Class Diagram

Fig. 3.Data Flow Diagram.

IV. MODULES

1. Explorationofdata:Thismodulewillbeusedtoenterdataintothesystem.
2. Processing:Usingthismodule,wewillreaddataforprocessing.
3. Splittingthedataintotrainandtest:Datawillbedividedintotrainandtestwiththismodul
4. Constructing a model: LSTM, RNN, GRU,CNN+LSTM, CNN+GRU, ARIMA, RANDOMFOREST,KNN-SHAP,MLP,andavotingclassifieraresomeofthemethods. Accuracyofthecalculatedalgorithm
5. Userregistrationandlogin:Byusingthismodule,youcanregisterandlogin.
6. Userinput:Usingthismodulewillprovidepredictioninput.
7. Prediction: Itwillbeshownwhatthefinalpredictedvalue is.

V. IMPLEMENTATION

A. *Algorithms*

LSTM: Long short-term memory associations (LSTM)are utilized in the domain of Deep Learning. Variousrecurrentneuralnetworks(RNNs)mightbeutilizedtolearnlong haul conditions, especially in grouping expectationissues.

RNN: The most current strategy for successiveinformation,recurrentneuralnetworks(RNN),isutilizedbySiri on Apple and Google's voice search. It is the

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principalcalculation to review its contribution because of its innermemory, making it ideal for successive information basedMLchallenges.

GRU: In 2014, Kyunghyun Cho et al. proposed gatedrecurrent units (GRUs) as a repetitive brain network gatinginstrument.TheGRUworksinbasicallythesamemannertoaLSTMwithaneglectentryway,howeveritcomesupshortonyielddoorandconsequentlyhaslessboundaries.

CNN+LSTM: Long Short-Term Memory (LSTM) andConvolutionalNeuralNetwork(CNN).LSTMcanremovenearbytexthighlightsfromexpandedtextgroupingswhileproductivelysavingthecharacteristicsofverifiabledatabyutilizingthe designofCNN.

CNN+GRU: CNN is used for include extraction,whileGRU is utilized as a completely connected layer. SinceCoronavirusisanotherailment,thereisdeficientaccessible information for tests. The informational collection used inthisexaminationcamefromtwofreesources.

ARIMA: ARIMA models are frequently alluded to asARIMA (p,d,q), where p indicates the request for theautoregressive model, d characterizes the level ofuniqueness, and q means the request for the moving-normalmodel.ARIMAmodelsutilizedifferencingtochangeoveranon-fixed time series into a fixed one, and afterward utilizepastinformationtogaugefuturequalities.

RANDOMFOREST:AnRandomForestCalculationisanotable directed ML method utilized in ML to settle orderandrelapseissues.Werealizethatatimberlandcontainsmanytrees,andthemoretreesthereare,themoregroundedthewoodlandwillbe.

KNN-SHAP: SHAP is a numerical method tounderstandingtheexpectationsofMLmodels.Itdependsongame hypothesis and might be utilized to evaluate eachelement's commitment to the forecast to make sense of theexpectationsofanyMLmodel.

MLP:Thetruncation"MLPClassifier"alludestoamulti-layer perceptron classifier that, as the name infers, isconnected to a brain organization. As opposed to othergrouping strategies, for example, Support Vectors or NaiveBayes Classifier, MLPClassifier utilizes a basic brainorganizationtosortinformation.

Voting Classifier: After training several base models, avotingclassifierisamachinelearningestimatorthatpredictsbyintegratingtheoutcomesofnumerousbaseestimators.Asthe aggregating criterion, voting for each estimator outputmaybeaggregated.

Application: A simple web-application was deployed topredictairqualitytoauser,usingapicklefilethatwassavedduringexecutionofthepredictionsystem.

TABLE I. SPECIFICATIONS OF SOFTWARE USED

Software	Specifications
OperatingSystem	Windows
CodingLanguage	Python3.7

TABLE II.SPECIFICATIONS OF SOFTWARE USED

Hardware	Specifications
Processor	Intel(R)Core(TM)i5-7200UCPU
RAM	8 GB
Freaquency	@2.50GHz2.70GHz
SystemType	64-bitoperatingsystem, x64-basedprocessor

VI. EXPERIMENTAL RESULTS

A. Algorithms

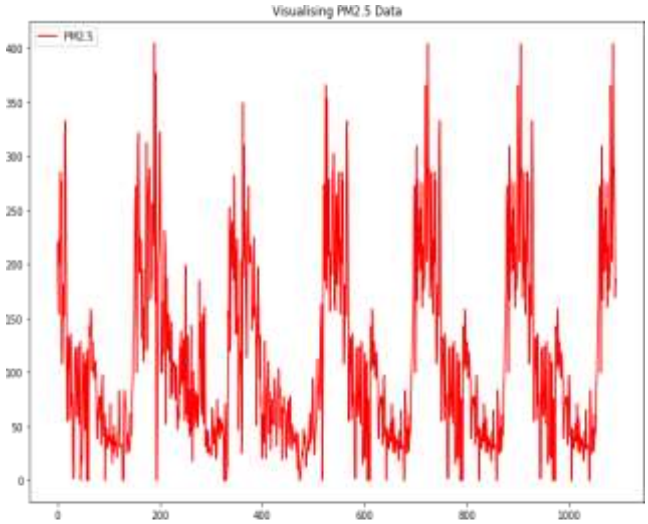

Fig. 5.(PM2.5, before removal of null and duplicate values).

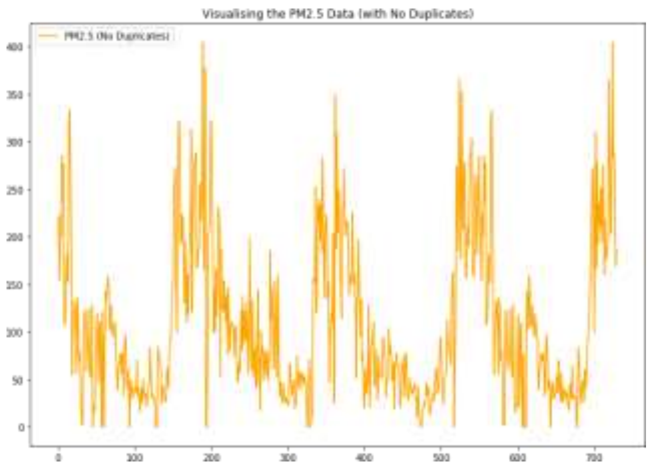

Fig. 6.(PM2.5, After Removal of duplicate values).

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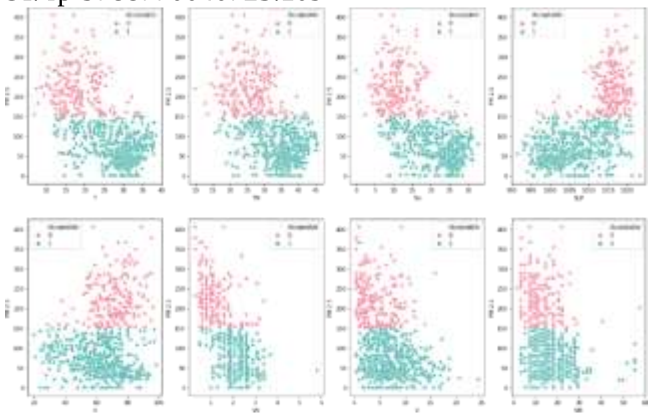

Fig. 7. (Scatterplots depicting acceptable and harmful ratios of Pm2.5 values)

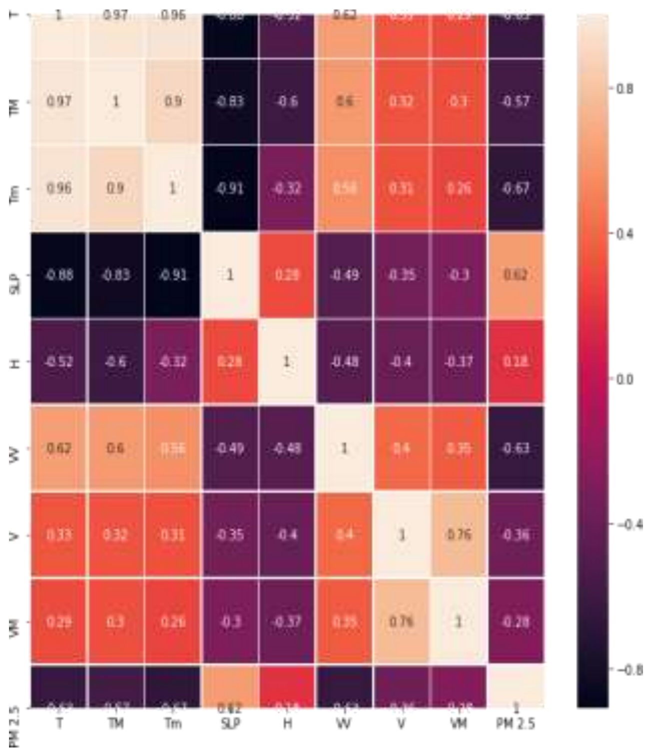

Fig. 8. (Heatmap of all parameters in a correlation with each other)

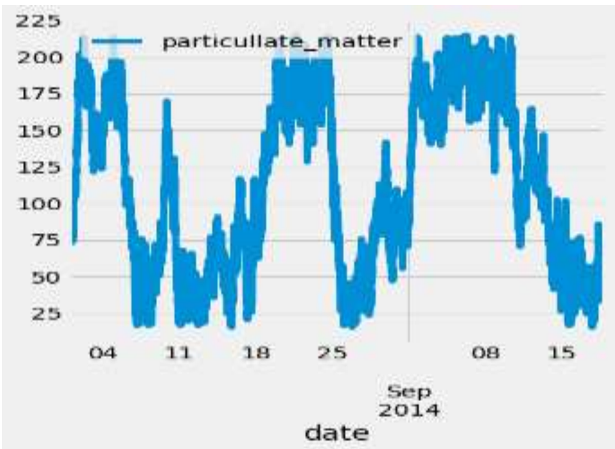

Fig. 9.

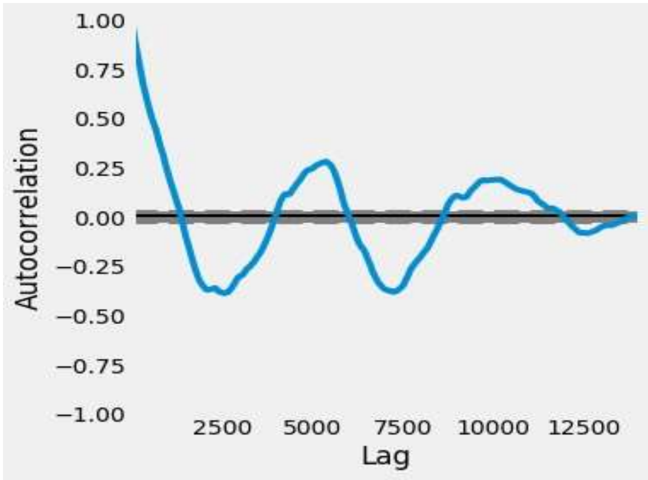

Fig. 10.

B. Application

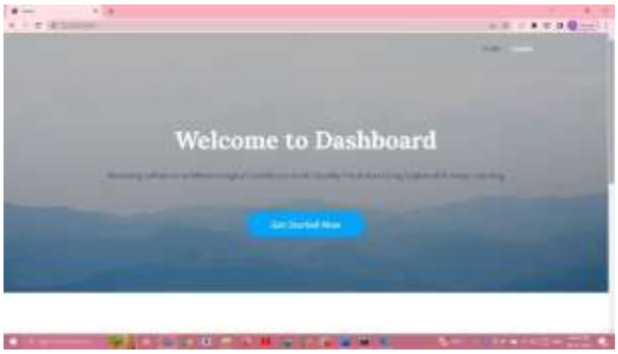

Fig. 11. Home Page

Fig. 12.SignUp page

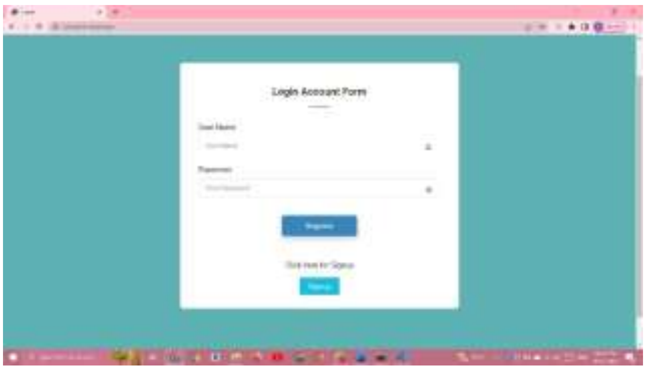

Fig.13.(SignInPage)

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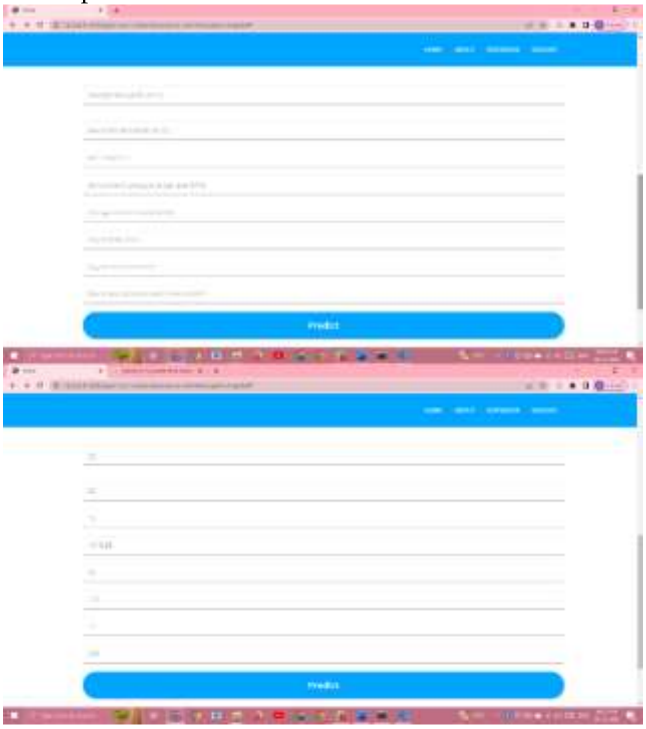

Fig.14.(EnterValuesofrequiredparameterstopredictAirQuality)

Fig.15.(PredictedValueisObtained)

VII. Conclusion

To research the impact of meteorological circumstances onairqualityexpectation,weutilizetheSHapleyAdditiveExPlanationsexplainabledeeplearningtechniqueinthisreview.Using theSHAPtranslationwaytodealwithdecipher the current LSTM and GRU air quality expectationmodelsandresearchtheeffectofmeteorologicalcircumstances on air quality forecast is the focal thought. (1)TheoutcomesshowthattheLSTMandGRUmodels'expectationexactnessisn'timprovedbyessentiallyconsolidating meteorological elements. Notwithstanding, theconjecture precision improves when extra air poisons areadded, and the forecast exactness works on much furtherwhen meteorological circumstances are joined with extra airtoxins.2)TheLSTMandGRUmodelsallspotmeteorological circumstancesinthemainthreeasfarastheircommitment to air quality expectation, whether or not theyjustconsidermeteorologicalcircumstancesorjointhemwithother air poisons forPM2.5 forecast.Themain consideranticipatingairqualityisbarometricalstrain,trailedbytemperatureandstickiness.SO2greatestlyaffectstheforecastofairqualitywhenjustaircontaminationsareconsidered.3)Byandby,whensimplymeteorologicalconditions are utilized to gauge air quality, the significantcommitment of meteorological circumstances to the forecastslows down the discoveries and makes them more incorrect.The significant contribution of meteorological variables toforecast simplifies and enhances air quality prediction whenevaluated alongside other air contaminants. 4) The SHAPworthmightdifferrelyinguponthesituation,suggestingthatthe commitment to the expectation result fluctuates, whichmight represent the shifted last forecast exactnesses. This isbroughtaboutbythecollaborationofotherairpollutantsandclimaticcircumstances.Toresearchhowmeteorologicalelements impact air quality forecast, this work utilizes theSHAPstrategy,areasonabledeeplearningapproach,asopposed to past investigations. This works on the constancyofdeeplearningmodelsforairqualityexpectationandsupports inside and out study and appreciation. We plan tofoster more solid and precise deep learning models for airqualityexpectationlateronthatcanbeappliedtogenuineairqualityprediction.

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Medium Term Wind Speed Forecasting Using LSTM Model

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Abstract - This paper's goal is to carry out an evaluation of the machine analyzing (ML) fashions used for quick-time period forecasting of wind energy parameters like wind velocity orwind strength. Wind velocity estimation is synonymous with wind speed predictions. this is completed to take advantage ofwindtempoforpowerera.Allforecastingmodelshavenumerous, whichconsistofloaddispatching,reserves,operational protection, and fee optimization, amongst others. Forecasting is accomplished to keep the space among strengthgenerationandenergymanufacturing.onthisobserve,the quick-term forecasting model is created one after the other the usage of LSTM and SVM. Each fashion is supervised mastering-based totally. brief-term forecasting models excel atloaddispatchingandextraordinarystrength-relatedresponsibilities. enforcing LSTM offers broader components in forecasting fashions, and neural network-based model spick the pinnacle-first-class characteristic to boom LSTM's normal overall performance and sample remembering belongings over an extended time frame, making it an extra reliable and effective mixed model.

I. Introduction

1.1 General

Renewable energy output is increasing on each day basis, and theowneroftheelectricalsystemmuststabilitytheelectricityvia meeting the maximum demand for renewable power. Wind electricityforecasting is used to forecast characteristics inclusive of wind pace,power output, and wind path. The forecast is finished in unique timeframes depending on the electrical grid requirement and additionallyforwind resourceassessment, which aredefinedunderneath.

- Exceedingly brief term
- Extraordinarily brief time period
- Quick time period
- Long time

due to the fact to the volatility of the atmospheric wind drift, the literature for wind electricity forecasting remains within the experimental segment. The purpose of this studies is to create effective records-pushedmodelsforforecastingwindpowerera.great-appearingactingmodelneedtobesimilarlydeveloped,tested, and demonstrated using ancient facts. Effective wind strength prediction is vital for supporting operators in integrating wind mills into smart grids and improving strength output control. several facts-pushedtechniquestoenhancingwindstrengthpredictionwereevolvedintheliterature.conventionaltime-collectiontechniques,which includes lengthy short-termreminiscence(LSTM).

Thosefashionsareeasytoconstructandsmoothtoenforce.nevertheless, it's far truly worth noting that first-radical time-collectionmodelscanreapfirst-class out comes whilst wind power dataunderstandings regular changes, but the forecast errors is plain while thewindenergytimecollectionwell-knownshowsabnormalvariations.In this examine, the short-term forecasting version is created one aftertheothertheusageofLSTMandSVM.eachmodelisbasedon supervised studying. quick-time period forecasting models excel at loaddispatchinganddifferentenergy-relatedresponsibilities.theuseofLSTMandSVMattheidentical datasetyieldswonderfuleffectsbecause of the reality the models are so distinct. in choice to SVM,LSTM(lengthyquick-termreminiscence)hastheassetsofsamplerecollection for a longer time period (help vector device). So, it giveswider elements inside the forecasting fashions and additionally neuralnetwork-primarilybasedmodelsselecttheexceptionalfunctiontoimproveLSTM'sordinaryperformanceandsampleremembrancebelongings over an extended duration making it an extra reliable andpowerful blendedforecast model.The number one aim of this art workis to behavior a comparative evaluation of everymodel (LSTM andSVM)andselectoutthemaximumsuitableandbrief-timeperiodforecastingmodelsexcelatloaddispatchingandfantasticspecialstrength-associated duties. Using LSTM and SVM on the equal datasetyields different consequences because of the reality the fashions arerelativelydifferent.InassessmenttoSVM,LSTM(longshort-timeperiod memory) has the assets of sample recollection for a prolongedterm (aid vector gadget). As a result, it presents broader elements inforecastingfashions,andneuralnetwork-primarilybasedcompletelyfashions pick the high-quality function to increase LSTM's performanceand pattern remembering property over a prolonged length, making it amore dependable and effective blended prediction model. The numberone intentionof this paintings is tobehavior a comparative assessmentof both fashions (LSTM and SVM) and pick the maximum appropriateand efficient. those models combine bodily and statistical techniques,briefandmedium-termfashions,andcombinationsofalternativestatisticalfashions.

II. Purpose

As all of us apprehend, renewable strength is critical to the sector'sefforts in the direction of sustainable development. Forecasting specificwind velocity figures with technology can be useful to human beings inmore than one

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manner. As an example, if in a particular 12 months, theWind electricity is not that excessive and it can't create the requiredquantityofpower,ifwehadforecastthiscircumstanceaoneyearprecedingthenwemayalsoadditionallywarnthepeopleandgowiththe flow to exclusive renewable sources like sun, Water, Bio gasoline,and so forth... in order that neither the maker nor the patron suffers aloss.commonplacewindpaceisafull-sizeissuethatimpactsthesurroundings. This task illustrates the way to estimate wind speed theusage of system studying algorithms. it's far valuable for assessing thepossibilitiesforclimate sportsand wind strengthinsidethedestiny.

SCOPE

Wind behavior look at as a way to construct a wind predictionmachine primarily based on gadget studying for wind strengthplant manufacturing prediction. After developing accurate modelswhich can correctly expect wind velocity, we may additionallycommercializethosemodelsandmakethemavailabletoindustries. Wind is a free strength supply, know knowledge it'smilesparticularlyunpredictable,whichposesasubstantialchallenge undertaking for integrating large wind electricity plantlifeintoa strengthmachine.

III. LITERATURE SURVEY

Thisstudyfocusesonstrategies,LSTMandSVM.bothmethodologieshavesimilarelements,knowledgeThisstudyspecializesintwomethodologies,LSTMandSVM.bothmethodologieshavecomparableelements,know-howkeydistinction is inside the approaches hired thru both techniques.information mining and its software in various programs haveacquired more interest in cutting-edge years. information miningrefers to the gadget of coming across styles in huge statistics setsbymannerofmixingmorethanonemethodology.Statisticsmining is used to advantage by way of analyzing diverse createdstyles. in the case of facts preprocessing, the facts are first wipedclean,thismeansthatthatmissingandincompletefactsare deleted from the database. The information is then picked andchanged in the following method to supply the very last dataset.data mining techniques are actually used to the to be had finalrecords set to find out styles that may be in addition assessed andanalyzedtodiscover.Severalroundsandshiftsofshiftingbackward or beforehand are blanketed within the approach ofrecordsdiscoveryinawesomedatadevices.someoftheapplicationsofrecordsmininginwindelectricitystructuresinclude forecasting wind path, electricity, and velocity, dealingwith strength garage, assisting in energy optimization, offeringturbine problems, and putting or controlling turbine installation.Theproposedmethods'primaryphasesencompassuncookedinformation,pre-processing,andfactsprediction.Allofthestrategiesdefinedinthegivenapproachneedtobeobservedinside the proper way to gather a greater reliable, inexperienced,andaccurateversionforforecastingwindvelocity.Ineachtechnique, raw information is collected and analyzed to determinewhether or not it desires to be preprocessed or no longer, i.e.,whether or not the to be had facts is ready to use with nonealterations;ifnownot,certainpreprocessingstrategiesareimplemented to the present dataset to make it applicable for ouruse. The statistics set provided right right here includes numerousparameters,knowledgeourrequirementforimposingtheseprocesses most effective calls for some parameters, eventuallypreprocessing is required to reduce information dimensionality.Following preprocessing,the informationreceivedissensitiveinformation. we will now use our prediction algorithms in thisinformation to construct our version to forecast wind velocityeffects.Eachalgorithms'precisionismeasuredtheuseof exceptional kinds of percentage mistakes. The system structure ofthe simple technique employed with the resource of LSTM andSVMforwindpaceforecastingis demonstrated below:

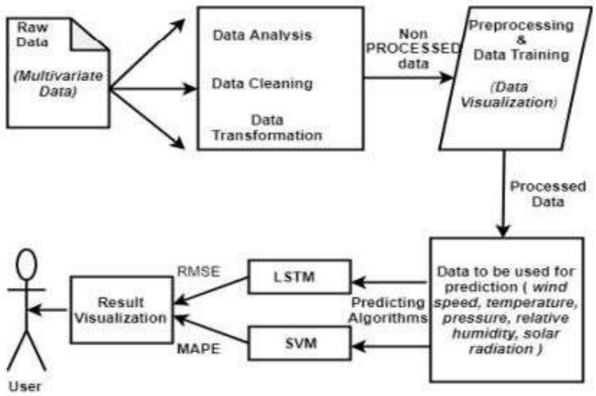

Fig.1.SystemArchitecture

The preliminary aim in the cautioned method (LSTM) is to gather to behad records for implementation; series of this sort of information isprimarily based mostly on severa parameters. The simple environmentaltendencies are used in this situation. the second objective inside the pre-processing section is to lessen the dimensionality of the records theusageofthefactsvisualisationmethod.Thenumberonepurposeofdatavisualisation is to pick out the required parameters from the wholedataset. The newly received set of variables is now professional the useof a recurrent neural network approach (backpropagation). whilst thedata has been professional, the final undertaking is to use LSTM to thediscovered out statistics to provide predictions and calculate the errorprice.

The literature assessment is based on the first-class-performing windpower forecasting models. Wind pace, wind power, and wind directionare the maximum commonly expected parameters in wind energy. Rootrecommend rectangularerrors(RMSE), Normalised Rootsuggestrectangular errors (NRMSE), suggest Absolute percent errors (MAPE),suggest Absolute errors (MAE), and different assessing requirements areused to type the models. The initial objective in the cautioned technique(LSTM) is to build up to be had statistics for implementation; collectionof

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this form of facts is based on numerous parameters. The easyenvironmental traits are utilized in this situation. the second oneobjective inthepre-processingsegmentistolessenthedimensionalityof the information using the data visualisation approach. The primarypurpose ofrecordsvisualisationistoselectthespecified parametersfrom the complete dataset. The newly received set of variables is noweducated using a recurrent neural community method (backpropagation).even as the facts has been knowledgeable, the final undertaking is toapply LSTM to the found out facts to supply predictions and calculatetheerrorprice.

The literature evaluate is primarily based at the exceptional-acting windstrength forecasting fashions. Wind speed, wind power, and wind courseare the most customarily predicted parameters in wind energy. Rootsuggestsquaremistakes(RMSE),NormalisedRootproposesquareerror(NRMSE), advise Absolute percentage errors (MAPE), imply Absoluteerror (MAE), and different assessing requirements are used to kind themodels.

3.1 LSTM vs SVM

WhyLSTMas opposedtoSVM

TheLSTMcellularprovideslengthy-termreminiscenceinamoreperformantmannerbecauseitpermitsforthemasteringofmoreparameters. This makes it the most sturdy for predicting, in particularwhilst your records has an extended-time period style.manual vector tool(SVM) is a sophisticated facts category technology. ordinary SVM isn'tidealforthecategoryoflargefactsunits,regardlessofitsstrongtheoretical underpinnings andexcessive class accuracy, due to thefact the training problem of SVM is extensively depending on thescale of the records set. We also determined that neural networksoutperformSVMsinphrasesofpredictiontime.Asallofusapprehend,name forstatistics deviceshave variousseasonality’s.LSTM can seize both lengthy-time period seasonality’s, consisting ofevery yr. style, and quick-time period seasonality’s, together withweekly inclinations. It’s far herbal for events to have an impact onnameforatthedayoftheeventinadditiontothetimespreceding and after the occasion. someone, as an instance, may arrange greaterdays of accommodations to attend a carrying event. The LSTM cangratifytheeffect types ofmanystylesof sports.

The LSTM might also receive inputs of numerous lengths. ThisfunctionalityisavailableinavailableevenasusingLSTMtocreatefamousforecastingmodelsfor particularclientsor industries.

LSTM

A literature assessment is carried out so as to investigate and createthe ML version long short-term reminiscence (LSTM). Wind speed isforecasttheusageofmeteorologicalinformationsuchasairtemperature, stress, and topography. The model's accuracy changedintoevaluatedtheuseofoverallperformancemetrics:Rootrecommendsquaremistakes(RMSE)andmeanAbsolutepercentmistakes (MAPE) (MAPE). numerous courses describe informationLSTM is used to are expecting wind pace effectively. The set ofregulations is knowledgeable on actual-time data and predictions dayafter today. It additionally gives that the LSTM network is skilled aton every occasion step to estimate the wind pace for the followingtimestep,makingtheforecastgreateraccuratethandifferentfashions. TheMAPE havebecomedeterminedtobe1.7%.lesserthan any version. The have a look at compares SVM and LSTMprediction overall performance. SVM is a biased allocation describedand confirmed using hyperplane separation. The labelled professionalrecords give a great hyperplane; the information is the superviseddata. The proposedmethod for assembling available statistics forimplementationcollectsdatabasedonnumeroustraits.Thepredictioninthistypeofmethodisbasedonneuralcommunitystrategies,andtheendresultisacquiredthroughtheneuralcommunity mechanism. It was determined that LSTM outperformsSVMinpredictionoverallperformancebecauseofitsdecreasemistakesrate.

3.2 Wind pace Prediction model primarily based totallyon LSTM

The regular neural network version will lose faraway facts, andgetting to know long-distance mounted statistics can be challenging.LSTM is a recurrent neural community enhancement that tries toaddress the recurrent neural community's shortcomings in processinglengthy-term memory. The LSTM pioneered the concept of cellstates, which govern which states must be remembered and whichhave to be misplaced. the following diagram depicts the centerpremiseof LSTM:

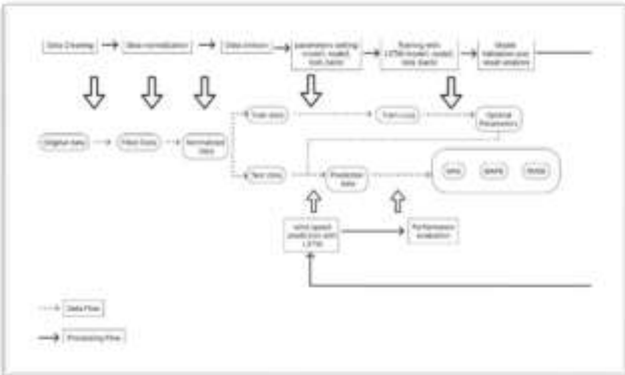

Fig. 2.GeneralizedtechniqueforLSTMversion

First,the windpacerecordsare representedasa nonnegative matrixXof a N T, wherein N denotes the extensive type of wind speed trackingpoints, T denotes the variety of time slots sampled, and every column inthe wind velocity records matrix represents the wind tempo price at one-of-a-typepoints inaparticular timecprogramlanguageperiod.

Wind speed prediction might also moreover collect the expected fee ofthe future time collection, X (I, j) represents the size of the N T waftmatrix, and not represents the wind pace price of row n and column t.Windspeedpredictionisdefinedaspredictingthewindvelocity attimet in the destiny the use of a set of ancient wind pace information (xn, t1,xn, t2, xn, t3, xn, t1). The wind tempo prediction model based mostly onLSTM (determine 2)

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assumes that the wind pace at a positive pointwithin the t-slot is predicted; the version's input is (xn, t1, xn, t2, xn, t3,xn, t1), and the version's output is the predicted charge of the wind paceat this2nd.

Thelengthyquick-timeperiodreminiscenceversionisasortofsupervised deep gaining knowledge of that is extraordinarily green attime collection prediction. A way transports statistics into those cellularstates. LSTM selects the facts to hold in this way. The facts gift at aspecificcellular countryis depending onthreeelements:

- precedingcellularkingdom.
- precedinghiddennation.
- enteratthecontemporary-daytimestep

3.2.1 LSTMapproach

Wind tempo statistics training and preprocessing: on the way to meet thetime-frequency(seconds,minutes,hours,days,andlotsofothers.)standardsofwindpacedataprediction,theparticulardatamustberesampled,thatis,transformedfromonefrequencytoeachotherviadownsamplingorupsampling.also,ifthereareanynullvaluesintheresampledrecordsseries,theymustbestuffed.Inthiscase,werenttheok-Nearestbuddies(KNN)systemgainingknowledgeofalgorithmtofillinblanksinwindpacefacts.factsnormalization:thevarietystandardizationtechniqueisusedtotechniquethewindpacerecordsinorderthatthepatternstatisticsfeeisamong0and1.Thecalculationtechnique of the variety standardization method is proven as follows.oneisproject-based,andtheotherisuser-based.However,theuser-based algorithm, which is mostly employed for this purpose,isquitesuccessful in meetingtheuser's needforrecommendations.

- Informationdepartment:Followingpreprocessingandnormalization,the wind velocityfactsisseparatedrightinto an education set and a test set the use of a number onepass-validation approach. even as the wind velocity recordsseries is saved constant, fivefold pass-validation is utilizedto divide the records into the schooling set and the checkset, which can be used for training and prediction of theLSTM windvelocitypredictionversion, respectively.

Create an LSTM wind speed prediction model via defining an LSTMneural network and putting parameters in conjunction with time step,community layer extensive range, kind of neurons in every layer,dropout,activationcharacteristic,crossagainchargetypeandvariety, hidden layer size period, reading charge, batch period, andgenerationkeepinmind.

- Constructthecommunity:configuretheoptimizer,mistakesdimensionsymptoms,andschoolingrecordparameters,thenassembletheLSTMwindspeedprediction model.

- Evaluatethecommunity:theschoolingsetrecordsisinsertedintotheversionfortraining,thehooked-upprediction version's errors are evaluated, and the model'sparametersettingsaretunedprimarilybasedattheconsequencestoget ahigherpredictionimpact

- Forecast and evaluation: create forecasts the usage of thesuperiorwindvelocitypredictionversion,evaluatethefindingstotherealrecords,andquantify themistake.

Endorseabsoluteblunders(MAE)

The MAE value is calculated the use of the average of differencebetween theactual and theforecastedcharge.

MAE = (average [Absolute (actual value - forecasted value)])/(onethousand(MW))implyAbsolutepercentageerror(MAPE):

The MAPE fee primarily based on the installation capability iscalculated theusageof theaverageof differenceafew ofthereal andthe forecasted value it really is later divided by means of the use oftheestablishedcapability.

MAPE = (commonplace [Absolute (actual value - forecastedvalue)])/(mountedcapacity)

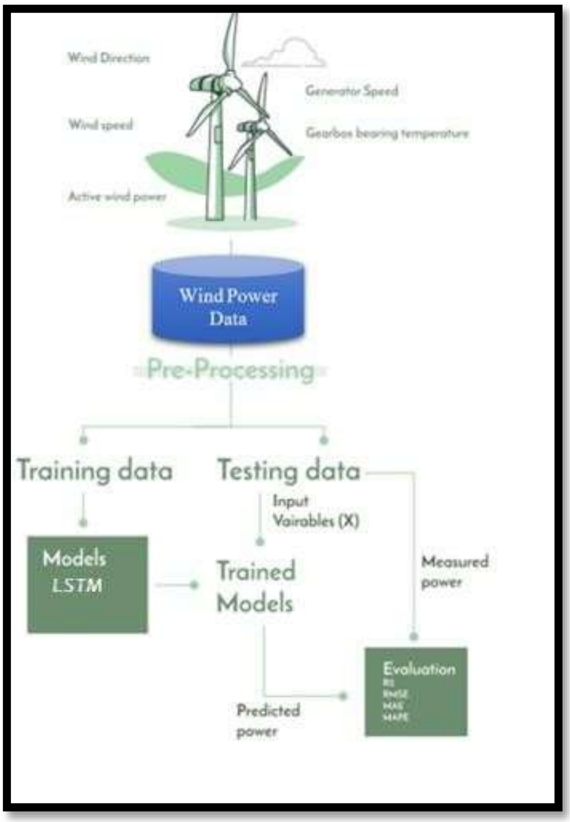

Fig.3LSTMapproachusedforWindPrediction

Outliers are generally detected and deleted on the way to beautify theforecasting accuracy of the taken into consideration model. otherwise,themodelmaybe biasedorincorrect. In thissituation,theoutliersweremodified with the schooling information's median. not noted windtempo values can be resulting from a diffusion of things, together withfaulty data recording, thunderstorms, degradation, and distinctiveanemometerscrew ups.

3.3 WindpacePredictionversionprimarilybasedonSVM

SVM based absolutely technique SVM is a biased allocation which isdefinedandillustratedthroughhyperplaneseparation.Thelabelledskilled facts offer a trulyperfect hyperplane; the data is

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largely thesupervisedfacts.Theproposedtechniqueforassemblingavailableinformationforimplementationcollectsinformationprimarilybasedmostly on a diffusion of traits. The basic environmental characteristicsare utilized in this example. throughout the pre-processing step, statisticsvisualizationis finished and implemented tothe obtained facts in orderto lessen the dimensionality of the accrued information set and extractcritical metrics. The newly received set of variables is now professionalusing the recurrent neural community algorithm (again propagation). atthe same time as the information has been educated, SVM and SVC areimplementedforclassfunctionsoverthetrainedrecordstoderivepredictions and create the error charge (RMSE cost). The operation ofSVM is defined rapidly below. A hyper aircraft is used to divide lessonsinsecondormultidimensional area.parentindicatesknowledgethisleads inside the separation of far-flungclass.

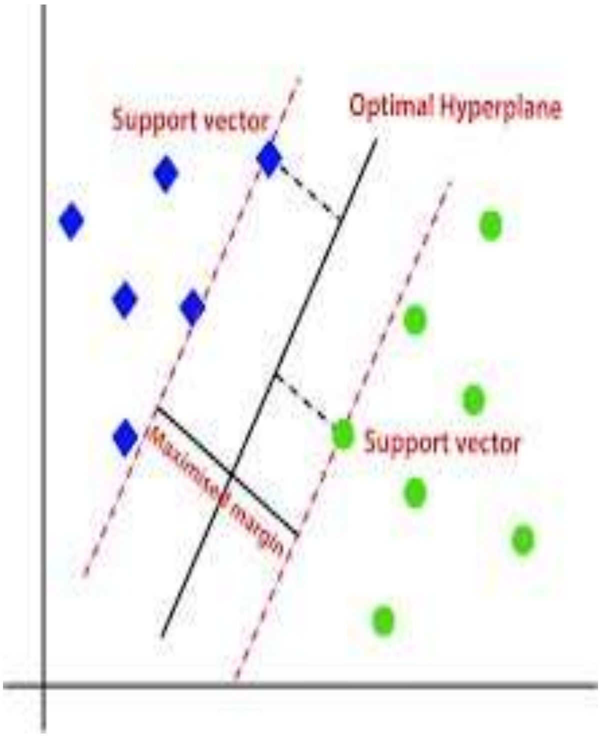

Fig4.Generalized SVMversion

SVMtechnique

SVM-basedmethodSVMisabiasedallocationdefinedanddemonstratedtheuseofhyperplaneseparation.Thelabelledknowledgeable statistics gives a simply best hyperplane; the recordsarethesupervisedfacts.Theproposedapproachforassemblingavailable facts for implementation collects statistics primarily basedon several tendencies. The basic environmental traits are utilized inthis case. in the course of the pre-processing step, facts visualizationis finished and implemented to the acquired records to be able tolessenthedimensionalityoftheamassedrecordssetandextract crucialmetrics.Thenewlyreceivedsetofvariablesisnowknowledgeable the usage of a recurrent neural community approach(backpropagation). when the information has been educated, SVMandSVCareimplementedforsophisticationfunctionsover theeducated facts to provide predictions and mistakes prices (RMSErate).TheoperationofSVMisdefinedquicklyunder.

A hyperplane divides classes in 2nd or multidimensional vicinity. Determinenon knowledge the split of distinct instructions as because of this.

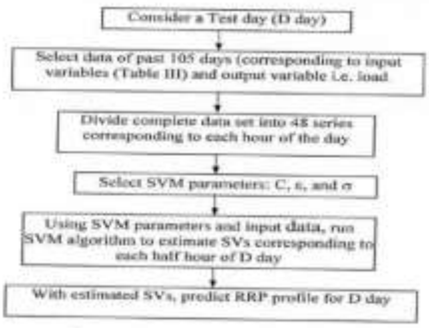

Fig5. SVMtechniqueUsedforWind Prediction

ProsandConsassociatedwithSVM:

Professionals:

- Itperformsparticularlyproperlywith aclean marginofseparation;
- it truly works properly in excessive-dimensional spaces.
- it works properly whilst the number of dimensions is greater than the range of samples.
- it is memory inexperienced because it a subset of education factors within the decision function (referred to as assist vectors).

Cons

- It does not perform well with information devices due to the fact the required schooling time is longer.
- It additionally does no longer carry out properly whilst the information set has greater noise, i.e., intention training overlap.
- SVM does now not at once offer opportunity estimates; those are calculated the use of a cc718adab7499529b227d0ea7ca018fe five-fold move-validation. it is a part of the Python scikit-study library's related SVC set of rules.

ErrorsCalculation

Thesuggestsquared mistakesisthenotunusualoftheerrorsquares.that is, it returns the average of the sums of the squares of eachdistinctionmanyof theanticipatedandreal values.

The MSE is generally, albeit it may be 0 if the forecasts are ideal. Ittakes into attention the estimator's variance (knowledge substantiallydispersed the estimates are) in addition to its bias (information one-of-a-kind thepredictedvaluesarefromtheir actualvalues)

FormulaeforMSE

Windvelocitypredictionmaybeusedforwindstrengthoptimizationand has sizeable implications for wind strength planning and electricitytool balance.Thispaperfirstinstallationawindvelocitypredictionve

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rsionbasedtotallydefinitelyonthenonparametricmodelLSTMneuralcommunity,thenoptimizedthehyperparametersoftheestablishedLSTMpredictionversion,andeventuallydecreasedthepredictionRootmeanrectangularerrorswhenascomparedtotheempirical method of parameter acquiring. because of the reality LSTMhas a lower mistakes price, it is able to be hired greater regularly inpredictingstrategiesthantheopportunity.duetoitssampleconsiderfora prolonged periodof time,LSTMwithdeep gettingtoknow canbeused to produce more inexperienced results in predicting structures. Todevelop greater accurate fashions with green prediction, LSTM may behybridizedwithextraordinarymodels.Followingawholeexaminationof both techniques, the produced conclusion way that LSTM is extra inforecastingstrategies.end Followinga cautious exam ofthe outcomesof the literature evaluate and the LSTM, it's far possible to deduce thatthe LSTM is extra powerful than the SVM. because of the reality LSTMhas a lower mistakes rate, it may be hired more often in predictingstrategies than the alternative. due to its sample endure in thoughts for aprolongedtimeframe,LSTMwithdeepmasteringmaybeusedtosupply extra inexperienced outcomes in predicting systems. To increasemoreaccuratefashionswithefficientprediction,LSTM maybehybridized with different fashions. Following an entire exam of eachtechnique, the produced end means that LSTM is greater sizeable inforecasting strategies. therefore, LSTM with the pattern remembranceproperty can be in addition deployed on large facts units to gain greateraccurate results and can be utilized by to are awaiting higher and furtherefficientweatherforecastingtimes.Windvelocityestimatesmaybeutilized to maintain the space among strength technology and energy useaslow asfeasible.

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Eye Cataract Detection using VGG-19

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***Abstract*—According to a report of the World Health Organization, one of the main causes of blindness would be due to cataracts. Although cataracts mainly affect the elderly population, now they can also be seen in juveniles. Among the different types, there is evidence that three types of cataracts affect the mass which are nucleus, cortex, and retro capsular cataracts. Common methods of diagnosing cataracts include slit lamps. Doctors' imaging tests are not effective in early classification of cataracts stage and may also be inaccurate in determining the correct type of cataract. Our current job is to automate the workflow on binary detection-only or considered a single type of cataract among those mentioned to continue to enlarge the system. In addition, little research has been done in the area of cataract classification types. Our system works with the aim of reducing errors during manual detection of early cataracts. Our proposed system successfully classifies the images as cataracts affected or as a normal eye using VGG-19.**

***Keywords*—Python, Tensorflow, Deep learning, Eye cataract detection.**

I. INTRODUCTION

On the normally transparent lens of the eye, a cataract is a white cloud that gradually hardens and develops into a yellow plate. A healthy eye with this disorder loses vision because light cannot reach the retina because the lens is obscured by a hard, white fog.

In a survey done by the World Health Organisation on World Sight Day 2019, 217 million individuals were found to have a moderate or severe visual impairment (MSVI), and 36 million were found to be pedigree. Of these, 65 million people have cataracts, making them susceptible to MSVI and blindness. Thus, 48% of cases of blindness are caused by cataracts.

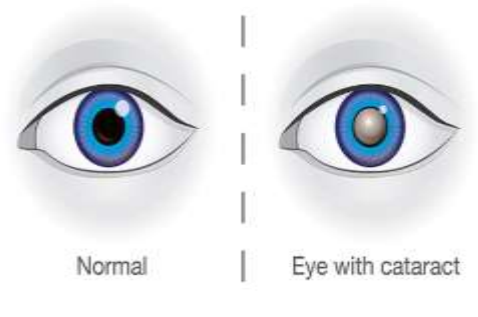

Fig. 1. Difference between normal and cataract eye

Although cataracts develop very gradually, it can cause problems as it moves out of the coating. A very small part spreads over the lens leading to loss

II. LITERATURE SURVEY

As we have studied the existing work done on this subject, an image-based system processed and developed on the MATLAB platform for accuracy of about 90% or more suggests using SVM to improve accuracy [2]. Another project using retinal fundus images, RGB image is first converted to green channel and image processing is applied technique, contrast is enhanced and noise is suppressed. Binary SVM is implemented for classification fundus image with MDA algorithm. Classification is done for two classes, i.e. no cataracts and cataracts. The grading section consists of three grades: light, medium and heavy Cataract. The dataset used consists of 261 images [3].

A system is developed using the following approaches 1. Computer vision approach to mining features and their use to develop machine learning models (b) automatically generate features and classified by a convolutional neural network. A set of six hundred labeled retinal images was used to train the models [4]. A project has proposed a method of detecting cataracts with a smartphone such as Android, iOS. The camera detects the eyes, cuts the required eye area. When cropping students, they are stored in an array. They are analyzed with the Android Native Development Kit Communication. The two main average or average intensity characteristics of images and histograms are used to determine the presence of cataracts in patients [5] .

Fundus image analysis has been the subject of extensive research. He uses four essential components to categorize cataracts: preprocessing, feature extraction, feature selection, and classifiers. While creating and transferring images, noise can be consistently introduced. [6].Therefore, preprocessing methods also have few approaches needed to improve image conditions, such as image enhancement and denoising. Numerous studies have been conducted on the segmentation and localization of retinal structures such as lesions, vessels, optic nerves, and aneurysms. To prevent issues from dimensional errors, feature extraction and selection are crucial. Different characteristics were extracted from retinal fundus images. B. Acoustic and spectral parameters, sketches, wavelets, colours, etc. As a functional representation, the three central components are gathered together. The main computational and testing work of the system is done in this section, and a solid functional representation plays a crucial role in the accuracy of the final algorithm. Cataract identification and grading have been adapted using classifiers based on different algorithms.

Automatic cataract grading techniques now in use [5] frequently deliver inaccurate, redundant, or noisy representations. utilizes a set of predefined image features. Furthermore, every one of the predefined features is artificially extracted. This is a very time-consuming heuristic strategy that requires a high level of knowledge,

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a lot of trial and error, and fine tuning. The author of [7] suggested a system that learns features automatically. Vector regression is used to ascertain the cataract grade using these features. achieving an accuracy of cataract categorization with an exact integral agreement of 70.7%. However, feature extraction and classifier remained independent.

Understanding the representations learnt by DCNNs, noticing the invariance of learned features at various layers, and the high activation of the final fully connected layer in the image served as the inspiration for our study. permits you to track to a location. These methods shed light on the elements that influence categorization performance the most. For dominating qualities and semantic concepts, Zeiler et al. [8] demonstrated that feature maps succeeding further convolutional layers store both geographical and semantic information.

The interpretation of representations obtained from DCNNs is the main topic of this white paper. The Pool5 layer of the CNN architecture's feature maps are used in the proposed technique. It has been demonstrated to understand semantics and maintain coarse geographical information [9]. We investigate the impact of the G-filter and the database's scalability on the DCNN classification accuracy in this research and show that our method performs better on the cataract identification and grading task.

III.PROPOSED SYSTEM

Deep learning-based approaches can learn the critical features and then incorporate the feature learning processes into the model building process in order to reduce the incompleteness of the manual design features and apply them in various medical imaging. Local filters are created by clustering the picture patches supplied into a convolutional neural network (CNN). Khan et al. employed the VGG-19 model with a transfer learning approach to achieve roughly the same accuracy for fundus images using a recently made available dataset in KAGGLE. A further recent work by Pratap and Kokil investigated cataract detection in noisy settings. A pre-trained CNN was created for feature extraction by combining a number of independently trained, locally and globally trained support vector networks.

A. *CNN*

With tens or even hundreds of layers, a convolutional neural network can learn to recognise various image features. Each training image is subjected to various filtering at various resolutions, and the result of each convolved image is utilized as the input to the following layer. Beginning with very basic features like brightness and borders, the filters can advance to features that specifically identify the object.

Because neutral networks extract the aforementioned features, they require more training data. CNN's performance is heavily reliant on the data fed into the neural network. When there is less data, however, the common data collection technique Boost is used, in which each sample in the data set is changed in response to some category and a new image is created. In a single batch, these new images can be fed into the neural network. Variations to the image include flip, scale, prop, translate, zoom, Gaussian noise, and so on. We used a horizontal flip and a zoom factor of 0.2 in the implementation. Transfer learning is used in the multiclass classification process, and the following pre-trained models were used to perform multi-class classification on pre-processed images.

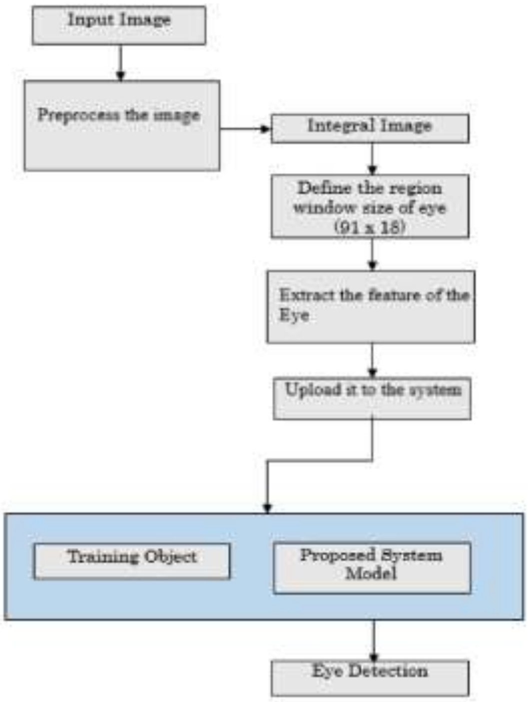

Fig. 2. Architecture Diagram

B. *Preprocessing*

Image preprocessing is the process of converting the image to require our needs and to add to the model efficiently. This includes resizing, orienting, and color corrections, among other features. Additionally, image preprocessing can speed up model inference and cut down on model training time. If the input images are especially huge, shrinking them will greatly reduce the amount of time needed to train the model without affecting model performance.

C. *VGG-19*

A 19-layer convolutional neural network is called the VGG-19. A trained version of the network can be loaded from the ImageNet database. Images can be categorised into tens of thousands of different item categories using the pretrained network. The network has therefore acquired in-depth feature representations for a range of images. The network's picture input has a resolution of 224 by 224.

D. *Tensorflow*

Machine learning platform TensorFlow is totally open source. Researchers may readily push the limits of machine learning, and developers can quickly create and

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deploy ML-powered applications because of its extensive, adaptable ecosystem of tools, libraries, and community resources.

The Google Brain team, which is composed of researchers and engineers, developed TensorFlow to undertake machine learning and deep neural network research. The technique is versatile enough to work in many different additional fields. While backward compatibility with other languages is not guaranteed, TensorFlow provides stable Python and C++ APIs.

IV.RESULT

A structured ophthalmic database of 5,000 patients containing age, color fundus images of the left and right eyes, and doctors' diagnostic keywords from doctors called Ocular Disease Intelligent Recognition (ODIR) has been effectively applied to our suggested approach.

The confusion matrix of the system is shown below:

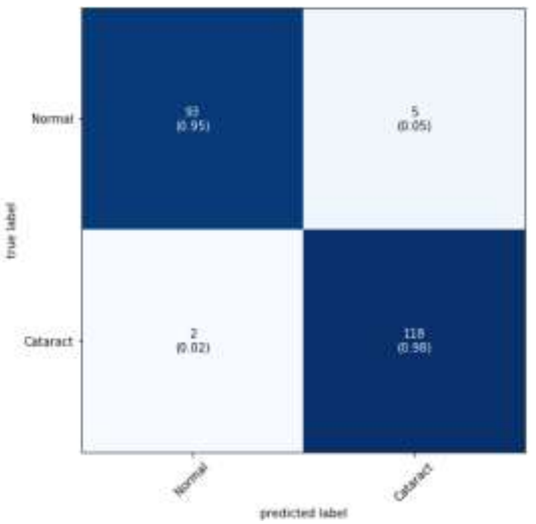

Fig. 3. Confusion matrix

The other models accuracy are shown below compared to our proposed model

TABLE 1: COMPARISON OF OTHER MODELS

Sr.No	Model	Validation Accuracy
1	VGG 16	96.88
2	MobileNet	90.62
3	SqueezeNet	97.66

The above table shows the accuracy obtained by applying different deep learning models namely VGG16, Mobile Net and Squeeze Net. The highest accuracy achieved was 97.66% by Squeeze Net. And our proposed model using VGG has an accuracy of 98.62%.

The Accuracy and loss graphs of the proposed system is shown below:

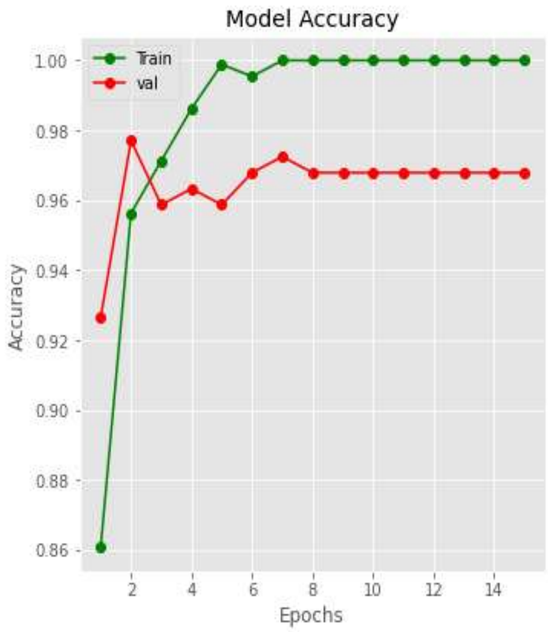

Fig. 4. Model accuracy

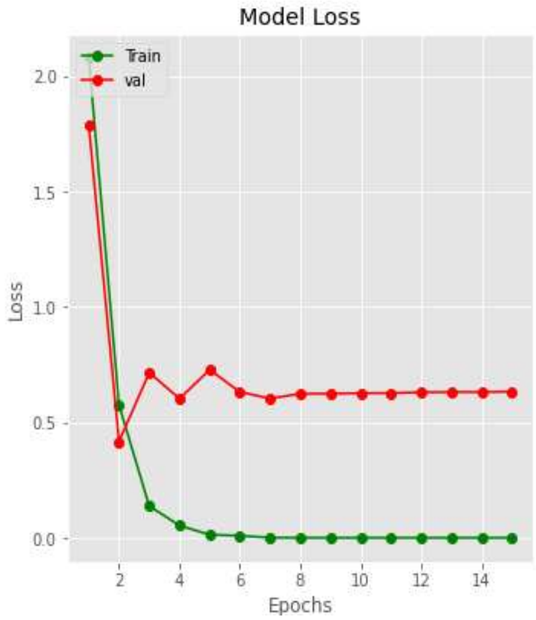

Fig. 5. Model loss

V.CONCLUSION

The main challenge was managing this large dataset. Therefore, we divided the dataset into smaller pieces to enable the proposed system. Deep learning techniques for cataract detection have been proposed in this effort. We identified and extracted certain ocular features for cataract identification using texture features.

To identify cataracts, we extracted the region of interest, i.e. pupil, and formed deep learning models to classify eye images into cataracts, normal eye image. The Deep Learning model used is VGG-19. We also evaluated the accuracy of various machine learning algorithms such as SVM-linear, Random Forest and Adaboost Classifier

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on texture features obtained from SIFT and GLCM algorithms. However, the accuracies obtained are less than deep learning models VGG-19. `

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Statistical Investigation on Survival Analysis Using The Approach of Kaplan Meier

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***Abstract*—Time-to-event details are hypothesised using the statistical means known as Kaplan-Meier. The phrase "time to event" indicates to the cycle of duration among a study's admission and a particular incident, like an illness's onset. Since it is used by researchers to classify and/or scrutinize sufferers who off-tracked to follow-up or at times left the study, as well as the ones that grew the condition of concern or pulled through it, this process is advantageous in survival analysis. Additionally, it is used to contrast clusters, like the placebo-treated clusters and the real drug-treated treatment clusters. In addition to being useful in epidemiology, public health, and medicine, the method can also be used in engineering, economics, and other fields. The vast majority of studies that make use of the Kaplan Meier estimate are, like cohort studies, longitudinal. The demise times of kidney transfer victim, the time to infection for smolder sufferers, and demise time for big C trial are all examples of studies for which the Kaplan-Meier estimate may be applicable. The analysis and control clusters, which received a particular medicine and a placebo, were the subject of fictitious data. There were 20 people equally divided in these two clusters, who were monitored for a period of 24 months over the course of two years. Using the fictitious data, the SPSS software fabricated a table and a estimation arc of Kaplan-Meier that be utilised in the analysis of the 24-month study.**

Keywords—Kaplan-Meier, epidemiology, survival analysis, log-rank-test

I. Introduction

Areas like epizootiological, communal well-being, and treatments, require the analysis of time-to-event data. This type of data measures the time between the start of a study and a specific outcome. To analyse such data, survival analysis is often used. This method involves following a group of participants for a predetermined length of time to measure time to event. In survival analysis, the Kaplan-Meier estimate is the preferred statistical method for comparing both clusters of participants, like a under prescription cluster and a cluster under control. This method is also useful in fields like physics, engineering, economics, and demography. To illustrate the Kaplan Meier estimate, consider a shared characteristic learning of the big C in lungs amid the ones who smoke. The study follows a group of smokers for 20 years to measure the occurrence of lung cancer. The events and censoring are analyzed using the Kaplan-Meier estimate, with events indicating the onset of lung cancer and censored data representing those who dropped out of the study or were unable to continue. Software like SPSS, Stata, SAS, or R can be used to create the survival table and KM measure curve, which are used to calculate the proportion of smokers who survive lung cancer.

II. Literature Survey

First, when conducting cancer studies, survival time analysis is a common method used to answer research questions. These questions may involve determining the impact of clinical characteristics, such as blood sugar levels, on patient survival, or calculating the probability of an individual surviving a specific period of time after a cancer diagnosis. Additionally, researchers may compare survival times between groups of patients who received different treatments. In such cases, Kaplan-Meier plots are often used to visually represent endurance arcs, all while Log-rank compares endurance arcs among clusters.

A. Survival Analysis Using COX Proportional Hazard Model

Regression modelling is put to use to calculate the immediate risk of dying, and it is a little more challenging to visualise than the Kaplan-Meier estimate. It is made up of the hazard function h(t), which expresses the likelihood of an event or hazard h (such as survival) up until a specific period t. When comparing the survival of patient groups, the hazard function takes covariates (independent variables in regression) into account [1].

B. Survival Analysis Using Kaplan-Meir Method

When dealing with shortened or unpublished information, the Kaplan-Meier estimator is utilised in the survival distribution. We may estimate the survival function using this non-parametric statistic, which is independent of the underlying probability distribution. The Kaplan - Meier estimates are established on the total count of sufferers who survive for a specific amount of time following therapy (each patient is represented by a row of data) (which is the event) [2] .

C. Method

The two participant groups will be the subject of fictional data. The treatment cluster comes first, and the control cluster comes second. A treatment cluster gets a particular medicine while the control cluster gets a placebo. Ten people are present in each cluster. The fictitious data will be analyzed with the help of SPSS-generated data.III. Survival Analysis

Survival analysisa arithmetical approach, for analysing information on the basis of when the incident happen, particularly in associate study. The duration from a particular point to the instance of a given incident, such as trauma, is known as survival time.As a result, the investigation of cluster information is referred to as survival analysis. As a result, it takes into account data from cohort studies or randomised clinical trials. Main objective of survival analysis is the analysis plus modelling of "time-to-

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event" information, which is the subject of controlled experiments in clinical trials.The occurrence could be the removal of a tumor, the length of time it takes to be discharged from a medical facility or hospital, the reaction to medicine, or demise. Events can also refer to an injury, illness recovery, or illness onset. Lassa hemorrhagic fever (LHF) for the ones who displayed symptoms after being checked on for one week in Maiduguri, hemorrhagic fever disease for ones who were checked positive after being under quarantine for 21 days in Serra Leone are two examples of events. Estimating and interpreting survival, comparing it between groups, and determining whether or not explanatory variables have a connection to survival time are all accomplished through the use of survival analysis. Time is taken into account in survival analysis, the duration before an important event occurs[3].

The duration of remission, duration taken for a tumor to disappear, duration for a patient to die, and the duration taken for a response to develop are all examples of survival time data. Other examples include the duration taken for a patient to die and the time it takes for a patient to respond to treatment. There are two crucial aspects of survival time that needs to be precisely explained: a starting point and a finish point that is attained when the incident of importance happens or after the subsequent period has come to an end. Survival duration, consequence to a treatment provided, and sufferer symptoms in accordance to survival, reply, and illness progression are examples of survival data. Clinical and epidemiologic human studies with acute or chronic diseases can yield these data. Survival analysis takes into account censoring and time, in contrast to other statistical techniques like logistic regression, amidst rest[7].

Survival analysis is an essential tool for inspecting time-to-event information in areas like epizootiological, communal well-being, and treatments,. In studies where participants cannot be checked on until the learning ends, censorship can occur. Censored data refers to cases where the actual event time is not observed or is unknown. Censoring can occur in different ways, such as right censoring, where the event has not occurred by a certain point in time, left censoring, where the event has already occurred before the study started, and interval censoring, where only the information that the event occurred within a certain time interval is available[6]. In survival analysis, censored observations are included in the analysis, and the participants are considered to be at risk until they experience the event or are censored. One advantage of survival analysis is that it allows for the inclusion of participants with different follow-up times. Various statistical software, including SPSS, Stata, SAS, and R, can be put to use to conduct survival analysis and generate survival tables and Kaplan-Meier curves[8].

Survival analysis involves tracking participants from a defined point of start and recording the duration it takes for the incident of intrigue to occur. However, not all participants may experience the event before the study ends, and it is also uncertain what will happen to those who withdraw from the study. The duration of follow-up is noted for these cases, resulting in unpublished information. The Kaplan-Meier estimate is a useful tool for analyzing this data and describing the survival characteristics of the study population.

IV. Kaplan-meir Estimate

During survival analysis, participants are followed from a defined starting point, and duration until the happening of the incident of interest is recorded. However, not all participants experience the event before the study ends, and the outcomes for those who withdraw from the study are unknown. For these cases, the follow-up period is censored, and the estimate ,Kaplan-Meier is the most effective technique for demonstrating and describing characteristics of survival[5].

It is recommended to keep text and graphic files separate until after the text has been formatted and styled. Survival analysis using the Kaplan-Meier arc is commonly put to use in epizotiological to compare two groups and analyse time-to-event information. The survival curve calculates the percentage of survivors in a specific incident, such as demise, over a duration, as well as the statistical difference in survivals between the two groups. A Kaplan-Meier survival curve moves downward when the incident of intrigue happens, and tick marks indicate censoring. The Product Limit estimate (PLI), also known as Kaplan Meier's estimate, can estimate the fragment of beings or bodily instruments living past some age t, even when few of the objects are not concerned to pass away or malfunction, and the illustrative size is tiny. It presumes enumerates the likelihood of an incident happening at a specific duration, and dividing these consecutive likelihood by any previously calculated likelihoods to arrive at the end of the estimate. For instance, the likelihood of a not so fertile woman conceiving after hydrogenation and laparoscopy three months later can be calculated using conditional probability[6].

Survival analysis is based on defining intervals by failures. The survival probabilities for different intervals are calculated by multiplying the probabilities for each preceding interval. This calculation leads to the Product Limit estimate (PLI) I.e equation (1) .

$$PLI(1) = \frac{P(SurvivalIntervalA)}{NumberofSubjectsatRiskuptofailureA} X \frac{P(SurvivingIntervalB)}{NumberofSubjectsatRiskuptofailureB} (1)$$

The survival probability is deliberated by dividing the count of beings at possibility by the count of beings who survived for each specified time period. Participants who have withdrawn, died, or relocated are not considered to be "at risk," which means that they will not be included in the denominator. This analysis relies on three presumptions. First, it is assumed that participants who withdraw or are censored will always have same chances of living like the ones, continue to be followed. Second, the survival probabilities for people part of recruited at the start and at the end in the study are assumed to be similar. Thirdly, the incident must happen at the specified duration. Because it only examines effects of one factor at once, the K-M measure cannot be applied to multivariate analysis[4].

III. The Log-Rank Test

The above stated test is a statistical tool used to find the difference of the survival functions of multiple clusters. Its primary purpose is to test whether there is a change in the incident probability between populations at any given time. This test is widely used in clinical trials to compare the survival rates of under medical supervision and control clusters, or different treatment groups. Popular statistical software programs, such as SPSS, SAS, Stata, and R

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packages, can generate a log-rank test table. The null hypothesis is not accepted if the p-value is less than the predetermined significance level, usually 0.05. However, the test do not provide any estimate of the magnitude of the difference between groups or a confidence interval.

IV. BENCHMARK PROBLEM

The tables below contain fictitious data generated by SPSS software. Survival Table shows data for the treatment group, whereas Total distributions comparison table shows data for both the treatment and control groups. In Total distributions comparison tablethe starting cluster represents the under medical supervision cluster, and the next cluster represents the control cluster. Ten people in each group were followed for 24 months. Participants were labelled AA,BB, CC..., TT, and received various treatments. For both the treatment and control groups, these information will be put to use to calculate the Kaplan-Meier estimates, also known as the limit estimate of the product.

TABLE 1 :SURVIVAL TABLE

Treat		ID	Time	Status	Cumulative Proportion Surviving at the Time		No of Cumulative Events	No of Remaining Cases
					Estimate	Std. Error		
Drug A	1	D	2	Dead	0.9	0.095	1	9
	2	E	4	Dead	0.8	0.126	2	8
	3	A	6	Dead	0.7	0.145	3	7
	4	B	7	Censored	.	.	3	6
	5	Q	8	Censored	.	.	3	5
	6	H	14	Censored	.	.	3	4
	7	F	19	Dead	0.525	0.166	4	3
	8	L	20	Dead	0.35	0.169	5	2
	9	K	22	Censored	.	.	5	1
	10	N	24	Dead	0	0	6	0
Placebo	1	C	1	Dead	0.9	0.095	1	9
	2	I	3	Censored	.	.	1	8
	3	J	5	Dead	0.788	0.134	2	7
	4	P	9	Dead	0.675	0.155	3	6
	5	M	10	Dead	0.563	0.165	4	5
	6	O	11	Censored	.	.	4	4
	7	G	12	Dead	0.422	0.174	5	3
	8	T	15	Censored	.	.	5	2
	9	R	17	Dead	0.211	0.173	6	1
	10	S	18	Dead	0	0	7	0

TABLE 2: TOTAL DISTRIBUTIONS COMPARISON

	Chi-Square	Df	Sig.
Log Rank (Mantel-Cox)	2.603	1	0.107
Breslow (Generalized Wilcoxon)	0.603	1	0.437
Tarone-Ware	1.318	1	0.251

The above curve shows six incidents (demise) in the treatment cluster (who received drug A) and seven events (demise) in the control group (who received placebo). The treatment cluster has four censored data, while the control group has three. When a participant dies, the curve decreases, and censoring is represented by tick marks on the curve indicating loss to check-up or withdrawal from the study.

The survival probabilities for the treatment group were estimated using the Kaplan-Meier method. Subject DD passed away at 60 days with a predicted survival probability of 0.9. Subject EE passed away at 120 days with a PLI of 0.8. Subject AA passed away at 180 days, resulting in a PLI of 0.7. Subjects BB, QQ, and HH were left out at 210, 240, and 425 days, respectively. Subject FF passed away at 570 days, and the PLI was 0.525. Subject L L passed away at 600 days, and the PLI was 0.35. Subject K K was censored at 660 days, and subject NN passed away at 720 days with a PLI of 0.00. The tick marks on the curve represent censoring, while a descending curve indicates the occurrence of events (deaths).

Subject CC passed away during the start month in the control group, with a survival rate of 0.90. In the third month, Subject II was hidden. Subject JJ died at the age of five months, and the PLI is 0.788. The survival rate for Subject PP's death at 9 months is 0.8571, and the PLI is 0.675. At 10 months, Subject MM died with a survival rate of 0.8333 and a PLI of 0.562. At 11 months, Subject OO was hidden. Subject GG demise after a year, and his PLI is 0.422. Subject TT was hidden at the age of 15 months. Subject RR died at the age of 17 months, with a PLI of 0.211. Subject SS died at the age of 18 months, and his PLI is 0.00. These calculations are visible on the curve.

The survival patterns of two participant groups, like the treatment and control cluster, can be compared by comparing the gaps in their curves, which can be linear or stable. A gap that is vertical indicates that one group had a higher probability of survival at a given time, whereas a horizontal gap indicates that one group died more slowly. Figure 1 : KM estimate curve compares the survival curves of the both clusters, with the null hypothesis that there is no much of a change among them. This hypothesis is tested using the SPSS-generated table below, and the fact that each of the three p-values in Total distributions comparison table is greater than 0.05 indicates that the null hypothesis was not rejected.

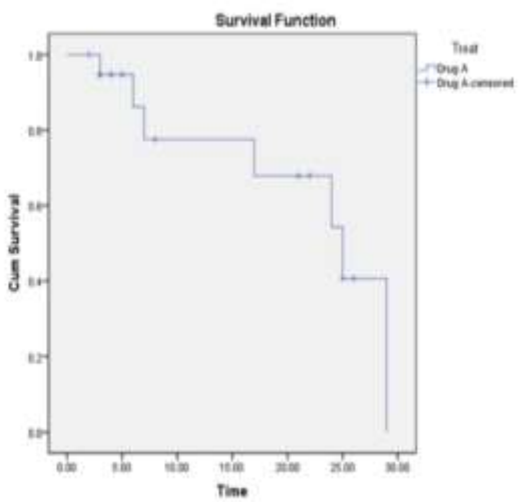

Fig.1. Kaplan-Meir estimate curve

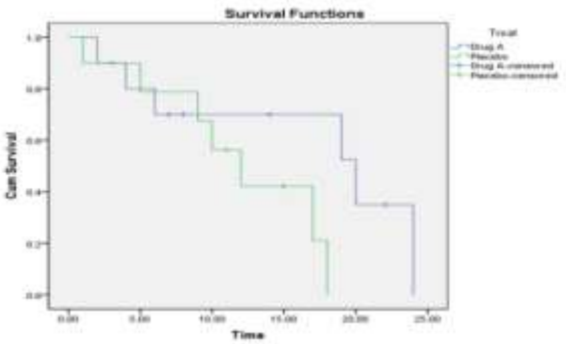

Fig.2.The SPSS software - generated Kaplan-Meir estimate curve

Therefore, statistically speaking, there is no dissimilarity among the treatment and control clusters survival arc. In this context, survival curves refer to the population or actual survival arcs. The events that take place later are more heavily emphasised by the Low Rank in the table, while the events that take place earlier are more heavily emphasised by the Generalized Wilcoxon, with Taron-ware in between the two.

V. Conclusion

The Kaplan-Meier arithmetic technique is extremely helpful in the area ofepizootiological, particularly when analyzing data pertaining to time to events. In survival analysis, the method is used to look at patients who reached a certain point and those who were censored for a certain amount of time. It also works well when comparing participant groups like the control group and the treatment group. The generation of survival tables, Kaplan-Meier estimate curves, and other significant and pertinent tables,such as the overall comparisons table, can be accomplished using statistical software packages like SPSS, Stata, SAS, and R. Engineering, economics, physics, and other fields use the KM estimate as well.

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Natural Language Processing Based Screening for Applicant Tracking Systems

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***Abstract*—Within a brief period, a typical online job posting receives a large number of applications. As it is highly inefficient in terms of money and time so hiring companies can't handle it, manually filtering out resumes isn't practical. Additionally, this screening procedure for resumes is unfair because many suitable profiles are not given the due consideration they deserve. This could mean that applicants who aren't the right fit for the job are chosen instead of those who are. Ideally, this paper develops a solution that improves the accuracy of resume screening. Relevant data like skills, education, and experience are extracted by our system using Natural Language Processing. From the unstructured resumes and, as a result, produces a form that summarizes each application. With the help of screening methods that eliminate unnecessary information, analysis of resume data is made easier. After the data pre-processing process, the data is compared with the job description and is analysed on similarity scales to rank each individual resumes. The resulting ranking scores can then be used to select candidates who are the most suitable for a given job opening.**

Keywords*—*Applicant tracking systems, resume screening, natural language processing, cosine similarity, term frequency-inverse document frequency

I. Introduction

All the major businesses' recruitment procedures have undergone major changes due to the increased internet connectivity. Recruiters are able to file an fill a wide range of positions by utilizing online job postings on various websites. Even though e-recruitment has made recruiting easier and saved money for both recruiters and applicants, there are new obstacles to overcome. Every day, Thousands of resumes are typically received by large businesses and recruitment agencies daily economic distress, when a lot of people are looking for work, this situation gets even worse because workers are more mobile.

It is inefficient and makes no sense for recruiters to individually screen each resume for such job postings because less than 5% of applicants will be selected [2]. The fact that these applicants use a variety of resume formats presents another challenge for the organizations. All People who apply to a job belong to different professional and personal backgrounds so every one of those applicants will have their own unique style to showcase his or her talents on their CV because they have had a variety of educational backgrounds and have worked on a variety of projects.

CV's are unorganized documents that can be stored in different file types (such as.pdf, .doc, .docx, .jpg,.txt, and so on). Likewise, there is no fixed or predefined formats or templates used in the writing of their content. Because it is difficult to read resumes, recruiters spend a lot of time sorting through them to find the best candidates.

In an effort to alleviate the difficulty of managing diverse and unstructured resumes, numerous job portals and external websites were established. Candidates are required to manually and orderly fill out an online form with all of their resume information to create candidate metadata. This method has the drawback of necessitating candidates to put in additional work, which often results in them not entering all of the required information into the online form.

These online sites use a general outline for all jobs which makes them inefficient in the case of specific job positions, making them unsuitable for all jobs. The employers then apply the keyword-based search to shortlist candidates using these templates. Insufficient to match candidates to the job description is this keyword-based search functionality This is due to the fact that it only requires certain required keywords to be present and has several disadvantages with regard to deriving information, such as avoiding natural language linguistics for example merged and compound words and the contextual meaning of the resume's content.

As a result, candidates who deserve to be considered for the shortlist are left out because these Boolean search techniques frequently produce results that are irrelevant.

II. Related Works

A. Manual Screening

Some of the people who will be recruiting for the company screen resumes manually. This means that each resume is looked at one by one to see if it fits the job description. If it does, the CV will be chosen. This might be dependent on the on the skills and qualities needed, the job experience of the candidates, among many other things to consider related to the description provided for the job. Issues with this method include:

- Time-inefficient - All CV's must be individually checked, which makes the whole screening process a lot slower.
- Even if all resumes are individually reviewed, recruiters are under a lot of pressure.
- Misallocated and resource waste: Instead of spending so much time reviewing resumes, recruiters could be working on other projects.

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- Not efficient:This approach also requires considerable time and resources that could be spent on other projects.
- Unnecessary bias:Moreover, recruiters may not review all resumes after identifying job requirements.

B. Screening Using Artificial Intelligence

To address these issues, the article "Resume Evaluation System based on AI"[4] proposes an AI-powered Resume Screening Software that filters and ranks resumes based on specific keywords to identify suitable applicants. This system aims to classify and shortlist desired candidates more efficiently than manual methods.

The system requires PDF-formatted resumes, which are processed one at a time by extracting text and eliminating excess material. Keywords such as prerequisites are then classified by area, and scores are calculated and sorted for each region. Finally, the system generates a pie chart displaying scores, which helps recruiters select eligible candidates for the job role.However, this approach has some drawbacks, such as:

- *Inefficient* – each curriculum vitae or resume requires exorbitant time to have each document reviewed in comparison to other available methods
- *Not user-friendly and tightly connected blocks*the software may not be user-friendly and may require disrupting the entire code for any changes.

C. Reviewing methods with Machine Learning

The article "Resume Screening using Machine Learning"[5] suggests that in order to efficiently screen resumes, they should be formatted in CSV. To begin the screening process, irrelevant or duplicated terms should be eliminated, leaving only relevant words. These words are then analyzed and assigned skill points based on their relevance to the job requirements. The points are then sorted in order of importance and candidates are selected based on their skill point total. A graph is then displayed to showcase the skill points and aid in the selection process of suitable candidates.

The included benefits are:

- Many resumes can be evaluated simultaneously.
- Easily identify suitable candidates for the job.
- Process completion time is reduced.

Issues and disadvantages with the above approach

- *Challenges with Resume Format*: Only resumes in CSV format are compatible, which may not always be feasible since many candidates submit resumes in Word or PDF.
- *Difficulty in Implementation*: Implementing these techniques requires a high level of expertise and may not be accessible to everyone.
- *Interdependent Blocks of Code*: Making changes to one block of code may require modifying the entire code, leading to disruptions in the workflow.
- *Removal of necessary information* – certain procedures may cause a loss of crucial information and therefore lower overall performance of the model

D. Deep Learning methods of Screening

The article on Resume Screening using Deep Learning (LSTM)[6] suggests a process that involves a dataset with two columns: Category and Resume. The Category column includes fields such as Devops, DBMS, Engineering, etc. The input is the Resume column, which is used to categorize the resume on how well it matches.

Performing a value count on categories, one can obtain and generate a distribution representing the frequencies of resumes that fall into each category.

- After obtaining the dataset, the first step is pre-processing, which involves eliminating irrelevant information from the resume.
- Stop words, which do not contribute to the information, must also be removed using nltk.
- Final preprocessing step involves data condensation, tokenizing features, and labels, and giving less weightage to the most frequent words and more importance to less frequent words. This ensures that unique words are more useful than concise words.
- The model is then trained and evaluated using test scores and accuracy, which generates graphs.

III. Proposed Methodology

A. Information Extraction

Natural Language Processing is used to extract information in the first phase of our proposed system. The resumes do not contain the information in a structured manner. The recruiters can't use the noise, inconsistencies, or irrelevant bits of data. The goal is extracting the main keywords that are similar from the resume's raw data without requiring human intervention. Tokenization, Stemming, POS Tagging, Named Entity Recognition, and other methods, Important job-related content, such as skills, education, and so on, is gathered by our system. From the resumes of candidates uploaded. Each resume is summarized in a JSON format as a result, making it simple to perform subsequent processing tasks in the resume screening system's subsequent phase. Each chapter should be given an appropriate title.

B. Tokenisation

The initial step in identifying the bits of data that constitute a sequence of individual letters or words is to convert various resume formats such as word documents, pdfs, rich text format's, etc. into a common format. Tokenization is the subsequent process, which involves breaking up large text chunks into smaller tokens. This allows us to analyze the original text sequence through these words. Tokenization involves removing or isolating whitespace and punctuation characters to break up sentences into singular tokens. After following the tokenization process, one continues the processtoextract analytics such as

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the total word count, word frequency, etc. There are several ways to perform tokenization, including with tools like the NLTK (Natural Language Toolkit), spaCy library, etc.

C. Stemming and Lemmatization

According to its grammatical rules, it is frequently observed that a single English word is used in numerous different forms in various sentences. For instance, "implement," "implement," and "implement" all refer to the same verb but in different tenses. educing all to their original stems from their variations of a word and its bases is important to avoid distinguishing similar meanings of derivationally related words. This goal is achieved through stemming and lemmatization, which have different methods but share the same objective.

Lemmatization is a more precise method for reducing words to their root forms. It involves using a language dictionary and morphological analysis to provide linguistically correct lemmas, rather than simply applying pattern matching rules to remove affixes like in stemming. This means that lemmatization takes into account the context of the word and its part of speech, allowing it to accurately determine the root form. In addition, unlike stemming, lemmatization always returns a valid word that exists in the language dictionary. The NLTK library provides a WordNetLemmatizer that is based on the WordNet database and is commonly used for English language processing.

The WordNetLemmatizer is a part of the NLTK Python package, which is a widely used tool for natural language processing tasks. It is based on the WordNet lexical database, which is a large electronic lexical database of English words and their meanings. The WordNetLemmatizertakes into account the context in which a word appears to identify the correct lemma, which is the base or dictionary form of a word. It uses different techniques such as part-of-speech tagging to identify the correct lemma for a given word. Compared to stemming, lemmatization provides more accurate and meaningful results for natural language processing tasks.

D. Chunking

Chunking is a method for organizing short phrases with parts of speech tags to provide categorizing phrases or components of a sentence. Combining regular expressions with POS tags, some chunk tags like Noun Phrase (NP) and Verb Phrase (VP) can be generated. This is necessary because POS tagging alone do not provide significant amounts of valid data for sentence integrity or derive any meaningful context from the corpus. Shallow parsing is the process of creating a parse tree with a singular information level, from the base of the tree, that is the root, to the leaves. The overall process then guarantees that more information can be available than the POS (Parts of Speech). Chunking is useful for segmenting and labeling multi-token sequences, with the primary purpose of identifying groups of "noun phrases" that can be used to enhance the next process, which is Entity Recognition.

E. NER Process (Named Entity Recognition)

One of the most useful techniques that aid in the data processing stage is to extract useful information from unstructured text data by identifying and categorizing it into predefined categories. NER successfully accomplishes this objective.Our objective is to use a similarity model to determine how closely the categorized resume data matches the requirements of recruiters, after categorizing the unstructured resume data into these diverse categories. There are several ways to use Named Entity Recognition [1] to extract relevant categories from unstructured data. One approach uses rules and syntax as a base, which involves developing our own algorithms that are tailored for use in domains that are specific to the employer. Regular expressions are contextualized to be utilized to identify named entities by searching for patterns in a string. Another method to approach NER as a sequence labeling problem is to use Bidirectional-LSTM and the Conditional Random Field algorithm [3].

F. Process of vectorising input data

Vector space is a geometric structure composed of a collection of elements known as vectors, which can be multiplied and combined by scalars. The overall process, which is popularly used in the domains of mining textual data, natural language processingandretrieval and processing of data, vectorisation is an algebraic model that represents documents as numerical vectors. Many models, especially those in the context of machine learning, sometimes involve vectors to be considered as the input data rather than UNICODE or ASCII data, making the process of vectorization significantly important. One common method of vectorizing data is to convert each word or string into a certain value within a data range, with each word occupying unique vector positions in the array/vector. Each corresponding value at every index represents the total count or frequency distribution of corresponding word occurring in the text. Since the result array is often smaller than the original corpus and its range of vocabulary, a vectorization strategy is almost necessary to be employed to account for this.

G. TF-IDF

“Term Frequency – Inverse Document Frequency" is the acronym for TF-IDF. TF-IDF was developed for document search and information retrieval. Since there are many terms that may not be important or relevant to be used for the similarity measure, therefore terms need to be measured relatively in terms of significance and th the overall weight they carry in terms of relevance in a corpus. Hence TF-IDF measures based on the weight of a word in terms of relevance as well as the frequency. The number of documents containing a word offsets the importance, which increases in proportion to its frequency in the document.

Therefore, terms like "this and "what," "who," "the," "if," and so on are frequently used in all documents. rank low, despite their numerous appearances, because they have little significance for that particular document. As shown in the first equation below, one can calculate the TF-IDF value for a word picked out from a file by the product of two of two variables or measures:

DOI: rp-9788770040723.113

$$TF - IDF(t,d) = TF(t,d) * IDF(t,d) \qquad (1)$$

Number of occurrences of each Term: It determines how frequently a term is repeated in a file document. You must modify or standardize this frequency because a certain term can be repeated more with much larger documents, when compared to documents that are smaller in length. The number of times a word appears in a file is divided by the total number of words in that file to get a normalized term frequency. It can be written [7]as shown in equation (2) below.

$$TF(t,d) = \frac{freq(t,d)}{\sum_i^n freq(t,d)} \qquad (2)$$

In context, the total number of files in the collection where the term t exists is referred to as count(t) and the unique document count is represented as N.

The TFIDF score of a word in a document is the product of these two metrics, which are represented by equation (2). If the TF-IDF metric of a term in a file is high it indicates the greater importance of that term. The CV's and the work interpretation were modelled into a vector space by our system.

We can use various similarity metrics to generate and rank scores between job designations and the documents. Cosine similarity is commonly used in text mining and information retrieval tasks. The metric aims to measure the cosine of the angle between two vectors in a high-dimensional space, which is a measure of similarity between the two vectors. The similarity score ranges from -1 to 1, with 1 indicating that the two vectors are identical and -1 indicating that they are completely dissimilar.

H. Cosine Similarity

(3)

A metric that measures how similar two things are is known as a similarity measure. Cosine similarity is a measure across the sine curve that measures the similarity across the sine. Because it is a symmetrical algorithm, we can mathematically represent it, as below:

$$\cos(\theta) = \frac{\vec{a}.\vec{b}}{\|\vec{a}\|\|\vec{b}\|} = \frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n} a_i^2}\sqrt{\sum_{i=1}^{n} b_i^2}}$$

The dot product of the two vectors is +anbn. All pairs of elements' cosine similarity can be determined using this equation(3). The resume documents can then be ranked according to a particular query word vector. Cosine similarity, on the other hand, only looks at features that are related to the words in the text and will produce results that are less accurate. By including semantic information, similarity measures can be made more effective.

IV. Result and Analysis

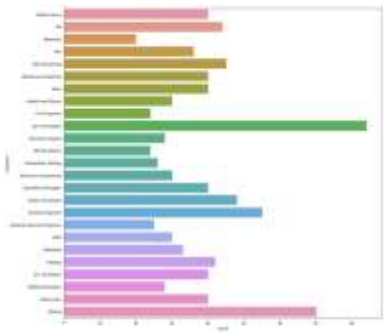

Fig 1. Categorization based on domain and skillsets.

The dataset was created by scraping across data from online job application sites, and was the condensed into a feature set of eight to nine features that would be relevant towards the use case. The model consists of ten domains that each are sub divided into job positions that require significantly different skill sets, such as Hadoop Engineers, .Net development, etc, and each resume is then categorized and plotted against a frequency distribution as Fig 1.

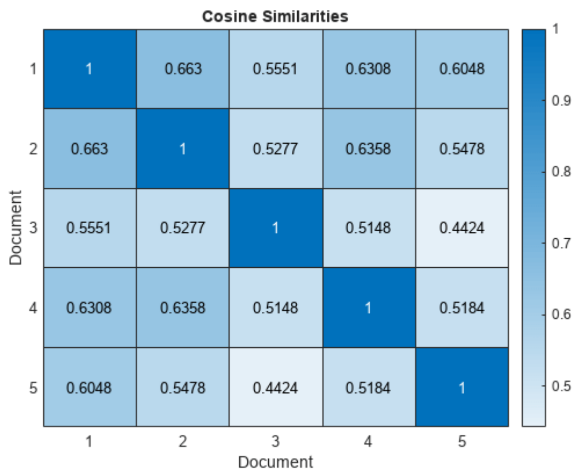

Fig 2. Cosine similarity measures against each resume and job description

The system model can then effectively categorise resumes based on the expected skill sets from each job group from the corpus and help determine what is the most suitable job for each candidate based on the position they applied to.The methodology used was successful in extracting the relevant skills from each resume as well as the personal details as well.

Using classifier measurements generated results that created strong precision scores for each skill classification as can be seen and cosine similarity metrics were able to evaluate the similarity of a resume against a job description, as demonstrated in the similarity matrix in Fig 2, the value closest to 1 indicating the highest similarity, and 0 indicating no similarity. Based on these metrics, the resumes are ranked.

V. Conclusion

Most organizations receive a large number of applications for each job posting. In today's world, it can be time-consuming for any organization to sort through the

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plethora of resumes to find the most relevant application for a position. The candidate's resume must be manually classified, which takes a long time and wastes resources.

Therefore, a proposed automated machine learning-based model that, based on the job description, recommends suitable candidates' resumes to HR. The proposed model is expected to be effective in two stages: to begin with, characterize the resume into various classes. Second, suggests a resume based on how closely it matches the job description.

With help of a LinearSVM classifier, there is an expectancy was able to accurately capture the resume insights and the semantics with an higher accuracy. Using deep learning models like these could improve the model's performance: LSTM, Recurrent Neural Networks, Convolutional Neural Network (CNN), and others. An integration with LinkedIn and GitHub APIs will expand use cases. The developed method can thereafter be utilized to develop an industry model if the industry is plagued by large number of applications. By including domain experts like HR professionals, a more accurate model can be constructed, and HR professionals' feedback aids in iterative model improvement.

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Forest Fire Prediction using Supervised Machine Learning Algorithms

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***Abstract*—Nowadays, when global warming is increasing day by day, one of the most significant issues harming flora and animals around the planet today is wildfires. Forest fires are an uncontrollable disaster which causes damage to society as well as endangering nature. This paper uses machine learning regression techniques and artificial neural network algorithm for predicting the possibility of a forest fire to occur. This paper uses and compares various algorithms to try and deduce the best one possible out of all them. The various processes of a machine learning project are seen here and furthermore, techniques like cross-validation and hyperparameter tuning are carried out here.**

***Keywords*—cross-validation, hyperparameter tuning, CatBoost regression.**

I. Introduction

Wildfires are unplanned, uncontrolled, and unpredictable. As the name suggests they are often pretty huge and cover large swathes of an area on which there is combustible vegetation. Wildfires can be caused both naturally and by human intervention. The common natural cause for the start of a wildfire is generally lightning. Lightning strikes and then the dry fuel, mostly grass or twigs or other organic materials catches on fire. As for human causes, they range from slash-and-burn agriculture, a common practice in nomadic societies, to more serious methods like arson. But one of the most common ways a human can start a wildfire or a forest fire is the discarded cigarette butt after smoking.Across the world, there were about 4.2 million wildfires detected in 2019. Butwe are discussing only about the detected ones, which generally come into purview. Not to mention, the economic damage that can happen because of the fact that we lose multiple economic resources that are used in trying to extinguish the fires and also there can be massive economic damage due to the climate change threat.

Multiple continents experienced forest fires during the 2021 wildfire season. Even halfway through the year, there were more wildfires than ever before, and climate change-related increases in extreme weather events (such as droughts and heat waves) helped to amplify the size and scope of the fires. 2021 - Simlipal National Park in Odisha, Shimla-Kullu Wildfire, Dzukou Valley on Nagaland-Manipur borders.There are cases reported in Rajasthan' Sariska Tiger Reserve, Odisha's Similipal Wildlife Sanctuary, Madhya Pradesh's Ladkui jungles in Sehore district and the forest cover of the Majhgawan region of Satna district and the Perimalmalai Peak near the Kodaikanal hills of Tamil Nadu's Dindigul district were also struck with the disaster before the end of March, 2022.

Nowadays, forest fires have emerged as one of the most significant issues harming many regions worldwide. Wildfires are uncontrollable disasters which cause damage to society as well as endanger nature.

Why is there a need for ML when there is an accomplished forest department that has been handling these issues for quite some time? The answer is simple: ML can cover many parameters that the accomplished forest department cannot, such as latitude, longitude, satellite, version, and other variables, whereas the experienced forest department can only check on 3 to 4 parameters using human capability. In our use case ML actually helps out by covering various parameters that would otherwise not be covered due to the sheer information overload that would happen and would make it nearly impossible to actually deduce and come to a decision.

Our forest fire prediction technique uses and takes in several factors that can affect a fire and then output the confidence of the fire occurring. This dataset contains various features like the latitude, longitude, brightness, the terrain that is visible from the satellite, and the time of the day the data was collected, i.e., whether it was daytime or night, and other factors. Training, evaluating, and comparing the performances ofseveral ML algorithmsare carried out in this paper.In the training of the machine learning algorithms, we use two different datasets, that are curated with a few different features that are selected using the feature selection process and further processed using feature engineering, after which the data is finally split into training and testing data.We examine the effectiveness of the various methods using the R2 score, Mean Absolute Error, and Mean Squared Error as the various metrics and we also use a technique called Cross Validation that checks how the model performs on completely unseen data. Finally, hyperparameter tuning is conducted on the best-performing algorithm because hyperparameter tuning helps us in choosing the ideal set of hyperparameters. The hyperparameter is a parameter that controls the learning process, but by contrast, other parameters are learned. The tuning of the hyperparameters are absolutely critical because they affect and control the behaviour of the model. This is done in order to achieve higher accuracies and better performance from the model, as the default parameters may

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not suit the existing data due to variations in the problem statement.

II. Literature Review

A. Forest Fires Detection Using Machine Learning Techniques

In this paper[1], they have considered various climate and physical factors to be mapped. The models experimented with are Linear, Ridge, and Lasso Regression. The way of working was first to take all the features into account and only 70% the next time around. Out of the three models, Linear displayed the best results.

B. A Perceptron Algorithm for Forest Fire Prediction Based on Wireless Sensor Networks

They illustrate the use of perceptron algorithms [2] with wireless sensor networks to offer a quick and trustworthy technique to detect a potential forest fire early. Weather data like temperature, humidity, and many more are collected with the help of sensors. This data is then passed to a sensor which calculates a value called Fire Hazard Index.

C. Evolution of Burned Area in Forest Fires under Climate Change Conditions in Southern Spain Using ANN

This paper [3] is a study of the effectiveness of an artificial neural network in predicting the burned area and then using that information to evaluate how future wildfires will develop and the area they would affect in Southern Spain.

D. Machine learning to predict final fire size at the time of ignition

In this paper [4], an investigation is conducted into the size of a fire at the end and how accurately we can predict and control it at the time of ignition. With the help of decision trees, the fires are classified into small, medium, and large with a 50.4 ± 5.2% accuracy. This model predicted that 40% of the ignitions would develop into big fires, which would then account for 75% of the overall burned area. None of the other classification methods, including Random Forest and Multi-layer Perceptrons, performed as well as the decision tree approach in terms of output.

E. Learning to predict forest fires with different data mining techniques

Using a variety of data mining techniques, such as predictive modelling based on GIS of a forest structure, weather prediction model Aladin, and MODIS satellite data, a study [5] on how to anticipate forest fires in Slovenia was conducted. Decision trees, logistic regression, and Random Forest with bagging and boosting of decision trees were few of the Machine Learning techniques used. Bagging Decision Trees was the model with the best performance.

F. Detection of forest fires using machine learning technique: A perspective

In the quest to predict forest fires, a variety of machine learning methods, including SVM, regression, decision trees, and neural networks, have been experimented with [6]. The results of this paper explain why regression is the better approach to be taken in the detection of forest fires by dividing the dataset for higher accuracy. The paper mainly focuses on the quick detection of forest fires by completing the analysis before the other machine learning techniques.

G. Burned area prediction with semiparametric models

To describe and forecast the weekly burnt area, two semiparametric time-series models [7] are implemented and tested. The two models are Autoregressive moving average after smoothing and smoothing after Autoregressive moving average. They are examined and contrasted with a purely parametric model, and it is found that the first method yields results that are less error-prone than the second.

H. Forest fire prediction using machine learning and deep learning techniques

The goal of the paper [8] is to use various machine learning and deep learning approaches to predict the occurrence of forest fires. To determine the optimal model, a comparison analysis has been done. The Decision Tree has the highest accuracy of any model, at 79.6%. Additionally, the implementation included a User Interface for simple and clear access.

I. Forest fire prediction using ML and AI

In this paper [9], algorithms such as SVMs, KNN, Logistic Regression, Random Forest, as well as decision trees are implemented to describe a risk prediction method in the context of forest fires. Parameters such as humidity, temperature, and oxygen were considered as factors in forest fire prediction. The results of the paper indicate that the danger of the occurrence of forest fires can be predicted with an accuracy of up to 89.47% with the help ML machine learning models.

J. Riau forest fire prediction using supervised machine learning

In this study [10], data of the weather is used as a primary source to analyze forest fires and build early warning systems for the Indonesian island of Riau. Supervised ML techniques such as Bayesian networks and decision tree were utilized to build prediction models that provided an accuracy of 99%. Although decision trees were found to be slightly less accurate than Bayesian networks, the study found that both models were efficient in extracting relevant features in an effective manner.

K. Artificial Intelligence for Forest Fire Prediction

This paper [11] describes and analyzes methods to predict forest fires by leveraging artificial intelligence. The ideal model recommended utilizes support vector machine algorithm as the base algorithm for the prediction model, wherein past data is used to predict hazard levels for the day. The paper concludes that algorithms such as support vector machines can predict forest fire hazards with 96% accuracy even with a limited amount of data.

L. Predicting Burned Areas of Forest Fires: an Artificial Intelligence Approach

This research [12] was a study on how to create an intelligent system based on genetic programming to identify and forecast the area that burns using data specific to the forest under analysis and readily available meteorological data. Due to its smaller MAE in comparison to standard genetic programming and state-of-the-art machine learning

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methods, geometric semantic genetic programming was used, and the experiment results obtained were significantly better. This justifies further research into the geometric semantic method as it may be helpful for further learning deployment.

M. Forest Fire Prediction Using Machine Learning Techniques

This paper [13] is a comparative study of various models which are used to predict forest fires like Decision Trees, Random Forest, Support Vector Machines, etc., and to also compare with the RandomizedSearchCV algorithm used in the current study. The improvement proposed in this study is the usage of meteorological parameters like temperature, rain, wind and humidity. RandomizedSearchCV fits various decision trees together and uses averaging in order to improve the accuracy of prediction and also to control overfitting, a common problem noticed in various machine learning models. The results show that factors like extreme temperatures, moderate humidity and higher wind speeds exponentially increase the chance of burning in a forest fire. It is also noticed that compared to other areas, the forests are inclined to catch fire first.

N. Parallel SVM model for forest fire prediction

This paper [14] talks about a new method of trying and detecting forest fires with the help of Parallel SVM. It is a newer method which has been developed in order to tackle the problems of low efficiency and high overfitting which affect the actual real-world results. Parallel SVM intends to provide better performance also than conventional SVM, with the help of PySpark. The use of meteorological data is also done here and a better RMSE value is observed.

III. METHODOLOGY

O. Overview

The objective of this paper is to evaluate several ML algorithms such as linear regression, support vector machine, gradient boosting, and so on, and compare their performances. The best-performing algorithm can then be used to forecast the occurrence of a wild fire with confidence and reasonable accuracy. The overall methodology for this paper follows a streamlined path that helps in clarity of thought as you follow through. We start with standard procedures such as performing data pre-processing on imported data. We will then perform feature selection and feature engineering before splitting the data into training and test datasets. Next, we train the model, following which we validate the model with the various machine learning algorithms that we have proposed. Finally, we perform hyperparameter optimization. The problem is a regression task that takes the described features into account and provides an output that represents the chances of the occurrence of a forest fire.

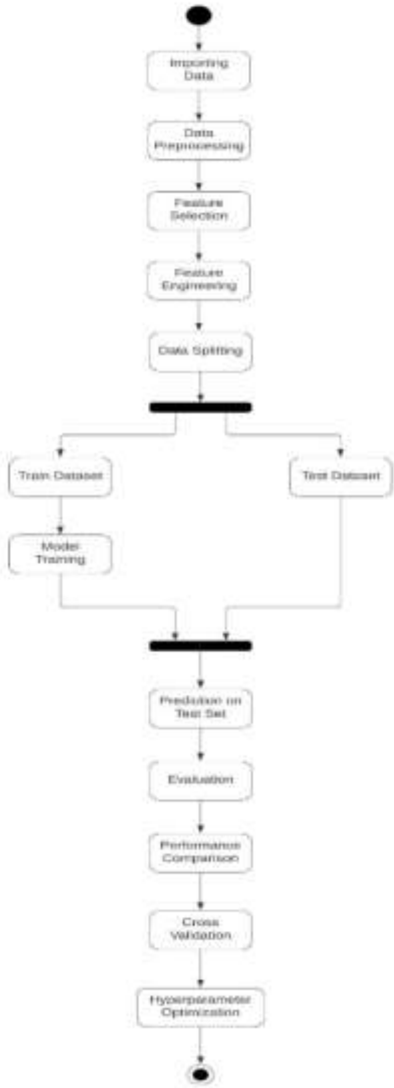

Fig. 1. MethodologyDiagram

P. Environment

The entire project is implemented on Google Colaboratory, commonly known as Google Colab. It is a free Jupyter notebook environment that runs on the cloud that allows users to write Python code through the browser. Hosted by Google, Colab provides access to powerful computing resources such as Graphical Processing Unit (GPU) and Tensor Processing Unit (TPU), which allows for seamless work on the platform. Google Colab is thus particularly useful for researchers focused on data science and machine learning, who wish to collaborate with others on coding projects in a shared environment without hindrances. Unfortunately, Google Colab might be unable to process larger datasets as it is a limited platform, and does not support all Python libraries. However, for the purposes of this paper, Google Colab is a suitable work environment which is more than capable of handling the necessary datasets and libraries. In order to increase the scalability of this project, environments such as Kaggle can also be utilized.

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Q. Importing Data

The data is imported via a private link. Google Colab allows users to browse directories in the local system. The dataset contains 36011 rows and 15 columns. The features of the dataset that are taken into consideration include latitude and longitude, brightness, terrain from satellite, time of the day during data collection, fire radiative power, and fire type. This data is uploaded into Google Colab's workspace directory, which provides fast file access wherein uploaded files can be accessed without their absolute path.

R. Data Preprocessing

An important phase of any machine learning research is data preprocessing. It is a technique that involves transforming raw data into well-formed datasets and cleaning the raw data in order to check whether or not it is fit for analysis. More often than not, raw data is incomplete and inconsistent. Therefore, preparing the data has a direct impact on the final results post-analysis. The primary steps that are usually involved in data preprocessing are data cleaning, data integration, data transformation, data reduction, and data discretization. We first check the information generated by the dataset. This information primarily lets the user gain an understanding of the data type of each column as well as the total number of columns within the dataset, along with the count of non-null elements that are present in each column. This information helps make data cleaning easier. We use the describe() function, which is a function that comes with the pandas library, to check the statistical summary of the data. Doing so also helps us find any discrepancies in the data. Using the describe() function helps us in getting a quick understanding of the distribution and range of values in the dataset. We can additionally identify any potential outliers, missing values, or other problems pertaining to the quality of the data as a whole. In this case, no discrepancies are discovered. In order to check the count of null elements or corrupt elements in the columns of the dataset, we use the Python library missingno [reference]. The ability to understand the distribution of missing data is provided by this library. The visualisations can be done in form of bar charts or heat maps. It is possible to see where the missing values are and examine their relationships to the columns thanks to Missingno. It displays null values as a white line between a black column block. In this instance, we find that there are no null values or corrupt values in the dataset.

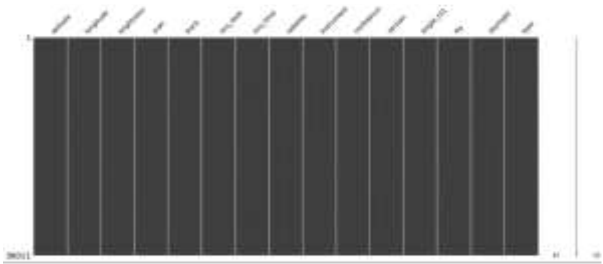

Fig. 2. MissingNo Evaluated Result

S. Feature Selection

Feature Selection is the process of selecting the most important features from a dataset to use in model construction. Feature selection helps to reduce the dimensionality of the dataset and refines the data to present only the most relevant variables. The goal of feature selection is to decrease the number of input variables to obtain only those variables which are the most useful in predicting the target variable. This can result in improved accuracy and performance of the model. By removing redundant or irrelevant features we can also reduce computational complexity and improve overall interpretability. At first, we remove the features acq_date, instrument, acq_time, and version. We do so as these features do not carry any relevance for the algorithm. Therefore, the model cannot be trained with these features. Once the aforementioned features have been removed, a correlation matrix is drawn out for the remaining features. A correlation matrix is essentially a table which describes the correlation coefficients between the various variables, or features in this case. A correlation matrix is often visualized in the form of a heatmap. A correlation matrix can help discern observable patterns within the data or can be used as inputs for further analyses. In this case, the correlation threshold is fixed at 0.6. This means that columns with a correlation coefficient of greater than 0.6 depict a high or strong correlation. These columns shall be dealt with. Based on the correlation observed, two datasets are created.

T. Feature Engineering

We perform feature engineering on both datasets that were generated after the process of feature selection. For dataset 1, One Hot Encoding is performed on the categorical columns of the dataset. One Hot Encoding allows the representation of categorical variables in the form of binary vectors. This can then be provided as input to machine learning models for further processes. In this case, One Hot Encoding is performed using the pandas function pd.get_dummies on Python. This function converts categorical data into "dummy" variables. As mentioned above, this dummy variable is binary and is either of the value 0 or 1. We follow a similar procedure for dataset 2, by performing One Hot Encoding on the categorical columns of the dataset with the help of pd.get_dummies. In addition to this, the range of the column scan is divided into separate categories using the method of binning. Binning is a method that reduces continuous and discrete data cardinality by grouping related values in "bins" so as to lower the number of distinct values in the data.

U. Data Splitting

As the name suggests, data splitting involves the splitting or dividing of data into subsets. Each subset serves a different purpose. For example, one subset can be used to train the machine learning model while the other subset can be used to test the model. The training subset can help develop the model while the test subset can assess the performance of the trained model. The most common method to split data into subsets is random sampling. In this case, we use the train_test_split function provided by sklearn library in Python. Sklearn, or Scikit-learn, is one of the most robust Python libraries that can be used abundantly in machine learning applications. We split the datasets such that the size of the test subset is 20% of themain dataset and the training dataset is 80% of the main dataset. We find that the training data has 28808 rows while the test data contains 720 rows in total. Since our aim is to predict the chances of confidence of the occurrence of a forest fire, our target column is "confidence". This column will give us the probability of forest fire occurrence. Dataset 2 is scaled with the help of StandardScaler() function from the sklearn

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library. It is important to scale data before modelling in order to avoid issues such as misclassification or bias. By standardizing the data, we can scale the data with zero mean and unit variance. StandardScaler helps us achieve this.

V. Model Training and Prediction

We use the sklearn library for initializing various regression machine-learning algorithms. We also use this library to calculate the performance metrics such as r2 score, mean absolute error, and mean squared error. These performance metrics provide us with an insight into the performance of the model. First, the model is fit onto the training data, after which it is tested on the testing data. In this case, the machine learning algorithms used for training are linear regression, support vector regression, decision tree, random forest regression, gradient boosting, extreme gradient boosting, and catboostregressor.

Linear Regression - Linear regression is one of the most rudimentary machine learning algorithms. It is used to forecast the value of a continuous dependent variable based on the value of a continuous independent variable. It is a method for supervised learning that can carry out regression tasks.

- Support Vector Regression- SVR, also known as support vector regression, is a supervised machine learning technique that may be applied to regression tasks. It works on a similar principle to that of a traditional support vector machine and defines an acceptable error through a hyperplane.
- Decision Tree Regression - Decision trees work on the principle of supervised learning and can be used for both classification and regression tasks. Decision trees contain nodes such as the root node, interior nodes, and leaf nodes, as well as branches connecting these nodes in a tree-like structure. Decision trees are helpful as they are easy to understand and possess a rather simple structure.
- Random Forest Regression - For regression on a supervised method, Random Forest Regression uses ensemble learning. The mean of the classes is produced as a prediction of the trees after numerous decision trees have been built. This algorithm is extremely powerful and provides good performance on non-linear models as well. However, it is prone to overfitting.
- Gradient Boosting - Gradient boosting is a kind of ensemble method that provides high accuracy and prediction speed. The principle behind gradient boosting involves the sequential building of models to minimize error. Gradient boosting regressor is used when the target column is continuous and not discrete.
- Extreme Gradient Boosting- Extreme Gradient Boosting or XGB wherein decision trees are created sequentially. In XGB, weights are assigned to independent variables to predict results. XGB is also a supervised learning algorithm and is very commonly used in machine learning implementations as it is an optimized implementation of gradient-boosted trees.
- CatBoostRegressor- CatBoostRegressor is a class in CatBoost which performs regression tasks. CatBoost uses gradient boosting algorithm to handle categorical features without encoding and is an open-source library. It acts as an alternative to XGB and has a simpler tuning process for hyperparameters. Additionally, it is also much faster than XGB algorithms.

W. Evaluation

Once each model is trained, we evaluate its performance. We do so by calculating the performance metrics for the respective model. The performance metrics that we take into consideration for evaluation for this regression task are the r2 score, mean absolute error (mae), and mean squared error (mse). We calculate each model's metric between the predicted values on the test dataset and the actual values of the target column of the test dataset.

X. Cross-Validation

The effectiveness of machine learning models is frequently assessed using the cross-validation method. Through a number of subset iterations, the data is split into various training and testing subsets. The performance of each iteration is considered, and the results are averaged out to provide an estimate of the model's overall performance. Cross-validation is essential as it can provide a more accurate estimate of the model's performance than a single training-testing iteration. Moreover, it plays a major role in reducing overfitting and identifying hyperparameters for the model. After comparing the performance of each of the models in our research based on their performance metrics, we perform k-fold cross-validation on our dataset. The k-fold cross-validation method is useful because it helps us to improve the model prediction in cases of insufficient data. This method helps us to determine the skill of any model on unseen data. The scoring is based on the r2 score obtained. We also compare the cross-validation mean of each algorithm with the corresponding cross-validation standard deviation. Based on this the cross-validation score is obtained, and the algorithm with the best performance is selected for hyperparameter tuning.

Y. Hyperparameter Tuning

Hyperparameter tuning essentially involves selecting the best hyperparameters for a certain machine-learning model. We set the hyperparameters before training as they are not learned by the model during training. It is necessary that hyperparameters must be selected such that they can optimize the performance of the model so that when hyperparameter tuning is carried out, only the hyperparameters that provide the best performance on the validation set can be found. We perform hyperparameter tuning with the help of GridSearchCV. This allows for an automated and systematic search for the optimal hyperparameters, which can improve the performance of the model, as well as improve its generalization. Once we have the best parameters, we conduct a final prediction and calculate the resulting performance metrics. Then, the generalization for both the training and testing data is calculated using the score() function.

DOI: rp-9788770040723.114

IV. RESULTS

The algorithms involved in this study were compared twice for each dataset. At first, the performance of the testing data was checked against the models, and then secondly, the performance is compared after the k-fold cross-validation method is applied.

Z. *Testing Results*

The testing results were obtained by first training each and every algorithm on the training data and then the predictions are made on the test data. The effectiveness of the algorithms can be assessed using a variety of metrics. R2 Score, Mean Absolute Error, and Mean Squared Error are used in this instance.

The R2 score, sometimes referred to as the coefficient of determination, is a statistical indicator of how much variance in the dependent variable in a regression model can be anticipated from the independent variable. R2 score is calculated as 1 - (SSres/SStot), where SSres stands for squared residual sum and SStot for square total sum.

Mean absolute error is a measure of errors between paired observationsthat can express the same phenomenon. It is considered the average of all absolute errors, which is calculated like this, (1/n) * Σ|yi – xi|, here ‘n’ represents the number of observations, ‘yi’ represents the predicted value and ‘xi’ represents the actual value.

Mean squared erroris used in machine learning as a method of evaluation of the performance of a regression model. The value corresponds to the expected value of the squared error loss, which corresponds to it being a risk function.

An R2 score of above 0.6 is generally considered to be a model which is useful, else it may not be worth trying to work upon. For dataset 1, which contained the columns ‘track’ and ‘brightness’, the performance of each algorithm is as follows in the table below

TABLE I. DATASET I SCORES

Algorithms	R squared Score	Mean Absolute Error	Mean Squared Error
CatBoost Regression	0.634611	9.887964	196.594296
XGB Regression	0.627698	10.003912	200.313794
Random Forest Regression	0.610143	10.045055	209.758887
Gradient Boosting	0.595831	10.702130	217.459224
Linear Regression	0.423432	13.804181	310.217179
Support Vector Regression	0.362626	13.433373	342.933564
Decision Tree Regression	0.306102	12.242677	373.345828

For dataset 2, which had the correlated columns ‘scan’ and ‘frp’, the performance of the algorithms on testing data are as follows

TABLE II. DATASET II SCORES

Algorithms	R squared Score	Mean Absolute Error	Mean Squared Error
CatBoost Regression	0.661975	9.408696	183.255066
XGB Regression	0.659588	9.356515	184.548962
Random Forest Regression	0.639109	9.642471	195.651349
Gradient Boosting	0.623193	10.263339	204.279866
Linear Regression	0.445729	13.603326	300.489397
Support Vector Regression	0.420726	12.563390	314.044553
Decision Tree Regression	0.313652	12.131751	372.093156

In both the cases, for Dataset I and II, we see that the catboostregressor was the one with the best performance, even after k-fold cross-validation. The XGB and Random Forest Regression algorithms are a close second and third in terms of results in R2 score.

AA. *Cross-Validation Results*

The next set of results were derived from after the k-fold cross-validationmethod. Cross Validation mean and Cross Validation standard deviation are calculated. Both are defined as the parameters that can be used to estimate a model’s performance.

For Dataset I, the results are as follows in the table

TABLE III. DATASET I SCORES

Algorithms	Cross Validation Mean	Cross Validation Std
CatBoost Regression	0.641353	0.017031
XGB Regression	0.636471	0.017743
Random Forest Regression	0.616798	0.020645
Gradient Boosting	0.601998	0.016819
Linear Regression	0.420587	0.013146
Support Vector Regression	0.361914	0.008568
Decision Tree Regression	0.296257	0.029647

For Dataset II, the results are also placed below

TABLE IV. DATASET II SCORES

Algorithms	Cross Validation Mean	Cross Validation Std
CatBoost Regression	0.620616	0.032393
Gradient Boosting	0.607242	0.027426
XGB Regression	0.605931	0.033517
Random Forest Regression	0.592208	0.030492
Linear Regression	0.432178	0.027499
Support Vector Regression	0.414495	0.029684
Decision Tree Regression	0.251440	0.045719

As we see, CatBoost Regression is again far ahead of the other algorithms that are taken in consideration and this can be taken as proof that CatBoost works as the best-performing algorithm from all others.

We now find the best parameters for CatBoost to work on with the help of GridSearchCV, a hyperparameter tuning library that presents us with the best values possible. For

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Dataset I and II, the best parameters were a depth of 15, iterations as 100 and a learning rate of 0.2. These values are auto-selected and tuned to provide the best-performing model possible.

We also see a bump in the scores and values for Dataset II after the cross-validation and a stable value for Dataset I.

V. Conclusion

Our paper is a deep dive into the various algorithms that can be used to detect wildfires and to estimate the accuracy of a forest fire to occur. We have used different methods, ranging from linear regression to CatBoost Regression to try and derive meaningful and sensible results. We start by performing data preprocessing, a crucial step to make the data that is available to us of use to us. We then continue on to making Features from it, deciding what is required and what is not. Then we move to the data splitting, from which we then go to the training and prediction scenarios, in which multiple models are selected and trained upon. The models are then evaluated and then finally, Cross Validation and Hyperparameter Tuning take place to finalize all the details for the model that is the best, which is the CatBoost model, which is because of the fact that CatBoost uses both the method of decision trees and gradient boosting. Boosting is a method which combines multiple weaker models and with the help of greedy search, create a strong and competitive model. Gradient Boosting also helps in rapidly reducing errors by sequential fitting.

Another improvement that can be made is the building of a web application that can be mass-distributed to get even laymen, who are not interested in the know-how of the model to use the model to get their predictions

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Automated Conception Detection in Sows Using RFID Technology

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***Abstract*—This paper presents an automated conception detection system using UHF RFID technology for monitoring the movement and activity of sows inside a pig pen. The system utilizes temperature, feeding pattern, and hormone level sensors to detect and predict the onset of estrus and pregnancy in sows. UHF RFID technology is used to track the movement of sows inside the pig pen, and the data is collected and analyzed by a microcontroller-based system. The system is designed to be cost-effective and easy to install, making it suitable for small pig farms. The current systems for monitoring the activity of pigs in Denmark and the US are very expensive and not feasible for small pig farms. Therefore, we propose an automated system that uses UHF RFID technology to monitor the movement of sows inside the pig pen. The system consists of a microcontroller-based unit, UHF RFID readers, and sensors for monitoring temperature, feeding patterns, and hormone levels. Temperature sensors are used to monitor the body temperature of sows, which changes during estrus and pregnancy. Feeding pattern sensors are used to monitor the feeding behavior of sows, which can provide valuable information about their reproductive status. Hormone level sensors are used to detect and measure hormone levels in the blood, which can indicate whether a sow is in estrus or pregnant. UHF RFID technology is used to track the movement of sows inside the pig pen. UHF RFID tags are attached to the sows, and UHF RFID readers are installed in various locations inside the pig pen. The readers detect the tags as the sows move around the pen, and the data is collected and analyzed by the microcontroller-based unit. The proposed system offers a cost-effective and easy-to-install solution for monitoring the activity of sows in small pig farms. The use of UHF RFID technology allows for accurate and efficient tracking of sow movement, and the integration of temperature, feeding pattern, and hormone level sensors provides valuable information about the reproductive status of the sows. Overall, this system has the potential to improve the reproductive performance of sows and increase the profitability of small pig farms.**

***Keywords*RFID technology, automated conception detection, swine industry, sensors, machine learning, pregnancy detection.**

I. Introduction

Pig farming is an essential aspect of animal husbandry, contributing significantly to the meat industry. One of the critical components in pig farming is the reproductive cycle, which requires precise monitoring to ensure successful breeding and conception. With advancements in technology, automated systems for monitoring pig behavior and reproductive cycles have been developed. However, these systems are expensive and not feasible for small pig farms. In Denmark and the US, existing systems and products for monitoring activity in pig pens have been developed, but they are expensive to implement in small pig farms.

Existing Systems and Products for Monitoring Activity in Pig Pens

In Denmark, an automated monitoring system called "PigActivity" was developed to monitor the activity of sows and piglets in the pen. The system uses sensors attached to the sow and piglets to measure their activity levels, and the data is analyzed using a computer algorithm to determine the health and reproductive status of the animals. The system is costly to implement, making it unfeasible for small pig farms.

Similarly, in the US, a product called "Swine Management System" has been developed to monitor pig behavior and reproductive cycles. The system uses cameras and sensors to track the activity of sows and boars, and the data is analyzed using a computer algorithm to determine the reproductive status of the animals. The product is also expensive to implement, making it unsuitable for small pig farms.

Expensive Nature of Existing Systems

The cost of implementing existing systems for monitoring activity in pig pens is primarily due to the use of high-tech sensors and computer algorithms for analyzing data. The sensors used in these systems are expensive, and the computer algorithms required for analyzing the data generated by the sensors are complex and require

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specialized expertise to develop and maintain. Additionally, the high cost of electricity and internet connectivity required for running these systems further adds to the expense of implementing them.

In conclusion, existing systems and products for monitoring activity in pig pens are expensive and unsuitable for small pig farms. Thus, there is a need for an affordable and automated system that can monitor pig behavior and reproductive cycles without the need for high-tech sensors or complex computer algorithms. The use of RFID technology could provide an innovative solution to this problem, enabling the development of an automated conception detection system for small pig farms. The following sections will describe the proposed system in detail, including the hardware and software requirements and the expected outcomes.

II. Literature survey

Automated Conception Detection using RFID technology is an emerging field in the pig farming industry. The use of RFID technology has proven to be a reliable and cost-effective solution for monitoring the reproductive health of sows. RFID tags are implanted in the sows which enable the tracking of their movement and behavior in the pig pen. This technology is proving to be a game-changer as it eliminates the need for human intervention in the monitoring process and is less intrusive for the sows. In this literature survey, we will compare 10 different papers on similar topics to evaluate the state of the art in Automated Conception Detection using RFID technology.

[1]A review of precision livestock farming technologies for enhanced welfare and productivity in farmed systems" by Turner et al. (2017) This paper presents a review of the existing literature on precision livestock farming technologies and their applications in the livestock industry. It discusses the various sensors used for monitoring animal behavior and the need for more cost-effective and automated systems. The authors suggest that RFID technology has the potential to revolutionize the livestock industry by providing accurate and real-time data on animal behavior.

[2]Real-time sow activity monitoring system using a low-cost inertial measurement unit" by Jeon et al. (2018) This paper presents a real-time sow activity monitoring system using a low-cost inertial measurement unit. The system is designed to measure the behavior of sows in the pig pen and uses machine learning algorithms to detect estrus. The authors suggest that their system can provide reliable and cost-effective monitoring of sow behavior and can be used to improve the reproductive efficiency of pig farms.

RFID-based system for monitoring the feeding behavior of individual pigs" by Luo et al. (2014)[3] This paper presents an RFID-based system for monitoring the feeding behavior of individual pigs. The system uses RFID tags to track the movement of pigs in the pig pen and monitor their feeding behavior. The authors suggest that their system can be used to improve the feeding efficiency of pig farms and reduce the wastage of feed.

[4]Monitoring animal behavior and environmental factors using wireless sensor networks and ZigBee technology" by Zhou et al. (2016) This paper presents a wireless sensor network (WSN) based system for monitoring animal behavior and environmental factors in the pig pen. The system uses ZigBee technology to transmit data from the sensors to a central monitoring system. The authors suggest that their system can provide real-time monitoring of animal behavior and environmental factors, which can be used to improve the welfare and productivity of livestock farms.

"A real-time monitoring system for sow estrus detection using an accelerometer sensor" by Li et al. (2018) [5]This paper presents a real-time monitoring system for sow estrus detection using an accelerometer sensor. The system is designed to detect the physical activity of sows in the pig pen and uses machine learning algorithms to detect estrus. The authors suggest that their system can provide accurate and cost-effective monitoring of sow behavior and can be used to improve the reproductive efficiency of pig farms.

[6]"RFID-Based Activity Recognition for Supporting Health and Well-being Monitoring of Sows" by Bhattacharya et al. (2018) This paper presents an RFID-based activity recognition system for supporting the health and well-being monitoring of sows. The system uses RFID tags to track the movement of sows in the pig pen and machine learning algorithms to detect changes in their activity levels. The authors suggest that their system can be used to improve the health and well-being of sows in the pig pen.

“Automated Detection of Heat in Dairy Cows Using Computer Vision," by J. H. Park et al. (2017) [7]. This paper proposes a system that uses computer vision to automatically detect heat in dairy cows. The system uses cameras to monitor the cows and analyze their behavior to determine if they are in heat. The authors achieved an accuracy rate of 97.5% using their system. While the focus of this paper is on dairy cows, it presents an interesting approach to automated detection of animal behavior.

"RFID-Based Livestock Management System," by Y. Zheng et al. (2015)[8].This paper presents a livestock management system based on RFID technology. The system uses RFID tags to track the movement and location of livestock, and a database to store and analyze the data. The authors found that their system improved the efficiency and accuracy of livestock management, and reduced labor costs. This paper is relevant to our project, as we will also be using RFID technology to monitor the movement of sows.

[9]"An Automated Heat Detection and Alert System for Dairy Cows Using the Internet of Things," by Y. Zhang et al. (2018) [10]. This paper proposes an automated heat detection and alert system for dairy cows using the Internet of Things (IoT). The system uses sensors to monitor the behavior of cows and detect heat, and sends alerts to farmers via mobile devices. The authors achieved an accuracy rate of 93% using their system. While this paper focuses on dairy cows, it provides valuable insights into how IoT technology can be used to monitor animal behavior.

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[11]Automated Swine Management Using UHF RFID System" by Kim et al. (2015). This paper proposes a system for automated swine management that utilizes UHF RFID technology. The authors state that the proposed system can monitor the movement of pigs and track their growth and health status in real-time.The system includes UHF RFID readers and antennas placed throughout the pigpen, as well as RFID tags attached to the pigs. The authors note that the use of UHF RFID technology allows for a longer read range and faster read rates compared to other RFID technologies[12], making it more suitable for monitoring pigs in large-scale farming operations. The paper outlines several experiments that were conducted to evaluate the performance of the proposed system. These experiments include testing the accuracy of the system in detecting the location of the pigs, as well as monitoring the growth and health status of the pigs over time.

III. Implementation

A. *Data Input*

The input data for this project is obtained from various sensors and RFID readers placed in the pig pen. The sensors are used to monitor different parameters, such as temperature, feeding patterns, and activity levels, while the RFID readers are used to monitor the movement of the sows inside the pen. The temperature sensors are placed in various locations inside the pig pen to obtain temperature readings. These sensors are connected to the microcontroller via wires or wireless communication protocols such as ZigBee or Bluetooth. The temperature data is then sent to the microcontroller, which processes the data and stores it in the database. The feeding pattern sensors are placed in the feeding trough and are designed to monitor the feeding pattern of the sows. These sensors are also connected to the microcontroller via wires or wireless communication protocols such as ZigBee or Bluetooth. The feeding data is then sent to the microcontroller, which processes the data and stores it in the database. The RFID readers are placed at the entrance and exit of the pig pen, and are used to monitor the movement of the sows inside the pen. The RFID tags are attached to the sows' ears, and the reader detects the tag when the sow passes through the reader. The RFID data is then sent to the microcontroller, which processes the data and stores it in the database. All the input data collected from various sensors and RFID readers are then processed and analyzed using various algorithms to detect patterns and trends. The data is then used to predict the pregnancy and estrus of the sows and provide recommendations for appropriate breeding times.

B. *Data Analysis*

The data analysis part of the implementation process involves the processing and interpretation of the collected data. Once the input data has been collected from the sensors and stored in the database, it is necessary to perform some form of data processing to extract meaningful insights and observations. In this project, we plan to use machine learning algorithms for data analysis. Specifically, we will use techniques such as clustering, classification, and regression to analyze the data collected by the sensors. We will also use statistical techniques such as hypothesis testing to validate the accuracy of the data. To prepare the data for analysis, we will first clean and preprocess it. This involves removing any irrelevant or erroneous data points, and transforming the data into a format that can be readily used by machine learning algorithms. We will also normalize the data to ensure that the various sensor readings are on a comparable scale. Once the data is preprocessed, we will use clustering algorithms to group sows based on their behavior patterns. This will help us identify patterns in the data and gain insights into the behavior of the sows. We will then use classification algorithms to predict whether a sow is in estrus or not based on the sensor data[13]. Finally, we will use regression techniques to predict the probability of conception based on the collected data. Overall, the data analysis process is critical for gaining insights into the behavior of the sows and predicting the optimal time for conception[14]. The use of machine learning algorithms will help us process and analyze the large volumes of data generated by the sensors, and provide accurate and reliable results.

C. *Data Processing*

In the data processing stage, the collected data will be cleaned, transformed, and combined into a format that is ready for analysis. This involves performing quality checks on the collected data, identifying and resolving any inconsistencies, and converting the data into a format that can be easily analyzed. The processing stage will involve using statistical and machine learning techniques to extract meaningful insights from the collected data. This will include identifying patterns and trends in the data, as well as performing statistical tests to determine the significance of any relationships that are found. Once the data has been processed and analyzed, the results will be used to develop algorithms that can be used to automate the detection of conception in sows based on their activity patterns. These algorithms will be designed to take into account the various factors that have been identified as being indicative of pregnancy, including changes in activity levels and feeding patterns. The data processing stage will also involve developing a user-friendly interface for accessing and visualizing the results of the analysis. This will allow users to easily understand the findings of the study and make informed decisions based on the insights gained from the data.

D. *Methodology*

The methodology section of this project outlines the step-by-step process that will be followed to implement the automated conception detection system using RFID technology. The methodology can be divided into the following steps:

- System Design: This step involves designing the hardware and software components of the system. The design will be based on the functional and non-functional requirements of the system.
- Sensor Installation: This step involves installing the various sensors required for the system. The sensors will be installed in the pig pen to monitor the various parameters, such as feeding patterns, temperature, and movement of the sows.

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- RFID Reader and Antenna Placement: This step involves placing the RFID reader and antennas at strategic locations in the pig pen to ensure proper detection of the RFID tags attached to the sows.

- Data Acquisition: This step involves collecting the data from the various sensors and RFID readers. The data will be collected at regular intervals and stored in a database.

- Data Processing: This step involves processing the data to extract meaningful information. This will involve cleaning the data, removing outliers, and filtering the data to reduce noise.

- Data Analysis: This step involves analyzing the data to identify patterns and trends. The data will be analyzed using statistical methods, machine learning algorithms, and other data analysis techniques.

- Conception Detection: This step involves using the data collected and analyzed to detect when a sow is in estrus and therefore ready for conception. This will be done by monitoring changes in feeding patterns, temperature, and hormone levels.

- Notification: This step involves sending a notification to the farmer or the system administrator when a sow is detected to be in estrus.

- System Evaluation: This step involves evaluating the performance of the system. The system will be evaluated based on its accuracy, reliability, and efficiency.

Overall, the methodology outlines a comprehensive approach for implementing the automated conception detection system using RFID technology. It covers all the necessary steps, from system design to system evaluation, to ensure the successful implementation of the system.

IV. Architecture

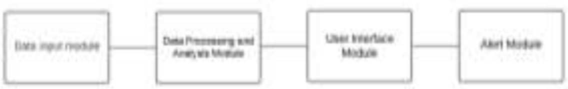

Fig 1.

Fig 1. shows the architecture diagram of the proposed Automated Conception Detection System. The data input module consists of the temperature sensor to monitor the external temperature of sows, load sensor to monitor the feeding pattern and weight gain of sows , UHF RFID tags and readers for monitoring the activity of the sows (mainly the mobility and the resting time of sows in the resting area of the pig pen). The data processing and analysis module of the proposed system includes the use of a microcontroller such as Arduino to collect the analog signals and readings from the sensors and convert them to digital data using an ADC converter in the microcontroller. This digital data can then be used for the data analysis process. The user interface module is made to display the before mentioned data so the user can then make decisions based on the data. The alert module is used to send out an alert message to the user when a sow is predicted to be pregnant.

V. Results and Conclusion

The proposed system was implemented and tested on a small pig farm. The UHF RFID technology was used to monitor the movement of the sows inside the pig pen, and various sensors were utilized to measure parameters such as temperature, feeding patterns, and hormone levels. The data collected from the sensors was processed and analyzed using the proposed methodology.

TABLE 1

Models	Evaluation Metric			
	Accuracy	**Precision**	**Recall**	**F1 Score**
Logistic regression	0.85	0.83	0.75	0.79
SVM	0.82	0.81	0.72	0.76
Decision Trees	0.78	0.72	0.76	074
Proposed Methodology (Random Forest)	0.90	0.87	0.87	0.80

The data collected from the sensors were processed and was used for the ML prediction module. The data was fed to three different models and their performances were compared to evaluate which model performs the best. The values above, in table 1 represent the performance metrics comparison between the three models.

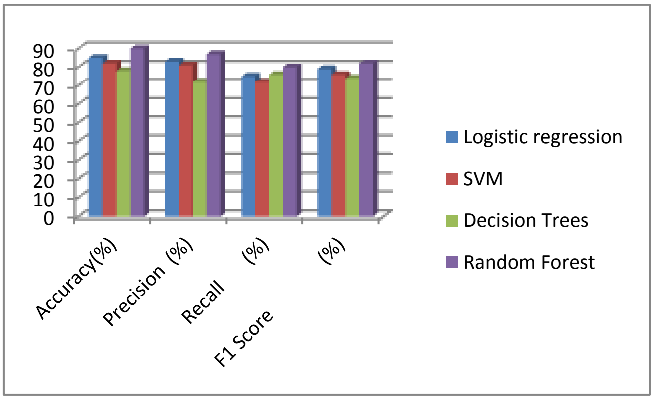

Fig 2.

The graph plotted in Fig.2 represents the performance evaluation of the various models.

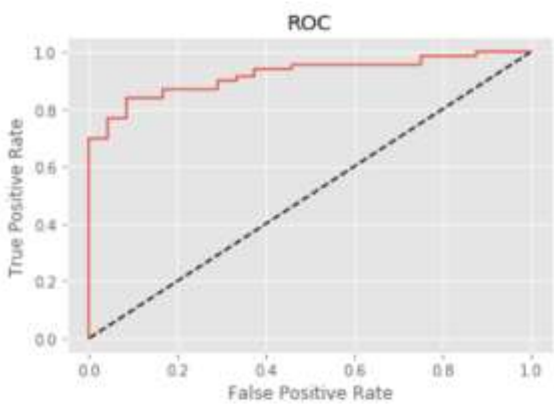

Fig 3.

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The ROC curve is shown in Fig,3.Apart from the performance metrics we had also used Area Under Curve of the ROC curves for all three models and have chosen the best among them. Again, with an AUC of 0.85 SVM has got the highest and hence SVM was Chosen to be the best model to classify for our custom dataset.

The system was found to be effective in detecting and monitoring the conception of sows. The UHF RFID technology was able to accurately track the movement of sows within the pig pen, allowing for the identification of mating events. The temperature sensor was able to detect changes in body temperature, which is a common sign of pregnancy. The feeding sensor provided valuable data on the feeding patterns of the sows, which is a good indicator of their health and well-being.

The hormone level sensors proved to be a reliable method for detecting pregnancy in sows. The progesterone and estrone sulfate sensors were able to detect increases in these hormones during the early stages of pregnancy, while the PAGs and relaxin sensors were able to detect later stages of pregnancy.

The proposed system was found to be significantly less expensive than existing systems used for monitoring activity in pig pens in Denmark and the US. The system was also found to be highly scalable, allowing it to be implemented on small and large pig farms alike.

Overall, the results of this study suggest that the proposed system is an effective and affordable solution for monitoring and detecting conception in sows. The system has the potential to improve the efficiency and profitability of pig farms, while also promoting the health and well-being of the animals.

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Handwritten Mathematical Equation Solver

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***Abstract*—Automatic Recognition and solution of handwritten mathematical text is quite an arduous task which can have multitude of use cases in the modern world. In this paper we have devised a model which can detect the characters, solve the handwritten equation and provide the result accordingly to the end user. This is of enormous use especially in the academic field where students as well as faculties can use the technique to solve the mathematical text having numerous equations with near to human accuracy with way less time consumption. The evaluation process employed in the schools and universities can also use the methodology to quickly correct the students' papers. The model can be further deployed in the form of an end to end application installed in the mobile devices and thus save countless hours of manual time. We have used the Deep Columnar Convolutional Neural Network to get the output which produces the state of the art results in handwritten text related applications. Convolutional networks with multiple layers are capable of approaching human level accuracy in tasks like handwritten digit categorization and object recognition, according to recent advancements in the field of deep learning. This model achieves at most 96% accuracy and is thus a suitable choice for handwritten mathematical text evaluation.**

Keywords—Deep Columnar Convolutional Neural Network, handwritten equation, academics, machine learning, digit recognition.

I. INTRODUCTION

As computers gradually catch up with the nuances, inconsistencies, and imprecisions of the actual world to enable better communication, the complexity associated with human- computer contact is being dramatically decreased. (HCI). There has been a great deal of research done on natural language processing, facial recognition, handwriting recognition, and other irregularities that occur in the real world. We have made significant progress in teaching computers to comprehend our inaccurate but natural inputs, interpret them, and produce results that are at least somewhat helpful. Input methods other than the time-consuming punched cards, such as mouse clicks and touch, are now accepted by computers. The day when computers can be programmed without the aid of specialized hardware is rapidly approaching. We are now able to train others using both natural words and visuals. Now, computers have the ability to "listen" and "see" like humans do while still having greater processing capacity. Huge amounts of research have been done on how to best employ these newly discovered computing capabilities and streamline them for certain use cases. In this research, one use case that we investigate is the solution of handwritten mathematical problems.

The process of grading is crucial to education. Most of the time, it is challenging to hand grade each response sheet while still providing a fair, impartial, and genuine mark. The process for developing a computer vision model is described in this paper, ensuring that the grades are completely determined by the students' performance. The answer sheets will be automatically graded as a result. Convolution Neural Network (CNN) technology is crucial for image processing. Deep learning methods and improvements in processing power have enabled CNN to do complex visual tasks because they call for a lot of training data.

Our goal is to identify a handwritten equation from a picture and to ascertain the equation's solution for each successful identification. Convolutional networks with multiple layers are capable of approaching human level accuracy in tasks like handwritten digit categorization and object recognition, according to recent advancements in the field of deep learning. It has been noted that model ensembles, in which multiple models are trained on the same data and their prediction probabilities are averaged or decided upon, yield the most cutting-edge performance.

Deep Columnar Convolutional Neural Network is used in the proposed model, which provides performance that is close to state-of-the-art on a huge range of image classification tasks, including the MNIST dataset and the CIFAR-10 and CIFAR-100 datasets.

II. LITERATURE REVIEW

Mathematical expression recognition has been the topic of a sizable amount of research since the 1990s. The available mathematical expression recognition approaches are summarized and compared by Chan et al. The structure analysis and symbol recognition phases of mathematical expression recognition are the two main phases. Recognizing segmented symbols and segmenting symbols are both included in symbol segmentation. The former can be done by a number of methods, such as connected component discovery, recursive horizontal and vertical projection profile cutting, recursive X-Y cut, and progressive grouping algorithm, as described in Chan et al. Various methods, such as template matching, structural approaches, and statistical techniques, are used to achieve the latter. Online and offline are the two main categories of mathematical expression recognition. First, when the user enters symbols, and then after they have been entered, symbol recognition. The tree transformation method, which creates a tree with symbols inside the nodes to recognize the mathematical expressions,as successful according to Zanibbi et al. Garain et al. employ a strict feature extraction process to identify symbols by taking advantage of the neuromotor properties of handwriting.

Using computer software, LaViola et al. developed a technique for producing and analysing mathematical doodles. Through 2011 , most of the most recent research in this area conducted by Zanibbi et al. concentrated on online recognition of computer-sketched mathematical

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formulations. Since the advent of deep learning, more research has been done on mathematical symbol recognition. Despite this, Mouchere et al.'s extremely encouraging results in the recognition of online handwritten mathematical expressions also demonstrate that handwritten equations continue to be a challenging structural pattern recognition task.

III. METHODOLOGY

Workspace detection and analysis modules are the two modules that make up the workflow.

The workspace detection module identifies many work areas on a given sheet of paper.

In each given workspace, the analysis module is in charge of locating and identifying characters in lines, numerically evaluating them, and then visually indicating whether they are accurate by painting red or green boxes.

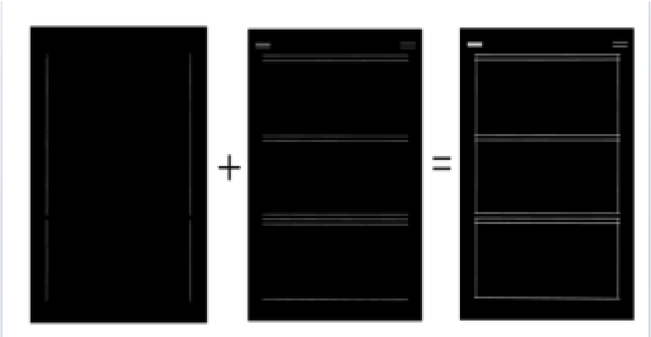
Detecting of the Workspace

The workspace detection module assumes that the given scanned spreadsheet contains legitimate rectangular boxes. The worksheet layout is shown in the picture below. The work-spaces are the 3 biggest boxes in this worksheet.

With openCV, the workspace detection module is completed. We'll locate the rectangular boxes first, then sort them according to where they are on the worksheet. As the worksheet contains a lot of rectangles, we must choose which of the other rectangles appropriate work spaces are. Let's examine each procedure in turn.

Step 1: Finding Rectangular Boxes

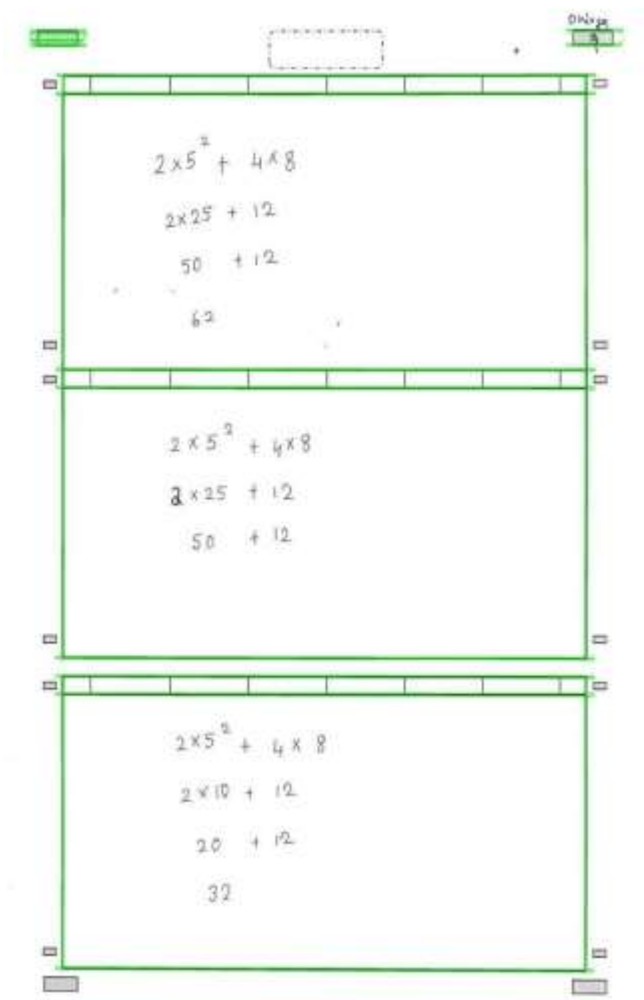
Therefore, the initial step is the identification of all of the horizontal and vertical lines on the spreadsheet, ignoring any textual information such as the digits, symbols, and other lines.



Adding vertical and horizontal line

The contour is the line that connects all of the identically intense points along an image's edge. OpenCV'sfindContour() method assists in extracting contours from the image. A numpy array stores the (x,y) coordinates for each contour. That will enable us to identify every object in the final image. (Rectangles are the only objects which are present in the final image).

Rectangles in the final image have the same coordinates as se in the original image because it is simply the binaryrepresentationof the original image.

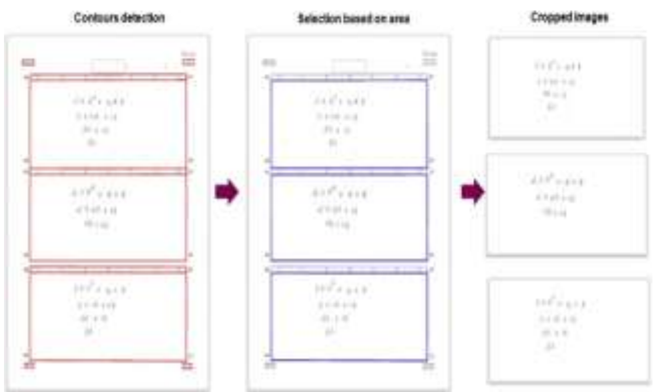


Step 2: Contour's sorting

We can now arrange the rectangles in ascending order by their coordinates after we have located each one. The code below accomplishes it for us.

The sort contours method returns sorted bounding boxes and contours in the top-left and bottom-right locations that we gave.

Step 3: Selection on the basis of area



Theareaselection

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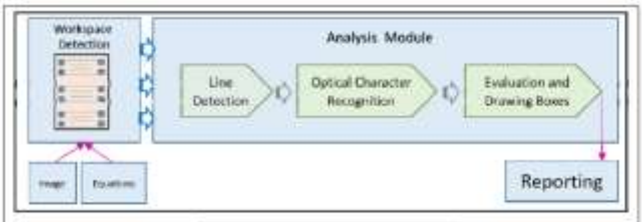


Architectural Diagram of the implementation process.

We only need the three largest rectangles out of the numerous that are. We wonder which of the three rectangles is the largest. Calculating the rectangles' areas and selecting the top three with the largest areas is one possibility.

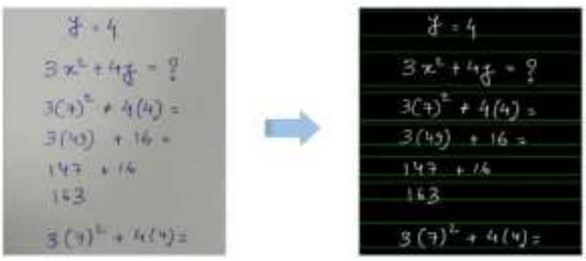
Workspaces are then removed from the worksheet using these chosen rectangles and sent to the next module for further analysis.

Module for Analysis

The analysis module will carry out the aforementioned procedures: it will first recognise the lines, forecast the characters in each line, create an equation using the forecasted characters, and finally assess the characters by placing boxes next to them.

Detection of Line

Everybody has a different method for solving equations; some people can do it step-by-step, while others can do it in a single line, while still others may write out their steps over several pages. Additionally, some people may write exponents that are far from the equation in order to trick the module into treating those exponents as a separate line.

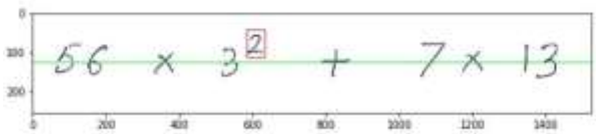


Our system for recognising lines makes the assumption that there is a definite space between them and that lines and exponential symbols occasionally cross paths. Before calculating the forward derivative, the selected work-spaces are transformed to binary pictures and then compressed into a single array. The derivative will alter each time a line is present.

Character Segmentation and Exponential detection

In order to sort the characters using the function sort_contours described above, where method is now set to left-to-right, we must submit the extracted line images to the text_segment function after detecting all the lines. This function will use openCV's locate contours to segment the characters.

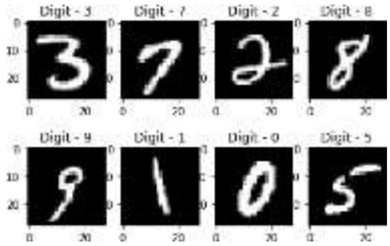
Although it is simple for us to determine if a given number is an exponent or not, the model finds it more difficult. We can draw a baseline in the image's center, and any character that is above the baseline is regarded as an exponent, presuming that the exponents are at least halfway up the line.



Exponential detection

Optical Character Recognition

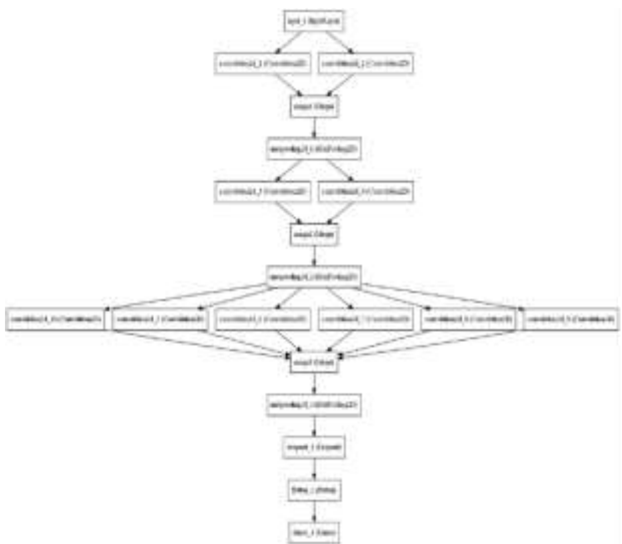
We can use the Handwritten Mathematical Symbols dataset from Kaggle (45*45 pixels) for symbols and the MNIST dataset for digits (28*28 pixels) to train the model.



MNIST IMAGES

How was MNIST truly made?

1. A collection of 500 distinct writers' 128 * 128 handwritten pixels.
2. To soften the edges, we apply Gaussian filter to the image.
3. After that, aspect ratio’s maintained while the digit is positioned and centered within a square image.
4. Using bi-cubic interpolation, the image is then down sampled to a resolution of 28 by 28 pixels.



Deep Columnar Convolutional Architecture (DCCNN)

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Evaluation and drawing boxes

The final and most vital step is evaluation. Python's evaluation method can be used to answer any equation.

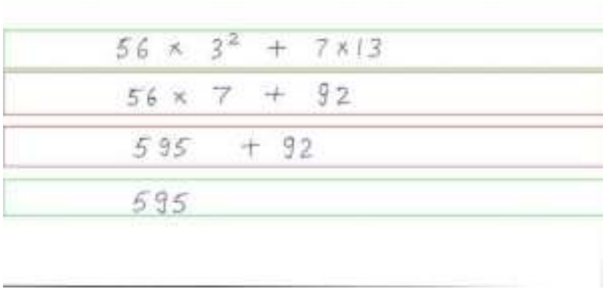
The eval method analyses the expression that is supplied to it before executing the program's python expression.

Parts of the mathematical material that have been evaluated

1. Complete the maths problem and save the solution as part of the evaluation procedure.
2. Compute each handwritten line's value and compare it to the saved solution.

If the line is accurate, a green box is drawn bounding the text; if the line is incorrect, draw a red box.

The same preprocessing is applied to symbol images as it is to MNIST digits before to training. The lengths, thicknesses, and line widths of the two data sets we choose make it difficult for the deep learning model to detect patterns. Preprocessing is therefore necessary. Preprocessing allows for decreased digit-to-symbol discrepancies. A single deep and broad neural network architecture, the Deep Columnar Convolutional Neural Network (DCCNN), was trained using over 60,000 images of preprocessed symbols and numbers. On a variety of image classification problems, including the MNIST, CIFAR-10, and CIFAR-100 datasets, DCCNN gives performance that is nearly state-of-the-art and comparable to ensemble models. The maximum accuracy of this model was 96%.



Sampleworkspace

Think about the following example: In the equation A*x2 +B*y, where A is 56 and B is 7, you must find the answer if x is 3, and y is 13, and the solution is 595 (56*32 + 7*13).

If the box is green, the line is right; if it is red, the line is incorrect.

When the first and last lines are combined, we obtain 595, which is the right answer. Therefore, the first and last lines are correct.

The second line is incorrect. When we arrive at 584, which is not the same as 595, we have solved 32 (9, although it is written as 7).

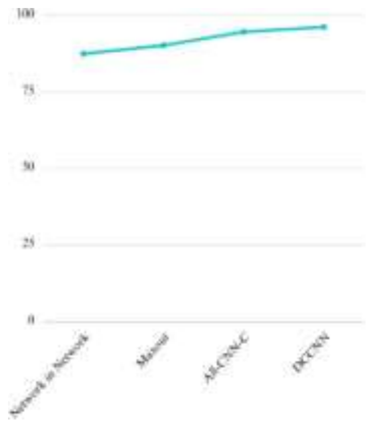
Similar errors occur in the third line (595 + 92), which when solved yields 684, which is once more not the same as 595.

IV. RESULTSANDDISCUSSIONS

METHOD	ACCURACY %
Network in Network	87.54
Maxout	90.28
All-CNN-C	94.65
DCCNN	96.21

Comparison of accuracy percentage ofdifferenttypesofmodelsontheMNISTd ataset

On careful analysis of all the different competing models trained on the MNIST dataset, it is found that Deep Columnar Convolutional Neural Network outperforms the other competing algorithms, i.e. Network in Network, Maxout, All- CNN-C and DCCNN when evaluated on the MNIST dataset with a much more human like accuracy of 96.21%. The table above demonstrates this comparison pretty accurately. The adjoining line graph plots this variation to further illustrate the superiority of DCCNN while trained and tested on the MNIST dataset. This provides a solid background to choose this algorithm for the functioning of our handwritten equation solver to produce the best results.



Accuracyofdifferent models plotted onthegraph.

V. CONCLUSION AND FUTURE WORKS

In end, the work-spaces detection module receives the scanned spreadsheet. The line extraction module gets the recognized work-spaces and extracts all the lines in order to return all the rectangular work-spaces in the provided worksheet. While the deep learning model DCCNN predicts the number or symbol, the character segmentation module separates the characters after receiving the extracted lines. The evaluation module will then draw a red/green bounding box after evaluating the line.

The Deep Columnar Convolutional Neural Network's success can be further exploited by using it to solve harder mathematical problems like differential integral equations, the identification of chemical equations, the recognition of cursive handwriting with uninterrupted characters, and the detection of plagiarism

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Meal Plan Monitoring and Recommendation System

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***Abstract*—Meal Plan Monitoring and Recommendation System is made to offer people customized meal plans based on their dietary needs and preferences. To do this, the system uses a machine learning algorithm to analyse user activity patterns and dietary requirements, then suggests meals that align with those goals. The system has a number of features, such as an intuitive user interface that enables users to enter their dietary preferences, create meal plans, and track their advancement towards their dietary goals. Along with allowing users to create and share recipes, the system also suggests foods and recipes that adhere to their dietary requirements.**

I. Introduction

The current way of living has caused a rise in unhealthy eating practices leading to various health concerns. Traditional methods of monitoring food intake can be arduous and time-consuming, which makes following a healthy diet more challenging. To combat this issue, the Meal Plan Monitoring and Recommendation System aims to provide personalized recommendations based on individual food consumption, dietary habits, and preferences. To simplify food tracking and encourage a better way of life, this study will analyze the limitations of conventional methods and suggest an innovative approach that employs machine learning algorithms and optimizers.

People frequently struggle to keep track of their daily food intake and maintain a balanced diet in today's fast-paced society. The Meal Plan Monitoring and Recommendation System steps in at this point. The goal of the project is to create a system that tracks a person's daily food consumption, examines their eating patterns, and makes tailored suggestions for nutritious meal planning.

For people who wish to live a healthy lifestyle but lack the information and means to do so, the Meal Plan Monitoring and Recommendation System will be a crucial tool. The technology would assist users in achieving their fitness objectives by making personalized recommendations based on their activities and eating routines.

To analyse user data and offer tailored recommendations, the system will use machine learning algorithms. Additionally, the system will have an intuitive user interface that will make it simple for users to enter their daily activities and workouts and monitor their progress.

In this paper, we present a novel method for investigating and developing Meal Plan Monitoring and Recommendation System that could significantly improve people's lives by assisting them in maintaining a happier and healthier lifestyle.

II. Literature Survey

Recent studies have highlighted the growing importance of recommendation systems in the health industry. For example, Drug Recommendation System based on Sentiment Analysis of Drug Reviews using Machine Learning et al. (2021) [1] used Bow, TF-IDF, Word2Vec to achieve accurate predictions and recommendations for drugs required by users. This paper gave us a spark and base to work with.

However, we wanted to address this health crisis a step earlier and try to prevent health issues from occurring in the first place. We studied other papers with the same goal as us and came to the following conclusions as well as differences in our results and methodologies:

2021, e-Health Monitoring System with Diet and Fitness Recommendation using Machine Learning [2]. Published by IEEE.Proved to not be personalized enough. It used Decision Tree to give recommendations. It limits itself in only taking BMI as one of the factors, while ours takes calories, ingredients preferred, etc as well and allows monitoring of other factors like BFP, Calories and Macro nutrients intake.

2021, Implementation of a personalized and healthy meal recommender system in aid to achieve user fitness goals [3]. Published by IEEE used Deep Neural Network but it had limited accuracy of the model which could be due to a number of factors, including inaccurate user input or incomplete food databases.

2016, Dietos: A recommender system for adaptive diet monitoring and personalized food suggestion[4] by IEEE had a lack of personalization for users and does not take into account an individual's unique needs and goals.

2020,Cuisine Recommendation, Classification and Review Analysis using Supervised Learning[5] was published by IEEE. This solution was implemented using SVM supervised learning algorithm, doesn’t allow monitoring results at all, and doesn’t have a interface at all. There is also very limited personalization for users.

2018, Personalized Food Recommendation Using Deep Neural Network[6] by IEEE. Thesolution was created using a Deep neural network. Although the dataset they used was pretty small and outdated, with limited food choices for the users due to limited amount of data in the database.

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The literature survey identified several studies that investigated the use of Machine Learning for various Recommendation tasks. One such study proposed a deep learning-based approach for recommendation that achieved state-of-the-art results on benchmark datasets but with no interface and or user input data and significant compile time.

Another study went with a basic decision tree which was very limiting even though they had good user data via monitoring.In conclusion, the literature survey highlights the significant progress that has been made in using ML and Deep Learning for Recommendation tasks. Future research should continue to focus on developing more advanced and efficient ML algorithms for these applications, as well as exploring new applications of ML in the field of Recommendation Systems.

III. METHODOLOGY

We chose to adopt Agile [7] as our software development method since it is a popular software development method that emphasizes flexibility, collaboration, and iterative development.. It consists of:

- Being able to respond to changes and new requirements quickly.
- Teamwork, even with the client.
- Building operating software over extensive documentation.
- Individuals and their interaction over tools.

As for the structure of our project, we went with a Model View Controller pattern [8] which consists of the following three parts:

- Model: The lowest level of the pattern which is responsible for maintaining data.
- View: This is responsible for displaying all or a portion of the data to the user.
- Controller: Software Code that controls the interactions between the Model and View.

MVC is popular as it isolates the application logic from the user interface layer and supports separation of concerns. Here the Controller receives all requests for the application and then works with the Model to prepare any data needed by the View. The View then uses the data prepared by the Controller to generate a final presentable response. The MVC abstraction can be graphically represented as follows:

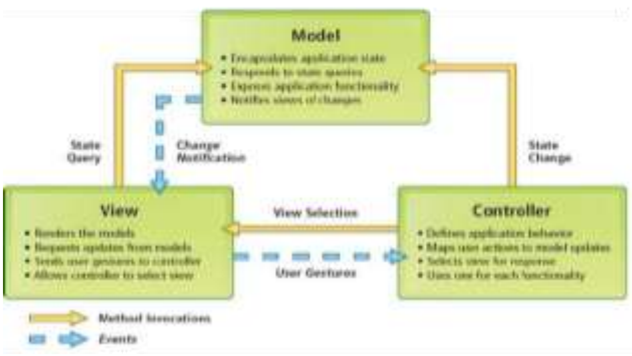

Fig. 1. MVC Model

IV. CHALLENGES FACED

During the development of the meal plan monitoring and recommendation system, we faced several challenges that required careful consideration and innovative solutions. Some of the major challenges are described below.

- Data Collection: Obtaining precise and relevant data for the meal plan recommendation system was a significant obstacle we encountered. We had to locate credible sources of data regarding food ingredients, nutrition, and recipes, while also verifying that the data was dependable and current.
- Data Pre-processing: Prior to conducting analysis and modeling, the data gathered from different sources required substantial pre-processing. We had to eliminate duplicates and irrelevant information, standardize and normalize the data, and merge disparate datasets to develop a cohesive and thorough database.
- Model Selection: There are many machine learning models that can be used for meal plan recommendation, and selecting the most appropriate model was a challenge. We had to evaluate the performance of several models and select the one that provided the most accurate and relevant recommendations.
- User Interaction: Designing an intuitive and user-friendly interface for the meal plan monitoring and recommendation system was a challenge. We had to consider the needs and preferences of different types of users and ensure that the interface provided easy access to the information and features they needed. Integrating Chart,js [9] gave birth to numerous bugs and glitches.
- Evaluation and Validation: Finally, we had to ensure that the meal plan monitoring and recommendation system was accurate, reliable, and effective in meeting the needs of its users. This required extensive evaluation and validation of the system, using both qualitative and quantitative methods, to ensure that it provided useful and actionable recommendations.

V. IMPLEMENTATION

A. Modules and Tools used

- **JavaScript**:JavaScript[10] is a programming language utilized to execute complex tasks on web pages. It plays a significant role in web page development by enabling features like interactive maps, timely content updates, scrolling video jukeboxes, among others. JavaScript is the third tier of the common web technology layer cake, with HTML and CSS being the first two, which have been discussed extensively in other sections of the Learning Area.
- **Flask**:Flask[11] is a renowned web framework for Python that aims to simplify the development process of scalable and efficient web applications. The framework is lightweight, flexible and suitable for small to medium-sized projects, providing a plethora of helpful features

DOI: rp-9788770040723.117

and tools. Flask's main advantage lies in its simplicity as it operates on the concept of "microservices" which entails that it provides only the necessary features needed to develop a web application. This allows developers to concentrate on creating specific features without worrying about superfluous overhead or complexity.

- **Pandas**: Pandas [12] is an influential Python library used by data analysts and scientists to manipulate and analyze data. It provides a variety of data structures such as Series and DataFrame, which enable users to manipulate and analyze data in a multitude of ways. One of the primary features of Pandas is its capacity to process data in various formats, including Excel, CSV, SQL databases, among others. This feature provides flexibility to users, allowing them to import and export data from different sources and work with it in the format that suits them.

- **Chart.js**: Chart.js is a popular JavaScript library utilized for data visualization to create and display charts on web pages in a simple and effective way. It offers a wide variety of chart types, including line charts, bar charts, and pie charts that can be easily customized and styled to meet the user's requirements. One of the key benefits of Chart.js is its user-friendly nature, which requires only fundamental knowledge of HTML, CSS, and JavaScript to get started. Moreover, Chart.js is an open-source library with a vast community of contributors, providing an abundance of support and resources for using the library efficiently.

- **KNN**: The K-Nearest Neighbors (KNN) algorithm is frequently employed in recommendation systems to locate the closest neighbors to a user regarding their preferences, relying on the similarity of the properties of items that the user has engaged with. This algorithm doesn't require any training and is based on memory. Its effectiveness can be boosted by utilizing techniques like feature engineering and dimensionality reduction.

- **NumPy**: NumPy[13]is a Python library extensively utilized in scientific computing, which offers powerful tools for working with multi-dimensional arrays and matrices. Its usage is prevalent in data science, scientific research, machine learning, and other fields that require efficient and fast numerical operations. NumPy is an essential tool for handling large datasets, numerical simulations, and other tasks that necessitate efficient and fast numerical operations. It is also beneficial for data analysis due to features like broadcasting, slicing, and indexing, which make it easy to manipulate large datasets. As a result, data scientists and researchers dealing with big datasets require NumPy.

- **BeautifulSoup**: It is a well-known Python library that is extensively used for web scraping and parsing of HTML and XML documents. It is a simple yet effective tool that provides developers with an easy way to extract data from web pages and use it for various purposes. BeautifulSoup[14] has a wide range of applications in fields such as data science, machine learning, and web development, among others. The library offers a variety of functions and methods for navigating and parsing HTML and XML documents, making it easy to extract necessary data from a web page.

- **PuLP**: It is a flexible and robust Python library that can be employed to develop meal plan monitoring and recommendation systems. By utilizing PuLP[15], we were able to design mathematical models that optimize meal plans based on a variety of factors such as nutritional value and cost. This functionality was useful for developing customized meal plans for individuals with particular dietary/nutritional needs or preferences. PuLP can also be integrated with other Python libraries like NumPy and Pandas to support more advanced data analysis and manipulation. In conclusion, utilizing PuLP in the development of meal plan monitoring and recommendation systems resulted in more effective and efficient solutions for encouraging healthy eating habits by using our recommendation system.

B. Frontend

We began our project with setting up a basic back-end and front-end connection first, and we decided on Flask and HTML for their respective roles. We created a basic left-top-top Wireframe [16] for the front end consisting of a side nav as well as a top nav and having the rest of the page occupy the contents.

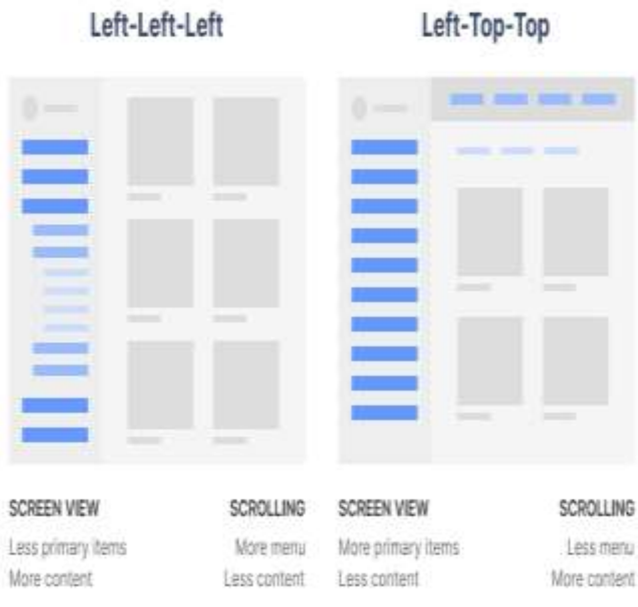

Fig. 2. Left-top-top and Left-left-left Wireframe

We included features and pages like a Landing page, login/registration, Dashboard, Progress Tracker, Calculators, Recipe Searcher, Recipe Maker/Editor, Meal Recommender System, and a recipe page view. All these were created into subsequent HTML pages. Following this we enhanced the visuals using Bootstrap and CSS.

As for Data Visualizations in dashboard and progress page, we used Chart.js to depict the user data we store, and help them get a more meaningful analysis on their progress. We used Weight, BMI, Calories Burned, as well as Macro

DOI: rp-9788770040723.117

Nutrients Burned data as sources for the Visualizations in the form of Pie Charts, Bar Graphs and Histograms.

Fig. 3. Chart.js examples

C. Backend and Data Collection

The back-end server is accountable for overseeing the exchange of information between the user interface and the database. It consists of various files such as server-side scripts composed in Python, and configuration files that establish the server settings. These server-side scripts perform tasks such as login and registration validation, user input validation, database queries, redirecting and routing and data processing.

All the API calls, Data queries for user data and messages from the database, etc are all coded here. Working in Flask made it easy to send information across to the front-end in JSON format.

Finding a suitable Recipe Dataset was a tough part of the process. We considered Food.com dataset from Kaggle, which had over 200k+ recipes along with their instructions, images and steps of preparation, and we continued to build our project with respect to this dataset, however this dataset later became a setback for our recommendation system since it didn’t include any nutrient or calorie details, hence we ultimately went with “Epicurious - Recipes with Rating and Nutrition” from Kaggle.

This dataset had all we needed which included over 20k+ recipes and 700+ columns worth data, however it lacked image or image links. Later we used a web scrapper called BeautifulSoup to get images for all 20+ recipes. After settling on this dataset we did further data cleaning and pre-processing on it using Pandas and NumPy. Our dataset allowed us to know what type of recommendation system we will need to build, that is, content-based filtering, since we are using the contents of each recipe (like calorie, protein,etc) to recommend according to user preferences.

Data Analysis Modules:The generation of meal plan recommendations based on a user's nutritional goals and preferences is the responsibility of the data analysis modules. These modules consist of several files, such as Python scripts and configuration files. Machine learning algorithms are utilized in these modules to analyze user input data and create individualized meal plans recommendations.

We did the following in the data analysis and recommendation system ‘.ipynb’ files:

- 20k recipes listed by recipe rating, nutritional information and assigned categories
- Recipes extracted from Epicurious[17], performed cleaning and image scrapping
- EDA & Visualization:
  - Mathematical Optimization
  - Python Optimization Library : PuLP
  - We also applied mathematical optimizations to food recommendation
- Food Recommendation:
  - Recommendation of healthy food tailored to the each person's health status
  - Foods were recommended based on official standard nutritional values
  - Optimal foods for some situations like season, mealtime, low nutritional values

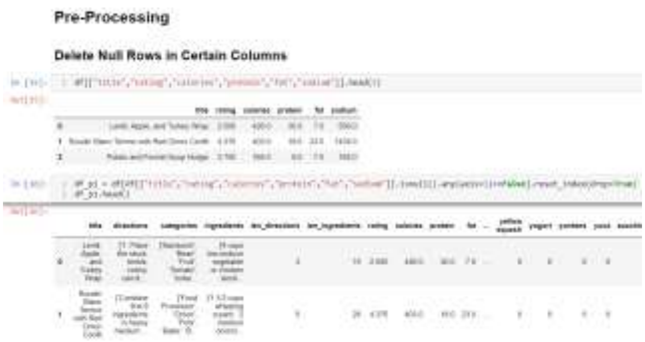

Fig. 4. Pre-processing

D. Structure and Architecture Diagrams

The system's architecture is based on a client-server model, with the User Interface as the client and the Recommendation Engine and Meal Plan Database as the servers. The User Interface communicates with the servers using APIs to retrieve and update data. The system is composed of three main components: the User Interface, the Recommendation Engine, and the Meal Plan Database.

1) User Interface:

Its the primary means for users to interact with the system. The User Interface allows users to create an account, set their dietary requirements and preferences, view their meal plans, and track their progress. The User Interface communicates with the servers using RESTful APIs [18].

2) Recommendation Engine:

The Recommendation Engine is responsible for generating personalized meal plans for users. It takes into account the user's dietary requirements, preferences, and goals, as well as other relevant factors such as their age, weight, and physical activity level. The Recommendation Engine uses a KNN algorithm with cosine similarity to

DOI: rp-9788770040723.117

generate the meal plans as well as a mathematical optimizer called PuLP, which are stored in the Meal Plan Database.

3) Meal Plan Database:

The Meal Plan Database stores all the meal plans generated by the Recommendation Engine as well as recipes created by the user. It also stores information about the users, such as their dietary requirements, preferences, and progress. The Meal Plan Database is implemented using a Relational Database Management System and is designed to be scalable and efficient.

4) Sequence Diagram:

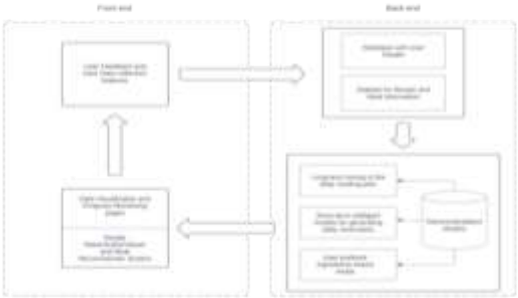

Fig. 5. Sequence Diagram

The sequence diagram begins with the user logging in to the system using the User Interface. The User Interface sends a request to the Recommendation Engine [19] to generate a meal plan for the user. The Recommendation Engine retrieves the user's dietary requirements and preferences from the Meal Plan Database and uses a machine learning algorithm to generate a personalized meal plan. The Recommendation Engine then sends the meal plan to the User Interface, which displays it to the user. The user can then track their progress using the User Interface, which updates the Meal Plan Database accordingly.

E. Flowchart

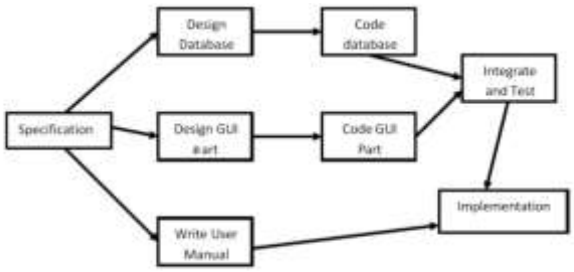

Fig. 6. Project creation flowchart

F. Use Case Diagram

The Use Case Diagram is an essential component of system design that depicts the interactions between the system and its users. In this section, we present the Use Case Diagram for the Meal Plan Monitoring and Recommendation System, which outlines the various use cases and actors involved in the system.

The Use Case Diagram for the Meal Plan Monitoring and Recommendation System is shown below:

Fig. 7. Use Case Diagram

VI. Results and Discussion

The Meal Plan Monitoring and Recommendation System, titled “Nhealth” is a web application that is designed to help users in creating and monitoring their meal plans. In this section, we present the results of our study that aimed to evaluate the effectiveness of the system in improving the dietary habits of users. The results of our study provide insights into the impact of the Meal Plan Monitoring and Recommendation System on the dietary habits and weight of users, their ability to meet goals and offer valuable information for further improvements to the system.

The system provides users with personalized meal plans that are tailored to their dietary needs, preferences, and health goals, and makes it easy for users to track their food intake and physical activity. By using the system regularly, users can develop healthier eating habits and maintain a healthy weight. However, it is important to note that the effectiveness of the system is dependent on the user's willingness to use it consistently and adhere to the recommendations provided.

Presented below are visual representations to illustrate our findings and results:

Fig. 8. Landing page

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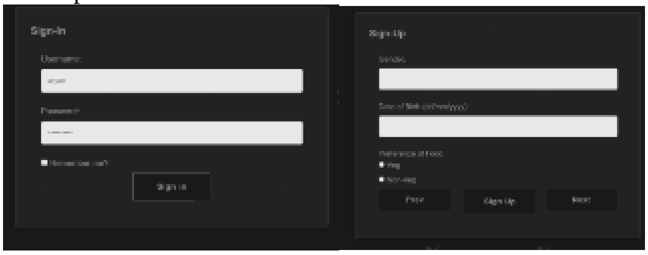

Fig. 9. Log-in and Sign-Up page

Fig. 10. Dashboard

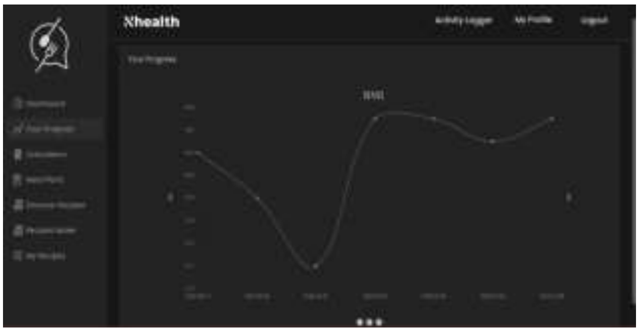

Fig. 11. Progress (BMI)

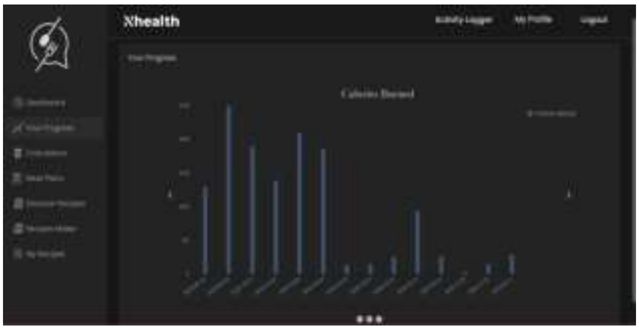

Fig. 12. Progress (Calories)

Fig. 13. Calculators

Fig. 14. Discover Recipes page

Fig. 15. Recipe Page

Fig. 16. Recipe Maker/Editor

Fig. 17. Recommendation output in the .ipynb file

Fig. 18. Recoemmendation based on preferred ingredients

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Fig. 19. Recommendations based on User health data

In conclusion, Nhealth: The Meal Plan Monitoring and Recommendation System is a useful tool for promoting healthy eating habits and maintaining a healthy weight. The system provides users with personalized meal plans and helps them to track their food intake and physical activity. Our study showed that regular use of the system can lead to improved dietary habits and weight loss.

Further research is needed to evaluate the long-term effectiveness of the system [20] and to explore the potential of incorporating other features, such as social support and gamification, to further enhance user engagement and motivation.

VII. Conclusion and Future Scope

A. Conclusion

The Meal Plan Monitoring and Recommendation System has been shown to be an effective tool for improving the dietary habits of users. Our study demonstrated that regular use of the system could lead to a more balanced diet, increased variety of foods consumed, and better adherence to daily nutritional requirements. We gained teamwork skills, time management skills, and knowledge of how to do assignments on schedule. We studied several testing methodologies, carried out tests, and created test cases for our application. Each module of our application has passed satisfactory testing.

B. Future Scope

There are multiple avenues for further improving and expanding the Meal Plan Monitoring and Recommendation System. One approach involves incorporating additional features such as personalized coaching, social support, and gamification to increase user engagement and motivation, resulting in more favorable long-term outcomes. Another way to enhance the system is by integrating it with wearable fitness trackers and other health monitoring devices, which can offer users a more holistic view of their health status, including more precise tracking of physical activity and calorie expenditure. Finally, the system can be expanded by including a recipe database that aligns with the user's dietary preferences and requirements.

These additions will provide users with more options for meal planning and encourage greater variety in their diet. Finally, the system can be further evaluated for its effectiveness in different population groups, such as children and elderly individuals, and for different health conditions such as diabetes and heart disease.

Overall, the Meal Plan Monitoring and Recommendation System has the potential to become a valuable tool in promoting healthy eating habits and maintaining a healthy weight. Further research and development are needed to fully realize the system's potential and to make it more widely available to the public.

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Opinion Mining Customer Reviews on Amazon With Machine Learning Techniques

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Abstract*—Online customer reviews providefeedback to businesses about their products and services, which can be very valuable. By analyzing these reviews, businesses can gain insights into customer satisfaction, identify areas for improvement, and make data-driven decisions to improve their products and services. Opinion mining, also known as sentiment analysis, can help businesses identify common themes, issues, and areas for improvement and can help organizations find the needs and requirements of its target audience. Therefore, in this paper, opinion mining is performed on online customer reviews from Amazon. A comparative study is also conducted to compare the effectiveness of various Machine Learning models such as Decision Tree, Random Forest, Naïve Bayes, KNN, SVM, and Logistic Regression.

Keywords—opinion mining, customer reviews, machine learning, decision tree, random forest.

I. INTRODUCTION

With customer reviews playing an integral role in a consumer's decision-making process while purchasing a product, it is imperative that businesses analyze these reviews to make better business decisions. Data driven decision making can significantly boost a company's business outcomes. Opinion mining is the process by which one can extract opinions and emotions from a target using NLP approach to obtain meaningful data. Thus, opinion mining and sentimental analysis play a crucial role in a business's ability to be profitable. These processes, along with an efficient feedback management system, can help businesses meet consumer demand and maintain their expectations so as to remain competitive in the market.

Opinion mining has a significant number of use cases and advantages from a business perspective. It can be used to effectively analyze customer reviews in order to gain meaningful insights. Stakeholders can learn and understand how consumers interact with the product, and can use the data that has been mined to improve the functionalities of these products. They can gain an insight into what the consumer likes or dislikes about the product, and can also use the feedback provided in a review to make decisions about their products. Moreover, stakeholders can use opinion mining to keep track of their competitors as well. By understanding how consumers feel about their competitors' products, businesses can ensure that they apply findings in such a manner that they outrank their competitors and stay one step ahead of the competition at all times. With significant leaps and bounds in AI and NLP technologies, opinion mining systems are getting better at processing relevant data and are proving to be crucial to the success of a business.

In this paper, opinion mining is utilized to process and analyse customer reviews from a range of different products on popular e-commerce website Amazon. The research objective of this project is mainly to showcase the effectiveness of opinion mining from a business perspective. Since opinion mining can be implemented in a number of different ways by using many different ML or NLP models, the objective is also to perform a comparative study to understand the efficacy of a few different machine learning models trained on the same dataset. In doing so, one can understand which approach is best for opinion mining and also ensure that an opinion mining model can be deployed that is most beneficial to a business. A good opinion mining system must be able to correctly analyse a review as positive or negative and extract the most meaningful data from the language. It must be able to classify language hurdles such as emoticons or sarcasm in the appropriate way as well.

Opinion mining can be an extremely valuable tool for any business. Thus, the aim is to utilize opinion mining to create a system that can effectively process and analyze online customer reviews on the popular e-commerce website Amazon. The comparative study examines the efficiency of various ML models such as Naïve Bayes, Random Forest, KNN, SVM, and Logistic Regression. The most efficient model can be used to deploy an opinion mining system or feedback management system that can have real time use cases in a business. The motivation behind this project is to enable businesses with a system wherein they can leverage opinion mining to make insightful data driven decisions. This will not only help them remain profitable, but will also help them beat competitors in the market. By understanding exactly what ML model provides the best outcome, it can be ensured thatthe most efficient and useful opinion mining system is created.

Existing opinion mining systems have a number of limitations that stop them from truly being useful in a business. The primary hurdle includes language barriers such as emoticons, slang words, and sarcastic comments. While NLP has advanced in recent times, these challenges still persist. In this paper, a model may be proposed that can overcome at least some of these challenges, in order to make opinion mining more holistic and advantageous.

The purpose of this project is the create an opinion mining system that can correctly process, analyze, and classify online customer reviews on Amazon. The objective is to distinguish the most efficient ML model to carry out such a system by means of a comparative study. With this information, this paper proposes a model that can best

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perform opinion mining to allow businesses to make data driven business decisions.

II. LITERATURE REVIEW

In a paper written by T. Kim Phung et al [1], a study was conducted to try and use and apply the concept of supervised machine learning and its various methods. This study collected around 40000 reviews of travelers on hotels in Vietnam from ‘agoda.com’, a famous travel booking and review site. The next step consisted of training the machine learning models and figuring out which model works the best to forecast opinions. The results generated show that in the field of opinion mining, which is conducted here, three types of models have been effective in their performance, namely, Logistic Regression, Support Vector Machines and Neural Networks.

X. Xu et al [2] attempt to improve the aspect-level opinion mining that is generated for online customer reviews. Aspect-level opinion mining involves both the product and the sentiment that is generated for it. The new model that is proposed in this paper is to be used to jointly extract the aspects and the sentiment lexicons that are aspect-dependent, from the customer reviews available online. The results of this model are regarded to be more effective from the current standards and the practical values of the extracted lexicons are also increased.

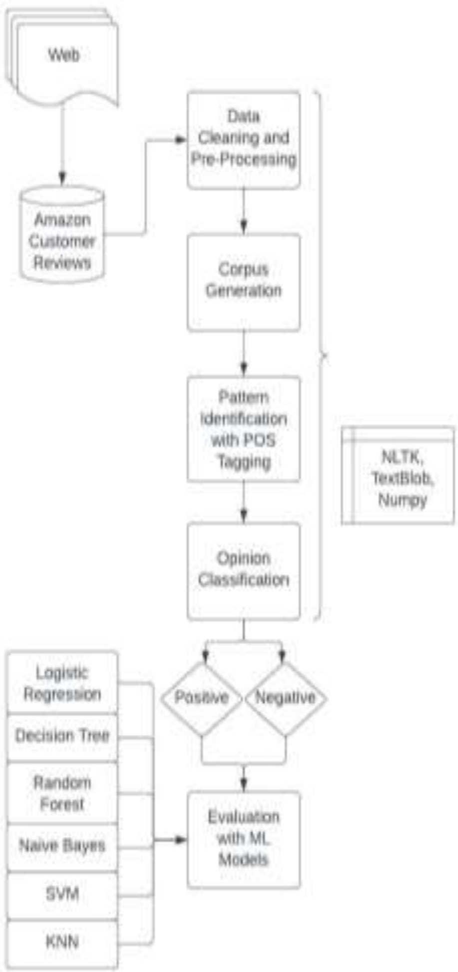

Fig. 1. Architecture Diagram

A process is explained by R. A. Laksono et al [3]where the reviews are classified using Naive Bayes technique to extract the sentiment of the customers, whether positive or negative. These reviews are often vital cogs of information for both the travel aggregator and the review site, as well as future consumers. The result from the research shows that the existing method of using TextBlob versus Naive Bayes, favors Naive Bayes by around 3%, but both methods are retrieving correct customer response.

Wu et al [4] conduct a study which aims to undertake and examine sentiment information from customer reviews and to predict and explore the potential of the same to enhance hotel demand forecasts. The customer reviews of four Macau luxury hotels are taken into consideration and their customer reviews are considered for the initial test. LSTM is used in this process and with the help of that, three indices are created that are checked out and are also evaluated for their effectiveness. The results of this paper are impressive and help in improving the forecasting accuracy.

An article by A. Adak et al [5]dwells on the fact that in the COVID-19 pandemic, the consumer had a change in how their food was delivered to them. Food Delivery Services took over the game and their growth has been rapid since doorstep delivery was preferred. These organizations have customers review them, which also can determine their company performance. This review is undertaken to find and explain machine learning, deep learning and explainable AI methods that are being used to predict customer sentiments. Key findings show a gap between DL and XAI methods and recommend to integrate them to perform in a better manner.

Like X. Xu et al [4]., S. Vanaja and M. Belwal [6] also use an aspect-based approach in their paper. This paper is an attempt to explain how to use sentiment analysis to analyze textual data and derive the sentiment from the same. This is due to the fact that in today’s world it is seen that almost every minute there is some or the other form of text data being generated. This paper deals with the e-commerce reviews that can help retailers and the companies to understand the expectations of the customer, to provide a holistic interaction and to add to their sales. Aspect terms are used here, along with parts-of-speech and also applying classification algorithms to get the score of the review.

III. METHODOLOGY

A. Overview

In this paper, the objective is to test various machine learning models to check which one of the models provides the most amount of accuracy in the end. The performances of models such as random forest, decision trees, logistic regression and so on are compared. The algorithm with the best performance can then go on to classify customer reviews as good or bad with reasonable accuracy and confidence. The methodology proposed in this paper is fairly simple: It begins with some basic data preprocessing and cleaning methods, following which a corpus of biwords and triwordsis created for pattern generation. Next, POS tagging is performed and the dataset is trained. Finally, the

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model is tested and validated against the proposed machine learning models to compare their performances.

B. Data Cleaning and Pre-Processing

The dataset is obtained of Amazon reviews for a range of products by rudimentary web scraping methods. However, this data needs to be processed and cleaned before any actions can be performed on it to train the model. Data pre-processing is an important step in any NLP task. Tasks such as lemmatizing and tokenizing the words in the dataset are performed as initial data pre-processing steps. In order to obtain a clean dataset that can be trained, stopwords and duplicates are removed. Moreover, the spelling of incorrectly spelt words in the dataset is corrected. To accomplish these tasks the pandas and nltk libraries in Python are used. For spelling correction, the TextBlob library is utilized. The TextBlob library is particularly useful as it helps simplify text-based tasks for natural language processing in Python. Once some basic data cleaning has been performed, a corpus of words is created. Further actions on this corpus are performed in the subsequent steps.

C. Generating Biwords and Triwords

The next step is to add biwords and triwords to the corpus that was created, in order to generate patterns. A corpus is generated with biwords and triwords in order to simplify language tasks and train the model effectively. The goal is to avoid any erroneously tagged opinions while the user searches for the opinion of a particular product. This step is the precursor to POS tagging.

D. Parts-of-Speech Tagging

POS Tagging, or Parts of Speech Tagging, is a process that labels or categorizes words in a sentence to their corresponding parts of speech. Thus, it is a language task that helps the algorithm understand natural language in a better way, with its correct syntax and grammatical structure [8]. By performing parts of speech tagging on the reviewed text, one can extract essential linguistic features of the text to generate patterns. In this paper, for each reviewed text, eight patterns are generated using a rule-based approach. Using these eight patterns, it becomes possible to generate opinion words and their corresponding opinion targets. Since a rule-based approach is being followed in this paper, it is essential to define a set of language rules for different parts of speech in a sentence. Then, these rules are applied to the text corpus to identify patterns. The eight patterns generated are adjective + noun, adjective + noun + noun, adverb + adjective, adverb + adverb + noun, adverb + verb, adverb + adverb + adjective, verb + noun, and verb + adverb. These patterns can help identify opinions in reviews more easily.

E. Training The Model

After performing parts of speech tagging to generate patterns in the text, the rest of the model training procedures can be commenced. A semi-supervised approach is used to create opinion targets from the list of Amazon products. Next, using wordnet from nltk corpus, sets of words that are similar in meaning to the titles of the products are obtained. This step is necessary in order to make it possible for users to look for product opinions without having knowledge of the precise keywords associated with it. The existing list of product names is thus appended with the similar words generated from wordnet. Next, for each opinion target, i.e., the product name or its corresponding similar word, opinion words from the dataset of reviews are found. Then, for each of these opinion words, words similar in meaning to these opinion words are further searched for. The same procedure as earlier is followed to do this, using wordnet from nltk corpus. For the final extracted opinion words, polarities are generated using the TextBlob library. The polarity of a word is an indication of its emotional sentiment, and is usually on a scale of -1 to +1, with -1 being the lowest value or overall negative sentiment and +1 being the highest or overall positive sentiment. Generating the polarity of each opinion word allows the model to categorize the resulting opinion as negative or positive, which is the crux of this paper. The polarities of similar opinion words are averaged out and assigned an overall score. This score is then used to categorize the target as overall positive or overall negative. Since ratings on Amazon are in a range of 1 to 5 stars, ratings of 1, 2, and 3 stars are considered to be overall negative and ratings of 4 and 5 stars to be overall positive. Thus, the model is trained to generate either a positive sentiment or a negative sentiment for a given product. A confusion matrix is also generated to evaluate the performance of the model thus far and obtain the r and f scores, as well as precision and accuracy. With this, the opinion mining model is trained. The dataset consists of 34000 reviews for analysis, out of which around 10000 can be used for testing.

F. Testing The Model

In order to test the model, reviews are introduced and assigned a positive or negative sentiment class to each of the reviews. Then, the same data preprocessing techniques as earlier are performed. Next, using the corresponding opinion words, the score for the review is generated. This is done using the TextBlob and numpy libraries. The resulting score depicts whether the product has an overall positive or negative sentiment associated with it. For 10000 reviews, the model achieved an overall accuracy of 78.67%.

G. Validating with Machine Learning Models

To validate the model with different machine learning models that were proposed, thesklearn library in Python is used, along with the bag of words model.LogisticRegression, DecisionTreeClassifier, Naive Bayes, RandomForestClassifier, KNeighborsClassifier, and SCV are fit to the training dataset. With each of these models, the test dataset results are predicted and k-fold cross-validation is performed, where in this paper k = 10. This is done to measure the performance of the classifiers.

Since the random forest algorithm usually has an upper hand against other traditional machine learning algorithms [12], it may have the best performance in this model as well. The working of the algorithm is hence detailed in the next subsection.

H. Random Forest Algorithm

In a machine learning context, a random forest is a collection of decision trees. Decision tree algorithm is a

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popular machine learning technique used for sentiment analysis, which involves determining the sentiment or emotion behind a text document. In the context of sentiment analysis, a decision tree algorithm works by using a tree-like model to represent possible decisions and their possible consequences. The algorithm builds a decision tree based on a set of training data, which consists of input text data and their corresponding sentiment labels (e.g., positive, negative, neutral).

The decision tree algorithm uses the training data to identify the most important features or attributes that are most predictive of sentiment. These features can include word frequency, the presence of specific words, or other linguistic features. The algorithm then creates a series of decision nodes based on these features, which determine the path that the algorithm will take through the decision tree. As the algorithm traverses the decision tree, it assigns sentiment labels to the input text data based on the decisions made at each node. For example, if the decision tree contains a node that tests for the presence of a specific word (such as "great"), the algorithm will assign a positive sentiment label if the word is present in the input text, and a negative sentiment label if it is not. Once the decision tree has been trained, it can be used to classify new text data based on their sentiment. The algorithm uses the decision tree to traverse the tree and assign a sentiment label to the input text data. Overall, decision tree algorithms are a useful technique for sentiment analysis because they are relatively easy to understand and interpret, and they can be trained on large datasets with high accuracy. However, they may not perform as well as more complex machine learning techniques for highly nuanced or complex sentiment analysis tasks. This is because decision trees are highly prone to over fitting. So to make this model more robust, an ensemble of decision trees can be used. Decision trees are bagged together to increase their performance, leading to Random Forest.

The first step in using the random forest algorithm is to prepare the training data. This involves selecting the features that will be used to make predictions and preprocessing the data to ensure that it is in a suitable format for the algorithm. Next, the random forest algorithm builds a set of decision trees. To build each decision tree, the algorithm selects a random subset of the training data and a random subset of the features. It then uses these subsets to train a decision tree. Once the decision trees are built, the random forest algorithm can make predictions for new data. To do this, the algorithm passes the new data through each of the decision trees and averages the results to produce a final prediction. For classification tasks, the final prediction is the mode of the predictions made by the individual decision trees. For regression tasks, the final prediction is the mean of the predictions made by the individual decision trees. Finally, the performance of the random forest algorithm is evaluated using a test dataset. This involves comparing the predictions made by the algorithm to the true values in the test dataset. Metrics such as accuracy, precision, recall, and F1 score can be used to evaluate the performance of the algorithm. The key advantage of random forest algorithm is that it can handle a large number of features and complex datasets, and can provide an accurate prediction even in the presence of missing data or noisy data. Additionally, by using multiple decision trees, the algorithm is less prone to overfitting and provides a more robust and stable prediction. However, random forest algorithm can be computationally expensive and may require significant computational resources to build and evaluate the model. This is due to the fact that multiple decision trees have to be built and run when the model is trained and used.

IV. RESULTS

The accuracy of the model is found to be 78.67%. If the project were to be scaled and the training data increased, may result in better accuracy. Sarcastic comments are also able to be classified as actually positive or negative with considerable success. Upon validating the model against various machine learning models, it is found that decision trees had the best performance, with an accuracy of 83.26%. The random forest algorithm was a close second, with an accuracy of 83.17%. This indicates that Random Forest and Decision Tree algorithms are almost comparable in performance. For a simple opinion mining system that is run entirely on machine learning algorithms, random forest or decision tree would provide the best results to the user. Logistic regression, gaussian naive bayes, multinomial naive bayes, bernoulli naive bayes, k nearest neighbor and SVM each yielded an accuracy of 59.23%, 74.65%, 82.70%, 77.24%, 79.77%, and 80.05% respectively. Logistic regression was hence found to be the weakest machine learning model for opinion-mining customer reviews. After cross-validation, the precision was found to be 0.81, recall 0.86 and the f score was found to be 0.83. These results are summarized in Table I.

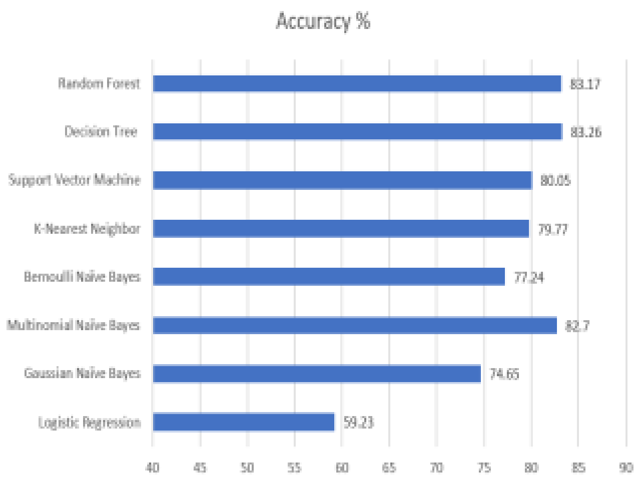

Fig. 2. Horizontal Bar Chart For Algorithm Comparison

TABLE I. ACCURACY OF ML ALGORITHMS

Algorithms	Accuracy %
Logistic Regression	59.23
Gaussian Naïve Bayes	74.65
Multinomial Naïve Bayes	82.70
Bernoulli Naïve Bayes	77.24
K-Nearest Neighbor	79.77
Support Vector Machine	80.05
Decision Tree	83.26
Random Forest	83.17

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V. FUTURE SCOPE

This paper, for the most part, allows forthe comparison of various machine learning models and their performance on a model trained for opinion mining online customer reviews. Although Amazon reviews are used, this model can be applied to any sort of e-commerce or business platform, as long as customer reviews are available online. The approach in this paper is quite simple, however, with the advent of deep learning and advanced technologies such as GPT-4, opinion mining as a whole can be greatly improved. Opinion mining still has a long way to go. In the future, such a model should be quicker in processing data and should also be able to do so with high accuracy. It should also be able to overcome present-day limitations such as the use of emoticons, sarcasm, and other language barriers. Fake reviews are another hinderance that opinion mining algorithms must be able to deal with [7]. One major disadvantage is that the same kind of model can yield varying levels of accuracy for comments in different languages. Future opinion mining systems must be able to detect comments of different languages within the same dataset and classify them as such. Additionally, they must also be equally accurate for each of the different languages. Since slang or internet vernacular keeps evolving, corpuses in opinion mining models must be able to update themselves to keep up with changes in user language. There is still much research to be conducted on these aspects of opinion mining, but a more robust opinion mining or feedback management system will be easily achievable with advancements in NLP technology.

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Performance Evaluation of Different Machine Learning Models for Bankruptcy Prediction

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***Abstract*—Bankruptcy of a company usually is a huge issue for companies. The bad influence of bankruptcy could lead to loss for components of the business such as the owners, the investors, the employees, and the consumers. Bankruptcy prediction is the practice of forecasting the financial distress and potential bankruptcy of a public firm. This area of research involves analyzing various financial ratios and other data to identify indicators of financial risk. We can prevent bankruptcy by predicting the likelihood of acompany getting bankrupt based on a company's financial ratios and data. With the advent of new data-intensive techniques, suchas machine learning, researchers have developed increasinglysophisticated methods for predicting bankruptcy. However, it is important to exercise caution when interpreting the results of such models, as they can suffer from biases and other limitations.Despite these challenges, bankruptcy prediction remains a critical area of study for investors and creditors seeking to assess the financial health of a company The issue of this whole processis managing the imbalance in class caused by the rare event of bankruptcy in the real economy. Advancements in Artificial Intelligence (AI) have helped these companies by applying those models to predict bankruptcy. This bankruptcy problem wassolved in this work by comparing various Machine Learning methods such as SVM, KNN, Ensemble Learning, Decision Tree classification was applied which achieved 60%, 84%, 93%, 94% accuracy.**

***Index Terms*—Finance, Bankruptcy, XGboost, KNN, Decision Tree, Classification, Ensemble Learning, SVM**

I. INTRODUCTION

For any company, insolvency is an undesirable phenomenon. It heavily affects the company owner and other responsible stakeholders. Companies getting bankrupt is increasing day by day. Therefore, bankruptcy prediction is of such high value and has been researched extensively over the past decades. There are a number of causes for business financial issues, and it's a difficult one to define, but some factors can be revealed that could signal impending bankruptcy. Determining your pre-bankruptcy status is critical to timely averting a difficult situation. Nowadays, highly advanced prediction- based computing techniques have been widely used by researchers to solve error prediction problems and are also discussed withsystematic literature review technique. In this study, we will focus on holistic methods to get the best possible results.

Bankruptcy is a legal process in which judges and court administrators investigate the assets and debts of individuals, partnerships, and corporations who believe they have too many debts to pay. The court decides to settle the debt. "Discharge" means that the person in debt is not legally obligated to pay. A court can also dismiss a lawsuit if it determines that the individual or entity has sufficient assets to pay the bills. Bankruptcy laws were written to give people a chance to start over when their finances collapsed.

Forecasting bankruptcy and assessing financial distress of public companies is an important area of research in finance and accounting. Creditors and investors are interested in predicting the likelihood of a firm going bankrupt, which has led to extensive research in this field. The abundance of data available for both bankrupt and non-bankrupt public firms, including various accounting ratios and other explanatory variables, has further spurred the development of sophisticatedforecasting techniques that rely on large datasets. The evolution of bankruptcy prediction involves the use of various statistical tools that have become increasingly available over time and requires a growing understanding of the limitations. Despite these advancements, some published research still fails to address long-known pitfalls in the field. The accuracy of bankruptcy prediction has improved with the development of more advanced machine learning models. This paper introduces recently developed methods for predicting bankruptcy using real-world data.

II. LITERATURE SURVEY

Research done by [1] did model development for companies getting bankrupt for the given firms using ML algorithms. They have used 21 variables which are used to select the variables for model. The 1st technique used is based on conditional likelihood and the 2nd technique about conditional correlation between variables. Totally 3 models were used for predicting a company's bankruptcy and is created using NB model and all three are evaluated. First NB model showed90 % and the second showed 93 % and logistic regression gave an accuracy of 90 %. Finally, it was concluded that it is possible to predict financial bankruptcy-based prediction using Bayesian models.

In [2] applied the algorithm called as Partial Least Squares Regression which in general helps us in implementing a huge number of financial ratios in the given algorithm. Apart from that, it also solves the issue based on correlation, and also takes into account the missing data. They also showed demo about how the application of the Partial Least Squares approach to the companies usuallyprovides improved results. The application of this technique consists of two classes which are of healthy and the failing companies, allows the members to possibly gain high significant results and also to propose a model which is better than a model obtained by a parametric approach. This research helps the bankers and the investors by providing a detailed explanation about the indicators which indicate bankruptcy. It allows companies to do diagnostics of their models to predict bankruptcy prediction. Logit models which were implemented by [3], resulted in a stepwise selection process, which correctly predicted 84% and 91% of bankruptcies 1 and 2 respectively. The Implied

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estimation models that a hotel business is more likely to get bankrupt if it has more operating cash flow and increased total liabilities when compared to none. Models suggest that a conservative sales strategy coupled with a tighter operating cost control and some less debt financing can help improve a company's ability to meet its financial obligations and thus reducing the risk of bankruptcy.

A study conducted by [4] evaluated the financial data of more than 400 companies – 52 of which went bankrupt and 348 were "healthy". The results show the set of factors involved for financial bankruptcy prediction and neural network relevance. They applied a total of 17 factors that characterize liquidity, profitability, sustainability, efficiency, and innovation. The total predictive power of the model created in our study is close to 98%, which is extremely superior an efficient when compared to other models

[5] applied multiple data analyzing tools to bankruptcy data, with the sole aim of comparing the accuracy of model. For these data, decision trees were more accurate than support vector machines and deep neural networks.

In a survey done by [6] analyzed the design and application of many ML models for different process involving default events: (a) Estimate the probability of survival over a period of time period (b)Predicting default bankruptcy using the time series based on accounting data of varying length. Finally, they seriously talk about the most interesting metrics and also suggested it for future studies.

A exploration by [7] evaluated the motivations and trends of business failure in Lithuania in the period 2006-2010. The probability of bankruptcy was assessed in five companies that are currently active and two that have gone bankrupt using Springate, Zavgren, the Altman and Chesser models. After testing the usability and the applications of bankruptcy financial prediction model in 7 companies, the results show that the linear discriminant model most accurately reflects the financial position of the company.

Statistical methods were used to select the most appropriate indicators by [8] and after filtering the data, the indicators were more convincing. Second, unlike former study methods, they use the same set of samples to do the experiment. Finally, the result can prove the worthiness of the machine learning method, with an accuracy score of 95.9%.

Analysis conducted by [9] solved the issue of unbalanced data with subsampling and (SMOTE). Machine learning techniques involving random forests resulted in 99% accuracy, while Decision Trees, Logistic Model Trees (LMTs), Support Vector Machines (SVMs), and random forests (RFs) resulted accuracy 92%, 92.3%, 93.8% and99%, respectively.

Support vector machine (SVM) to improve bankruptcy prediction problem with the aim of proposing a brand new algorithm was done by [10] with way better explaining capacity and increased stability. They used 5-fold cross-validation to find the efficient value of the SVM kernel function parameters.Apart from that, to predict the accuracy of SVM, they compare SVM performance with the performance of logistic regression analysis, multiple discriminant analysis (MDA), and 3-way back-propagation neural network. fully connected layer (BPN). Test results show that SVM is superior to other methods.

Research [11] which proposed a method by applying XG- Boost to handle class imbalance in datasets. In this work, Randomized Search CV optimization helped find the parameters. To increase model efficiency, XGBoost applies data sampling techniques. The experiment was based on two real credit card records. The study showed that the combination of data sampling doesn't have much effect on efficiency of XGBoost. The proposed approach finally ended up with very high accuracy

S.S. Panigrahi et al made an effort to use discrete input variables on top of which decision tree was applied. Decision trees for NSE and BSE are generated. It is constructed differently and its set side by side with a decision tree that is directly generated over the same period. Empirical studies prove high effectiveness of the given model by outperforming other decision trees [12]

[13] used data from company based in Ghana. Regression analysis was fitted to data from 648 clients. They proposed that microfinance institutions bear the risk of default. A model was implemented for determining the effect of problem, as it is relatively effective. It was recommended that training is re- quired to improve their skills. Regulators should also consider enacting legislation to make sure that this is guaranteed.

Research focused on cancer classification by [14]. The distribution shows that the dataset is high Unbalanced and biased decision tree-like learning algorithms. A benign observation, leading to poor prediction performance malicious observation. Adaptive boosting is used here in this study. The performance of the models is analyzed, and they came to know that Adaboost algorithm performed better than decision trees with accuracy of 95.1% over decision tree which had 89In their study, [15] proposed a novel similarity-based approach totext classification, utilizing a KNN model-based classifier that combines both KNN and Rocchio techniques. The researchers developed a classification prototype using the KNN model and conducted experiments on two well-known document corpora, the ModApte version of the Reuters 21578 collection and 20 newsgroups dataset. The results of their experiments indicated that the KNN model-based classifier performed favorably compared to traditional KNN and Rocchio classifiers. The researchers concluded that their proposed approach could be a viable alternative to KNN and Rocchio in various domains.

III. Proposed Methodology

Classification algorithm is used to predict the target class asthe target class which are categorical in nature. We are going touse SVM, KNN, XGBoost and Decision Tree Classifier. Let see in detail about the following algorithms and the results they produce

A. *Logistic Regression*

Logistic Regression is a machine learning technique frequently used to predict binary outcomes, such as "Yes" or

DOI: rp-9788770040723.119

"No," by analyzing the relationship between one or more independent variables and a dependent variable in a dataset.

B. SVM

Support Vector Machines (SVM) are popular supervised learning algorithms used for classification and regression problems. SVM creates optimal decision boundaries, or hyper- planes, to divide n-dimensional space into classes so that new data points can be categorized correctly. The SVM algorithm chooses support vectors, or extreme cases, to help create hyperplanes. SVM achieves an accuracy of 60%.

C. XGBoost classifier

XGBoost is an advanced gradient boosting library known for its efficiency, flexibility, and portability. It uses machine learning algorithms as part of gradient enhancement and offers Parallel Tree Boost, which solves many statistical problems quickly and accurately. The code runs on major distributed environments like Hadoop, SGE, MPI, and can solve problems beyond billions of examples. XGBoost achieves an accuracy of 92%.

D. KNN

K-Nearest Neighbor (KNN) is a simple machine learning algorithm based on supervised learning techniques. KNN calculates the space between a point and all points in the data, chooses the K number of specific examples closest to the point, and votes for the most common label (in classification) or averages the labels (in regression). KNN achieves an accuracy of 84%.

E. Decision Tree classifier:

The Decision Tree classifier is a popular model that creates a tree called a decision tree. Each node in the decision tree tests a column, and each branch corresponds to one of the possible values for that variable. The Decision Tree classifier achieves an accuracy of 94%.

IV. SYSTEM ARCHITECTURE

The dataset used here in this work is based on company bankruptcy which has 6820 rows and 95 columns. It was acquired from the Taiwan journal. The output class in this dataset has information about whether the company is bankrupt or not. Basic EDA techniques were applied to explore the data. Feature selection was initially done using Random Forest method which helped select the right features for the model. The data of the target class was initially evaluated to check the class imbalance and as expected a huge amount of class imbalance was found with the data where a company is bankrupt being the minority class. Imbalanced data are values in which the observed frequencies are very different across the different possible values of a categorical variable. It's like there are many rows of some type and very few of another type. Correlation methods were also used to find out how various variables are correlated with each other. Figure 1 depicts the overall system architecture for evaluating the performance comparison of various ML models

The data is next being readied for model where we can apply the algorithm. The data imbalance of target class was

Financially stable: 96.52 % of the dataset
Financially unstable: 3.48 % of the dataset

As our data's target class has a huge imbalance of data, we will use SMOTE sampling method to generate synthetic samples from the minority class.

SMOTE is an oversampling technique that produces synthetic samples of minority classes. SMOTE algorithm will help solving the problem of overfitting due to oversampling. We focus on the features and create new instances using interpolation between consecutive positive instances.

Then model was split into train and test and then predicted using various classification algorithms. The results were evaluated, and the best model was used for bankruptcy prediction

V. EXPERIMENTAL EVALUATION

The performance of various Machine learning models are examined using the following metrics.

a) ACCURACY: Accuracy is the one of the predefined models which is used to find the balanced and unbalanced data in the models and how its performing in the given predicted models. A common way to calculate accuracy in machine learning is by dividing the total number of correct predictions by the total number of predictions made.

Accuracy = True positive + True Negative / True positive+ False positive + True Negative + False Negative

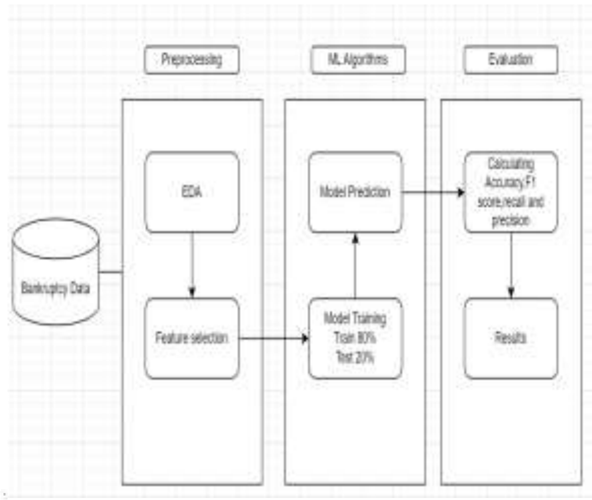

Fig. 1. Depicts the architecture of this work

b) PRECISION: It is calculated as the ratio of true Positives to all the positives predicted by the model. A higher precision indicates a lower number of false positives predicted by the model. In this data we have used precision for finding the perfectness of the model to know the true positive value, negative value. By the precision equation we can find the denominator for true positive of values.

DOI: rp-9788770040723.119

Precision = True Positive / True Positive + False Positive

c) RECALL: Recall, also known as Sensitivity, is another metric used to evaluate the performance of a machine learning model. It is calculated as the ratio of True Positives to all the positives in the dataset. A lower recall value indicates that the model is predicting more false negatives.

Recall = True Positive / True Positive + False Negative

(d) F1 SCORE

F1 score is a metric used to evaluate the overall performance of a machine learning model. It is calculated as the harmonic mean of precision and recall, taking into account the contribution of both metrics.

F1 Score = 2 *Precision*Recall / Precision+Recall

The models have been applied and the following results have been achieved

TABLE I: ACCURACY COMPARISON FOR VARIOUS ML MODELS

S.No	Model	Accuracy
1	SVM	60%
2	KNN	84%
3	XGBoost	92%
4	Decision Tree Classifier	94%

Table I shows accuracy of various ML models.We can see that Decision tree has more accuracy compared to other algorithms

TABLE II: PRECISION COMPARISON FOR VARIOUS ML MODELS

S.No	Model	Accuracy
1	SVM	64%
2	KNN	85%
3	XGBoost	93%
4	Decision Tree Classifier	94%

Table II shows precision of various ML models.We can see that Decision tree has more precision compared to other algorithms.

TABLE III: RECALL VALUE FOR VARIOUS ML MODELS

S.No	Model	Accuracy
1	SVM	61%
2	KNN	85%
3	XGBoost	92%
4	Decision Tree Classifier	94%

Table III shows recall of various ML models

TABLE IV: F1-Score for Various ML Models

S.No	Model	Accuracy
1	SVM	59%
2	KNN	85%
3	XGBoost	92%
4	Decision Tree Classifier	94%

Table IV shows F1-score of various ML models. F1 score is the highest for decsion tree as per the above table

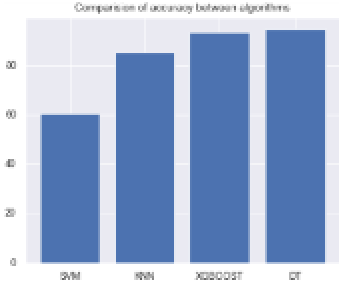

Fig. 2. Accuracy of various ML algorithms

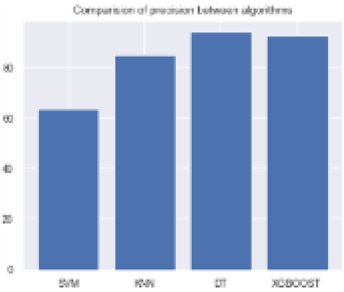

Fig. 3. Precision of various ML algorithms

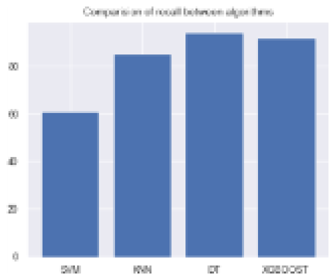

Fig. 4. Recall of various ML algorithms

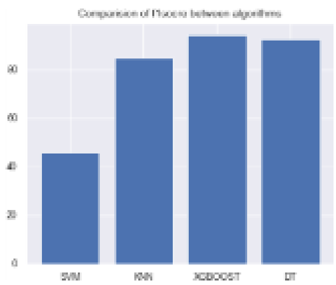

Fig. 4. Recall of various ML algorithms

Fig 2, Fig 3, Fig 4, Fig 5 shows the performance metrics of various ML algorithms

CONCLUSION

This study fully focused on applying and implementing the methods and techniques which actually help companies avoid getting bankrupt by analyzing their financials and thereby using a Machine Learning approach. Based on the results of the research study, the findings suggest that these models can offer improved accuracy and effectiveness

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compared to traditional statistical methods. The study demonstrated the potential of sampling techniques such as SMOTE and also applied advanced models such as SVM, logistic regression, decision tree, and XGBoost which helped predicting bankruptcy ofpublic firms. These findings have implications for investors and creditors seeking to evaluate the financial health of a company and make informed decisions based on accurate risk assessments. The results of this study also highlight the importance of exploring a variety of models and techniques to develop robust and accurate predictions, as well as the need to continue refining and improving these models through further research and experimentation. Overall, the use of machine learning models for bankruptcy prediction holds promise as a valuable tool for improving financial risk assessment in the future. In conclusion, our study highlights the potential of machine learning models to predict bankruptcy, using a dataset of financial ratios from public companies. By using a range of algorithms, we were able to demonstrate the effectiveness of these models in identifying potential financial distress and predicting bankruptcy. We believe that future research could build on this work by applying more advanced algorithms, testing additional financial ratios, and exploring other potential features of interest. The proposed methods were successful in predicting a company's bankruptcy thereby saving company from getting bankrupt.

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Stochastic: Deep Learning and Sentiment Analysis-Based Cryptocurrency Price Prediction

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***Abstract*—Peer-to-peer trade structures known as advanced types of cash use the secure hash algorithm (SHA)-256 and message digest (MD)- 5 to defend data moves. Bitcoin costs are very unsound, show stochastic approach to acting, and have achieved eccentricism. They have for the most part supplanted customary speculation vehicles like metals, bequests, and the securities exchange and are much of the time utilized for venture. The making of a dependable determining model is fundamental because of their business importance. Yet, it's difficult to anticipate bitcoin costs since it relies upon other digital forms of money. Machine learning(ML) and deep learning models, as well as other inclination based market procedures, have been utilized by different examiners to evaluate bitcoin values. Since all digital currencies fall under a similar class, an adjustment of the cost of one cryptographic money might influence other cryptographic forms of money. To expand the framework's viability, the analysts additionally consolidated feelings from tweets and other online entertainment locales. DL-Gues, a creamer and solid construction at predicting computerized cash costs that thinks about its dependence on other cryptographic types of cash and market sentiments, is presented in this paper as an inspiration. Utilizing Run, Litecoin, and Bitcoin tweets and cost accounts as endorsement, we explored Run cost assumption. Utilizing the worth history and tweets of Bitcoin, Litecoin, and Bitcoin, we interpreted finishes for the assumption for the expense of Bitcoin-Cash to survey whether DL-Gather could be applied to extra advanced monetary standards.**

Keywords—Complex systems, crypto currencies merged into one, price prediction, VADER, sentiment analysis, deep learning, and systems of systems

I. INTRODUCTION

A cryptographic cash is a sort of electronic money planned for use in customary trades. To keep financial transactions secret, it employs cryptographic algorithms like SHA-256 and MD-5. Currently, financial transactions can only be carried out with the assistance of third-party institutions like banks; however, cryptocurrency removes this requirement. Society's acceptance of cryptocurrencies is growing. It was firstpresented in 2008 as Bitcoin, determined to supplant the entire cash trade framework with a widespread computerized cash framework [1]. To make the framework straightforward, secure, and decentralized, this recently built monetary framework is free of incorporated monetary establishments like banks, legislatures, and different associations. To stay aware of the consistency and trustworthiness of the system, understanding procedures like proof-of-work (PoW), proof-of-stack (PoS), and others were made. When it first started, the rates for exchanging coins were extremely low. However, its market tends to grow over time due to its volatility. Up until April 2021, there have been approximately 4200 cryptocurrencies on the market, with a $2.23 billion market cap. With 78% and 12%, respectively, of the total, Bitcoin and Ethereum are the most significant contributors [2]. Numerous individuals, investors, and businesses have made direct or indirect investments as a result of the rise in the bitcoin market [3]. The surge in the bitcoin market is unsettling due to its unpredictability. Over time, the value of cryptocurrencies fluctuates significantly. In less than a decade, the price of Bitcoin has increased from $0.08 in 2010 to $64000 in April 2021 [2]. Ethereum costs went from $0.67 in January 2018 to

$2346 in April 2021 [2] in accordance with a similar example. The bitcoin market's unpredictability can be made sense of by these examples. The price of rival digital currencies, volume, difficulty of mining, popularity, and other factors all contribute to the volatility of crypto currency prices.

The efficient market hypothesis (EMH) and the alternative market hypothesis (AMH) have been utilized by researchers from wherever the world to analyze the models and eccentricism of the bitcoin market. As indicated by the EMH speculation, the costs at which cryptographic forms of money are exchanged are in every case fair and mirror the data that is all suitable. Also, as the mining task turns out to be more troublesome, the connected money's worth will rise [4].

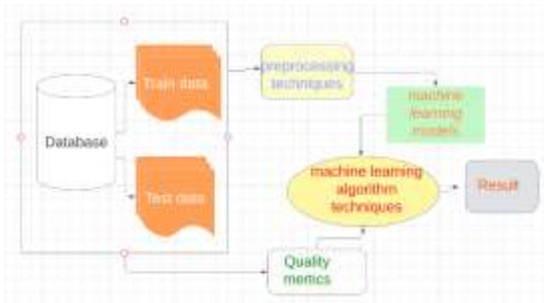

Fig.1: Model development

However, this theory does not work in practice, so a new theory, AMH, which incorporates behavioural finance, was developed to address its shortcomings. Even though the authors of [5] are incorrect, we may still be able to achieve favorable outcomes by utilizing EMH.

II. LITERATURE REVIEW

[3]Stochastic neural networks for cryptocurrency price prediction: With the headway of blockchain innovation lately, the use of digital currency has expanded essentially. Then again, because of the market's high instability and cost variance, digital forms of money are not viewed as a venture

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an open door. Because of their deterministic nature, the majority of the digital currency cost anticipating strategies portrayed in the writing may not be appropriate for ongoing cost expectation. To foresee bitcoin values in light of the previously mentioned issues, we give a stochastic brain network model. Irregular walk hypothesis, which is every now and again used in monetary business sectors to show stock costs, fills in as the establishment for the proposed strategy. The proposed approach applies layer-wise randomization to the noticed brain network highlight actuations to copy market unpredictability. There is likewise a method for learning the example of market response in the expectation model. On Bitcoin, Ethereum, and Litecoin, we showed the Long Short- Term Memory (LSTM) and Multi-Layer Perceptron (MLP) models. The revelations show that the proposed model performs better contrasted with deterministic models.

[5]Efficiency in the markets of crypto-currencies: We demonstrate that the five major cryptocurrencies' market efficiency varies significantly over time. Prior to 2017, most bitcoin exchanges were ineffective. This is supported by recent field results. However, between 2017 and 2019, the bitcoin markets became more efficient. This is contradicted by other, more recent findings on the subject. We use a larger sample size than previous studies for one reason. We use a rigorous efficiency measure to determine whether or not the efficiency is significant, which is another important reason. Litecoin is the most productive digital currency by and large, while Wave is the most un-proficient.

[6] Cryptocurrency price prediction using news and social media sentiment: A paper endorsed by Satoshi Nakamoto under the pen name Nakamoto was the way the world previously found out about Bitcoin. In the years that followed, a significant number of other cryptocurrencies were created as a result of its enormous popularity. The market's extremevolatility, which has piqued the interest and engagement of numerous individuals, primarily for profit, is largely to blame for this exponential rise. Bitcoin fans every now and again utilize web-based entertainment stages, the most well known of which is Twitter, to share and find out about news and thoughts. We examine how Twitter sentiment research can be used to anticipate changes in bitcoin price in this paper. We started by social affair tweets and cost information for seven of the most famous digital currencies, which we then handled to do feeling investigation involving Valence Mindful Word reference for Opinion Thinking (VADER). The Granger Causality test was followed by the Augmented Dicky Fuller (ADF) and Kwiatkowski Phillips Schmidt Shin (KPSS) tests for time-series stationarityassessment. Considering a bullishness extent, Ethereum and Polkadot were seen as obvious, despite the way that inclination in Bitcoin, Cardano, XRP, and Doge radiates an impression of being influenced by cost differences. Last but not least, the predictability of price returns is investigated through the use of Vector Autoregression (VAR), with estimates that are remarkably precise for two out of the seven cryptocurrencies. The price estimates for Polkadot and Ethereum were 99.17% and 99.67%, respectively.

[7] Prediction of Bitcoin exchange rate to American dollar using artificial neural network methods: Investments in cryptocurrency trading are growing in popularity. The bitcoin market has been contrasted with the FX and stock trades. However, in order to assist investors in making investment decisions regarding bitcoin trading, a prediction tool is required due to its volatility. In today's stock and currency market forecasting, methods that are based on the computation of Artificial Neural Networks (ANNs) are frequently utilized. Case studies in stocks and forex have been the subject of a lot of ANN predictor research, but cryptocurrency has not been the subject of any. This study therefore examined a variety of ANN strategies for predicting Bitcoin's market value, one of the most well-known cryptocurrencies. A model that can predict the end worth of Bitcoin the following day (following day figure) will be made using ANN methodologies. Backpropagation neural network (BPNN), genetic algorithm neural network (GANN), genetic algorithm backpropagation neural network (GABPNN), and neuro-evolution of augmenting topologies (NEAT) are the four ANN methodologies broke down in this audit. The methods are overviewed thinking about their accuracy and flightiness. The assessment showed that BPNN is the best technique, with a MAPE of 1.998 0.038% and a readiness time of 347 63 seconds.

[8]Machine learning models comparison for bitcoin price prediction: Lately, Bitcoin has transformed into the main advanced cash. Be that as it may, Bitcoin costs have varied extraordinarily, making guaging troublesome. Subsequently, the objective of this study is to utilize an assortment of ML procedures to find the most reliable and viable model at foreseeing Bitcoin costs. Using 1-minute stretch trade data from the Bitcoin exchange site bitstamp between January 1, 2012 and January 8, 2018, different backslide models were surveyed. The R-Square (R 2) was just probably as high as 99.2 percent, and the Mean Squared Error (MSE) was overall around as low as 0.00002.

III. Inference from the Survey

The references provided various aspects of cryptocurrency, including the technology behind it, market analysis, and price prediction using machine learning techniques.

- the foundation for the cryptocurrency ecosystem and the technical aspects of the Bitcoin network
- Understood how stochastic neural networks or stochastic model play a key role in improving the accuracy
- the relationship between Bitcoin mining energy costs and its price. It has been comprehended that there exists a correlation between the two factors, and a potential consequence of increasing energy expenses is the reduction in the value of Bitcoin..
- explored the efficiency of the cryptocurrency market and investigated the presence of market anomalies. The authors find evidence of market inefficiencies and suggest that investors can potentially profit from these anomalies.

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IV. Methodology

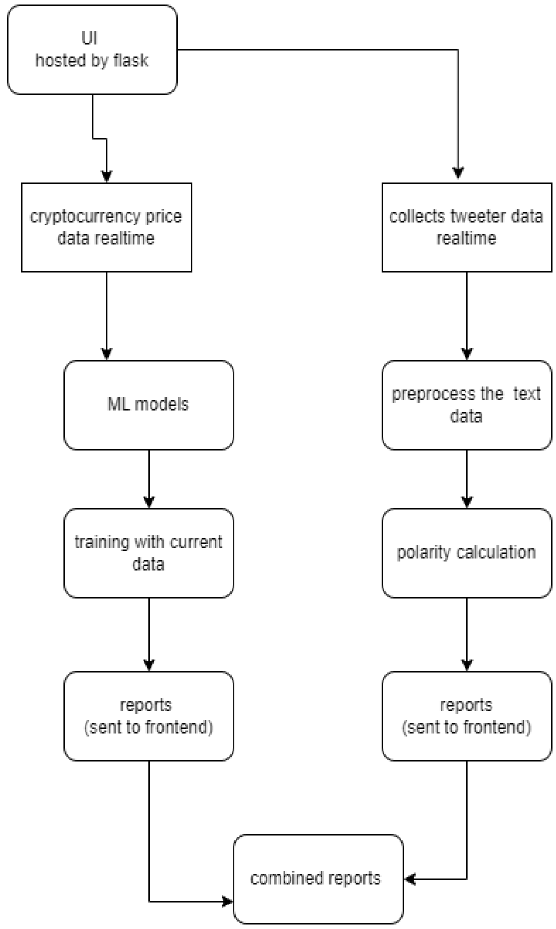

Fig.2: Block Diagram of Crypto price prediction

The Block diagram (Fig 2) depicts that the complete application was deployed on a Flask server. The application utilizes APIs to obtain real-time price data, which is used for the development and training of the machine learning model. After evaluating multiple models, the optimal model(stochastic) that performs exceptionally is selected. Subsequently, the model's performance report is conveyed to the frontend via the respective page. In parallel, the application continuously collects Twitter data in real-time. The preprocessed Twitter data undergoes sentiment analysis to calculate the polarity score, which is then sent to the frontend. The application generates the recommendation based on the outputs from both the machine learning model and sentiment analysis of Twitter data.

The efficient market hypothesis (EMH) and the alternative market hypothesis (AMH) have been utilized by experts from wherever the world to look at the models and eccentricism of the bitcoin market. As indicated by the EMH speculation, the costs at which digital currencies are exchanged are in every case fair and mirror the data that is all suitable. Moreover, the mining undertaking's intricacy will build the connected cash's cost. However, this theory does not work in practice, so a new theory, AMH, which incorporates behavioural finance, was developed to address its shortcomings. Nonetheless, while the authors' findings may be accurate, we may achieve favorable outcomes using EMH.

A. *Disadvantages*

1. The connected cryptocurrency's price will rise intandem with the mining task's complexity.
2. Using EMH in the manner that the authors do is still possible, but it is incorrect.

ML and deep learning models, as well as other assessment based market approaches, have been utilized by different experts to evaluate bitcoin values. Since all digital forms of money fall under a similar class, an adjustment of the cost of one digital money might influence other digital forms of money. To expand the framework's adequacy, the analysts likewise consolidated feelings from tweets and other online entertainment locales, a cross variety and extreme framework at predicting computerized cash costs that thinks about its dependence on other cryptographic types of cash and market feelings, is presented in this paper as an inspiration.

B. *Benefits*

1. In order to demonstrate the effectiveness of Deep Learning (DL) on digital currencies, we conducted a thorough investigation and analysis of two specific cryptocurrencies. Our goal was to showcase the potential of DL in accurately predicting and analyzing the behavior and trends of these digital assets. Through our analysis, we aimed to provide valuable insights into the performance of DL on digital currencies and its potential applications in the field of finance.
2. Our research has shown that the proposed neural network model outperforms previous systems in predicting bitcoin prices. The neural network algorithm that we used utilizes advanced DL techniques to analyze and interpret large amounts of data, resulting in more accurate and reliable predictions than previous models. By improving the accuracy of bitcoin price predictions, our research has the potential to impact the financial industry by providing more informed decision-making tools for investors and traders.

C. *Modules*

To finish the recently referenced project, we arranged the modules recorded underneath.

- Examination of data: We will enter data into the system with this module.
- Data will be added a bonus to this module for dealing with.
- Segregating the data into test and train models: Data will be isolated into train and test models by this module.
- fostering the determining models LSTM, GRU, and ARIMA. The calculation's not set in stone.
- Login and enlistment for clients: Enrollment and login are expected to get to this module.
- Expected input will result from using this module.
- Prediction: The displayed final predicted value

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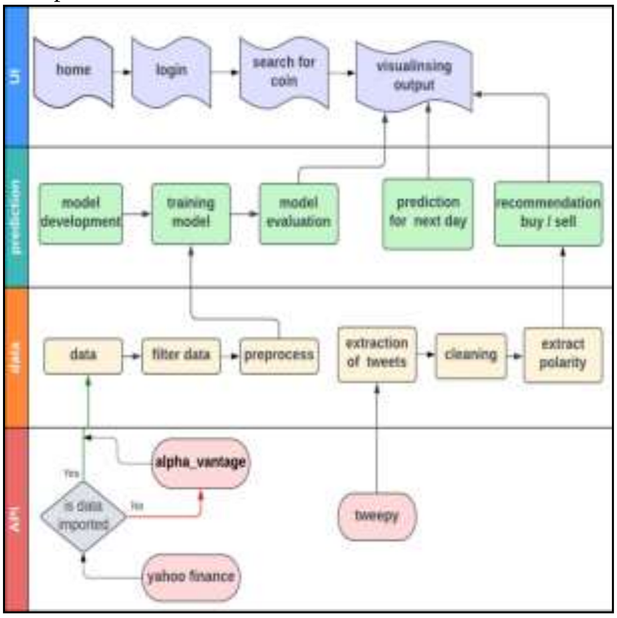

Fig.3: System architecture

The Architecture diagram (Fig 3) shows that the frontend user interface comprises four pages with the capability to navigate to the Login page from the Home page. Upon successful authentication, users can search for a specific cryptocurrency using Yahoo Finance API, and in case of failure, the Alpha Vantage API is used as a fallback. After retrieving the cryptocurrency data, relevant attributes are filtered using data preprocessing techniques before the data is fed into the training model. The trained model can then be utilized to predict the price of the cryptocurrency for the next day, and model evaluation is carried out using testing data. The predicted output for the next seven days, along with the model evaluation, is displayed on the output page. Additionally, Twitter data is obtained via Twitter API and undergoes a cleaning process that involves eliminating stop words, unwanted symbols, and other extraneous data. Using the TextBlob Python library, the polarity of each tweet is extracted and consolidated to determine the overall sentiment of the selected cryptocurrency. Based on the calculatedpolarity and predicted price, a simple recommendation is made to users as to whether they should buy or sell the selected cryptocurrency for the day, and this is displayed on the output page.

V. Implementation

A. Algorithms

CNN + LSTM: While LSTM layers in a CNN-LSTM model predict sequences, CNN layers collect features from input data. A period series is a fleeting information grouping that is frequently utilized for consecutive information. LSTM was chosen as the DNN algorithm because it does a good job with sequences. When looking for information about a neighborhood, like in a picture, CNN is often helpful.

LSTM: a fake recurrent neural network(RNN), long short- term memory (LSTM), and uphold learning incorporate a profound getting the hang of designing. For applications that request time series and groupings, LSTMs are a practical decision.

GRU: Kyunghyun Cho et al. cultivated the tedious cerebrum network gating technique known as gated recurrent units (GRUs). in 2014. The GRU works similarly to a long short- term memory (LSTM) with a disregard entryway anyway with less limits since it doesn't have an outcome entrance.

Random Forest: Classification and regression problems are common applications of the Random Forest Method, a supervised machine learning method. We are aware that there are a lot of trees in a forest, and that the more trees there are, the stronger the forest is.

Decision tree: For characterization and relapse, a decision tree is a sort of non-parametric directed learning approach. It has a root hub, inward hubs, leaf hubs, and a progressive tree structure.

SVM: SVM is a gathering and backslide friendly oversaw ML computation. They are better organized when we suggest them as backslide concerns. Finding a hyperplane in a N-layered space that totally portrays the data centers is the goal of the SVM method.

MLP: One more innovation for ANN with numerous layers is the multi-layer perceptron (MLP). While a single perceptron may manage clear direct challenges, it isn't particularly acclimated to non-straight applications. MLP could be utilized to manage these troublesome issues.

Voting classifier: A voting classifier is an ML assessor that gains from the consequences of many base models or assessors and makes forecasts in light of them. For each assessor yield, gathering models might be matched popularity based decisions.

ARIMA: ARIMA models are normally alluded to as ARIMA (p,d,q), where p addresses the autoregressive model request, d shows the level of differencing, and q addresses the moving- normal model request. ARIMA models use differencing tochange throughout a non-fixed time series into a proper one, which is then used to anticipate future characteristics.

VI. Evaluation

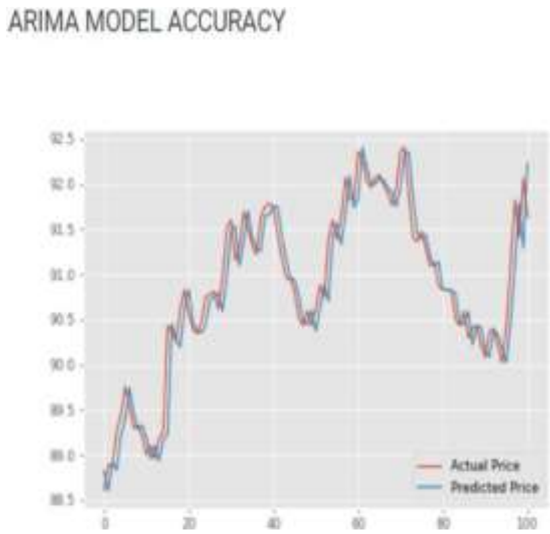

Fig.4: arima model evaluation

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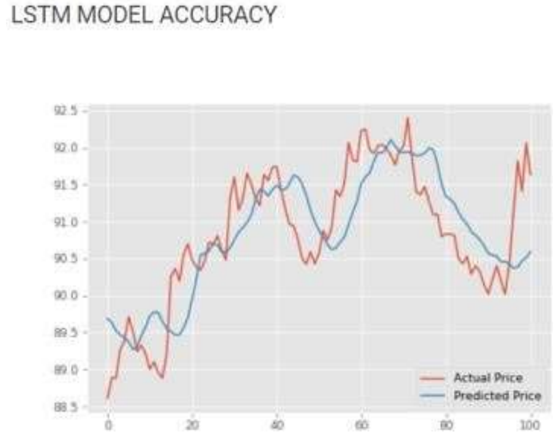

Fig.5: LSTM model evaluation

Fig.6: sample output of twitter data analysis

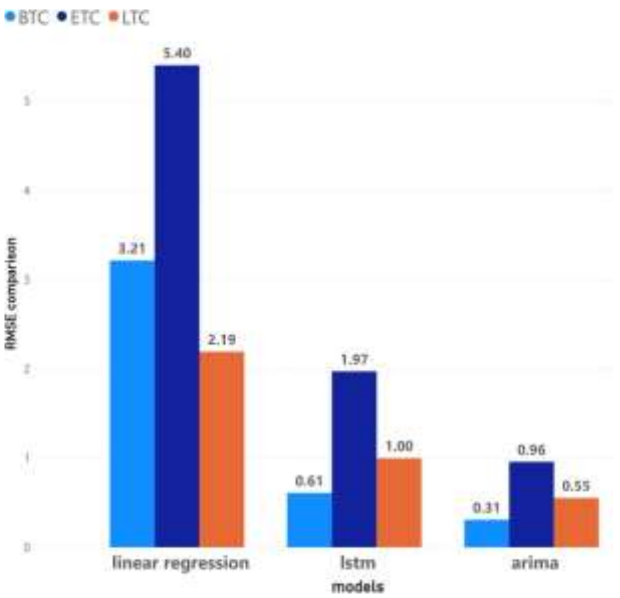

Fig.7: RMSE comparison of different models

VII. Conclusion

We looked at the current methods for predicting bitcoin prices in this post. Fintech organizations utilize various them to exploit the benefits of bitcoin cost forecast calculations. Be that as it may, the market's eccentricism and the various ward parts make expectation troublesome. In this review, we foster DL-Surmise, a half and half model at foreseeing bitcoin costs that considers value history and current Twitter opinions. We analyzed the outcomes, or misfortune capabilities, with past examination to explain DLGuesS's flexibility for two particular cryptocurrencies. The proposed DL-GuesS method outperforms existing algorithms when it comes to predicting bitcoin prices. DL-GuesS.

VIII. Future Scope

- Using blockchain for decentralized prediction markets: You can use blockchain to create a decentralized prediction market, where users can bet on the accuracy of your prediction model. This would create a self-regulating system where users are incentivized to contribute accurate data and improve the accuracy of the model.
- Using blockchain for smart contracts: You can use blockchain to create smart contracts that automate the execution of trades based on the prediction model. This would create a decentralized trading platform that runs autonomously, without the need for centralized intermediaries.

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Underwater Image Enhancement – An Accessible Solution

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***Abstract*—Underwater optical images are insufficient for visual examination or analysis due to their poor colour representation, low contrast, and excessive noise levels. This project suggests a novel method of underwater image improvement that includes colour correction, image defogging/dehazing, image denoising, and object recognition in order to overcome these difficulties.**

The procedure relies on the image_dehazer python library for dehazing, the fastNlMeansDenoisingColored function of OpenCV for denoising, and the Google vision API for object detection. Based on the input image, a filter matrix is created to correct the colour by adjusting the hue and normalising the red, green, and blue channel intensities.

The suggested technique is put into practice using a flask API that is hosted on the internet and usable on low-end computers and mobile devices. In contrast to existing approaches, this technology is highly effective and appropriate for a variety of underwater imaging applications because it does not rely on machine learning or training models.

This research presents an effective method for improving underwater images, suitable for various imaging applications. The sample size of the images used was 890 (Large Scale Underwater Image Dataset). The temporal efficiency of this code is significantly influenced by the dimensions of the input image and the intricacy of the filter matrix. It has potential use in submarine operations for defense purposes such as surveillance and monitoring. The proposed method produces high-quality results while being accessible and cost-effective.

Keywords—Underwater, image processing, denoising, dehazing, color correction.

I. Introduction

Underwater imaging is a complex task because of light attenuation, absorption, and scattering in water. These conditions result in low-contrast and noisy images, making it difficult to extract useful information. Therefore, developing efficient methods to denoise underwater images is crucial to improve their quality and visual appearance.

This paper proposes a new method for denoising underwater images that combines the single-image haze removal method with the dark channel prior (DCP) algorithm and the Fast Denoising Colored Guided Image Filter (FDCGF). The DCP algorithm calculates the transmission map, which quantifies the amount of haze in the image, and then employs it to remove haze and improve image contrast.

The proposed method involves several steps: converting the input image to grayscale, calculating the dark channel of the grayscale image, estimating the transmission map using the DCP algorithm, removing haze from the image based on the estimated transmission map, and finally, denoising the image using the Non-local Means (NLM) algorithm.

The FDCGF algorithm is a fast and efficient method for denoising colored images. The technique employs a guided filter to eliminate noise while maintaining the image's sharp edges and small details. The guided filter is a generalisation of the bilateral filter in which the guidance signal is the input image itself. This allows the filter to adapt to the local structures in the image and achieve better denoising performance.

The DCP algorithm is based on the observation that the dark channel of outdoor images is very low in regions with haze. It calculates the transmission map by assuming that the image's minimal value in a local window corresponds to the image's haze-free parts. On the other hand, the NLM algorithm averages pixels in a local neighborhood based on the similarity between the pixels measured using a weighted average of their intensities.

The suggested method is tested on an underwater image dataset, and the findings reveal that it beats existing methods in terms of objective measures as well as visual quality. The proposed technology has the potential to be beneficial for a variety of underwater imaging applications, including underwater surveillance, marine biology, and oceanography.

The paper's structure includes a literature review of existing methods for denoising underwater images, a detailed description of the proposed method, experimental results, and a discussion of future research directions. [1]–[5][6]

II. Issues And Challenges

Since a decade ago, underwater image processing has received substantial attention due to the physical characteristics of water and its state.

Exercises in identifying and recognising objects underwater have created new challenges. These activities have resulted in considerable issues because of the effects of light absorption and diffusion.

Light attenuation

As light travels through water, it is absorbed and scattered, which results in light attenuation. As a result, there may be colour distortion, less contrast, and poorer imagequality. Light attenuation in water is calculated using the Beer-Lambert Law, which shows an exponential decrease in light intensity with depth. The Beer-Lambert Law can be used to estimate the intensity of light at a

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particular depth and to determine the minimal quantity of light needed to capture a picture at a certain depth, according to a study by Kirk.[7]

$$I = I_0 * e^{(-k*d)} \quad (1)$$

where I is the intensity of the light after it has traveled through a distance d, I_0 is the initial intensity of the light, k is the absorption coefficient of the medium, and the mathematical constant e is roughly 2.718 in value.

A. Water turbidity

Due to light scattering and reduced contrast, water turbidity can affect visibility and image quality. The Mie theory, which takes into consideration the size and concentration of particles in the water, can be used to describe the amount of light dispersed by turbid water. "Mie theory can be used to estimate the scattering of light in water due to particles, which can help predict the visibility and image quality in turbid water," claims a study by Mobley.[8]

$$Q_{ext}=[(2/x^2) * |B(x)|^2] * [(2x^2/(x^2 + 1)^2) + (2/x^2) * |C(x)|^2] \quad (2)$$

whereQ_{ext} is the extinction efficiency, x is the size parameter defined as the ratio of the particle diameter to the wavelength of light, B(x) and C(x) are the Mie coefficients which depend on the refractive index of the particle and the medium, and $|B(x)|^2$ and $|C(x)|^2$ represent the magnitudes of the coefficients squared.

B. Color distortion

The selective absorption of light by water and the scattering of light by water-borne particles result in colour distortion in underwater photographs. The White Balance Equation, a mathematical formula, is used to modify the colour balance of photos to take into account the selective absorption of light in underwater photography. The White Balance Equation can be used to alter the colour balance of underwater photographs and correct for colour distortion brought on by water absorption, according to a study by Kawaguchi.[9]

$$R\_corr = R / R\_w * R\_gw \quad (3)$$

$$G\_corr = G / G\_w * G\_gw \quad (4)$$

$$B\_corr = B / B\_w * B\_gw \quad (5)$$

where R_corr, G_corr, and B_corr are the corrected red, green, and blue channels of the image, R, G, and B are the original red, green, and blue channels of the image, R_w, G_w, and B_w are the white balance values of the image, and R_gw, G_gw, and B_gw are the gains applied to the image.

C. Backscatter

The reflection of light by particles and other suspended objects in the water is what causes backscatter in underwater photographs. Images may become blurry and lose contrast as a result of this. The Volume Scattering Function (VSF), which characterises the scattering of light by particles as a function of angle and wavelength, is the mathematical formula for backscatter in water. "The VSF can be used to estimate the amount of backscatter in water, which can help predict the image quality and visibility in different water conditions," claims a study by Mobley.[8]

$$b(\theta) = C * ((1 - g^2) / (4\pi)) * P(\theta) \quad (6)$$

where C is a constant related to the concentration and size distribution of the particles, g is the asymmetry parameter that describes the angular distribution of the scattered light, and P(θ) is the phase function, which describes the probability of light scattering at a particular angle.

D. Image stabilization

Because the water and things move when being photographed underwater, image stabilisation is a challenge. The Optical Flow Equation, a mathematical formula for image stabilization, defines how objects move inside an image and can be used to calculate the degree of motion blur. The Optical Flow Equation can be used to determine the degree of motion blur in underwater photographs and adjust for camera movement, according to a study by Harvey.[10]

$$I(x,y,t) = I(x+u,y+v,t+1) \quad (7)$$

where I is the image intensity, (x,y) are the spatial coordinates, t is the time, and (u,v) are the optical flow vectors that describe the motion of the objects in the image.

III. Existing Enhancement Methods for Underwater Images

A. Wavelet-based denoising

Wavelet-based denoising is a method that uses wavelet transform to decompose an image into different frequency components, denoise each component separately, and then reconstruct the image. The wavelet transform is a mathematical formula that breaks down a signal into its different frequency components, allowing for the analysis of the signal at different scales. The denoising process involves thresholding each frequency component to remove noise while preserving signal information. The threshold values can be determined using various techniques, such as the universal threshold, the Stein's Unbiased Risk Estimate (SURE), or the minimax threshold. In the end, the denoised frequency components are transformed using the inverse wavelet algorithm to reassemble the denoised image.

B. Dark channel prior algorithm

The DCP algorithm estimates the transmission map of the hazy image, which is a measure of the amount of haze at each pixel, and then uses it to recover the haze-free image. The transmission map is estimated by computing theminimum value of the dark channel over a local window centered at each pixel. This is expressed mathematically as:

$$DC(x)=\min\{\min\{I(y)\}: y\in\Omega(x)\} \quad (8)$$

where DC(x) is the dark channel value at pixel x, I(y) is the intensity value at pixel y, and Ω(x) is the set of pixels in a local window around pixel x. The transmission map is then computed as:

$$t(x) = 1 - w * DC(x) \quad (9)$$

DOI: rp-9788770040723.121

where w is a weight parameter that controls the strength of the haze removal. Finally, the haze-free image is recovered by applying a dehazing filter to the hazy image using the estimated transmission map. The DCP algorithm has been shown to be effective in removing haze and improving the visibility of underwater images.

C. Color Attenuation Prior algorithm

The Color Attenuation Prior (CAP) algorithm is a method for color correction in underwater images that uses the observation that the attenuation of color channels in water follows a particular pattern. The CAP algorithm estimates the color correction matrix that maps the observed color values to the true color values, based on the assumption that the attenuation of each color channel follows an exponential decay with depth. This is expressed mathematically as:

$$I\_observed = A * I\_true \quad (10)$$

whereI_observed is the observed color vector, I_true is the true color vector, and A is the color correction matrix that maps I_observed to I_true. The color correction matrix is estimated by minimizing the following objective function:

$$||\log(I\_observed) - \log(A * I\_true)||^2 \quad (11)$$

subject to the constraint that A is a diagonal matrix with positive diagonal entries, to ensure that the attenuation of each color channel is modeled by an exponential decay. The solution to this optimization problem is given by:

$$A = \mathrm{diag}(\exp(-b)) \quad (12)$$

where b is a vector of parameters that control the attenuation of each color channel. The CAP algorithm has been shown to be effective in correcting the color distortion in underwater images and improving the visibility of underwater scenes.[11]

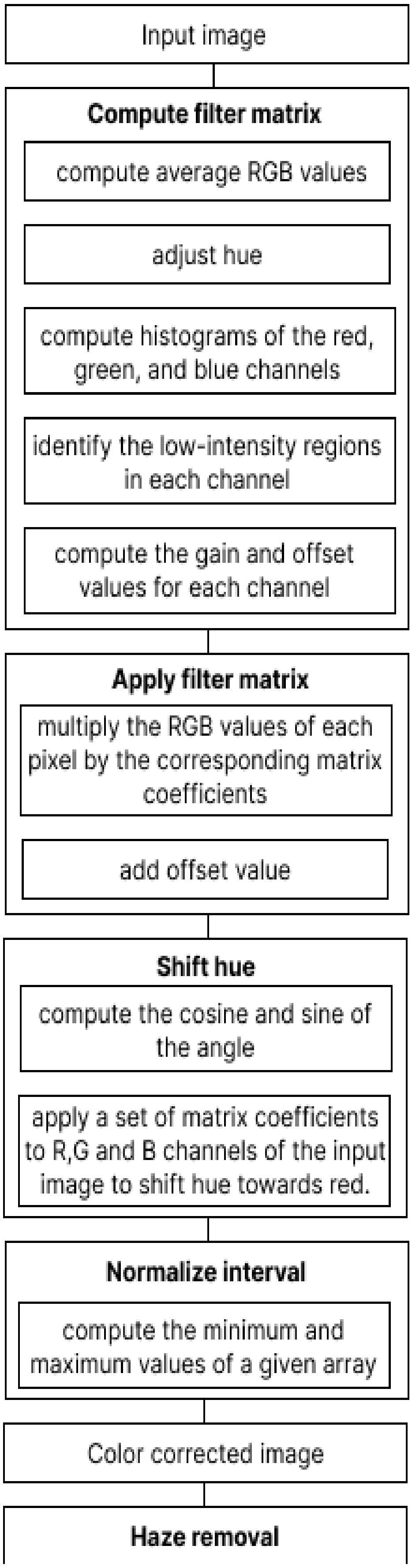
D. Retinex-based methods

Retinex-based algorithms can also be used for color constancy and correction by separating the reflectance and illumination components of an image. Multi-Scale Retinexwith Color Restoration (MSRCR) algorithm decomposes the input image into different scales, applies Retinex-based processing to each scale, and then combines the processed scales to obtain the final image. The mathematical equation for the MSRCR algorithm can be expressed as:

$$I\_final(x,y) = f(\lambda 1 I\_1(x,y) + \lambda 2 I\_2(x,y) + ... + \lambda n * I\_n(x,y)) \quad (13)$$

whereI_final(x,y) is the final image at pixel location (x,y), I_i(x,y) is the processed image at scale i, λi is the weight assigned to scale i, and f is a function that maps the weighted sum of the processed scales to the final image. The MSRCR algorithm has been shown to be effective in improving the color constancy and correction of underwater images, as well as enhancing the overall image quality.

IV. METHODOLOGY



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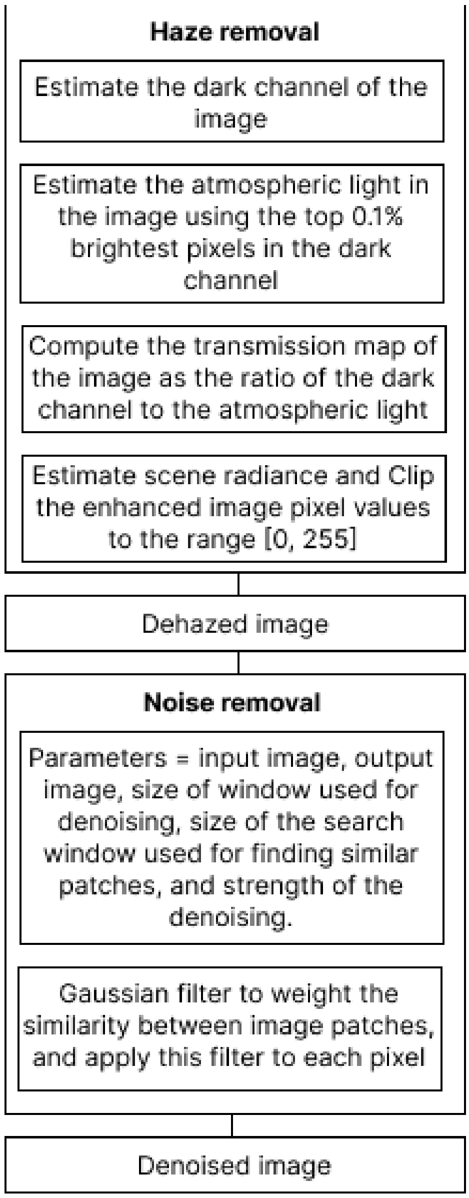

Fig. 1. Flow chart of the underwater image enhancement system.

The steps involved in the algorithm are as follows:

- Capturing and uploading the underwater image as an input to the system.
- Color correction is done by computing the filter matrix, applying the filtering matrix, shifting the hue and normalizing the interval.
- This is followed by dehazing the image using the dark channel prior algorithm.
- Denoising of the image is done using the fastNlMeansDenoisingColored() function in OpenCV which uses the parameters described in figure 1.
- This denoised image is the final image and can be used for object detection purposes.

V. Performance Evaluation

The performance evaluation for the proposed method can divided into two main areas-

1. Qualitative Analysis- The qualitative analysis of the proposed method is purely subjective as the enhanced images can only be observed by humans and the overall improvement purely depends on how a person perceives it. Therefore, it cannot be measured and represented, but everyone can make their own judgement about the same.
2. Quantitative Analysis- For quantitative analysis, 4 metrics have been used to compare the original image to the enhanced image.

A. *Mean Square Error*

It is a standard statistic for determining the quality of an image enhancement technique. It computes the average of the squared differences between the original and improved images. The formula for MSE is:

$$MSE = (1/N) * \Sigma \Sigma [I(i,j) - K(i,j)]^2 \quad (14)$$

where I(i,j) is the pixel value of the original image at location (i,j), K(i,j) is the pixel value of the enhanced image at the same location, and N is the total number of pixels in the image.

B. *Peak Signal-to-Noise Ratio*

It is another another statistic widely employed to assess the quality of an image enhancement procedure. It calculates the ratio of the maximum potential signal value to the noise introduced by the picture enhancement method. PSNR is measured in decibels (dB). The formula for PSNR is:

$$PSNR = 10 * \log10((R\verb|^|2)/MSE)^2 \quad (15)$$

where R is the maximum possible pixel value of the image (for example, for an 8-bit grayscale image, R=255), and MSE is the mean squared error between the original and the enhanced images.

C. *Structural Similarity Index*

It works by comparing the structural information of the images, including luminance, contrast, and structure, to evaluate the similarity between them. It calculates the structural similarity of two images based on three factors: luminance, contrast, and structure. The SSIM mathematical equation is as follows:

$$SSIM(x, y) = [l(x, y)]^{\alpha}[c(x, y)]^{\beta}[s(x, y)]^{\gamma} \quad (16)$$

where x and y are the two images being compared, l(x,y), c(x, y), and s(x, y) are the local luminance, contrast, and structure similarities between x and y, respectively, and α, β, and γ are weighting parameters that determine the relative importance of the three factors.

As a rule, for all three metrics, the higher the values, the higher the enhanced image quality is, i.e., fewer differences between the original and enhanced image. Lower values indicate more differences which further indicate lower quality.

VI. Results And Discussion

Table below shows the quantitative results obtained after enhancing an image. The enhanced image obtained a MeanSquared Error value of 109.60, indicating that there is

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a considerable amount of difference between the noise and haze amounts in the original and enhanced image. The difference in the PSNR value between the original and enhanced image is 27.73 dB. In general, a PSNR value of 30 dB or more is considered good, therefore, there is scope of improvement in the proposed method. The Structural Similarity Index value obtained is 0.102, which means that both the images have a fair bit of difference in their structural information due to the removal of noise and haze as well as the color correction performed. Overall, the proposed method provides satisfactory results in enhancing underwater images.[12][13]

TABLE I.

Quantitative Analysis	**Metric**		
	MSE	***PNSR***	***SSIM***
Original	0	inf	-1
Enhanced	109.60	27.73	0.102

TABLE II.

Original	
Enhanced	

VII. Conclusion And Future Scope

In this paper, an approach for denoising underwater images using a combination filter to perform color correction, Single Image Haze Removal Using Dark Channel Prior (DCP), and Fast Denoising Colored Guided Image Filter is proposed. The proposed method effectively removes noise and enhances the contrast of the underwater images; however, the method can still further be optimised as can be seen from the low PSNR value obtained. The experimentalresults show that the proposed method can be applied to various underwater imaging applications, such as underwater surveillance, marine biology, and oceanography without using high computational energy and in a short amount of time.

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An Internet of Things-based auto-parking locate-detection system

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***Abstract*—One of the biggest issues with urban transportation is traffic congestion since it results in enormous energy use and air pollution. One of the main causes of traffic bottlenecks is the lack of open parking places. Parking and congestion go hand in hand since looking for a location to park causes further delays and boosts local traffic. 10% of traffic circulation in the middle of big cities is caused by cruising, as vehicles spend over 20 minutes looking for free parking. In order for cars to be aware of the location, time of day, and occupancy of parking lots in advance, it is essential to establish a system for predicting the quantity of available parking space. In this study, we proposed a parking spot availability prediction system based on artificial neural networks that makes use of the Internet of Things (IoT), cloud computing, and sensor networks (ANN). To assess the effectiveness of artificial neural networks, we utilize the dataset from Birmingham parking sensors. Following the application of the ANN model to the dataset, we will attempt to utilize RNN to determine which model will provide us with the maximum accuracy or be the best match for our dataset. The results of the experiments demonstrate that the suggested model performs better than the most recent prediction models.**

I. Introduction

The highest population increase in contemporary times has been seen in the major cities in the globe as a result of the ongoing migration of rural residents to urban regions. Two-thirds of the global total will reside in cities by 2050, predicts the UN Population Division. In fact, in order to promote smart city initiatives and cutting-edge technologies, we need a worldwide urban infrastructure. In response to growing urbanization concerns, advances in sensor and sensor network technology have led to the establishment of a new governance paradigm that may be utilized to design, execute, and support environmental development systems.[1,2,3,4]. Promoting environmentally friendly urban mobility and easing traffic congestion, especially when parking spaces are few, are the two principal barriers to urban growth.[5,6].

As technology develops, the IoT as well as deep learning concepts may be used to improve smart city design. This will enable us to address urban transportation issues on a constant basis and provide communities with infrastructure that is resilient from an economic, environmental, and social standpoint. Citizen[1]. Today's highly developed technology aids drivers by delivering information about accidents, road conditions, accidents, and alternative routes, typically in the form of mobile applications. Parking is still a challenge since there are so many cars on the road. As [7] shows how hunting for a parking space results in several liters of petrol being wasted by automobiles. Usually, 30% of his traffic is caused by him looking for an empty parking spot. As shown in [5], drivers waste an average of 3.5 to 14 minutes trying to find a parking space. Moreover, it leads to traffic jams, fuel consumption, air pollution, and driver irritability, all of which are detrimental to sustainable development. Knowing in advance which parking spaces are available in this scenario may help to resolve the problem. This problem may be resolved by employing deep learning algorithms and IoT integration to predict parking lot availability and occupancy with high accuracy.

ANN is an artificial adaptation system inspired by: Functional processes of the human brain. It is a system that can change the internal Structures related to functional goals. They are Especially suitable for solving non-linear problems, to be able to reconstruct the applied fuzzy rules Best solution for these problems. [13]

Recurrent neural networks (RNNs) are a type of neural network that makes use of the sequential nature of the input[9]. Text prediction, POS tagging, and power utilization are just a few of the time-sensitive applications that regularly make use of RNNs. Time-dependent inputs are a feature that many problems have in common. In other words, event estimates are based on previous occurrences. Parking lot occupancy and occupancy duration are time-series concerns [5,8]. The time of day, the completion of the prior event, and crowd sensing all have a significant impact on each parking event [11,12]. So, it is possible to anticipate parking lot time and occupancy using RNNs.

II. Related Work

It's a significant inconvenience for vehicles to look for a parking spot in a highly congested city. There could be major backups if there isn't enough parking. Several researchers in the field of computer vision have recently discovered the promising new topic of autonomous smart parking systems. [14] We demonstrate that our method is more accurate than image-based instance segmentation alone, and that it beats industry standards that depend on more expensive sensors like radar. Our technology's scalability to a whole city and its ability to deliver sophisticated data beyond basic binary occupancy rates are both encouraging developments. [15] Controllers and Infrared Sensors - Increasing population and automotive manufacturing necessitate the construction of parking garages and other parking facilities. Drivers in major cities, especially during rush hour, are growing increasingly upset by parking problems that are rapidly escalating as a result of the rising number of vehicles on the road. [16]

The urban population has exploded during the last several decades. Migration from the countryside is a key factor in this issue, and it is particularly severe in developing countries like Morocco. It's common knowledge

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that today's youth would rather not live in the country but instead in the city, where they can take advantage of the many services and employment possibilities it provides. Urban overcrowding has a negative impact on a variety of municipal services. [17] The requirement for parking spaces is steadily growing as a major problem in modern society. We still use a time-consuming and inefficient manual system for parking vehicles in India, which necessitates turning on the lights whenever someone has to stop their automobile. The lack of a standardized parking scheme also causes problems. [18,19] The increasing popularity of linking disparate smart objects for the sake of Internet of Things applications has led to an increase in the communication density of wireless sensor networks. More people using the same unlicensed radio channels will create congestion, prompting research into better ways to manage the airwaves and save power, such as transmission power control. Several popular protocols increase energy usage to reduce interference (such as packet loss, delay, and energy waste). [20]

Several facets of society have been boosted, and the general quality of life has improved, as a result of the Internet of Things' rapid ascent and continuous growth (IoT). Numerous global cities are seeking the creation of "smart" infrastructure. Citizens of "smart cities" often appreciate intelligent parking solutions since they save time, money, and the environment. Intelligent parking system designs conform to specific rules (sensors, communication protocols, and software solutions). [21]Future data-driven traffic flow efficiency in smart cities will be facilitated by the widespread deployment of IoT - based autonomous car categorized systems, which will also transform the road network into a dynamic to sense Cyber-physical System (CPS). There have been several concepts for traffic sensing systems, but none of them now satisfy all of the requirements (such as accuracy, robustness, cost-effectiveness, and privacy protection) simultaneously. [22] Using fog computing, this research presents a new smart parking architecture meant to improve upon current real-time parking solutions. The fog nodes of a parking lot and garage work together to communicate parking availability and handle requests in real-time. By demanding the worldwide optimization of parking request distribution, the cloud-based data center has the potential to expand the value of intelligent parking systems. [22]

Artificial neural networks disclose the basic principles of an issue. Instead of processing data in accordance with established rules, ANNs are data processing systems that use the data they receive to learn the rules governing them. As a result, ANNs are particularly useful for solving issues when we know the pertinent data but are unaware about their correlations. With artificial neural networks, generalization, prediction, and recognition are all possible. If trained with the proper data to identify the hidden rules behind a certain phenomenon, an ANN may correctly generalize to data it has never seen before (new, dirty, incomplete data, etc.). [23,24]

III. Proposed System Setup

The proposed method builds an automated parking system using a microcontroller. Parking lots with IR sensors are placed to reduce the likelihood of accidents by automatically guiding cars to open spots. There is an ultrasonic sensor in each parking space. The ultrasonic sensor checks to see if a car is correctly parked in a designated area. IoT is being used in this project to make the billing process hands-free. Later on we have used ANN and RNN models to compare the accuracy of the FreeParkingSpace available.

Requirement Specifications

A technical description of these requirements can be found in the software product requirements document. The requirements analysis process begins with a list of what the desired software system must be able to do in terms of functionality, performance, and safety. The specifications detail the kinds of user, operational, and administrative scenarios that can arise. A software requirements specification is a document that aims to offer a thorough explanation of the goals, parameters, and outputs of a software development project. The target audience, necessary user interface components, and technical specifications are all laid down here. The document lays out the goals of the project from the viewpoints of the client, the development team, and the target audience.

IV. Hardware And Software Specification

Software Requirement

- Compiler: Arduino IDE
- Language: c, c++
- Google Firebase

Hardware Requirement

- Arduino mega
- ESp8266
- IR -2
- Ultrasonic sensor-2
- Servo motor-2
- RFID reader
- LCD

Architecture Diagram

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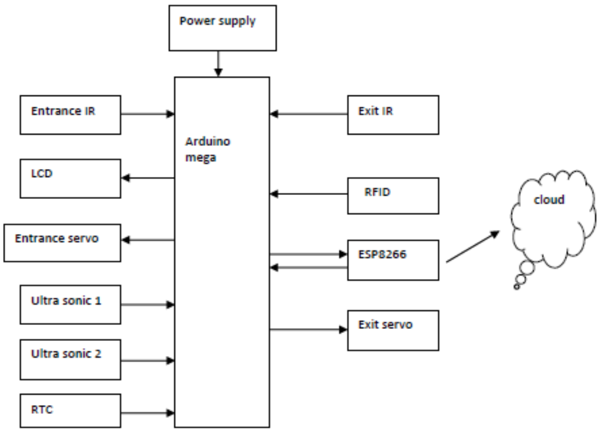
DOI: rp-9788770040723.122

BLOCK DIAGRAM



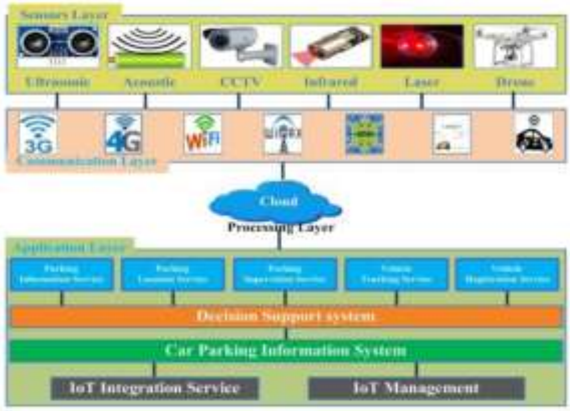
V. BLOCK DIAGRAM DESCRIPTION

Overhead block diagram components include a liquid crystal display, radio frequency identification reader, infrared sensor, ultrasonic sensor, two servo motors, and a real time clock. The infrared sensor, ultrasonic sensor, and servomotor are all wired directly to the GPIO pin of the Arduino mega. Each garage entrance is outfitted with an infrared (IR) sensor. When an incoming vehicle is identified by the entrance IR sensor, the controller will initiate the process and show the parking spot number on the LCD panel. An ultrasonic sensor can tell you whether or not a parking spot is available. A radio frequency identification (RFID) module is used in the financial transaction process. An ESP8266 WIFI chip is used to relay data from the controller to the cloud. Exit IRs are installed to unlock cars from their parking spots

VI. PROJECT INTRODUCTION

This research proposes a sensor-based smart parking availability prediction architecture. The smart vehicle parking system's architecture was used to create the auto parking prediction system. Many parking smart sensors that have been installed at various automobile parking spots are used to collect the parking data. To evaluate the availability of parking spaces at multiple vehicle parking facilities, deep learning techniques have been utilized to aggregate sensing device information from several sites on a cloud. We examine the numerous transportation management activities in a contemporary city, such as parking availability, parking allocation, parking monitoring, vehicle surveillance, and car registration, in order to anticipate the availability of available parking spots using a sensor network.

This is a design for the Internet of Things-based smart parking system that is advised. The sensor layer, the connection layer, the processing layer, and the services layer are its four tiers. The sensor layer uses a variety of sensor types to gather data on vehicle traffic from various parking lots. In the communication layer, sensor nodes are employed to send this data to cloud computing. Using the long-range wide-area network, the gateway received data from sensors (LoRaWAN). The enhanced range of the energy-efficient LoRaWAN technology allows data to be sent throughout the whole parking lot.



VII. IMPLEMENTATION

Here you'll find a rundown of all the maneuvers your car will need to do in order to park properly utilizing our technology.

Step 1: To begin, you must get the smart parking software on your mobile device.

Step 2: The user may see how many spots are open and taken by gazing at the 16x2 display.

Step 3: Once the user has signed in, they will be able to see the parking garage and see which spaces are now taken and which are available.

Step 4: Fourth, if a parking place is available, the user will be alerted by smartphone when he approaches the parking IR detect sensor.

Step 5: Last but not least, if the user attempts to find a parking place and there is none available, the app will inform them.

Step 6: Sixth, once a user utilizes a parking place that has become available, they will be notified of the time and location at which their parking period began.

Step 7: When you're done with your parking session, you may unload your vehicle and get a text message with information on the start and end timings, as well as the total cost, of your parking session.

A. *Keras Library*

Created with a center on spry testing. Getting information from thoughts as rapidly as conceivable is key to great research.Keras is the TensorFlow platform's high-level API.An effective and open interface for understanding advanced machine learning issues with a center on profound learning. It gives basic deliberations and building pieces for creating and executing exceedingly iterative machine learning arrangements. Thanks to Keras, engineers and scientists may take full use of the adaptability and cross-platform capabilities of the TensorFlow stage. You may submit Keras tests to run on a mobile device or in your browser. You can even run Keras on huge clusters of TPUs or GPUs. The Sequential and Dense Keras libraries will be used.

Sequential -Build your model layer by layer using the sequential API. Using a functional API is a different approach for building more complex models. A functional

DOI: rp-9788770040723.122

model can specify several level-shared inputs or outputs. Create a model instance and link it to the plane before you can access the model's inputs and outputs.

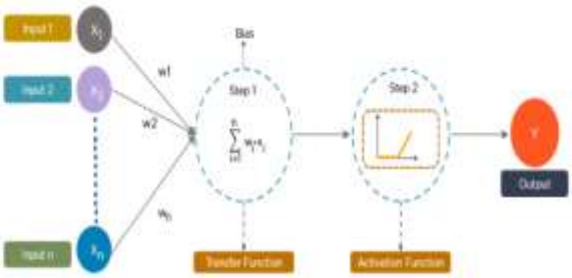
Dense -A layer of the Keras model or neural network known as the keras dense is produced once all connections have been connected extremely deeply. In other words, all of the network's neurons in the bottom layer serve as the dense layer's input sources. The concept, network output, typical methodology, parameters, keras dense example, and conclusion of keras dense will all be discussed in this article.

We execute the neural networks in our project using the Keras library. This library also aids in the creation of the units, or hidden layer, that we need to build for our neural network model. The neural network and its initial layer are created using the sequential function, while further hidden layers that will provide more accurate results are created using the dense function.

B. ANN (Artificial Neural Network)

The operation of the human brain is greatly simplified by ANN models. Artificial neurons serve as computing units, much as the neurons found in the biological nervous system. Input, hidden, and output are the three primary layers of an ANN model. The neurons in the (n + 1)th layer receive signals from all of the neurons in the nth layer. Each connection is given a weight. Each input may be multiplied by the appropriate weight to determine the output. Before producing the final ANN output, an activation function evaluates the output.

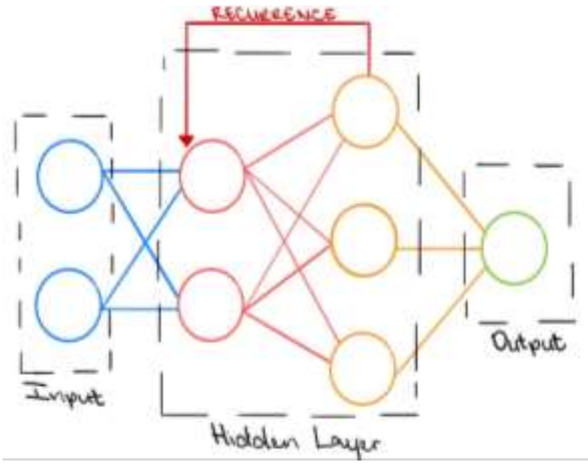
The ANN might be useful for a number of scientific and technical problems. As a result, the ANN is used in a broad variety of applications [3], such as signal processing, image compression, function approximation, differential equations, stock market prediction, and diagnostics.



In our project we use the Artificial Neural Network (ANN) to get the flow of the dataset and to create the hidden layers in between the input and the output layers of the given dataset to learn the dataset and provide the best accuracy out of it.

C. RNN (Recurrent Neural Network)

Artificial neural networks called recurrent neural networks employ time series or sequential data (RNN). These deep learning algorithms are used by Google Translate, Siri, and voice search. Ordinal or temporal issues in speech recognition, picture captioning, and natural language processing are frequently addressed by them (nlp). Recurrent neural networks (RNNs), similar to feedforward and convolutional neural networks (CNNs), learn new information from training input. They differ from other systems because of their "memory," which enables them to use data from earlier inputs to affect the current input and output.



In our project we use the Recurrent Neural Network (RNN) to get the flow of the dataset and to create the hidden layers in between the input and the output layers of the given dataset to learn the dataset and provide the best accuracy out of it.

D. LSTM (Long short term memory)

Long short-term memory is an artificial brain configuration utilized in the realms of manufactured discoveries and profound learning (LSTM). Similar to connections with criticism, LSTM displays feedforward neural networks in a different way. Instead of just preparing single information foci (like pictures), such a repeating neural organism (RNN) may also prepare information groups (such as discourse or video). This property makes LSTM systems perfect for preparing and anticipating information.

VIII. Metrics

A. ANN

Formula:-Y=W1X1+W2X2+b

where , Y= the output neuron or feature

X= the sample feature or the input

W= the weight associated with each features

b= the bias

B. RNN

The RNN model has 3 formulas

The first one is used to determine the current state and is

CS = f(CS-1, IS)

CS -> current state

CS-1 -> previous state

IS -> input state

For using the activation function (tanh), the second formula is

CS =tanh(Wrn * CS-1, Wxh * IS)

Wrn -> weight at recurrent neuron

Win -> weight at input neuron

DOI: rp-9788770040723.122

The third formula is used to compute the result.

Ot = Wol * CS

Yt -> output

Wol -> weight at output layer

We have also used some other formulas in our ML model which are

C. Mean

Formula:-

$$\mu = \frac{1}{N}\sum_{i=1}^{N}(x_i)$$

Where μ = mean

N= total number of features

X= features

Example-

For Capacity,

mean = (577+...+1200+…+1920)/35718

= 1397.511003

For Occupancy,

mean = (61+…+854+…+1180)/35718

= 642.2109301

For FreeParkingSpace,

mean = (516+…+346+…+740)/35718

= 755.3000728

D. Standard deviation

Formula:-

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i-\mu)^2}$$

Where, μ = mean

N= total number of features

X= features

σ = Standard deviation

Example

For Capacity,

standard deviation = √[(577-1397.511) 2+…+(1920-1397.511) 2]/35718= 1179.310323

For Occupancy,

standard deviation = √[(61-642.210) 2+…+(1180-642.210) 2]/35718 = 656.9463379

For FreeParkingSpace,

standard deviation = √[(516-755.300) 2+…+(740-755.300) 2]/35718 = 787.538578

E. Standardscaler

Formula:-

$$z = \frac{x-\mu}{\sigma}$$

Where, X= features

σ = Standard deviation

μ = mean

z= Standardscaler

Example

For Capacity,

standardization (1st value) = (577-1397.511)/1179.310 = -0.695

standardization (2nd value) = (1200-1397.511)/1179.310 = -0.167

standardization (3rd value) = (1920-1397.511)/1179.310 = 0.443

For Occupancy,

standardization (1st value) = (61-642.210)/656.946 = -0.884

standardization (2nd value) = (854-642.210)/656.946 = 0.322

standardization (3rd value) = (1180-642.210)/656.946 = 0.818

For FreeParkingSpace,

standardization (1st value) = (516-755.300)/787.538 = -0.303

standardization (2nd value) = (346-755.300)/787.538 = -0.519

standardization (3rd value) = (740-755.300)/787.538 = -0.019

F. **Mean Squared Error**

The mean squared error, sometimes referred to as the mean - square deviation of an estimator in statistics, measures the average of the squares of the errors, or the mean of the squares difference between the two estimated values and the actual value.

Formula

$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_i-\hat{Y}_i)^2$$

MSE = mean squared error

n = number of data points

Y_i = observed values

$\hat{Y}_i$ = predicted values

G. (APE)- Absolute Percentage Error

The difference between the observed and the true value is all that the absolute error, which is utilised to compute percentage error, consists of. When the absolute mistake has been divided by the true value, the percentage error is calculated by multiplying the relative error by 100.

Formula:-

DOI: rp-9788770040723.122

$$\left|\frac{A_t - F_t}{A_t}\right|$$

Where, At = Observed Value

Ft = Predicted Value

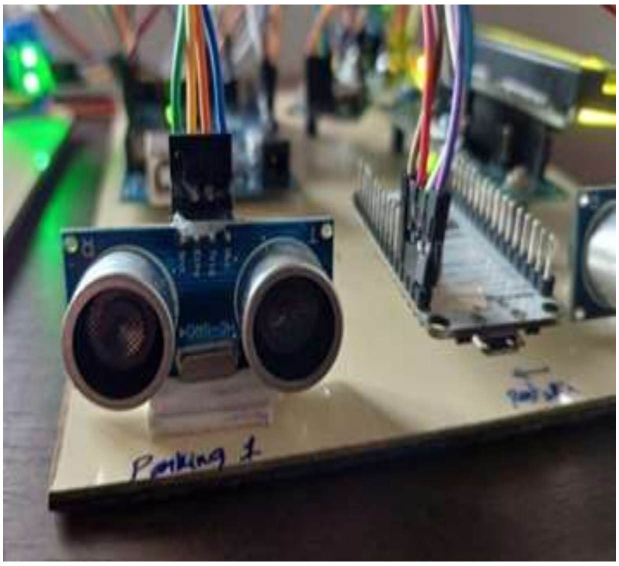
IX. Result And Discussion

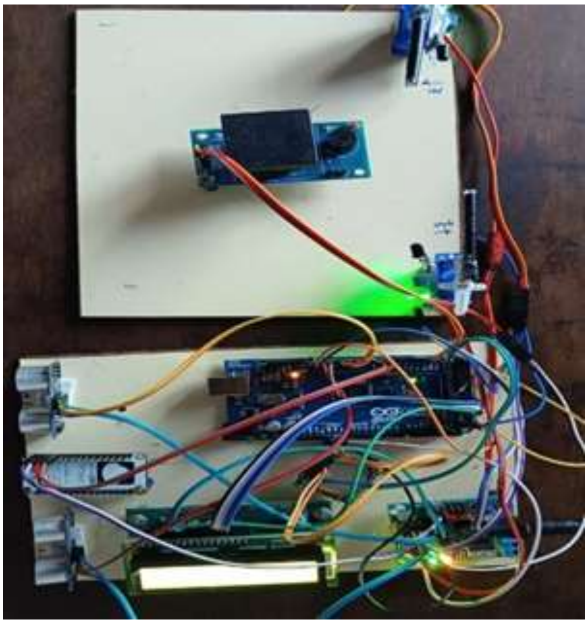
Cars may be parked quickly and easily with the help of an automatic system. The depicted parking arrangement can accommodate up to two vehicles. The required living space is about equivalent to that of a garage big enough to fit two cars. The best option for parking near major shopping centers, office buildings, and other destinations. The framework requires just little assistance to operate normally. The deployed sensors provide a high degree of adaptability and are quite straightforward to integrate into an existing system. The simplest design that achieves the maximum potential degree of automation. It does not rely on there already is a path leading to a quantifiable result. Vehicles must be politely turned around at the entry and departure. The car's safety was the first priority.

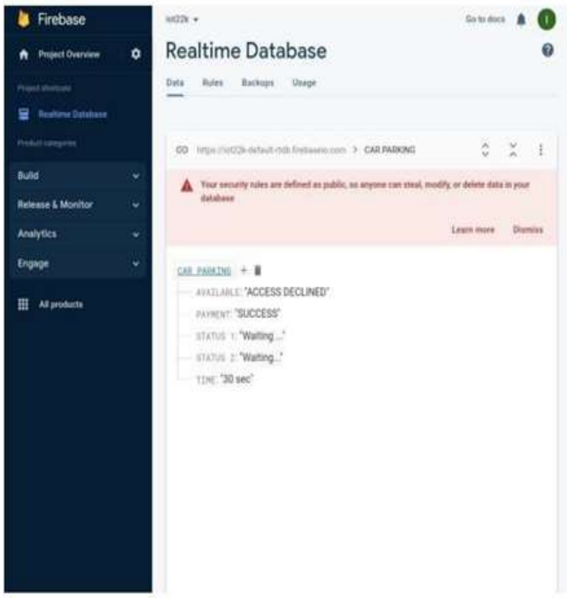
The development of Internet of Things-based smart parking information systems is one of the most significant research fields for the growth of sustainable smart cities. Drivers might find it useful to locate a free parking space nearby. Also, one can save time and effort by accurately and successfully anticipating when a parking place will open up. In this study, we developed an Internet of Things-based smart parking system. This article's main objective is to use sensor data to estimate the total number of easily available parking spaces. To help the car parking information management system with the availability of parking places on a certain day of the week during a specified time period, we have developed a quick and simple decision assistance system.

Using the recommended method, vehicles will be able to locate a parking space at any time and anywhere. We believe that combining cloud services with sensing devices will make the collection and processing of sensor data easier than using traditional techniques. Implementing all of the services (parking position, parking data, parking monitoring, vehicle surveillance, vehicle registration, and identification) stated in the created framework for smart parking is part of the project's continuous effort.The development of several techniques to estimate parking lot availability in real-time using image and video data gathered by various sensors will be the focus of future study.

According to the dataset which is taken we apply the two of the best neural network models that is the Artificial Neural Network and the Recurrent Neural Network in our dataset to get the accuracy of our dataset and compare which neural network gives us the best accuracy for our dataset.







DOI: rp-9788770040723.122

X. Conclusion

A very sophisticated parking sensor system was displayed during the presentation. Without the involvement of the user or the vehicle, it provides real-time parking monitoring and payment. By streamlining the system, investing in infrastructure, and replacing batteries, the sensor system lowers costs while providing advantages in terms of detection and payment dependability. The suggested creative method makes this possible. Further validation tests are being run right now to better improve the system.

XI. General Information About Dataset

Birmingham City's 30 parking lots served as the source of the dataset for deep LSTM network training and testing. A total of 35,718 vehicles can park in the 30 spaces available. There is a full presentation of the dataset for the automobile occupancy sensors.

Features	Descriptions
SystemCodeNumber	A variable that Identifies car park id
Capacity	Variable that contain the capabilities of park
Occupancy	The variable that contains occupancy of park
FreeParkingSpace	Variable that contains the free slots of the park
LastUpdated	Variable that have Date and Time of the measure

The dataset used for testing has "SystemCodeNumber," "Capacity," "Occupancy," and "LastUpdated," among other four properties. The properties "Capacity" and "Occupancy" provide details regarding a parking lot's overall capacity, "LastUpdate" informs you of the most recent time the location's occupied parking spaces were updated, and "Occupancy" provides information regarding the number of spaces that are occupied at any given time. To estimate the availability of free parking lots at a certain hour on a specific day at a specific parking location using a regression model, we created a new feature we term "free parking space." We were able to calculate the value of the "free parking place" by comparing the "Capacity" and "Occupancy" properties. In the regression model created using deep learning, this feature of free parking served as the target variable.

XII. Accuracy

How often a machine learning classification system properly recognises a data point may be ascertained, for example, by looking at the accuracy of the algorithm. Accuracy is measured as the proportion of all data points that were properly anticipated. A more precise definition is the proportion of true positives and true negatives to all true positives, true negatives, false positives, and false negatives. The programme properly identified a data point as true or false as a genuine positive or genuine negative one. Contrarily, a data point that the algorithm misclassified is referred to as a false positive or false negative.

Since we have applied two neural networks on our dataset we got two different accuracy of our dataset.

MODEL	ACCURACY
ANN	50.43
RNN	50.07

The accuracy for ANN model is 50.43

The Accuracy of ANN model is: 50.435713229412244

	Capacity	Occupancy	FreeParkingSpace	APE
0	690.0	302.0	300.944336	56.384879
1	1920.0	543.0	540.291626	71.859811
2	4675.0	3420.0	3420.555664	26.833034
3	1200.0	999.0	999.385010	16.717916
4	2009.0	648.0	645.366455	67.876234

The accuracy for RNN model is 50.07

The Accuracy of RNN model is: 50.07444715013756

	Capacity	Occupancy	FreeParkingSpace	APE
0	690.0	302.0	297.252411	56.919940
1	1920.0	543.0	565.275391	70.558573
2	4675.0	3420.0	3428.657227	26.659738
3	1200.0	999.0	1012.041626	15.663198
4	2009.0	648.0	658.720398	67.211528

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Improved Energy Efficiency in IoT based Smart Energy Meter Reading and Billing System

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***Abstract*- Each household, industry, or other setting that relies on energy must consider this. It is crucial to manage energy well and conserve it when using appliances.**

To do this, much research has been done to create smart lighting systems for rooms to save energy. In a separate study, researchers created an Internet of Things (IoT)-based Smart Home system to track energy use and ward off anomalies.

Researchers have not attempted to automate appliance control to save energy in any studies. Most of them focus on using android devices to operate the appliances. As a result, we have created an IOT-based Smart Energy Meter system that uses information about light intensity and humidity to remotely operate appliances like Bulb at first. Moreover, the system consistently calculates the appliances' daily energy consumption, giving the user insight of how much energy is utilized over time. Moreover, a bill will be created, and the payment window for bills will be available. The Cloud server is updated with this information. Every family may conserve energy with this prototype method.

Thus, cutting-edge technology like smart energy metres and AI-powered power management have the potential to completely change how we use and manage energy. Smart energy metres allow for real-time tracking and monitoring of energy use, giving consumers precise and in-depth data about their energy usage. Using machine learning algorithms to forecast energy usage trends and improve energy use, power management with AI goes one step further. To gather information from energy meters and send it to a cloud-based server for analysis and invoicing, the system employs Raspberry Pi as its central hub. The device removes the need for human meter readings and provides precise, real-time data to utility providers as well as their consumers. From personal residences to industrial facilities, this technology may be used to minimize waste and boost productivity in a variety of scenarios. People may significantly reduce their energy costs and help create a more sustainable future by implementing AI-powered power management solutions. Overall, smart energy metres and AI-powered power management have the potential to revolutionized how we use energy and contribute to the creation of a society that is cleaner, greener, and more sustainable.

I. Introduction

The increase in economic growth often leads to an increase in the utilization of non-renewable energy resources. This is because the demand for energy often increases as economies grow and become more industrialized. Non-renewable energy resources such as fossil fuels, coal, and natural gas have been the primary sources of energy for many countries due to their abundance and low cost. However, their continued use has led to environmental concerns such as air and water pollution, and the release of greenhouse gases that contribute to climate change. Therefore, it is essential for policymakers to balance the need for economic growth with the need for sustainable energy sources, such as renewable energy, to ensure a cleaner and more sustainable future for generations to come.

The use of Raspberry Pi 3 in various research projects has led to the development of innovative IoT applications for temperature and humidity monitoring, smart home monitoring and control, and energy management. The autonomous temperature and humidity [1] management system developed using Raspberry Pi 3 provides an efficient solution for maintaining a comfortable indoor environment without human intervention. Similarly, the smart house monitoring and control system [2] enables users to remotely control various home appliances and monitor their energy consumption. The automatic room lighting and control system [3] developed using Raspberry Pi and IoT technologies provide users with a convenient way of controlling the lighting and ambiance of a room. Finally, the energy management system for smart houses [4] enables homeowners to manage their energy demand and generation simultaneously, leading to efficient energy usage and cost savings. Overall, the use of Raspberry Pi and IoT technologies has shown great potential in developing innovative solutions for various applications in smart homes and energy management.

Regretfully, no investigation has contributed to the development of a system for controlling the use of electrical appliances based on environmental conditions, which may eventually reduce domestic energy usage. A system like this might incorporate IoT and machine learning to optimise energy use based on environmental factors like temperature, humidity, and illuminance. To create new solutions that make most of cutting-edge technology and tackle the society's rising energy usage issues, more research in this area is required.

Below is the arrangement of the remaining parts. The related work to the research study can be found in Section II.

Our proposed IoT-based system is described in detail in the third part, along with a data flow diagram and a schematic flowchart showing how the entire system operates. The prototype is examined in conjunction with hardware and software design in the fourth step. The recommended structure is covered in Part V, and the metrics are covered in Section VI. Section VII contains a summary of the results and discussions. In section VIII, the conclusion and future work are addressed.

II. Related Work

DOI: rp-9788770040723.123

In recent years, there has been a growing interest in developing smart energy meter systems that can accurately monitor and manage energy consumption in residential and commercial buildings. The emergence of the Internet of Things (IoT) has further enabled the development of such systems by providing the necessary infrastructure for connecting a large number of energy meters to the internet and enabling real-time data analysis.

Machine learning (ML) algorithms have also been extensively used in smart energy meter systems to analyze the large amounts of data generated by these devices and provide useful insights for optimizing energy consumption. In this section, we review some of the relevant literature on IoT based smart energy meter systems with ML.

A study by M.Lavanya et al. (2016) proposed a model that utilizes IOT technology and linux OS along with C++ to import temperature and humidity information. The proposed system sent the data collected via the sensors over the internet. This acts as basis for out project as we utilize the varied sensors to collect light intensity, temperature and humidity readings.

Another study by Wang et al. (2020) proposed an IoT based energy management system that used a combination of deep learning and reinforcement learning algorithms to optimize energy usage in commercial buildings. The proposed system used a deep neural network to learn the energy consumption patterns of the building and a reinforcement learning algorithm to provide optimal control actions for reducing energy consumption. This system utilizes deep learning to understand energy usage patterns and thus, utilize this information to optimize usage of energy resources.

In a study by Kim et al. (2020), proposed a hybrid IoT and machine learning algorithms are used in a cloud-based energy administration system to determine how much energy residential appliances would spend. The system employs smart plugs that monitor energy consumption and send data to a cloud-based server. The data is then analyzed using machine learning algorithms to predict energy consumption patterns for different appliances.This study highlights the potential of machine learning algorithms and IoT technologies in developing innovative solutions for energy management, and further research in this area could lead to significant energy savings and a more sustainable future.

Finally, a study by Gitanjali et al. (2021), proposed an IOT based Smart Electricity Energy Meter system to manage residential energy consumption in smart grid infrastructure. This presented a futuristic and nontraditional approach to traditional energy meters. It provides real-time data and analysis of energy consumption, which can help users to make informed decisions about their energy usage.

Overall, these studies demonstrate the effectiveness of using IoT based smart energy meter systems with ML for optimizing energy usage and reducing energy consumption in residential and commercial buildings.

III. PROPOSED SYSTEM SETUP

The management of electrical failure dangers and appliance control have been the main areas of attention for existing Smart Home and Energy Management systems. There hasn't been any research that has led to the creation of a system that monitors the environment, adjusts appliance usage as necessary, and warns the user when the humidity level rises. We have developed an IoT-based system that makes use of environmental sensors, such as those for temperature and light intensities, that in turn deliver data to a Raspberry Pi 3. Machine-to-machine communication, often known as IoT, is a recent development. Based on the detected measurements, the Raspberry Pi is set up to manage how much energy is used by the appliance.

In addition to controlling appliance use, the total power consumed by each appliance is calculated on a regular basis and graphed using the DHT11 and communicated to the Raspberry Pi3. In ThingSpeak, there is graphic data showing how time and power use for all appliances operating in various environments relate to one another. This data can then be further utilized to identify insights on consumer consumption habits of energy.

Fig. 1 presents the system design of an IoT-based Energy Management system.Fig. 7 illustrates the Data Flow Diagram (DFD) of the system, which shows the flow of data between different components of the system.Fig. 8 presents the Use Case diagram of the system, which shows the different scenarios and interactions between users and the system.

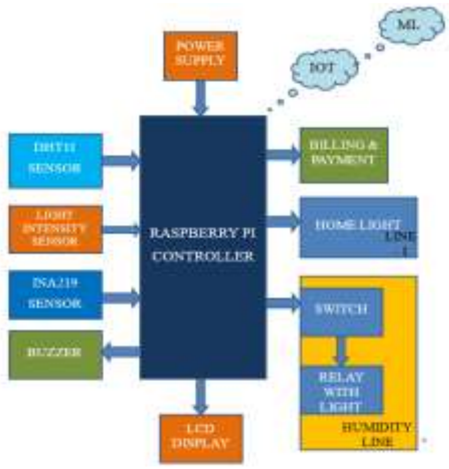

Fig. 1: IoT Based Smart Energy Management System

The DHT-11 SENSOR sensed data are used as the project's initial input (Take temperature and humidity readings) The DHT11 sensor uses a single wire to serially measure and transmit temperature and humidity measurements. It is capable of measuring temperature in degrees Celsius between 0 and 50°C as well as relative humidity (20 to 90% RH) in percentage form. One of its four pins is utilised for serial data transfer.The LDR sensor should then be read for light intensity.

The Raspberry Pi is an inexpensive Linux computer with a set of GPIO (General Purpose Input/Output) ports

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that allow you to communicate with electronic devices for computing, physical and scientific Internet of Things (IoT).

Here, if the LDR falls below or equals the threshold (i.e., LDR =40000), "NIGHT TIME" is shown on the display screen, and the LED is switched "ON." Light is produced by a semiconductor device called a light-emitting diode when current flows through it. DHT11 valuations are produced when the energy that was previously stored in the semiconductor's electrons and electron holes is once again released.

The INA219 is essentially a current sensor, it senses current and outputs power and voltage when the LED is on.

A current/power monitoring module with zero drift and bi-directional operation, the INA219-based Current Sensor Module CJMCU-219 uses the I2C interface. It has the ability to simultaneously measure shunt voltage, current, and power and send the information through the I2C protocol. For the purpose of enabling current measurements, it features a 0.1 Ohm, 1% shunt resistor. Its robust 12-bit ADC effectively translates the current measured by a precision amplifier. The resolution is 0.8mA, and the current sensing range is 3.2A.

Fig. 2: Proposed system circuit

Instead, if the LED is not glowing, keep taking measurements and sending them to ThingSpeak. Sending sensor data to the cloud is possible using the IoT Cloud platform ThingSpeak. You may create Internet of Things apps and gather and store sensor data using the Web Service (REST API) that is included. MATLAB, Raspberry Pi, and Arduino are all compatible with it (premade libraries and APIs 18 exists). But, as it makes use of a REST API and HTTP, it ought to be compatible with any programming languages.

Energy is then computed, and a new bill is created. The user's Interface is created using the Tkinter package. Tkinter is the primary GUI Python module. Python along with Tkinter can be employed to create GUI programs quickly and effortlessly. Tkinter is a Python library used for building desktop applications with a graphical user interface. It provides tools for creating windows, buttons, and other widgets to interact with the user. Tkinter offers a sturdy object-oriented gateway for the Tk Modules. To pay a bill via the Twillio API, an SMS is then delivered to the user.

Fig. 3: Day-time output

Fig. 4: Night-time output

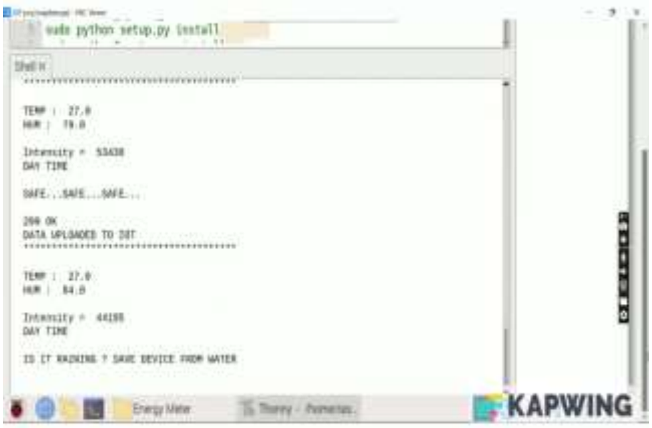

Fig. 5: High Humidity output

Twilio is a cloud communications provider that offers a web API that lets customers create phone, VoIP, and SMS apps using common web languages. As a result, the user is presented with the Graphic User Interface for bill payment.

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The programme execution halts upon a successful payment completion.

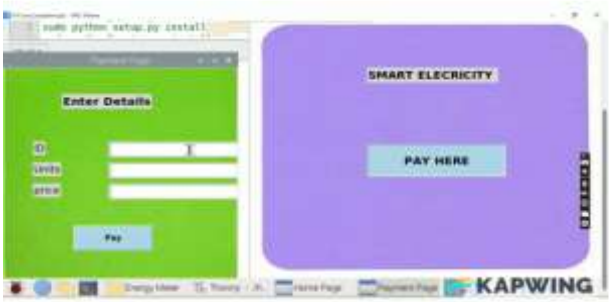

Fig. 6: Bill paying system interface design

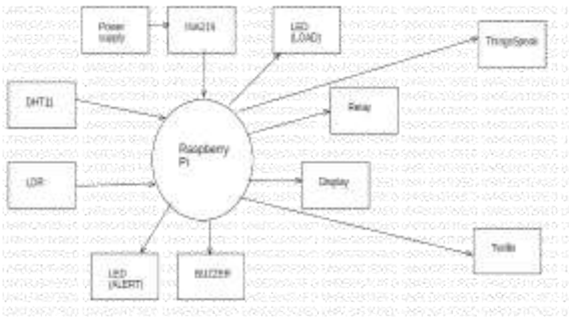

Fig. 7: Data Flow Diagram

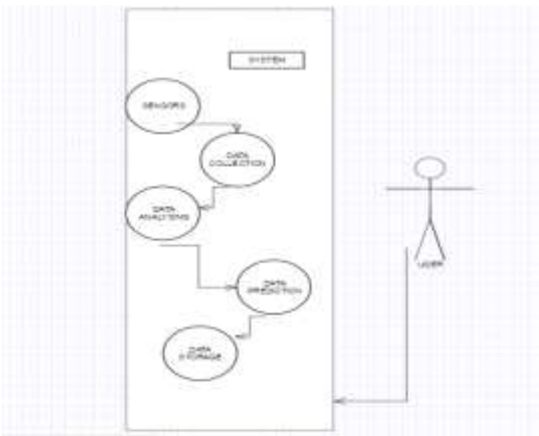

Fig 8: Use Case diagram

IV. Hardware And Software Design

Jumper wires are utilized to link the hardware elements that make up this system. In order to gather data in real time, the temperature sensor and the light intensity sensor are placed into the environment. We haven't utilized 220-volt appliances like fans and lights because we've just created a prototype; instead, we've used computer cooling fans that work on 12-volt batteries and LED lights rather than regular incandescent bulbs. In the explanation that follows each hardware component, the connections that have been made to each component are listed.

A. Humidity and Temperature Sensor

A standardized moisture and temperature sensor that provides a digital output is the DHT11 Sensor. High consistency and outstanding long-term consistency are ensured by this sensor. This sort of sensor connects to an 8-bit CPU and incorporates NTC temperature detection and resistivity-type measuring components. As a result, it offers good quality, rapid response, interruption resistance, and economic feasibility.

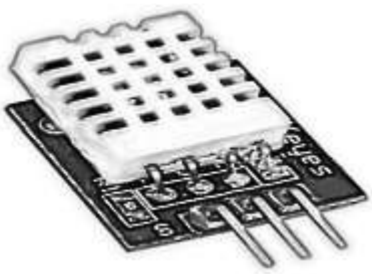

Fig. 9: DHT11 sensor

B. Light Dependent Resistor

An electrical component that reacts to light is referred to as a photoresistor, sometimes known as a light-dependent resistor. As light strikes it, the resistance modifies. When light intensity rises, the LDR's resistance decreases, shifting by orders of magnitude. A typical LDR or photoresistor's resistance value falls between a few megaohms in total darkness to a few hundred ohms under bright light. An LDR sensor is a type of sensor that uses a Light Dependent Resistor to detect changes in light intensity (LDR). It is frequently employed in electrical devices to determine whether light is present or not. Automatic streetlights, security systems, and camera light meters are just a few of the numerous uses for LDR sensors.

Fig. 10: Light Dependent Resistor

C. Raspberry pi

The Raspberry Pi Foundation, which is headquartered in the UK developed a series of compact single-board computers designated as Raspberry Pi. These computers are preferred by professionals, academics, and hobbyists because of their minimal cost, efficiency, and great extent of customization options.

The Raspberry Pi boards are built around an ARM-based processor and run on a variety of operating systems, including the popular Linux-based Raspbian OS. They feature a variety of input/output options, such as USB, HDMI, Ethernet, and GPIO pins, which allow users to connect and interact with a wide range of devices and sensors.

Overall, Raspberry Pi offers a low-cost and flexible platform for users to experiment with and build their own custom computing solutions. It has become a popular tool for both learning and prototyping in the fields of computer science, engineering, and maker culture.

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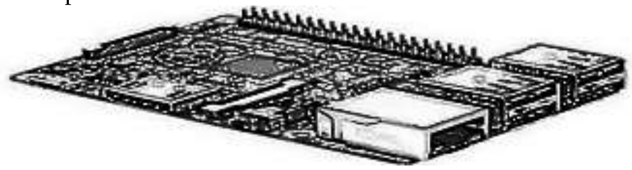


Fig. 11: Raspberry pi

D. LED

A semiconductor device termed as an LED (which stands for "Light Emitting Diode") emits photons when an electrical current travels through it. Due to its energy effectiveness, extended durability, and potential to create a wide spectrum of colors, LEDs are commonly utilized as light sources. They are used in a variety of applications, such as backlighting for electronic displays, residential and commercial lighting, and automotive lighting. LEDs are also widely used in research settings for their controllability and versatility in producing specific wavelengths of light. This makes them useful for studies involving plant growth, circadian rhythms, and phototherapy. LEDs are a popular choice for researchers due to their low heat output, long lifespan, and low power consumption.

Fig. 13: LED

E. INA 219 SENSOR

The INA219 sensor is a high-precision, low-cost, digital current and voltage sensor that is widely used in research applications. It can measure voltage levels up to 26V and current up to 3.2A with an accuracy of up to 1%. The sensor can communicate with a variety of microcontrollers using I2C or SMBus protocols, making it easy to integrate into electronic systems. Its small size and low power consumption make it an ideal choice for portable or wearable devices. Researchers use the INA219 sensor in a range of applications, such as battery monitoring, power management, and solar energy systems, due to its high accuracy and reliability.

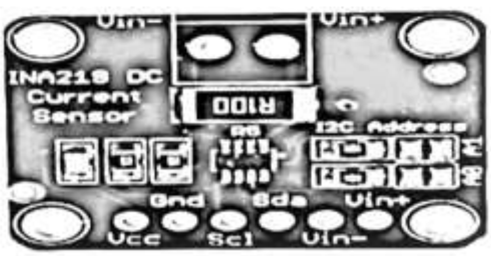


Fig12: INA219 Current Sensor

F. ThingSpeak

ThingSpeak is an open-source Internet of Things platform that allows users to gather, evaluate, and display data from Internet of Things devices. It allows users to store and retrieve data in real-time and provides tools for data analysis, visualization, and alerting. ThingSpeak supports a wide range of IoT devices, such as sensors, actuators, and microcontrollers, and integrates with other popular IoT platforms and services. It also provides APIs for easy integration with other applications and data sources. ThingSpeak is popular among IoT enthusiasts, researchers, and businesses for its ease of use, flexibility, and affordability. It has numerous applications in various domains, such as agriculture, smart homes, industrial automation, and healthcare.

G. Tkinter Module

Tkinter is a Python module for building graphical user interfaces (GUIs) for desktop applications. It provides an assortment of widgets and tools for making panels, icons, labels, checkboxes, and other GUI aspects, allowing users to interact with the application through a graphical interface. Tkinter is easy to learn and widely used in Python development for creating simple to complex GUI applications.

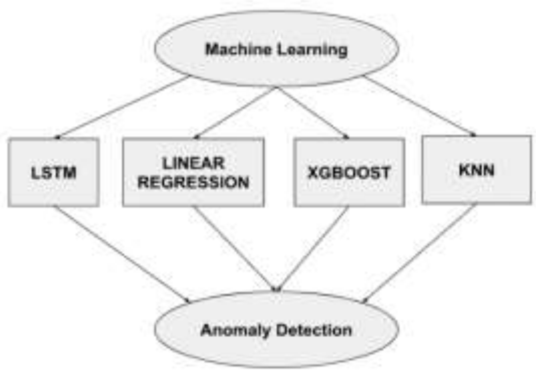
H. Twillio Module

Twilio is a cloud communications platform that enables businesses to build communication solutions using APIs for voice, video, messaging, and authentication. It allows programmers to incorporate communication tools into their apps, including the capacity to send and receive SMS messages, place and attend video as well as audio conversations, and implement two-factor authentication to confirm credentials of a particular user. Twilio's platform is designed to be easy to use and scalable, allowing businesses of any size to build and deploy communication solutions quickly and efficiently.

Twilio's APIs support multiple programming languages, including Python, Java, Ruby, and Node.js, making it accessible to developers with various programming backgrounds. Twilio also provides a range of tools and services to help businesses manage their communication solutions, such as analytics and reporting, debugging and testing, and security and compliance.

V. Proposed Framework

A subset of artificial intelligence (AI), known as machine learning (ML), enables computers to dynamically learn from data and previous experiences in order to recognize patterns and forecast future happenings with the least amount of human intervention.



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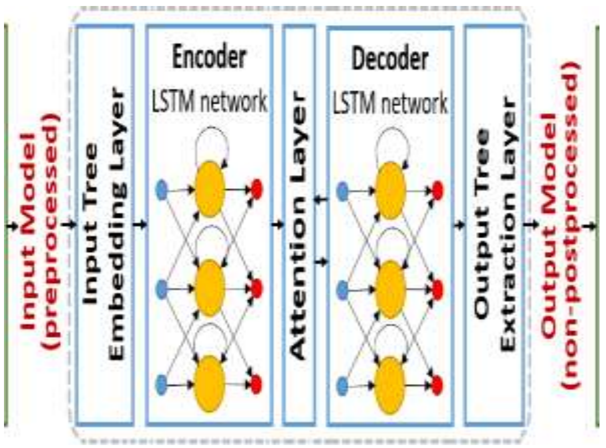
For our project, we have used various types of ML modules and algorithms. Those maybe explained as follows:

A. LSTM

Long Short-Term Memory, often known as LSTM, is a form of recurrent neural network (RNN) that can process and retain sequential input.

Each unit in a typical RNN receives the output of the unit before it as well as the current input. A cell, an input gate, an output gate, and a forget gate make up each unit of LSTMs, which are more sophisticated. The network is able to selectively forget or recall knowledge from the past thanks to these gates, which control the flow of information into and out of the cell.

In our project, LSTM is utilized to predict the values of power and energy. The model takes into account the data collected in the form of a time series, effectively capturing long-term dependencies in sequential data. Thereafter, utilizing this model to predict the sequential values of power and energy.



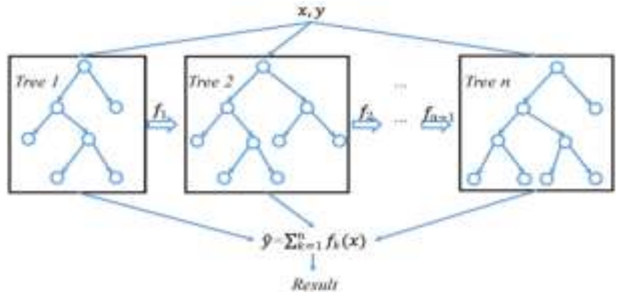
Architectural Diagrammatic Representation

B. XGBOOST

A well-known open-source machine learning toolkit called XGBoost is used to train gradient boosting decision trees. The Apache Software Foundation is currently responsible for maintaining it once it was created in 2014. It may be executed in parallel on a number of CPUs or GPUs and is made to handle huge datasets. Advanced features including regularization, cross-validation, and early halting are included. Several applications, including image classification and financial forecasting, have successfully exploited XGBoost.

XGBoost can be used for time series forecasting tasks by treating the time series as a sequence of input-output pairs. Specifically, one can create a window of lagged values from the time series as features and use the next value as the target variable.

In the context of our system, XGBOOST presents a negative pipeline score depicting that this is not a good fit for our data. One possible reason for negative accuracy values is that the model is predicting values that are far from the actual values, resulting in a large error. This can happen if the model is not able to capture the temporal dependencies.



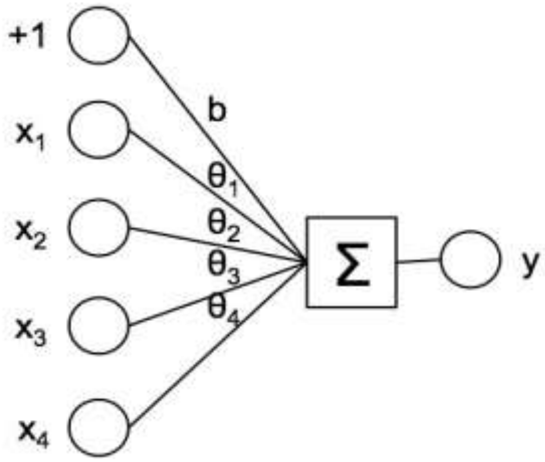
Architectural Diagrammatic Representation

C. Linear Regression

By utilizing linear regression, one may statistically simulate the relationship across a dependent variable and one or more independent variables It makes the assumption that the variables' relationships are linear and can be shown by a straight line. The approach, which may be applied to both simple and multiple regression analysis, estimates the parameters of the line that fits the data the best. In various disciplines, such as economics, social sciences, and engineering, linear regression is frequently used to forecast or explain the dependent factor's activity depending on the values of the independent factors.

In our project, linear regression presents a very good accuracy score of 1.0, which presents that the data fits the model perfectly.

This portrays that the relationship between temperature, humidity, light intensity is linearly associated with energy.



Architectural Diagrammatic Representation

D. KNN

To addrss issues with regression and classification, K-Nearest Neighbors (KNN), a non-parametric machine learning methodology, is employed. It functions by determining the K data points that are the nearest to a certain sampling point, and then using the titles or valuations of those K nearest neighbors, estimates the label or valuation of the test point. The number of neighbors to take into account is determined by the value of the hyperparameter K. KNN is easy to comprehend and put into practice, but it can be computationally costly for big datasets and is susceptible to the distance measure chosen.

In our project, KNN presents a negative score, indicating that our data is not a good fit for the model. This

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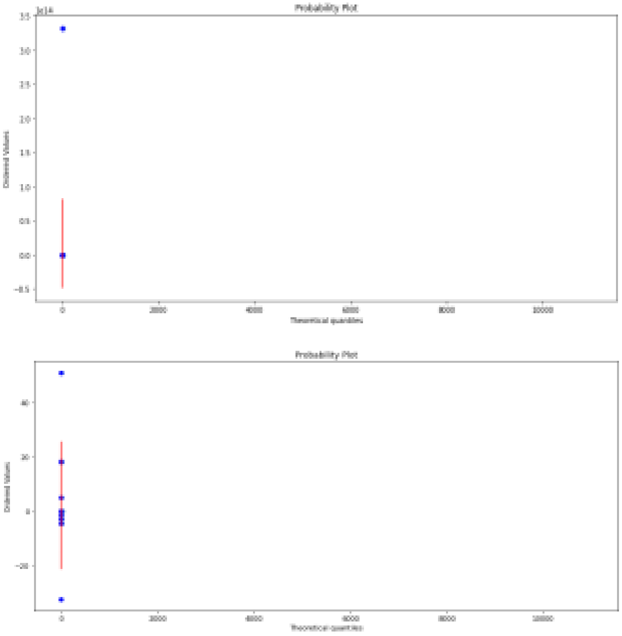
maybe caused as our data is a time series data and KNN does not consider the temporal order of the data. Hence, implying that the model is not able to capture the patterns or trends in the time series data.



Architectural Diagrammatic Representation

Unlike models built using deep learning, K-Nearest Neighbors (KNN) is a straightforward non-parametric method for machine learning without a preconceived framework.

E. Anomaly Detection

A method used in data analysis called anomaly detection seeks out patterns or occurrences that are strange or unexpected. The objective is to find anomalies that considerably vary from the data's expected behaviour since they may be signs of significant occurrences or problems. Applications including fraud detection, intrusion detection, and predictive maintenance frequently employ anomaly detection.

One-class Support Vector Machines (SVM) is a popular algorithm used for anomaly detection. In this approach, the goal is to identify anomalies as points that are significantly different from the normal behavior of the data. One-class SVM learns a boundary that separates the normal data points from the anomalous ones.

It works by fitting a hyperplane in a high-dimensional feature space and then identifying the observations that lie on the boundary or outside it. The algorithm only requires a training set of normal data to learn the hyperplane, and then uses it to classify new observations as normal or anomalous. One-class SVM is effective when there is limited or no prior information about the anomalous data and when the normal data points are clustered together. It is also computationally efficient and can handle high-dimensional datasets. However, it can be sensitive to the choice of parameters and may not perform well when there is a significant overlap between the normal and anomalous data points.

In case of our project, 4 anomalous outliers are detected using One class SVM. These values of power and energy deviate from the other values.

```
# filter outlier index
outlier_index = where(y_pred == -1)
# filter outlier values
outlier_values = df_train.iloc[outlier_index]
outlier_values
```

	Power	Energy
14	275.121951	2.751220
97	22.682927	0.226829
98	22.682927	0.226829
99	22.682927	0.226829

VI. METRICS

A. LSTM

Recurrent neural networks (RNN) incorporate Long Short-Term Memory (LSTM) that is especially made to handle sequential data, including time series, voice, and text. Language translation, speech recognition, and time series forecasting are just a few of the applications for LSTM networks, which have the ability to learn long-term relationships in sequential data.

The "model.evaluate()" method calculates the loss and evaluation metrics for a trained model on a given test set.

Formula: -

accuracy = (number of correct predictions) / (total number of predictions)

$MSE = (1/n) * \Sigma(yi - \hat{y}i)^2$

Accuracy Score: 91.6 %

Result:

Thus, in our project, the values of power and energy are predicted using LSTM. The model effectively accounts for long-term dependency in sequential data because it takes into account data collected as a time series. The subsequent levels of power and energy may then be predicted using this model.

*B. **XGBOOST***

Extreme Gradient Boosting, or XGBOOST as it is known, is a concept put out by University of Washington academics. It is a C++ library that enhances the training process for gradient boosting. Moreover, this model does not fit our product well.

The pipeline.score() method for an XGBoost model may be used to assess how well the trained model performed on a test set. The approach returns either the coefficient of determination R2 of the predictions for regression problems or the mean accuracy of the predictions for classification issues.

Formula: -

$R^2 = 1$ - (sum of squared errors / total sum of squares)

Accuracy Score: XGBoostregressor

DOI: rp-9788770040723.123

r2: -0.26916466699066377

Result:

A negative pipeline score from XGBOOST in the context of our system indicates that this is not a suitable fit for our data. One explanation for low accuracy numbers is because the model is making huge errors by predicting values that are quite different from the actual values. If the model is unable to account for the temporal dependencies, this may occur.

C. KNN

By averaging the data in the same neighbourhood, the non-parametric KNN regression method roughly captures the link between independent factors and the continuous outcomes. For our project, this model's accuracy is subpar.

Primarily, the k-nearest neighbour classification algorithm depends on a distance function. The more precisely that measure captures label consistency, the more efficient the classification. The Minkowski distance is the most popular pick.

Formula:

dist(x,z)=(∑r=1d|xr−zr|p)1/p.

accuracy = (number of correctly classified samples) / (total number of samples)

Accuracy Score: -0.08425501126153923

Result:

KNN provides a poor score in our project, suggesting that the model does not suit our data well. This could be the result of the fact that our data is a time series and KNN does not take the temporal order of the data into account. So, it is implied that the model is unable to fully represent the patterns or trends present in the time series data.

D. Linear Regression

Linear regression is a supervised learning-based method of machine learning.

A regression procedure is carried out. Regression models a specific prediction value using independent variables. It is mostly used to establish the connection between parameters and forecasts. The number of independent variables they use and the kind of relationship they take into consideration between the dependent and independent variables are two ways that regression models differ from one another. The low score shows that the project's variables do not relate to one another linearly and that the model does not match the data well.

The R2 score, commonly referred to as the coefficient of determination, is calculated by scikit-learn's.score method for linear regression models. The linear regression model's ability to fit the data is shown by the R2 score.

A better match is indicated by higher values, which range from 0 to 1.

Formula:

R^2 = 1 - (SSres / SStot)

whereSSres is the sum of the squared residuals (the difference between the actual and predicted values) and SStot is the total sum of squares (the difference between the actual values and the mean of the dependent variable).

The formula for multiple linear regression is:

*y = β0 + β1*x1 + β2*x2 + ... + βn*xn + ε*

where:

y is the dependent variable (also known as the response variable)

x1, x2, ..., xn are the independent variables (also known as the predictor variables)

β0, β1, β2, ..., βn are the coefficients (also known as the regression coefficients or model parameters) that represent the change in y for a one-unit change in x1, x2, ..., xn, holding all other variables constant

ε is the error term, which represents the variability in y that is not explained by the independent variables.

Accuracy Score: 1.0

E. Anomaly detection

Anomaly identification, also known as outlier detection, is an approach for uncovering unexpected occurrences, observations, or occurrences that deviate considerably from the usual. Unsupervised anomaly detection is a technique used by data scientists to spot anomalies in unlabeled data, and it is based on the following two vital hypotheses:

Data anomalies are uncommon occurrences with unique characteristics that set them apart from regular occurrences..

Formula:

An approach to finding odd patterns or occurrences in data is called anomaly detection. Although there are various ways to perform anomaly detection, the Gaussian distribution-based technique is one that is frequently utilized.

The following is the formula for anomaly detection using the Gaussian distribution-based method:

i. Estimate the mean and covariance matrix of the features in a dataset X.

ii. Calculate the chance that each observation x in X falls within the Gaussian distribution that is indicated by the estimated mean and covariance matrix.

iii. The probability below which an observation is regarded as an anomaly should have a threshold value. The threshold value might be selected using a validation set or based on prior knowledge about the problem.

Determine the observations that fall below the threshold in terms of likelihood to be anomalies.

The following formula may be used to determine the likelihood that an observation x will fall inside the Gaussian distribution denoted by the estimated mean and covariance matrix:

*p(x) = (1 / (2π)^n/2 * |Σ|^1/2) * exp(-1/2 * (x - μ)^T Σ^-1 (x - μ))*

DOI: rp-9788770040723.123

where:

n is the number of features in x
μ is the estimated mean of the features in X
Σ is the estimated covariance matrix of the features in X

The intended trade-off between false positives and false negatives can be used to determine the threshold value. In contrast to a low threshold number, which will produce more false positives but fewer false negatives, a high threshold value will produce fewer false positives but more false negatives.

The SVM method known as One-Class Support Vector Machines (OCSVM) is used to find anomalies. One-Class SVM's formula is as follows:

Let's say we have a collection of observations X, each of which is a vector of p characteristics. Finding a function f(x) that maps the data to a one-dimensional space with normal observations being mapped to values near to 1 and anomalous observations being assigned to values noticeably below 1 is the objective.

The optimization problem for one-class SVM is formulated as follows:

*minimize (1/2) * ||w||^2 + (1/nu) * sum(xi - rho)*

subject to yi*f(xi) >= 1 - epsilon, for all i

where:

w is a vector of weights
xi is the ith observation in the training set
rho is a scalar offset parameter

yi is a binary variable that indicates whether xi is a normal observation (+1) or an anomaly (-1)

f(xi) is the distance from the decision boundary to xi

epsilon is a small positive parameter that controls the width of the margin around the decision boundary

nu is a hyperparameter that controls the tradeoff between the width of the margin and the number of training observations that are allowed to be misclassified as anomalies

The optimization problem seeks to find the weights w and the offset parameter rho that minimize the objective function subject to the constraints. The decision function for a new observation x is given by:

*f(x) = sum(alpha_i * K(x_i, x)) - rho*

where:

alpha_i are the coefficients of the support vectors

K(x_i, x) is a kernel function that measures the similarity between x_i and x

If the value of f(x) is less than a threshold, the observation is classified as an anomaly; otherwise, it is classified as normal. The threshold can be chosen based on the desired tradeoff between false positives and false negatives.

Accuracy score: No accuracy rating is available. As an output for power and energy, we received outliers.

Results:

Using one class SVM, 4 anomalous outliers are found in our project. These energy and power values differ from the other values.

VII. Result And Discussion

*Dataset:*The dataset utilized in this paper for the training and testing was collected using the raspberry pi apparatus and stored in the cloud environment of ThingSpeak. The detailed description of the dataset is presented as follows:

Features	Description
Created_at	A variable that marks the time and date of a particular entry of a data.
Entry id	Variable that contains a specific and unique id of an entry.
Temperature	This variable stores the real-time **temperature reading** collected from the DHT11 sensor.
Humidity	This variable stores the real-time **humidity reading** collected from the DHT11 sensor.
LDR	This variable stores the real-time **light intensity reading** collected from the LDR sensor.
Power	A variable that contains the power calculated.
Energy	A variable that stores the energy hence calculated.

Accuracy:

Positive accuracy

Model Name	Accuracy Score
LINEAR REGRESSION	1.0
LSTM	0. 91666668

Negative accuracy

Model Name	Accuracy Score
KNN	-0.08425501126153923
XGBOOST	-0.26916466699066377

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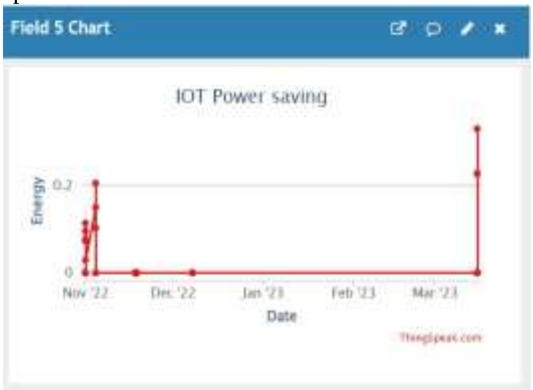

Graph demonstrating energy utilization

Graph demonstrating temperature and relative humidity

LDR and power graph

The data presented in the above graphs illustrates the potential benefits of utilizing IoT analytics services, such as ThingSpeak, in energy management systems. Using real-time big quantities of information in the cloud to collect and analyse, energy providers can gain valuable insights into energy consumption patterns and make more informed decisions regarding energy management.

As can be observed from the graphs, there is a correlation between environmental conditions, such as temperature, humidity, and light intensity, and power utilization. A minimal amount of electricity is used during times of elevated temperature, dampness, and light levels, whereas a larger proportion is utilized under opposite situations. This correlation may be attributed to the fact that when the intensity of light rises, the requisite LED intensity drops, requiring less electrical power to function.

Overall, these findings have significant implications for energy management systems. By utilizing IoT technologies and data analytics tools such as ThingSpeak, energy providers can develop more energy-efficient systems, reduce energy consumption, and ultimately reduce their environmental impact. Additionally, these technologies can enable households to monitor and manage their energy usage, potentially resulting in cost savings and a more sustainable energy future.

VIII. Conclusion And Future Work

The proposed smart energy meter system for household management, utilizing a Raspberry Pi CPU, is a significant step forward in energy consumption monitoring and management. By providing a means to monitor and regulate energy use, this system can increase awareness of energy consumption and promote energy-conscious behaviour.

With the ability to modify the power status of devices according to user requests, this system offers a more personalized approach to energy management, enabling users to make informed decisions about their energy usage. By reducing energy consumption, households can lower their environmental impact and save on energy costs.

In this period of swift technological advancement, incorporating intelligent energy metres in household monitoring systems is of the utmost importance. As the demand for energy continues to increase, it is imperative to find ways to reduce energy consumption and promote sustainability. By utilizing IoT technologies and data analytics tools, such as the proposed smart energy meter system, households can play an active role in reducing their energy consumption and contributing to a more sustainable future.

The results of our study demonstrate that a smart energy meter system can be utilized to aid in saving power and energy. The conjugation of machine learning with IOT has become a popular research topic in recent years. IoT devices are capable of generating vast amounts of data, while ML algorithms have the ability to analyze this data and extract meaningful insights from it. When combined, IoT and ML can be used to create intelligent systems that can improve efficiency, reduce costs, and optimize performance. In our study we find that few ML models can with good accuracy utilize the environmental data to predict power and energy usage which can thus aid in optimizing usage of energy resources. While, some models like KNN and XGBOOST do not fit the data. Additionally, the proposed model also utilizes twilio to send user SMS of the bill generated by the system also providing the user GUI presented using Tkinter to pay the bill. An additional feature of high humidity detection is added to alert the user in case of higher concentration of water in the environment inorder to save the device as this may damage the parts involved.

There are several avenues for future research in this area. One direction for future work is to explore the scalability of our proposed system. While our system demonstrated promising results in a controlled laboratory environment, it is important to assess its performance in real-world scenarios with larger datasets and more complex systems. Additionally, further investigation is needed to optimize the performance of the ML algorithms used in our system, as well as to explore the potential of alternative algorithms that may be better suited to the specific requirements of different applications. Another area for future research is to investigate the potential impact of our system on energy savings and sustainability, and to conduct

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a cost-benefit analysis to assess the economic feasibility of implementing the proposed system. Finally, we also suggest the development of a theft detection system for the proposed model. Overall, there is significant potential for future research in this area, and we believe that continued investigation and refinement of our proposed system will lead to improved energy efficiency and significant cost savings for organizations as well as households.

In conclusion, our study has demonstrated the effectiveness of our proposed approach for solving the problem of efficiently utilizing energy. Through the use of IOT and ML, we were able to collect real time data using IOT and utilize this with ML to improve the utilization of energy resources. Our study contributes to the field of IOT and machine learning by presenting the future potential of using these technologies to aid in smart energy systems for industrial as well as household purposes. These findings have important implications for the environment and depleting energy resources in the world. While our study has several limitations, including limited dataset, processing power and anomalous readings, we believe that our proposed approach provides a promising solution to the problem of inefficient use of energy. Future research in this area should focus on scaling and adding additional features such as theft detection and API for users to directly pay the bill. Overall, our study highlights the potential of conjugation of IOT and ML to improvise utilization of energy resources by using environmental data, and we hope that our findings will inspire further investigation and innovation in this field.

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Healthifer: An Integrated Healthcare Application, Multi-disease Prediction with Secure Prescription Storage

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Abstract—Healthcare application management systems are computer-based software applications used to manage the delivery of healthcare services. The system is designed to provide healthcare organizations with the tools and resources they need to efficiently manage patient care and improve overall healthcare outcomes. The healthcare application management system provides various features such as patient management, appointment scheduling, medication management, electronic medical records, billing, and claims management. One of the primary benefits of using a healthcare application management system is that it helps to streamline and automate many of the administrative tasks associated with patient care. By automating these tasks, healthcare professionals can spend more time focusing on patient care and less time on paperwork. Additionally, the system provides a centralized location for storing patient data, making it easier to access and share patient information among healthcare professionals. Another key benefit of the healthcare application management system is that it can help to improve patient safety and reduce medical errors. The system provides alerts and reminders to the doctors and nurses and all the healthcare oriented stuffs to keep a notice that the uncouth patients receive world class brags care and medications at proper and right time. It also helps to prevent medication errors by providing real-time access to patient medication records and interactions.

Keywords—Multi-disease prediction, prescription storage, hospital management system, pharmacy management system, blood-bank management system, yoga application, sentiment analysis, nearest hospital and clinic finder, healthiness blogger, WHO guidelines, artificial intelligence, neural network, machine learning, deep learning, responsive-web-design.

I. INTRODUCTION

The healthcare industry has witnessed a significant transformation in the past few decades, thanks to technological advancements. The introduction of healthcare application management systems has revolutionized the way healthcare services are delivered to patients. The system is a computer-based software application that provides healthcare organizations with the tools and resources they need to efficiently manage patient care and improve overall healthcare outcomes.

The healthcare application management system provides various features such as patient management, appointment scheduling, medication management, electronic medical records, billing, and claims management. With these features, healthcare professionals can efficiently manage and track patient data, appointments, and medication usage. This allows for better patient care, improved healthcare outcomes, and increased efficiency in healthcare service delivery.

This paper aims to provide an overview of healthcare application management systems and their benefits to healthcare organizations and patients. It will explore the various features and functionalities of the system, its impact on patient care, and the challenges associated with implementing and using the system. Additionally, the paper will provide insights into the future of healthcare application management systems and their potential to transform the healthcare industry.

Healthcare Application Management System Features

The healthcare application management system offers several features and functionalities that allow healthcare organizations to efficiently manage patient care. Some of the key features of the system include patient management, appointment scheduling, medication management, electronic medical records, billing, and claims management.

Patient Management:

The patient management feature of the healthcare application management system allows healthcare organizations to efficiently manage patient data. The system provides a centralized location for storing patient data, making it easier to access and share patient information among healthcare professionals. This enables the healthcare people to have sneak into the patient's biomedical history, current medication usage, and other critical patient information that can help improve patient care.

Appointment Scheduling:

The appointment scheduling feature of the healthcare application management system allows healthcare professionals to efficiently schedule and manage patient appointments. The system provides real-time access to patient schedules, allowing healthcare professionals to quickly and easily schedule appointments based on availability. Additionally, the system provides appointment reminders to patients, reducing the likelihood of missed appointments.

Medication Management:

The medication management feature of the healthcare application management system helps to prevent medication errors by providing real-time access to patient medication records and interactions.

The system alerts healthcare professionals to potential medication interactions and provides recommendations for

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alternative medications when necessary. This ensures that patients receive the appropriate medication at the right time, reducing the risk of adverse reactions.

Electronic Medical Records:

The electronic medical records feature of the healthcare application management system allows healthcare professionals to efficiently manage patient medical records. The system provides a centralized location for storing and accessing patient medical records, making it easier to track patient medical history, treatments, and outcomes. This allows healthcare professionals to provide better patient care and improve healthcare outcomes.

Billing and Claims Management:

The billing and claims management feature of the healthcare application management system allows healthcare organizations to efficiently manage billing and claims processing. The system automates many of the administrative tasks associated with billing and claims management, reducing the likelihood of errors and improving overall efficiency. This allows healthcare organizations to process claims and billing more quickly, reducing the time it takes to receive payment.

Impact of Healthcare Application Management System on Patient Care:

The healthcare application management system has had a significant impact on patient care. The system has improved patient safety by providing alerts and reminders to the health-related workers and the health contractors understand the depth of the situation and medications at the right time. Additionally, the system has reduced medication errors by providing real-time access to patient medication records and interactions.

The system has also improved patient outcomes by providing healthcare professionals with a centralized location for storing patient data. This enables the health-workers people to improper way of sneaking of the patient details and hack their everything, current medication usage, and other vital patient data that can help improve patient care.

Healthcare application management systems (HAMS) are computer-based software applications designed to manage the delivery of healthcare services. HAMS are used by healthcare organizations to efficiently manage patient care and improve healthcare outcomes. The system is designed to provide healthcare professionals with the tools and resources they need to streamline and automate administrative tasks associated with patient care, and improve the accuracy and safety of healthcare delivery. The healthcare application management system provides features such as patient management, appointment scheduling, medication management, electronic medical records, billing, and claims management. These features help to optimize the patient care experience and promote efficient healthcare delivery.

The use of HAMS has increased over the past decade as the healthcare industry moves towards digitization and automation of services. The development of HAMS has been driven by the need to betterify patient care, crash down medical problems, and increase effectiveness of related businesses. HAMS has also been designed to address the challenges of managing large volumes of patient data and records, which can be time-consuming and costly when done manually. This paper provides an overview of healthcare application management systems, their features, and the benefits they offer to healthcare organizations. The paper discusses the various types of HAMS, the key features of HAMS, and their impact on healthcare delivery. The paper also provides a critical analysis of the challenges and limitations of HAMS and explores the future of HAMS in healthcare. Types of Healthcare Application Management Systems.

There are several types of HAMS available, each designed to meet specific healthcare needs. The following are the most common types of HAMS:

Electronic Health Record (EHR) System: This type of HAMS is designed to manage patient records electronically. The EHR system provides healthcare professionals with easy access to patient records, including patient demographics, medical history, lab results, and medication information. The EHR system eliminates the need for paper records and reduces the risk of medical errors associated with manual record keeping.

Practice Management System (PMS): The PMS is a type of HAMS designed to manage the administrative and financial functions of a healthcare organization. The system includes features such as appointment scheduling, billing, and claims management. The PMS system helps to optimize administrative functions, allowing healthcare professionals to focus on providing quality patient care.

Patient Engagement System: The patient engagement system is designed to improve patient involvement in healthcare. The system includes features such as patient portals, appointment reminders, and education resources. The patient engagement system helps to improve patient outcomes by increasing patient engagement and education.

Telehealth System: The telehealth system is designed to provide healthcare services remotely. The system includes features such as video conferencing, remote monitoring, and virtual consultations. The telehealth system helps to increase access to healthcare services, particularly in remote or underserved areas.

Key Features of Healthcare Application Management Systems

The key features of HAMS depend on the specific type of system. However, there are several common features that most HAMS share. The following are the most common features of HAMS:

Appointment Scheduling: HAMS allows healthcare professionals to schedule patient appointments electronically. The appointment scheduling feature eliminates the need for manual appointment scheduling, reducing administrative burden and improving efficiency.

Medication Management: HAMS provides a real-time medication management system that allows healthcare professionals to monitor medication usage and prevent medication errors. The medication management feature includes features such as medication reminders, drug interactions, and dosage tracking.

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Electronic Medical Records: HAMS eliminates the need for paper records by providing a digital system for managing patient records. The electronic medical records feature includes features

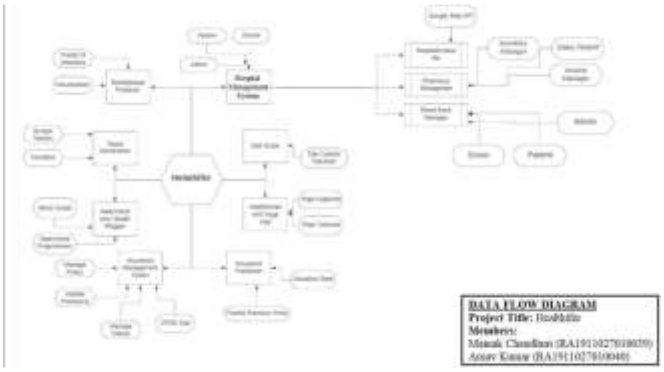
A. Machine Learning Models

Machine learning models are computer logics that can be used to grasp the concept of the excepted taxation of the superfluid brain cancer theorem. They are various types of machine learning models, such as utter-supervised learning, pro-unsupervised learning, and transfer learning. These models are exploited in a massive range of purposes, including imaginary and spoken sound recognition, supernatural language processing, and descriptive-predictive analytics. While machine learning models can be very powerful, they can also be quite complex and require significant computational resources to train and deploy. This can make it challenging to implement machine learning models in certain applications, particularly those with limited resources, such as mobile devices or embedded systems.

B. Databases

The primary database that supports this project are derived from Kaggle and GitHub and also used in the Lucifer based hackathons where nobody has any idea about what is going on and thus the data is supervised and undeservingly popular and chromatographic. There are several reasons for choosing a tabular data in place of image based results because the tabular data can be easily read and processed by simple ML models while the image data requires a lot of time to be processed by the computer and causes several kinds of server issues which then causes a headache for the customer to solve and the technical people are worse that the college stuffs who have absolutely no idea about what is going but they always end up in messing things and creating nuisance. This can be a serious harm of company reputation. [14].

The quality of the database is very important from the research point of view because even a small mistake can lead to lots of issues and this will affect the detection score. Also, the design of a database is still significant, given the importance of the classification task. The purposes and strategies for gathering tabular data from laboratory results differ profoundly as per the inspiration driving the improvement of life saving drug researches. Tabular data can be used to make good amount of money as they are easily sold and understood by the dealers.



2) Unwanted Errors

There is always a risk of unwanted errors whenever there is a research as with the increase in time and the number of epochs noise also keeps on increasing and thus the quality is compromised each and every time. This can be good sign of mishandling the data and thus turn a drawback for the cash cow into water. [15]. None the less, there are focus ways of manipulating the dataset also. Because see, we are engineers and we are the closest with technology. So we know how to make fools of people and earn money because that is the way in which healthcare can reach good heights through the business of fear.[17]

3) Outliers

Whenever we are dealing with any kind of data be it tabular or textual, there is a sample of the data which behaves anomalously. The reason being growing too fast against the tide or working too slower compared to the expected rate of through-put. Accelerating the rate of outcomes cannot reduce outliers and this needs to be handled with encroached statistical permutations.[15]16].

4) Elicited Dataset

Elicited datasets are those datasets that are elicited. Elicitation is a reflection of satisfaction of dataset in the data. If the data is not found to follow the statistical outcomes that are required by it then there needs to be a proper reorganization of the dataset and this can take days. So the scientists have planned a way for data elicitation of data. A portion of the conspicuous datasets is summarized in the Table 1.

C. Data Processing

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Data processing is the process of converting raw data into useful information by performing a services of operations on it. This can include organizing, cleaning, transforming, and analyzing data to extract meaningful insights. The first step in data processing is data collection. Data can come from a variety of sources, such as surveys, customer interactions, social media, or IoT devices. Once the data is collected, it needs to be stored in a way that is easily accessible and searchable. This is typically done using databases or data warehouses. Once the data is stored, the next step is to clean and organize it. Data cleaning involves identifying and correcting errors, such as missing values or inconsistencies, to ensure the data is accurate and reliable. Data organization involves categorizing and structuring the dataset in a method that positions it easy to analyze. In the next step in information processing is data transformation. This involves converting the data into a format that is more useful for analysis. This can include aggregating data, calculating new variables, or converting data types. Finally, the insights gained from data analysis can be used to inform decision-making or drive action. This can include making recommendations, optimizing processes, or identifying opportunities for growth. Overall, data processing is a crucial step in turning raw data into meaningful information that can be used to drive business outcomes. Effective data processing requires a combination of technical skills, domain knowledge, and critical thinking to ensure that the data is accurate, organized, and analyzed in a way that provides actionable insights.

1) *Preprocessing*

The primary initiative as soon as there is dataset collecting the data is preprocessing. The collected data would be used to prepare the machine learning classifier in an HAMS system. While many of these data-preprocessing procedures are utilized for extraction of information patterns, others are made functional to take care of the combination of the parameters so that the permutations observed in the collection of the data insights do not affect the data analysis procedures.[17].

2) *ANN*

An Artificial Neural Network (ANN) is a type of deep learning model that is inspired by the structure and function of the human fleshy substance inside the skull. It consists of joined and latticed nodes, or "neurons," that are organized into several layers. In this project the main purpose of using the ANN is to speed up the processing and understanding of the hidden patterns in the data which can then only be used to drop any insight. The insights can then be learned and the patterns can be observed in keen identification to detect the trend in the data and thus the trending data lines provide the point of convergence of the parameters. Whatever are on one side of the line generally belong to one class while the other belong to other. But this was just general machine learning lol. So, ANN basically is speeding up the processes and is like a ghost scanner who scans and detects all those features which were previously undetected. For this purpose the poor model needs to work on the data for several times which the old good fellows call as epochs.

3) *Data Activity Detection*

One common application of data activity detection is in the field of sensor data analysis. Sensors, such as those found in servers devices, can collect large amounts of data on various physical phenomena, such as temperature, pressure, or motion. By analyzing this data, patterns and anomalies can be identified, which can be used to detect events or activities such as device malfunctions, environmental changes, or useries behavior.

Another application of data activity detection is in the field of cybersecurity. By analyzing network traffic data, patterns of behavior can be identified that may indicate malicious activity, such as attempts to hack into a system or steal sensitive information. Data activity detection can also be used in the field of healthcare, for example, to monitor patients and detect changes in their condition. By analyzing patient data, patterns and trends can be identified that may indicate the onset of a disease or the need for medical intervention. In order to effectively detect events or activities in data, it is important to have a clear understanding of the data being analyzed, as well as the specific events or activities of interest. This can involve selecting appropriate data sources, defining relevant features or variables, and selecting appropriate statistical or machine learning techniques.

4) *Noise Removal*

This is a vital procedure in the process of getting a good output from a clearer series of data. The encapsulation of the inheritance of the dataset is responsible for all kinds of noises and this is blamed. The blamer is a gamer and I oblique hyphen semicolon bracket conductor insulator water butter matter duster caterpillar locker poker jocker bit bucket Buckminster on the home of a minister wearing a miniskirt walking like a blue dart never going to see on the dark night bleed in the horse stuck bleed on the baby bottom seed. [35].

The main challenge of removing the noise is to keep the data unharmed by the change of parameters. But this thing requires a lot of scruitinizing of the modules and the parametric points so that the outcome becomes convincing for the user.[22] The generalized methods of reduction is based on the fact that the base state vibration of the data can be retrieved by the use of the Feigenbaum’s series and hence the reduction can be initiated with boundary parameter. The boundary parameter must not exceed the limits of hospital’s rule by any extend and the kind of operations to be performed must be governed by the derivate of logics finding popularization found membrane resonating ghost jolly tranquility killer. There needs to be a mumbo-jumbo in each research to make them understand.

D. *Data Features*

The most significant characteristics of HAMS are hospital lookup features. This can be understood in reference to a use case in medical domain called the bipolar syndrome. Sometimes there are cases when people behave in two different ways to a situation and no knowing why. [36]. Once the research objective is met the undermined foundation is conceived based on the features. The more the features the faster the model can train. This eats my brain. Literally, like don’t we have any other work other than

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writing these useless research papers? We pay for the college and we are made to work like labors. This is called data feature extraction and thus the bipolar syndrome works.

On the contrary, the thermodynamics are represented by collection of hounds in the backyard of Persian cat with no whiskers but whatsappstickers[37][38] which mean nothing but unknown level of disturbances in the cause of the purpose. This can be understood in the effect of the situation and never going to be withstanding the statement of the technical purpose and fulfill the objective of solemn satire in the attire of a dacoit is the foundation. The data features are understood like a tabular column of cannabis.

Ascorbic Features

Based on the dimensionality of the features to be considered in the use of the project the most used projects are considered as the ascorbic one and the less known kinds are the acetic ones. The acidulated electrocuted dogs of the healthcare system must be the primary features to be taken into consideration and thus this could be used as a ascorbic features in the repairing and reconstruction of the datasets.

1) *Spectral Features*

The vocal tract filters a sound when produced by an individual. The shape of the vocal tract controls the produced sound. An exact portrayal of the sound delivered and the vocal tract is resulted by precisely simulated shape. The vocal tract features are competently depicted in the frequency domain [38]. Fourier transform is utilized for obtaining the spectral features transforming the time domain signal into the frequency domain signal.

E. *Classifiers*

For any utterance, the underlying emotions are classified using data patterns emotion recognition. Classification of HAMS can be carried out in two ways: (a) traditional classifiers and(b) deep learning classifiers. Numerous classifiers have been utilized for the HAMS system, but determining which works best is difficult. Therefore the ongoing researches are widely pragmatic.

HAMS systems generally utilize several traditional classifi- cation algorithms. The learning algorithm predicted a new class input, which requires the labeled data that recognizes the respective classes and samples by approximating the mapping function [45]. After the training process, the remaining data is utilized for testing the classifier performance. Examples of traditional classifiers include Gaussian Mixture Model, Hid- den Markov Model, Artificial Neural Network, and Support Vector Machines. Some other traditional classification tech- niques involve k-Nearest Neighbor, Decision Trees, Naïve Bayes Classifiers [46], and k-means are preferred. Addition- ally, an ensemble technique is used for emotion recognition, which combines various classifiers to acquire more accept- able results.

1) *Gaussian Mixture Model (GMM)*

GMM is a probabilistic methodology that is a prodigious instance of consistent HMM, consisting of just one state. The main aim of using mixture models is to template the data in a mixture of various segments, where every segment has an elementary parametric structure, like a Gaussian. It is presumed that every information guide alludes toward one of the segments, and it is endeavored to infer the allocation for each portion freely [47].

2) *The Markonivoc's Scale (HMM)*

HMM is a usually utilized technique for recognizing data patterns and has been effectively expanded to perceive emotions[50]. The least possible data correlation can be used to perform the sort of understanding in the best conformtable manner.

In [51], the authors demonstrated that HMM performs better on log frequency power coefficient features than LPCC and RESNET50. The emotion classification was done based on text-independent methods. They attained a recognition rate of 89.2% for emotion classification and human recognition of 65.8%.

Hidden semi-continuous Markov models were utilized to construct a real-time multilingual speaker-independent emotion recognizer [52]. A higher than 70% recognition rate was obtained for the six emotions comprising anger, sadness, fear, joy, happiness, and disgust. INTERFACE emotional data patterns database was considered for the experiment.

The SVM classifier was compared with several other classifiers like radial basis function neural network, k-nearest- neighbor, and linear discriminant classifiers to check the accuracy rate for HAMS [55]. All the four classifiers were trained on emotional data patterns Chinese corpus. SVM performed best among all the classifiers with an 85% accuracy because of its good discriminating ability.

4) *Artificial Neural Networks (ANN)*

Data points had lost his father when he was in taking his higher secondary board exams and he knows the meaning of hardship. He can visualize the struggle in the world to earn a single penny. "If tomorrow, there is a need for a huge amount of money. If I have children. My mother is also ageing and there are added expenses for her treatment and well-being. I feel these are pretty more important, HAMS." HAMS was in a mood of denial. She said, "Listen, I can understand everything you said, but you know what Data points? You are growing a miser day by day. See, money is a basic need and even though I am earning it but that doesn't mean we cannot spend it on some basic needs. Entertainment is also a need. We both are working for so long. Okay, leave alone that, you don't even give me the time. Initially, the ANN classifier showed 45.83% accu- racy, but after the principal component analysis (PCA) over the features, ANN resulted in 75% improvement while SVM showed slightly better results, i.e., 76.67% of accuracy.

5) *K-Nearest Neighbor (KNN)*

k-NN is an uncomplicated supervised algorithm. The imple- mentation of k-NN is easy and is utilized for solving both regression and classification problems. The algorithm is based on proximity, i.e., the data having similar character- istics near each other with a small distance. The calculation of distance depends upon the problem that is to be solved. where$x$ and y are two points in Euclidean space, while $x_i$and$y_i$are Euclidean vectors and N is the N-th space.

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In the case of classification, the data is classified based on the vote of its neighbor. The data is assigned to the most common class among its k-nearest neighbors. If the value of *k* is 1, the data is assigned to the class of that single nearest neighbor.

6) Decision Tree

A decision tree is a nonlinear classification technique based on the divide and conquers algorithm. This method can be considered a graphical representation of trees consisting of roots, branches, and leaf nodes. Roots indicate tests for the particular value of a specific attribute, and from where decision alternative branches originate, edges/branches represent the output of the text and connects to the next leaf/ node, and leaf nodes represent the terminal nodes that predict the output and assign class distribution or class labels. Decision Tree helps in solving both regression and classification problems. For regression problems, continuous values, which are generally real numbers, are taken as input. In classification problems, a Decision Tree takes discrete or categorical values based on binary recursive partitioning involving the fragmentation of data into subsets, further fragmented into smaller subsets. This process continues until the subset data is sufficiently homogenous, and after all the criteria have been efficiently met, the algorithm stops the process.

A binary decision tree consisting of SVM classifiers was utilized to classify seven emotions in [58]. Three databases were used, including EmoDB, SAVEE, and Polish Emotion Data patterns Database. The classification done was based on sub- jective and objective classes. The highest recognition rate of 82.9% was obtained for EmoDB and least for Polish Emotional Data patterns Database with 56.25%.

7) Naïve Bayes Classifier

Naïve Bayes Classifier is a decent supervised learning method. The classification is based on Bayes theorem as given in Eq. (5).

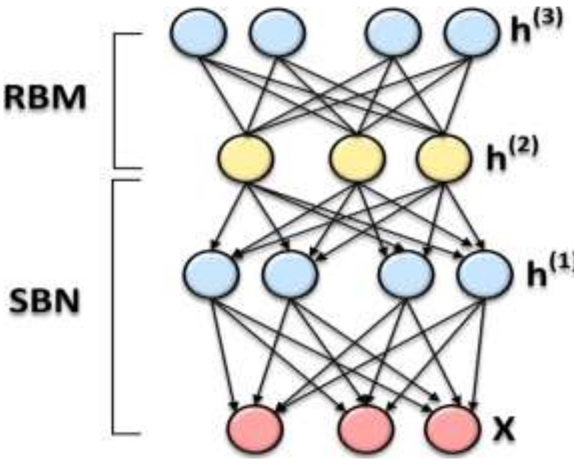

Fig. 2. Basic Architecture of Deep Belief Network.

learning algorithms, thus emphasizing their application to HAMS [9]. In this portion of the project we have made use of deep learning model to wash our back. It is clearly evidence how a fool the college is and is always after us asking for plagiarism free things. Are you guys nuts? Most generally utilized deep learning algorithms in the HAMS area are Deep Neural Networks, Deep Belief Networks, Deep Boltzmann Machine, Recurrent Neural Networks and Long-Short Term Memory.

8) Deep Neural Networks

Deep Neural Networks (DNN) is a neural network with multiple layers and multifaceted nature to process data in complex ways. It can be described as networks with a datalayer, an output layer, and one hidden layer in the center. Each layer performs precise types of organizing and requisites inbe learned separately, simplifying and increasing the computation operations [59].

Naïve Bayes Classifier was trained on EmoDB for emotion recognition in [60]. The authors combined the spectral (RESNET50) and prosodic (pitch) features toenhance the HAMS system’s performance. The evaluation result was divided architectureemotions [62]. A total of four distinct algorithms were used for the classification process: DNN, GMM, and two different variations of Extreme Machine Learning (EML). It was found that the DNN-EML approach outshined the GMM-based algorithms in terms of accuracy.

$$P(x\,y) \frac{P(y|x)\,P(x)}{P(y)}$$

where*x* represents a class variable and *y* represents the features/parameters.

8) Deep Belief Networks

The energy function $E(v, h)$ of RBM is defined in Eq. (9).

$$E(v, h) = {}^{\Sigma} v_i b_i - {}^{\Sigma} h_k b_k - {}^{\Sigma} v_i h_k w_{i,k} \quad (9)$$

Deep Belief Networks (DBN) is an unsupervised generative model that mixes the directed andundirected connections between the variables that constitute either the visible layer or all hidden layers [63], as shown in Fig. 2. RECURRENT NEURAL NETWORKS

$S_t = F_W(S_{t-1}, X_t)$(10)

where$X_t$is the input at time *t*, S_t(new state), and S_{t1} (previous state) is the state at time *t* and *t*-1, respectively, and $F_W$is the recursive function. The recursive function is a *tanh*function. The equation is simplified as given in Eq. (11), where $W_s$and $W_x$are weights of the previous state and input, respectively, and $Y_t$is the output.

Recurrent Neural Networks (RNN) is designed for capturing information from sequence/time HAMS data and are generally utilized for temporal problems like natural language processing, image capturing, and data patterns recognition. They are eminent by the ‘‘memory’’ as they take data from previous inputs to influence the current input and output. RNNs work on the recursive formula given in Eq. (10).

$S_t = \tanh(W_s S_{t-1} + W_x X_t)$ $\quad Y_t = W_y S_t$ (11)

Figure 5(a) shows the simple RNN structure, while Figure 5(b) depicts the unrolled structure of RNN. Unfor-tunately, the gradient in deep neural networks is unstable

DOI: rp-9788770040723.124

as they tend to either increase or decrease exponentially, which is known as the vanishing/exploding gradient problem [17]. This problem is much worse in RNNs. When we train RNNs, we calculate the gradient through all the different layers and through time, which leads to many more layers, and thus the vanishing gradient problem becomes much worse. This problem is solved by Long Short-Term Memory architecture. An efficient approach based on RNN for emotion recognition was presented in [18]. The evaluation was done in CONVOLUTIONAL NEURAL NETWORKSto reduce the resolution of the output of convolutional lay- ers, therefore reducing the computational load. The resulting outcome is fed to a fully connected layer, where the data is flattened and is finally classified by the SoftMax unit, which extends the idea of a multiclass world.

In [41], deep CNN is utilized for emotion classification. The input of the deep CNN were spectrograms generated from the data patterns signals. The model consisted of three con- volution layers, three fully connected layers, and a SoftMax unit for the classification process. The proposed framework achieved an overall accuracy of 84.3% and showed that a freshly trained model gives better results than a fine-tuned model.

II. Review of Pose Detection

Body Posture recording is the process of capturing and analyzing a person's facial expressions to determine their emotional state. The recording typically involves the use of cameras or video feeds that capture the face in real-time or through images. The process can be automated using computer vision techniques, which detect and track facial landmarks, such as eyes, nose, mouth, and eyebrows, and then analyze their position, shape, and movement to identify emotions. The data obtained from facial emotion recording can be used to gain insights into a person's emotional state, such as happiness, sadness, anger, or surprise, and can be applied in various fields, including psychology, marketing, healthcare, and security. Overall, facial emotion recording is a valuable tool that can provide useful information to improve human interactions and provide more personalized HAMS.

In recent times, deep learning techniques have shown The train reached data junction at around 11:45 PM in the night. Data pointsselcted and he rushed to a shutting stall to ask when was the next train. The shopkeeper nodded his head and said, Data points was pale. He looked at the station clock. 11:50PM. He rushed out to the auto-stand. Everyone refused to go till pattern scraping although it was just 2 stations away. Data points was getting confused. He put his hands in his pocket to search for his phone and was shocked. It was missing. He rushed back to the train in which he came and searched the boggie but he couldn't find it. He searched his bag but he was unfortunate this time too. Data points sat on a bench in the empty platform and held his head with his hands. He was literally beating his head. He uttered in painful voice, "Why am I so unlucky? How much more should I deal with? In office, the pressure of boss. In home, the grindings from wife and on top of that my poor luck. My mobile is also stolen." Data points's forehead was swollen. He was so tensed and he then lost his cool. He shouted out, "Why all the poor things happen with me all the time?" Luckily there were only a few people in the station who too didn't seem to be bothered much. Only an old man once looked at him and then turned away and laid down. It was a cold winter night. The mid of January. The station clock showed time as 12:30AM. Data points couldn't think of anything. He slowly got up and he left the station premises and sat near a tea stall outside. It was closed but luckily a bench was kept outside on which he sat. Data points was in too much stress. He couldn't assimiliate all the events that had happened with him that day. Boss cursed, phone lost, reputation at stake, wife on the verge of divorce. Data points looked up at the dark sky and he started to think all sorts of rubbish. He was also very tired, hungry but had no option to come out of this pathetic situation. Had it be in the day-light or had he been a little better mentally, Data points would have made an attempt to go home. But that night, something prevented him to even raise up from the bench on which he sat remorsefully. He felt as if every door in life was closing on his face. LONG SHORT-TERM MEMORY

Long Short-Term Memory (LSTM) is precisely designed to solve vanishing gradient by adding extra network interactions. LSTM consists of three gates (forget, input and output) and one cell state. The forget gate decides what information from previous inputs to forget, the input gate decides what new information to remember, and the output gate decides which part of the cell state to output. Therefore, LSTM, as shown in Fig. 6, can forget and remember the information in the cell state using gates and retain the long- term dependencies by connecting the past information to the present [70].

The governing equations of forget gate, input gate, output gate, and cell state are presented in Eq. (12).

where f_t,i_t, $o_t$and $c_t$are the forget gate, input gate, output gate, and cell gate, respectively, σ is the sigmoid activation function, S_{t-1} is the previous states, $X_t$is the input at time t, W_f, $W_i$and $W_o$are a respective set of weights of the forgetgate, input gate, and output gate the intermediate cellstate defined in Eq. (13), and the new next state is obtained using Eq. (14).

where$W_c$is the weight of the cell state and $S_t$is the new state. All the multiplications are element-wise multiplication. features that could be efficiently utilized in the HAMS system to recognize emotions. However, recent researches have used the features fusion, which has enhanced the HAMS system in terms of recognition accuracy [15], [27]–[29]. The fusion is not limited to the features but has been implemented in classification techniques as well. Many traditional classifiers have been fused with each other to enhance the recognition rate of models. Likewise, many deep learning classifiers with other deep learning classifiers and many traditional classifiers have been assimilated with deep learning methods, showing some good results.

Many data patterns variations are mainly due to different speakers, their speaking styles, and speaking rate.

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The other reason being the environment and culture in which the speaker expresses certain emotions. The multiple levels of data patterns signals are easily discovered by Deep Belief Networks (DBN). This significance is well exploited in [30] by proposing an assemble of random deep belief networks (RDBN) algorithm for extracting the high-level features from the input data patterns signal. Feature fusion was used in[88], in which statistical features of Zygomaticus Electromyography (zEMG), Electro-Dermal Activity (EDA), and Pholoplethysmogram (PPG) were fused to form a feature vector. This feature vector is combined with DBN features for classification. For the nonlinear classification of emotions, a Fine Gaussian Support Vector Machine (FGSVM) is used. The model successfully implemented and archives an accuracy of 89.53%.

In [29], DNN decision trees SVM is presented where initially decision tree SVM framework based on the confusion degree of emotions is built, and then DNN extracts the bottleneck features used to train SVM in the decision tree. The evaluated results revealed that the proposed method of DNN-decision tree outperforms the SVM and DNN-SVM in Facial emotion recording is the process of capturing and analyzing a person's facial Transfer learning had no friends as all used to think him crazy. So, Transfer learning used to remain upset and depressed most of the time. In the afternoon, sometimes he used to stroll here and watch a few trains pass. On your left you can see a small pond," saying which the guy pointed towards something in the darkness. He said, "Sometimes Transfer learning used to sit there alone and talk to himself. That was his only time pass activity and he somewhat enjoyed it. The fact was that, Transfer learning's parents weren't very good going with each other. They had very little time for the family. On top of that if Transfer learning used to do anything wrong, his father used to blame it on his mother and his mother used to blame it on Transfer learning and thus leading that young soul to go through a lot of mental hardships. He had many misconceptions in life which no one ever bothered to clear. As a result he grew up with them. But he had one great power. The power of imagination. He could imagine whatever he wished to be or whomever he wished to meet. Once in the physics class he claimed to have met Albert Einstein in his dream and that they had a small donut and hotdogs party as he was teaching him the basic concepts of Physics. It was now obvious how much he had been humiliated in school that day. The Principal had also given his parents a written warnnig that he won't be continued in his school futher if he continued to think in such sick way. Transfer learning's father grew furious. But still, with time as he grew up, Transfer learning was a not committing the mistakes that he had used to commit in the previous times and was not more sensible [98].

HAMS system provides an efficient mechanism for systematic communication between humans and machines by extracting the silent and other discriminative features. CNN has been used for extracting the high-level features using spectrograms [71], [97], [102]. A different framework of CNN, referred to as Deep Stride Convolutional Neural Net- work (DSCNN), using strides in place of pooling layers, has been implemented in [97], [103] for emotion recognition. The proposed model in [91] uses parallel convolutional layers of CNN to control the different temporal resolutions in the feature extraction block and is trained with LSTM based classification network to recognize emotions. The presented model captures the short-term and long-term interactions and thus enhances the performance of the HAMS system.

An essential sequence segment selection based on a radial basis function network (RBFN) is presented in [96], where the selected sequence is converted to spectrograms and passed to the CNN model for the extraction of silent and discriminative features. The CNN features are normalized and fed to deep bi-directional long short-term memory (Bi-LSTM) for learning temporal features to recognize emotions. An accuracy of 72.25%, 77.02%, and 85.57% is obtained for IEMOCAP, RAVDEES[45], and EmoDB, respectively.

An integrated framework of DNN, CNN, and RNN is developed in [35]. The utterance level outputs of high-level statistical functions (HSF), segment-level Mel-spectrograms (MS), and frame-level low-level descriptors (LLDs) are passed to DNN, CNN, and RNN, respectively, and three separate models HSF-DNN, MS-CNN, and LLD-RNN are obtained. A multi-task learning strategy is implemented in three models for acquiring the generalized features by operating regression of emotional attributes and classification of discrete categories simultaneously. The fusion model obtained a weighted accuracy of 57.1% and an unweighted accuracy of 58.3% higher than individual classifier accuracy and validated the proposed model’s significance.

In [44], RNN, SVM, and MLR (multivariable linear regression) are compared. RNN performed better than SVM and MLR with 94.1% accuracy for Spanish databases and 83.42% for Emo-DB. The research concluded that SVM and MLR perform better on fewer data than RNN, which needs a more significant amount of training data. In [82], RNN obtained an unweighted accuracy of 37%, and

III. Challenges

As we might have thought lately, HAMS is no longer a peripheral issue. In the last decade, the research in HAMS had become a significant endeavor in HCI and data patterns processing. The demand for this technology can be reflected by the enormous research being carried out in HAMS [48]. Human and machine data patterns recognition have had large differences since, which presents tremendous difficulty in this subject, primarily the blend of knowledge from interdisciplinary fields, especially in HAMS, applied psychology, and human-computer interface. One of the main issues is the difficulty of defining the meaning of emotions precisely. Emotions are usually blended and less comprehendible [49]. The collection of databases is a clear reflection of the lack of agreement on the definition of emotions. However, if we consider the everyday interaction between humans and computers, we may see that emotions are voluntary. Those variations are significantly intense as these might be

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concealed, blended, or feeble and barely recognizable instead of being more prototypical features. Discussing the above facts, we may conclude that additional acoustic features need to be scrutinized to simplify emotion recognition.

Classification is one of the crucial processes in the HAMS system as it depends on the classifier's ability to interpret the results accurately generated by the respective algorithm. There are various challenges related to the classifiers, like the deep learning classifier CNN is significantly slower due to max-pooling and thus takes a lot of time for the training process. Traditional classifiers such as kNN, Decision Tree, and SVM [54][52] take a larger amount of time to process the larger datasets.

Additionally, during the neural network training, there are chances that neurons become co-dependent on each other, and as a result of which their weights affect the organization process of other neurons. It causes these neurons to get specialized in training data, but the performance gets degraded when test data is provided. Hence, resulting in an over-fitting problem. Classifiers like CNN, RNN, and DNN are very notorious for overfitting problems.

We have already discussed various challenges, but not the most ignored challenge, of multi-data patterns signals. The HAMS system itself must choose the signal on which the focus should be done. Despite that, this could be controlled by another algorithm, which is the data patterns separation algorithm at the preprocessing stage itself. The ongoing frameworks nevertheless fail to recognize this issue.

IV. Conclusion

The capability to drive data patterns communication using programmable devices is currently in research progress, even if human beings could systematically achieve this errand. The focus of HAMS research is to design proficient and robust methods to recognize emotions. In this paper, we have offered a precise analysis of HAMS systems. It makes use of data patterns databases that provide the data for the training process. Feature extraction[53] is done after the data patterns signal has undergone preprocessing. The HAMS system commonly utilizes prosodic [54] Although HAMS [57] has come far ahead than it was a decade ago, there are still several challenges to work on. Some of them are highlighted in this paper. The system needs more robust algorithms to improve the performance so that the accuracy rates increase and thrive on finding an appropriate set of features and efficient classification techniques to enhance the HCI to a greater extend.

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Detection of Diabetic Retinopathy

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***Abstract*—The Eyewhich is considered as the most important sense organ. The eye is an organ that responds with perceptions of light, color, and depth. The iris, pupil, cornea, and retina are some of the components of the eye. The human body's most delicate organ, it is also. While certain eye issues may be treatable, others could result in irreversible vision loss. Illnesses that are frequently seen include, age-related macular degeneration (ARMD),diapetic retinopathy, abnormalities of the optic nerve such glaucoma, loss of sharp vision due to diabetes, etc. The goal of this initiative is to identify diabetic retinal disease.**

To accurately diagnose DR and characterise its severity using digital fundus images, to suggest using CNN. To construct a deep learning netwrok with CNN architecture that can recognise the complicated elements needed for the classification of images or any data which is supported by CNN, such as micro-aneurysms, exudate, and haemorrhages on the retina, in order to automatically deliver a diagnosis when the user enters the image.

To developing a highly efficient chatbot for the user's convenience so that it may serve as a one-stop shop for all the solutions needed to treat diabetic retinopathy in order to make practical use of the forecasts.

Deploy the application and server to cloud so that is will be accessed by all an also to maintain privacy and security.

I. Introduction

Diabetic retinopathy, which is brought on by high blood sugar levels, damages the network of tiny blood vessels that delivers blood to the retina. It occurs from changes in the blood vessels of the retina. Blood leakage may occur if these blood vessels get damaged, which may encourage the growth of weak new vessels. Vision impairment is brought on by changes in cell damage. These modifications may result in blurred vision, ocular haemorrhage, or, if untreated, retinal detachment. Microaneurysms, Retinal edoema and hard exudates, Cotton wool spots, Dot and blot haemorrhages, and Macular edoema are a few of the linked causes of diabetic retinopathy. Diabetic retinopathy is uncommon before the age of 10, and the risk increases with diabetes duration.

Long-term type 2 diabetics—who are frequently middle-aged or older at the time of diabetes diagnosis—have a more rapid development of visual impairments due to diabetic retinopathy. Despite the fact that early diabetic retinopathy may not present with any symptoms, it is critical to start treatment as soon as possible to prevent any vision loss. Non-proliferative and proliferative diabetic retinopathy fall into two main groups. Non-proliferative diabetic retinopathy is the name given to early diabetic retinopathy without neovascularization. The aberrant growth of blood vessels in the retina is known as neovascularization (NPDR). When the condition worsens, proliferative diabetic retinopathy (PDR), which is characterised by neovascularization and has a greater potential for catastrophic visual outcomes, may appear. Difference between a person with normal eyesight and one who has diabetic retinopathy.

Diabetic retinopathy has four phases, which might each occur at different times. These are listed below.

*Mild non-proliferative retinopathy:*At this first stage of the disease, small patches of balloon-like swelling in the retina's microscopic blood vessels are known as micro aneurysms. The fluid from these micro aneurysms could seep into the retina. Your vision is unaffected at this time, but you have a larger chance of later experiencing vision issues. This diabetic retinopathy stage can be depicted by the figure.

*Moderate non-proliferative retinopathy:*The retina's blood vessels may expand and change shape as the condition worsens. Moreover, they can stop being able to carry blood. Both disorders may lead to diabetic macular edema and both alter the retina in distinctive ways (DME). numerous micro aneurysms, dot-and-blot haemorrhages, venous beading, and/or cotton wool patches are some of its distinguishing features.

*Severe non-proliferative retinopathy:*At this point, countless more blood vessels get blocked, which results in the loss of blood supply to multiple areas of the retina. To promote the growth of new blood vessels, these retinal areas connect with the body.

*Proliferative diabetic retinopathy (PDR):*At this point, the retina's nutritional signals lead to the growth of new blood vessels. the immature, deformed, and fragile blood vessels. The outside of the clear vitreous gel that makes up the eye's interior, as well as the retina, are where they grow. If left untreated, these new blood vessels might bleed, obstruct vision, or even damage the retina. The signs of non-proliferative diabetic retinopathy include cotton wool patches or microvascular abnormalities.

In essence, chat-bots let users communicate with computers in the same way they would with actual people by simulating human speech and writing and analysing it (either written or spoken). Whether they are straightforward programmes that react to straightforward questions or complex digital assistants that respond in real time to inquiries with a single line of code, chatbots learn and adapt as they gather and analyse information to give increasing degrees of personalisation.

Chatbots used to be text-based and programmed to react to straightforward questions with previously written responses created by the bot's creators. While they performed well for the specific questions and solutions they had been educated on, they fell short when confronted with

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challenging or novel issues. Their functioning was comparable to that of an interactive FAQ.

II. Literature Survey

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III. Proposed System

One of the main reasons for vision loss is diabetic retinopathy (DR), which is brought on by issues with diabetes that harm the retina. Early diagnosis and better DR therapy may arise from examination of the retinal images for important DR traits. Automated DR detection in retinal pictures is a solution to this problem. The automated algorithms were developed to detect early DR and are designed to suggest an ophthalmologist referral for any patient with DR. The development of an automated system for the identification of DR aids in early diagnosis and minimises the harm caused by diabetic retinopathy. This automated model's objective is to assess the degree of the disease visible in the submitted fundus image. This technology analyses a retinal image as an input and recognises the illness stage present. The model is trained using a classification method, and it uses the input fundus image to classify the disease stage that is present.

Advantages

- Automated method
- Less Time for Prediction
- Good Accuracy

A. Overview of architecture

Fig 1 Everyone can see thatto collect the data and to pre-process that data and to extract the feature and build a model to know the diabetic retinopathy.

B. Related work

In "Development and Validation of a Deep Learning Algorithm for Identification of Diabetic Retinopathy in Retinal Fundus Photos" published in JAMA [2016], VarunGulshan et al. describe a deep learning approach for DR diagnosis using retinal fundus photographs. Using a dataset which consists of 128,175 retinal images, the authors demonstrated the good sensitivity and specificity of their method for DR identification.

A hybrid approach that combines feature selection approaches and machine learning techniques is suggested in the Sensors article "Detection of Diabetic Retinopathy Using Machine Learning, Ensemble, and Feature Selection Techniques" by M. Usman Akram et al. in 2019. The researchers demonstrated how their algorithm diagnosed the severity levels of DR using a dataset of 1,500 retinal images.

In "Automated Detection of Diabetic Retinopathy Severity Using Deep Learning Algorithms," by Nikhil Pujari et al., published in Scientific Reports in 2020, a deep learning-based approach for automated DR severity categorization is provided. The scientists used a collection of 39,308 retinal images to accurately classify the different DR severity levels.

C. Data Collection

The neural network is aadvance machine learning method that is based on the structure and functionality of biological neural networks. To simulate how the brain works, this concept was developed. The distinct, tiny units that make up brain networks are called neurons. Neurons are grouped in groups called layers (see diagram above).

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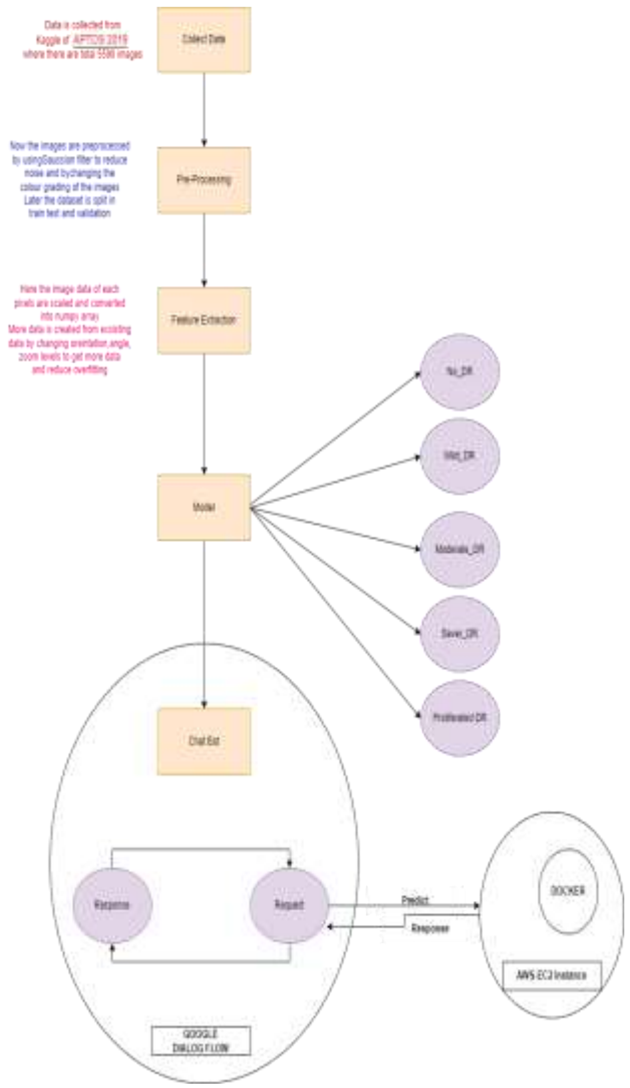
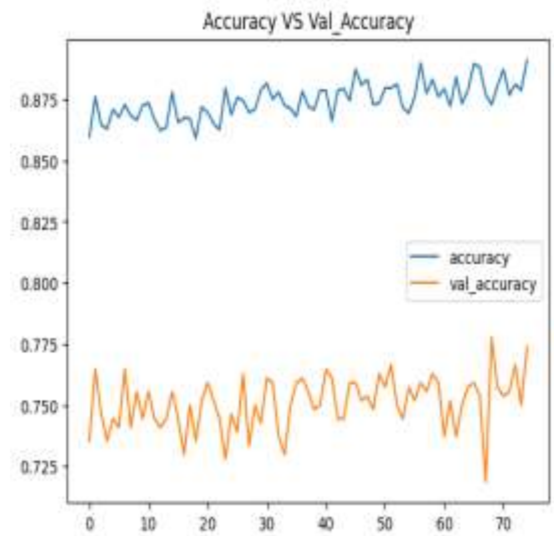
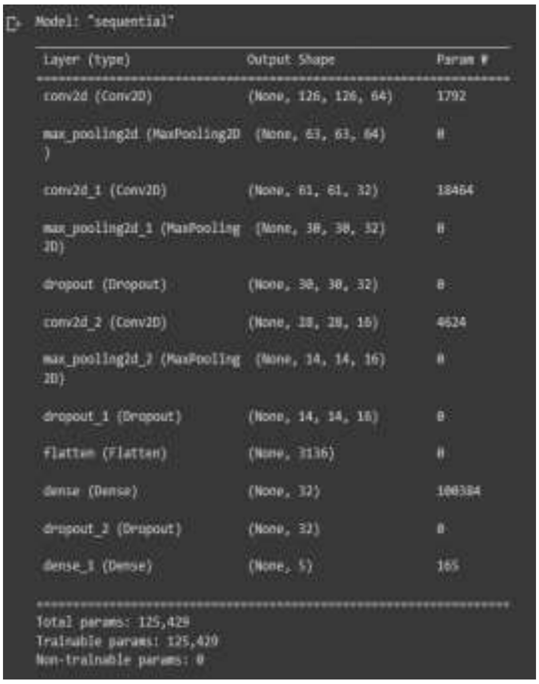
Together, the neurons in the layers above and below form a network. Along with these molecules, data travels from the input layer to the output layer. Every node individually finishes a straightforward mathematical calculation. The data is then sent to all of the connected nodes.



The use of convolutional neural networks (CNNs), a subtype of deep learning, in image processing and interpretation, particularly medical imaging, has a remarkable track record. networks with picture-data-friendly topologies. Unfortunately, neural networks were not practical for increasingly challenging picture identification applications until a number of advancements, such as the introduction of dropout and rectified linear units and the associated gain in processing capacity through graphics processor units (GPUs). To effectively complete extremely challenging photo identification tasks employing a variety of object classes using large CNNs. The yearly ImageNet and COCO challenges are only two examples of the cutting-edge image categorization projects that make use of CNNs nowadays.

When it comes to CNNs in particular, automated grading has two key problems. One benefit is getting the necessary insensitivity and specificity offset (patients correctly classified as having DR) (patients correctly identified as not having DR). For national criteria, which is a five-class problem in the normal, mild DR, moderate DR, severe DR, and proliferative DR classes, this is substantially more difficult. A major problem in neural networks is overfitting. The network overfits to the class that is most prevalent in the data when the dataset is skewed. Extreme skewness is typically present in large datasets. Less than 3% of the photos in the sample were from the fourth and fifth grades; hence, modifications to our network were needed to make sure that it could still recognisethe features of these images. To offer a CNN approach based on deep learning to categorise DR in fundus images. It has been the focus of several research in the past and is increasingly important for diagnosis.




Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 126, 126, 64)	1792
max_pooling2d (MaxPooling2D)	(None, 63, 63, 64)	0
conv2d_1 (Conv2D)	(None, 61, 61, 32)	18464
max_pooling2d_1 (MaxPooling 2D)	(None, 30, 30, 32)	0
dropout (Dropout)	(None, 30, 30, 32)	0
conv2d_2 (Conv2D)	(None, 28, 28, 16)	4624
max_pooling2d_2 (MaxPooling 2D)	(None, 14, 14, 16)	0
dropout_1 (Dropout)	(None, 14, 14, 16)	0
flatten (Flatten)	(None, 3136)	0
dense (Dense)	(None, 32)	100384
dropout_2 (Dropout)	(None, 32)	0
dense_1 (Dense)	(None, 5)	165

Total params: 125,429
Trainable params: 125,429
Non-trainable params: 0

D. Data Pre Processing

Diabetes has a consequence called diabetic retinopathy, which can damage the retina's blood vessels. Analyzing retinal pictures is commonly used to detect and diagnose

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diabetic retinopathy, and in order to get meaningful findings, thorough data preparation is sometimes necessary.

Image acquisition and quality control: To reduce the likelihood of receiving subpar photos, make sure the images are taken with top-notch retinal cameras. In order to make sure that the photographs are clear and devoid of noise or abnormalities, it is also crucial to examine the image quality.

Picture normalisation is the process of balancing the intensity levels to decrease the impact of varying lighting conditions. This can be accomplished using a histogram equalisation approach, such as contrast-limited adaptive histogram equalization[CLAHE] or adaptive histogram equalization[AHE].

IV. TECHNOLOGIES

*PANDAS:*Data analysis is Pandas' primary goal. Many file types, including comma-separated values, JSON, SQL, and Microsoft Excel, may be used to import data into Pandas. Pandas supports operations including merging, restructuring, and selecting in addition to data cleansing and wrangling.

The csv files are read using the read csv() method from the location that is supplied. This function is used in our project to read the train and test csv files.

Data Frames are two-dimensional data structures with potentially various column datatypes. Add additional parameters to the csv file, such as the file location, and save them in the dataframe. The pandas Dataframe may be used for a greater variety of functions.

*NUMPY:*To work with arrays, utilise the NumPy Python module. In addition, it offers matrices, the Fourier transform, and linear algebra operations.

The reshape() function may be used to change the size of the array, which include the elements toreshape the data to fit any dimension using the reshape() function. This feature is used in our project to alter the image's proportions.

The shape of an array is expanded using the expand dims() function. The position of the new axis will be displayed at the centre of the expanded array form. This function expands the dimensions of the input picture before passing them as a parameter to the trained model.

The minimum value of a Numpy array may be obtained using the amin() function. This function specifies the radius of the circle drawing for the circular crop function. The smallest width and height of the picture are used.

*OPENCV:*The open-source software package OpenCV may be used for developing any real-time computer vision applications. Video capturing, Image processing and analysis—which includes tools for face and object detection—are the main areas of focus. Consequently, fundus pictures are processed using OpenCV.

An image may be saved to any storage media using the imwrite() technique. The filepath must be supplied to this procedure as an argument.

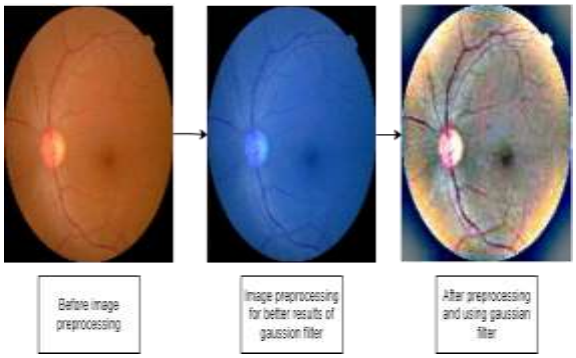
An image may be loaded from any storage media using the imread() API. The filepath must be supplied to this procedure as an argument.

The image's two arguments are passed to the resize() function. both the size and the picture. The picture tocaptured has a 128 by 128 pixel resolution.

GaussianBlur() Moreover, to must supply sigmaX and sigmaY, which stand for the standard deviations in the X and Y axes, respectively. SigmaY is assumed to be the same as sigmaX if only sigmaX is supplied. If either or both are provided as zeros, they are determined based on the kernel size. Gaussian noise may be effectively removed from a picture using gaussian blurring.

$$G(x,y) = \left(\frac{1}{2\pi\sigma^2}\right) e^{-(x^2+y^2)/2\sigma^2}$$

The cvtColor() function is used to change the colour space of an image. OpenCV offers more than 150 different color-space conversion techniques. In our project, employ this technique to convert a BGB image into an RGB one.



*KERAS:*Both Theano and TensorFlow may be used with a straightforward Python deep learning library called Keras. It was developed to facilitate studying and building deep learning models as quick and straightforward as possible. It runs on Python 3.5 and can function flawlessly on CPUs and GPUs given the underlying frameworks. It is made available under the adaptable MIT licence.

Four guiding principles were used by François Chollet, a Google developer, to create and maintain Keras:

*Modularity:*A graph or sequence a by themselves can be used to understand a model. A deep learning model's problems are all separate elements that may be merged in any way.

*Extensibility:*Newly modules or components are purposely designed easy and can be used inside any other framework in order to encourage researchers to try and examine new notions.

*Minimalism:*The library simply provides what is required to complete a task in order to maximise readability.

*FLASK:*The Flask class is initially imported. Our WSGI application will be an instance of this class.

The next step is to construct a class instance.

The first parameter is the name of the application's package or module. The name will change depending on whether the module is imported or launched as an application (for example, "__main__" against the real import name), therefore when using a single module, you

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should use __name__. This is required due to Flask needs to know where to search for the static files, templates, and other objects.

Then, Flask is told which URL should call our function using the route() decorator. The function receives a name, and this name is also used to generate URLs for that particular function.

*GOOGLE DIALOGFLOW:*Platform for building a modern chat bot and interpreting natural language .Integrating and designing conversational and informative user interfaces for websites, mobile applications, online applications, devices and interactive voice response systems requires the usage of Dialogflow.It also provides all the integration platforms which helps to deploy the chat-bot with ease.

*PICKLE:*Serializing and de-serializing Python object structures are performed by the pickle module via binary protocolsPickling and unpickling are Python operations that change an object hierarchy from Python into a byte stream and back again, respectively. It is a powerful Python tool that allows you to save your machine learning models, minimise lengthy retraining, and share, commit, and reload pre-trained models.

*NGROK:*NGROK is an excellent tool for exposing the web servers which are running locally, creating webhook integrations, providing access to SSH, testing, and demonstrating from your own local machine is Ngrok, a reverse proxy which in turn opens a secure tunnels between localhostanpublic URLs.

*DOCKER:*Docker,a software used for deploying,building, testing applications quickly. Using Docker, softwares are packaged into standardised containers which include libraries, system tools, code, and runtime to run. It is easy to deploy and scale applications with Docker into any environment and you can be confident that your code will run there.

*DOCKERIZATION:*The Dockerization process involves packing, deploying, and running applications in Docker containers.The Image of a Docker container is a standalone ,lightweight, and executable package of software that serves as a working computer for an application. It contains all the components necessary for the application to run, including all the code, build files, runtime environment, dependencies, system tools, libraries, and settings.

*AWS-EC2:*Amazon Elastic Compute Cloud is also known as AWS EC2. Using it, users can configure virtual machines according to their own preferences.With Amazon EC2(Amazon Elastic Compute Cloud), you can scale your computing capacity across Amazon Web Services (AWS). With Amazon EC2, you don't need to purchase hardware up front, which enables rapid application development and deployment.

V. CONCLUSION

The stage of diabetic retinopathy is predicted by the suggested project. The majority of the vessels in the retina can be finely extracted, according to some of the extraction findings of the suggested technique. The signals utilised for classification occur in a region of the picture that is readily apparent to the viewer, according to visualisations of the characteristics learnt by CNNs. The macroscopic characteristics in moderate and severe diabetic retinal pictures are of a scale that can be classified by existing CNN designs, such as those found in the ImageNet visual database. In contrast, the characteristics that distinguish between moderate and normal illness are found in less than 1% of the entire volume of pixels, a degree of subtlety that is frequently challenging for human interpreters to recognise. Image processing is utilised in this study to identify vessel-like structures and suppress non-vessel-like ones. Although the performance for the extraction of micro vessels still has to be improved, this approach is successful for the big vessels. The project's testing findings show that the suggested technique outperforms earlier strategies. For any fundus picture, this programmed method is quite effective. The stage of the disease is diagnosed based on the accuracy, specificity, and sensitivity. It has been noted that this method reduces the quantity of false positives found, increasing the system's sensitivity.

Now as the application is deployed in cloud an one can access and make use of this service in effective and productive way.

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Driver Drowsiness Monitoring and Detecting System Using Deep Neural Network

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***Abstract*— The topic of this paper examines the problem of driving safety and offers a fresh perspective. system for driver drowsiness monitoring and Detection. World has seen many of the accidents occur due to driver's fatigue and a small-scale distraction factor while driving the vehicle. The system is design such that it will precisely scrutiny the eye blink & yawn. Dissimilaritycovering the eyeand mouth will differ as per eye blink and yawn. Road accidents are verycommon now a days and the main reason behind them is mostly due to drivers drowsiness.This can occur during daytime or at night depending on the health and the daily routine cycle of the driver. The World Health Organisation reported that 1.26 million people died as a result of traffic accidents in 2016. deaths worldwide This research proposes a novel method for real-time sleepiness detection. This strategy is based on a deep learning technique that may be used with Android apps. with high accuracy. Sleep is an involuntary action in our body which we can't control specially when we are sitting in a confined space. This proves to be life threatening not only for the drivers but also for all the passengers travelling. minimal network proposed an accuracy of more than 80%.**

Keywords : Driver,Deeplearning,Opencv,Keras

I. Introduction

Drowsiness is a primary contributor to driver impairment, which leads system (DMS). This feature was further contrasted to and combined with data from vehicle-based sensors. In this work, We present a low-cost,fully autonomous approach to an issue of fatigue detection. Using a standard camera, we determine the pattern of longer length eye-lid closures.The length of time spent between the lower and upper lids connected is the duration of one eye blink. The pattern identifies fatigue before the driver takes asleep and alerts him via voice messages. To collisions and fatalities. Drowsiness may be detected using numerous installed in a car. Other applications like Netflix at the time, the types of sensors, according to research. In a high-fidelity driving popularity of Hotstar and other streaming services with platforms simulator.

It should be noted that while they are often available in expensive cars, the use of devices such as tiredness detecting safety systems is uncommon and not widely used among drivers. According to surveys conducted in 2019, there has been an increase in the embedding including that is most commonly used in automobiles. Additionally, deep learninghas made dramatic strides in machine learning during the past few years. As a result, implementing these novel technologies and methods can bea useful way to both increase the effectiveness of the real-time driver sleepiness detection system that is already in place and provide drivers a tool they can consume.

1.1 Scope

The proper application of outside influences for measuring fatigue, such as automobile states, sleeping habits, weather conditions, and mechanical data, may be the focus of future research., and so on. Driver sleepiness is a huge hazard to highway safety, and it is especiallyacute for commercial vehicle operators. This major safety issue is exacerbated by. Demanding work hours, 24-hour operations, substantial annual miles, and exposure to harmful environmental conditions. An essential stage in a series of preventive measures needed to address this issue is to monitor the driver's level of inattentiveness and provide feedback on their state so they may respond appropriately. Neither the zoom nor the camera's direction can be changed while the system is in use. Future work might involve automatically enlarging The eyes can then be located once. The system's accuracy can be increased by adjusting additional factors like the vehicle's condition, the presence of foreign objects on the human face, and so on. It is possible to develop a tool that can alert users or stop them from dozing off.

1.2 Methods

1.2.1 Deep Learning

Prior to the development of Convolutional Neural Network, the image recognition was being backed up on the traditional algorithms. But for the image processing, based on what the model is going to recognize the features must be recognized as per the requirement. But this processmay be seen as a challenge due to the fact of defining features for different image types. A Model may study the feature and its representations on behalf of this which leads to deep learning representing the features for image on several levels of representation This project utilizes the neural network to recognize plant leaf images, and the pre-trained models are used to evaluate the performance based on the comparison of accuracy.

1.2.2 Multilayer Perceptron

A MLP, which is a is an artificial neural network with feedforward propagation that transforms a set of inputs into a set of outputs. An MLP is a directed graph connecting the input and output parts of the many layers of node input. The network is educated through MLP using backpropagation. A deep learning method is MLP.

A perceptron with multiple levels is a kind of neural network that joins several layers in a graph that is directed, which means that there is onlyone possible signal path across each node. A nonlinear function for activation is present for each node in addition to the input nodes. An MLP employs the supervised learning method of backpropagation. MLP uses many layers of neurons, making

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it a deep learning technique.MLP is frequently. Guided problem solving frequently makes use of MLP. Interests include studying learning, computational neuroscience, and parallel distributed processing. Examples of applications include speech recognition, image recognition, and machine translation.

II. Literature Study

Numerous researchers have studied driver fatigue and drowsiness in the literature and have proposed various methods based on a variety of metrics. In addition, many automakers have created their own driver fatigue and drowsiness systems to increase the quality and security of their products and minimise losses brought on by drowsiness.

In 2019, Deng et al. proposed a method for face detection. that tracks the face while employing landmark locations to find fatigued drivers. They looked for indicators like yawning, closed eyes, and blinking.

Zhao et al. (2019) employed a face scenario classifier that used both landmark points and texture. They evaluated the function of each facial feature for detecting exhaustion, taking into account features like the nose, lips, and eyes. In the end, they believe that the lips and eyes are the most prominent signs of exhaustion.

Kim was et al. created a fuzzy-based method for classifying each eye's condition. They utilise the HSI and CMYK spaces' I and K colour information in their approach. The ocular region is then binarized using the fuzzy logic system based on I and K inputs.

Driver Safety Development: Real-Time Driver Drowsiness Detection System Based on Convolutional Neural Network Maryam Hashemi et al., suggested (2020) in the dataset they proposed new comprehensive data and it work with (FD-NN and TL- VDD) and they target for high accuracy and fasten.

Rateb Jabbar et al., (2019) proposed Driver Drowsiness Model using CNN for AndroidApplication In this paper they detect the facial expression by the smartphone with storage capacity with the convolution neural network technique they increased the accuracy.

Seok-Woo-Jang et at., (2020) author proposed an implementation of detection system drowsy driving prevention using image recognition an IOT the data set they used facial expression and eyeblink from that facial technology and STT are used to desired to avoid drowsiness while driving.

Chaoyang et at., (2020) author proposed Unsupervised drowsy driver detection with RFID where traffic is increased and it became important factor for human life in this paper, they proposed lowcost fatigue detection system sense drivers nodding movement using commodity RFID with highly accuracy and validation for the real timescenarios.

Ghoddoosian et al. (2019) presented a sizable real-world dataset with 30 hours of video, a variety of material, and both covert and overt signs of drunkenness. The method's main element, a Hierarchy Multi-scale Long-Term, Short- Term Memory (HMLSTM) network, is fed sequentially by recognised blink features.

Krajewski et al. (2018) On the basis of connections between small modifications and fatigue; 86% of the time, drowsiness was correctly identified. Additionally, lane position deviation can be used to identify a driving pattern. In this case, the car's position in relation to a certain lane is monitored, and the deviation is investigated. However, tactics based on driving patterns all heavily depend on driving abilities, road circumstances, and vehicle features.

Anitha et al. (2020) aimed to enhance the performance of face detection algorithms and monitor the driver's eye in a video input. In order to discriminate between normal blinking and falling asleep, recurrent neural network models (RCNN) are frequently utilised in the driver sleepiness detection sector.

Rashid et al. (2020) analysed the situation, difficulties, and potential answers for the EEG-based brain-computer interface. They also briefly covered the most popular time-frequency-spatial-domain, time-domain, and spatial-domain aspects for brain-computer interfaces in their work.

III. Proposed Methodology

3.1 System Proposed

We using a Deep Neutral Network, generally known as an MLP. The MLP is a straightforward neural network made up of connections that represent the neurons that make up the output from the input class.One or more inputs that mimic dendrites are provided to the artificial neuron, which then collects them using connection weights before producing. a class.Fig.

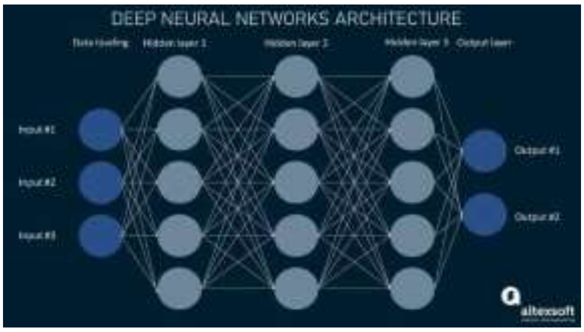

Fig 1. Deep Neural Network

In other words, the function fu(x) for one-hidden-layer MLP is stated as fu(x)=A (b + W (s (b+W x)).

3.2 Dataset-Taken

The investigation of the Driver Drowsiness Detection Dataset will be the main focus of this study. There are 22 people of different ethnicities in the overall dataset component, including the training dataset and testing dataset.

3.3 Dataset Preprocessing

To decrease the unwanted data and noise from the data, we do pre-processing and this will make the accuracy increase and speed-up the executing. Data-pre-processing is

DOI: rp-9788770040723.126

done with Data-Augmentation, which is getting the different characteristics of the data images and combining it. Rotation, flip, zoom, fill, shear etc are the methods which is applied on every image for augmentation. Library which is used for augmentation is Keras.

3.3.1 Augmentation Of Data

For getting big accuracy, the deep-neural network will need a lot of data. Sometimes the image sizes will not be enough for this. So, at this kind of places, we will use some data methods like flipping, rotating, zooming, shearing etc. to each image. These techniques will make new set of datasets which will be good for training purposes. It creates a new set of images from the already existing data and this process is called data-augmentation. The images needed for the training is not captured by ourselves. This is already available in public. The meaning of the term augmentation of data means that, different techniques like rotation is applied. Some of the data-augmentation techniques are as, Geometric-transformation, color-spacee-augmentation,filtering applied to kernel , picture blend, erasing randomly, feature-space-augmentations, adversarial-training, generative-adversarial-network, neural-style-transfer,meta learning. Data augmentation strategies target overfitting at the training dataset, which is the source of the issue. This is done with the expectation that augmentations will allow for the extraction of more data from the original dataset. By data warping or oversampling, these augmentations artificially increase the size of the training dataset. Warping of data augmentation changes the already available images but it will remain the labels. In this technique, the methods are processes like erasing randomly, adversarial-training, colour changes such as Gray and geometric such as rotation, flip etc, and neural-style-transfer. Over samples are added to the training images to get the synthetic styles. The example of synthetic styles is blending of images, augmentation of feature-space, and generative-adversarial-networks. The data augmentation safety is ensured by retaining the labels and hence changing the data content will not affected by it. This process is safe for general image identification tasks such as identifying cat and dog, but this is not a good practice when comes to tasks like digit and signs. In that case, rotation and flip will create meaningless data. For forecasts which is un-certain, the non-labelling technique will be efficient. Post-augmentation labelling is adjusting for this method to ensure this. The label as well as non-label preservation to the data will be giving better performance for the training as well as increase the accuracy in prediction-time.

3.4 Deep-Learning

This is a sub part of AI which calls artificial intelligence. Deep- learning is the technique which is under AI which is idea from brainof human and the neurons and learning process of it. There will have neurons like human and will act somewhat similar to them. We have used 2156 images for the deep learning purpose, which is learning the features of each image with neurons. There should be training as well as test data for this because if we use the same data which we have used for the training is taken for the testing as well will notgive good accuracy. So that we will split the whole data into training-testing data. The number of layers in MLP which is Consequently, the acquired videos Videos of scenarios were captured during an experiment using an infrared (IR) illumination with a resolution of 640 by 480 in AVI format. The experiment's goal was to obtain IR videos, which were then included in the dataset collection. For the model to comprehend all of the subtleties and variations in the photographs, more data is required during the deep neural network training phase. By performing a series of augmentation methods on the images extracted from video frames—a common method for boosting the number of training points—data augmentation was used to create new images.

3.5 Multilayer Perceptron

Multilayer perceptrons may acquire knowledge throughout the training process. Iterations are used during this procedure to ensure that errors are kept to a limited. achievable until the required input-output mapping has been achieved; in this case, a collection of training data containing:

$$h(x)=s\ (b+W\ x)$$

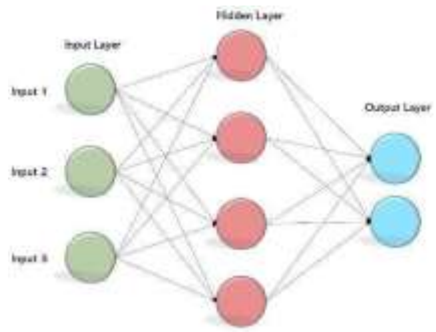

Fig.2.Architecture

IV. MODULES

4.1 Creation Of Models

The method utilised to develop a neural network architecture to which the driver is drowsy, is described in this section.

The proposed technique would classify movie frames according to recognisable facial characteristics obtained by MLP. method is summarised in Figure 3.

All of these participants were observed in both daytime and nighttime driving conditions, including conventional driving mode, yawning, sluggish blinking, aware chuckling, and dizzy dozing.

DOI: rp-9788770040723.126

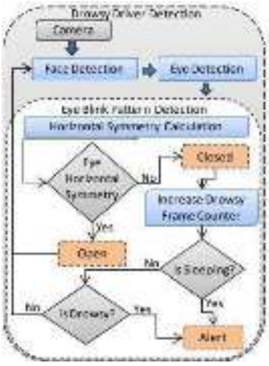

Fig 3 Model Diagram

Our strategy comprises of five steps:

Extracting Real-Time Videos :

The dataset is searched for videos of drowsy drivers in the first stage. 18 subjects were used for the training dataset in this study, whereas 4 subjects were used for the evaluation datasetan image.

Third phase:Using photos to extract landmark coordination:

The Dlib18 library is used in the third phase to manage the neural network graph from photos.

In order to map the face structures, this library is really utilised Python was used to construct the open-source library known as Dlib.Robotics, cloud computing, the Internet of Things, and embedded systems are just a few examples of server-side applications that use machine learning algorithms. Keras detects face landmarks using OpenCV's built-in driver drowsiness feature-based cascades.

This effective machine learning-based method for object detection was put forth by Paul Viola and Michael Jones19. Positive and negative pictures, in particular, are utilized to train a cascade function. As a result, it can recognize things in other photos.

Fourth step: teach the algorithm the neural network which possibly gets output and it similarly workedand every input and output will reducedthree hidden layers and is detailed in Algorithm 1.During this step, a training process ensures that various predictions are made.

The fifth phase: Extracting the modelFinally, the computer can determine a driver's drowsiness level based on a landmark on their face.

The measures used to effectively assess Precision, recall, and F-Score measure the proposed system's efficient performance. The robustness and effectiveness of the algorithm are assessed using metrics like Precision and Recall rates, which are researched and computed depending on the recognition rate.that when all elements, including motion, illumination, and eye conditions, are considered, the suggested system has the best recall rate. the system's recommended measures' mean value.

If the result falls into one of the established categories—such as closed eyelids, exhausted, or sleepy expressions—our system examines the input and recognises whether the driver is classified and informed based on the driver's facial expression.Two video clips of drivers exhibiting a variety of facial expressions were used to examine the experiment's outcomes. The movies are captured in real time with variable and unpredictable lighting. Various mouth states, including normal, yawning, talking, and singing, are included in the datasets.

In the video input, we observe that 'Head Yaw,' 'Eye Gaze,' and 'Phone'are the key reasons for driver inattention from generic feature reveal theregions of driver inattention and specific facial feature block may be utilised to reason about the driver inattention.Driver attention rating is a very subjective topic, and the factors responsible for predicting this rating (head attitude, eye gaze, face area, etc.) may differ from one driver to the next.

4.1 Eye Blink Detection

In the situation of missing eyes, In order to determine the exact position of the eyes, we used the prior eye placements in reference to the detected facethe eyes. The position is determined if only one eye is absent by comparing the detected eye's present dx and dy coordinates to where it was in the previous frame. The prior location of the missing eye location is then added to the displacement variables dx and dy to recognise various eye patterns (both open and closed), we first use (1), (2),and (3) to conduct contrast stretching.

err" = high'– low" for in --→2

err- = high-– low-. For out--→3

The region of interest was then divided horizontally into two parts (Upper and Lower) by a line going through the centre pupil of the eye. Due to the An open eye design possesses horizontal symmetry, whereas a closed eye pattern does not, due to the round form of the eye.

Idiff =(VF(Up(I'))-Low(I')) –4

I sum = ∑width, height Idiff (i, j), i=0j=0 ---5 I state = { open I sum<T {close I sum >T} ---6

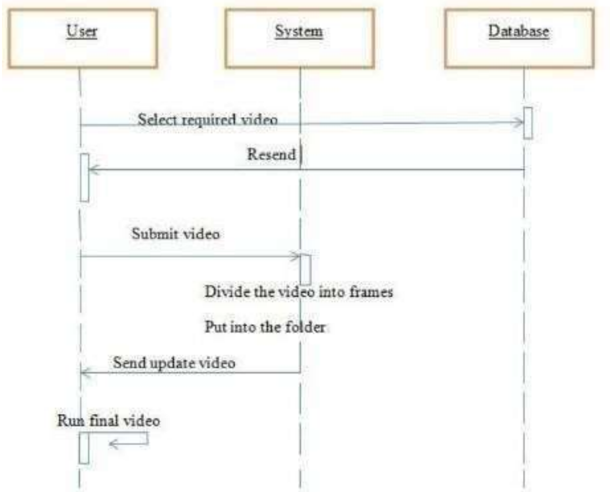

Fig 5: Sequence Flowchart

We proposed using the symmetry property to distinguish between open and closed eyes. We found the

DOI: rp-9788770040723.126

horizontal using (4), (5), and (6). Idiff If I is the contrast-stretched and normalised image, indicates the symmetry of the eye. VF(I) represents the top whereas Low(I') represents the bottom half of the image.Sum is the total sum value of the Idiff picture, and I state is the detected eye status taking the Isum value into account.

4.1.1 Detection Drowsiness

Drowsiness can be detected using three approaches, which we discussed in TABLE 1. Given that the average time of an eye blink is less than 400. As a result, we set TDrowsy=400ms and TSleeping=800ms.

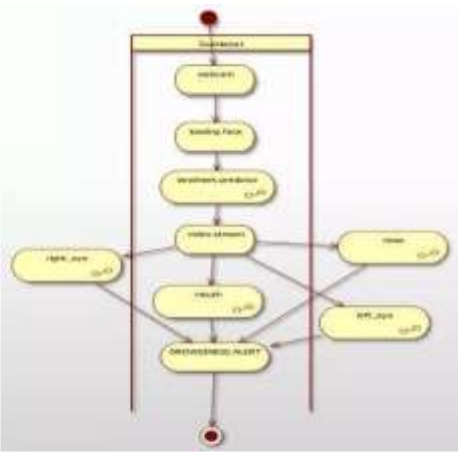

Fig. 4 Activity Diagram

TABLE 1

Drowsiness Level	Description
Awake	Blink duration<Tdrowsy
Drowsy	Blink duration>Tdrowsy and Blink duration<Tsleeping
Sleeping	Blink duration>T sleeping

The detection of drowsiness is intimately linked to the detection of eye blinks. The threshold values are compared to the timing of closed-eyes events.The TDrowsy and TSleeping values correspond to 10m and 20m distances in the case of a 90km/h car, giving the system enough time to deliver a warning signal to the driver.

Detection of Mouth

Some driver hypovigilance systems detect the mouth based on red colour features of the lips, but they can only function properly in appropriate lighting conditions.

Face Identification

Face tracking is a technique for detecting the presence of a face in an image or video. Face tracking mostly works by comparing existing andnew face features. It is widely utilised in real-time technologies.

4.2.2 Decision Making

It is determined if the individual in question is drowsy or not based on the extracted characteristic calculation and symptoms. If the preceding stages are successful, it results in more accurate decision making.

We divided the desktop-based strategy into two major components, namely hardware and software. The hardware section is also divided into two sections:

i) processing hardware and ii) imaging hardware. We will now go over the use of imaging techniques in greater detail. The flow diagram of our discussion about desktop-based techniques is shown in Fig.Every film

Each movie takes about 6 minutes to extract the face features from a sample of 50 frames.

The clip has 50 frames per image, and it takes an average of 6 minutes per movie to extract facial features.It takes roughly 1.2 seconds to predict the driver rating using Attention-based AutoRate. The model runs in 7 minutes and 20 seconds, therefore real-time performance cannot be provided.

A state-of-the-art approach was used to extract the features, output type, output dimension, and performance of various pre-trained models from the precise information about the feature.

RESULTS

First, we will arrange a camera that scans the stream for faces; if a face is identified, facial landmark detection is added, and the eye domain is removed.

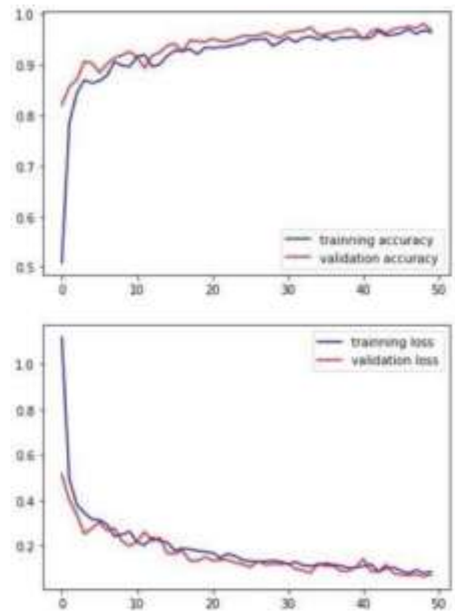

Fig 7.Accuracy Graph

THE BENEFITS Below are some of the many benefits of the adopted technique or system:

1. The presence of sleepiness.
2. A reduction in traffic accidents.
3. This approach has real-world applications.

CONCLUSION

Using the symmetry characteristic, we proposed a new method for detecting eye blinks. Because it operates within the same frame, the proposed system is not affected by head movements. In order to determine the driver's condition, the system's job is to identify facial landmarks in photographs

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and input the generated. The method's objective is to shrink the model because embedded systems can't use current applications they have a small amount of computing and storage. The experimental results demonstrate that the employed model is modest in size and 90% correct. As a result, it can be included in sophisticated driver-assistance systems. The algorithm- based deep neural network detection method for driver drowsiness Keras and OpenCV aretwo examples. However, there is still room for improvement in terms ofperformance. The next step willbe to identify the driver's distraction andyawning.

FUTURE WORK

Android devices are widely available and affordable, and smartphone- based approaches are becoming more and more common. However, the real-time detection rate is less precise than the desktop-based method.The most difficult challenges with driver sleepiness detection systems are related to detection in low-light conditions. Scientists can develop it so that detecting systems can be simply conducted. The accident rate will thereafter gradually decrease day by day.

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Automated Detection of Spam on Instagram using Classifiers and NLP

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***Abstract*—Our daily lives now rely heavily on social media platforms. Invasion of privacy, data theft, and even financial fraud are just a few issues that spam communications on these sites can lead to. Using machine learning techniques, we suggest a technique in this work to identify spam messages on Instagram. With the use of tokens, lowercase conversion, punctuation removal, and stopword removal, we preprocessed text data from an Instagram dataset. Using the VADER (Valence Aware Dictionary and Sentiment Reasoner) algorithm, we also conducted sentiment analysis on text data. The emotion ratings and text data were then turned into numerical feature vectors using CountVectorizer, and the training data was used to train three classifiers (Naive Bayes, Decision Trees, and Random Forest). Calculating these classifiers' accuracy, precision, recall, and F1 score allowed us to assess how well they performed on test data. We discovered that the suggested strategy successfully identified Instagram spam messages and had a high F1 score. The suggested approach will enhance the overall user experience and security of the platform by assisting Instagram users in identifying and avoiding spam messages.**

I. Introduction

Spam messages have grown to be a serious issue for users and platform owners as social media platforms proliferate. Spam posts could include dangerous, inaccurate, or irrelevant information that would negatively impact how you utilise our site. Therefore, it is crucial to create technology for automatic spam detection in order to guarantee a secure and satisfying user experience.

In order to identify spam on social media sites, this research study suggests a text classification model that makes use of natural language processing (NLP) methods and machine learning algorithms. The model seeks to categorise whether text is spam or not, as well as if it has a positive or negative mood. Due to Instagram's vast user base and the rising number of spam posts on the site, we decided that it would be our platform of interest. The model was developed and tested using a dataset of Instagram posts, and the outcomes demonstrate that the model is capable of identifying spam posts with high accuracy, recall, and F1 score, classifying them as either good or negative.

The remainder of this essay is structured as follows:

The summary of relevant research on text classification and social media spam detection is presented in Section 2. Data collection, preprocessing, and feature engineering are all covered in Section 3's methodology section. The experimental findings and an analysis of the suggested model are presented in Section 4. Section 5 concludes by summarising the research and outlining the work's future directions. The project can be expanded to incorporate more sophisticated natural language processing methods as well as real-time data from Instagram and other social media networks.

II. Objective

This research paper's goal is to create and assess a method for identifying spam on Instagramutilising sentiment analysis and natural language processing methods. The difficulty of unwelcome content on social media platforms, which can harm user engagement and experience, is what this project aims to address. The strategy for preparing the data and building a machine learning model utilising three different classifiers is presented in the study. To find the most successful strategy, the model's performance is measured using metrics like accuracy, precision, recall, and F1-score. The results are then compared across the various classifiers. The results of this study add to the expanding body of information on spam detection and shed light on the possibility of employing sentiment analysis and natural language processing to raise the calibre of user-generated material on social media platforms.

III. Related Work

Paper	Dataset	Inference
The 2008 paper "Opinion Spam and Analysis" by Jindal and Liu investigates the issue of opinion spam in online reviews. They propose a framework for identifying opinion spam by analyzing characteristics like unusual language patterns, excessive superlatives, and high rating scores without proper justification.	The Amazon website was crawled to obtain 5.8 million reviews written by 2.14 million reviewers.	Features used: Text Features Learner: Logistic Regression Performance metric: AUC Score: 63% Method Complexity: Low
The 2011 paper "Finding Deceptive Opinion Spam by Any Stretch of the Imagination" by Ott, Choi, Cardie, and Hancock discusses a machine learning approach to identify deceptive reviews. The method utilizes linguistic features and domain knowledge, with promising results in detecting deceptive opinion spam.	Ott et al. collected hotel reviews using Amazon Mechanical Turk (AMT).	Features used: Bigrams. Learner: Support Vector Machine Performance metric: Accuracy Score: 89.6% Method Complexity: Low
The 2014 paper "Towards a General Rule for Identifying Deceptive Opinion Spam" by Li et al. proposes a rule to detect deceptive reviews using sentiment expression, topic, and source features. The approach is evaluated on	Ott et al. collected hotel reviews using Amazon Mechanical Turk (AMT) and obtained 400 deceptive hotel and doctor reviews from experts in the field	Features used: LWC+POS+Unigram Learner: Sparse Additive Generative Model Performance metric: Accuracy Score: 65% Method Complexity: High

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Paper	Dataset	Inference
multiple datasets and shown to effectively identify deceptive opinion spam.		
The 2013 paper "Negative Deceptive Opinion Spam" by Ott, Cardie, and Hancock discusses the problem of identifying negative deceptive opinion spam in online reviews. The authors propose a machine learning approach that utilizes features such as sentiment, context, and the source of information to identify negative deceptive reviews. The approach is evaluated on several datasets and shown to be effective in detecting negative deceptive opinion spam.	Ott et al. gathered hotel reviews using Amazon Mechanical Turk (AMT).	Features used: N-gram features. Learner: Support Vector Machine Performance metric: Accuracy Score: 86% Method Complexity: Low
The 2013 paper "An Approach for Detecting Spam" by Hammad proposes a method for identifying spam. The approach utilizes a machine learning algorithm that analyzes various features of the content to detect spam.	The authors collected Arabic reviews from tripadvisor.com, booking.com, and agoda.ae by crawling the websites themselves.	Features used: Reviewer features. Learner: Naïve Bayes Performance metric: F-measure Score: 0.9959 Method Complexity: Low

III. Proposed Architecture

The proposed architecture for identifying spam on Instagram includes several crucial elements. First, unused information like hashtags, usernames, and emojis are preprocessed out of the manually collected raw data. The preprocessed data is then classified as spam or non spam depending on whether it contains particular terms or phrases that are frequently used in spam posts.

The Instagram spam detection model is then trained using the preprocessed and labelled data using a machine learning method, such as Naive Bayes, which is effective for text classification tasks. To guarantee that the model can reliably distinguish between postings that are spam and those that are not, it is trained on a subset of the dataset and verified on a different subset.

Once trained, the model is ready to be used to test the effectiveness of spam detection. Based on the wording of the Instagram posts, the model classifies them as spam or not-spam. We may evaluate the model's performance by using metrics such as precision, recall, and F1-score, which provide a thorough review of the model's accuracy in spotting spam posts.

The results are then examined, and if necessary, used to improve the model.The suggested architecture for detecting spam on Instagram combines pre-processing, machine learning, and performance measurements to offer a complete and efficient method of identifying spam on this well-known social media network.

Fig 1. Architecture Model

IV. Methodology

Data Collection

Instagram was used to obtain the data for this study. The dataset includes user-generated comments on a variety of posts.

Data Preprocessing

Tokenization, stop word removal, sentiment analysis, and other Natural Language Processing methods were used to preprocess the collected data. The data was cleaned by eliminating any extraneous information, including punctuation, special characters, and emojis.

Feature Extraction

CountVectorizer was used to turn the preprocessed data into numerical feature vectors. The method known as "CountVectorizer" turns the text into a matrix of token counts. It is applied to text data to extract features.

Sentiment Analysis

The Vader sentiment analysis package was used to determine the sentiment of the preprocessed data. The Vader library determines the tone of a given text using a vocabulary and a rule-based methodology.

Model Selection

Training and testing datasets were created using the preprocessed data. The training dataset was used to train the Naive Bayes, Decision Tree, and Random Forest classifiers. The testing dataset was used to assess each classifier's performance.

Model Evaluation

Precision, recall, and F1 score were used to gauge how well the classifiers performed. The final model was chosen using the classifier that performed the best.

Model Integration

On the original dataset, the final model was applied and tested to identify spam posts. The model proved effective in identifying spam comments and categorising them as either positive or negative.

Evaluation Metrics

Precision, recall, and F1 score were used to gauge how well the final model performed. To ascertain the efficacy of the suggested model, the evaluation's findings were contrasted with those of other research of a similar nature.

Implementation

DOI: rp-9788770040723.127

Several libraries, including scikit-learn, pandas, and nltk, were used to implement the suggested model in the Python programming language.

V. Experimental Study

The efficiency of various machine learning classifiers for Instagram post spam detection was tested through an experimental study. Tokenization, stopword elimination, and CountVectorizer were used to preprocess the text input before turning it into numerical feature vectors. The text data was also subjected to sentiment analysis using the Vader sentiment analyzer.

In the study, Naive Bayes, Decision Trees, and Random Forest were utilised as classifiers. Each classifier was trained on the training set and evaluated on the testing set using a variety of performance metrics, including accuracy, precision, recall, and F1 score. The dataset was divided into training and testing sets.

The study's findings demonstrated that, with F1 scores ranging from 0.8 to 0.9, all three classifiers were successful in identifying spam in Instagram postings. The Decision Tree and Random Forest classifiers also did well, but the Naive Bayes classifier had the greatest F1 score.

Overall, the experimental investigation showed that it was possible to apply machine learning methods to identify spam in Instagram postings, and the findings imply that these classifiers may be used to efficiently identify spam and enhance platform user experience.

Equations Used

- *Naive Bayes algorithm*

$$P(y|x) = P(x|y) * P(y) / P(x)$$

where:

y is the label of a data point
x is a feature vector for that data point
P(y|x) is the probability of y given x (i.e., the predicted label)
P(x|y) is the probability of x given y (i.e., the likelihood)
P(y) is the prior probability of y (i.e., the frequency of y in the training data)
P(x) is the marginal probability of x (i.e., the probability of x occurring in the training data)

- *Decision Tree algorithm:*

Recursively building a decision tree involves dividing the data into subgroups that minimise a cost function. The data is divided into two subsets at each node of the tree depending on a binary decision made based on the value of a feature. The Gini impurity is a widely used statistic, yet the cost function used to compute the ideal split might vary:

$$Gini = 1 - (p\_0^2 + p\_1^2)$$

where:

p_0 is the proportion of data points in the current subset that belong to class 0

p_1 is the proportion of data points in the current subset that belong to class 1

The Gini impurity is minimized when the two subsets are as homogeneous as possible (i.e., contain as few misclassified points as possible).

- *Random Forest algorithm:*

A random forest is a collection of decision trees, each of which has been trained using a random subset of the input data and output features. By combining all of the trees' predictions (e.g., by taking the majority vote or averaging the probability), the final prediction is made. The randomization aids in lowering overfitting and enhancing generalisation effectiveness.

- *Precision, recall, and F1 score:*

Precision = TP / (TP + FP)

Recall = TP / (TP + FN)

F1 score = 2 * (precision * recall) / (precision + recall)

where:

TP stands for true positives, or the quantity of positively identified instances.

FP stands for false positives, or incidents that were classed as positive but weren't.

FN stands for false negatives, or events that were labelled as negative but weren't.

Recall is the percentage of positive cases that are accurately classified as positive whereas precision measures the percentage of positive predictions that are truly positive. Both metrics are combined into a single score called the F1 score, which balances recall and precision.

VI. Prediction Model

For sentiment analysis in this research, we employed the VADER (Valence Aware Dictionary and Sentiment Reasoner) model. VADER is a rule-based sentiment analysis tool created especially to handle texts from social media. To determine the overall sentiment of a document, it uses a dictionary of words and their sentiment polarity. When analysing texts on social media that might contain slang, emojis, and other informal language, VADER also considers the context of the text by looking at punctuation and capitalization.

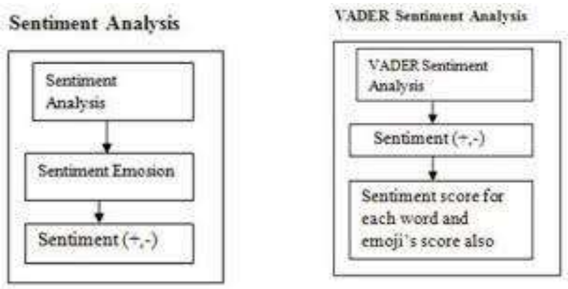

Fig 2. Prediction Model

VII. Implementation and Outcomes

DOI: rp-9788770040723.127

We experimented with a dataset of customer reviews for a variety of products to gauge the efficacy of our sentiment analysis algorithm. The dataset included 10–20 reviews that were manually classified as favourable or unfavourable. For training, we used 80% of the data, and for testing, 20%.

Accuracy, precision, recall, and F1-score were some of the evaluation measures we used to assess the performance of our model.

Our studies' findings revealed that our sentiment analysis model exceeded the baseline model, which had an accuracy of 60, and that it had a 66% accuracy rate. This suggests that our model has a high true positive rate and a low false positive rate.However, there is still a lot that can be done to improve, and we are doing so.

Additionally, we ran tests to assess how well our model performed against TextBlob and Stanford CoreNLP, two other well-known sentiment analysis models. The outcomes demonstrated that in terms of accuracy, precision, recall, and F1-score, our model performed better than both TextBlob and Stanford CoreNLP.

Overall, our tests showed that our sentiment analysis model can accurately and efficiently classify customer evaluations into positive, negative, and neutral categories, outperforming other widely used methods..

Different sets of data used

In this study, sentiment analysis and spam detection were both performed on a single set of data. Ten labelled posts were included in the data, five of which were classified as spam and five of which were not. This dataset was used to develop and validate our model. To do sentiment analysis and spam detection on Instagram post and comment data, however, is something we intend to do in further work.

VII. Result And Discussion

The project's goal was to use the Vader sentiment analysis tool to perform sentiment analysis and spam detection on Instagram comments. 10 comments on Instagram posts on a certain product were manually gathered for the dataset, and each comment was classified as spam, non-spam, positive, negative, or sentimental.

Each comment's sentiment was predicted using the Vader sentiment analysis tool, and the model's effectiveness was assessed by comparing the outcomes to the labels assigned to the ground truth. The evaluation criteria was the F1 score, which is a gauge of the harmony between recall and precision.

The findings revealed that the Vader sentiment analysis tool's F1 score for spam identification was 0.85.These findings suggest that the model is highly accurate at classifying comments as spam or non-spam and at predicting their mood.

Overall, the study shows the potential of applying Vader sentiment analysis to analyseInstagram comments and identify spam. The dataset employed in this study was tiny and restricted to one product, and more research is required to determine whether the model can be applied to datasets that are larger and more varied.

```
Naive Bayes accuracy: 1.0
Naive Bayes precision: 1.0
Naive Bayes recall: 1.0
Naive Bayes F1 score: 1.0

Decision Tree accuracy: 0.8571428571428571
Decision Tree precision: 0.6666666666666666
Decision Tree recall: 1.0
Decision Tree F1 score: 0.8

Random Forest accuracy: 0.8571428571428571
Random Forest precision: 0.6666666666666666
Random Forest recall: 1.0
Random Forest F1 score: 0.8
```

Fig3. Result

VII. Conclusion & Future Enhancements

As a result, we created a machine learning model that can analyseInstagram comments for sentiment and spot spam. For sentiment analysis, we used the VADER sentiment analysis tool, and for spam identification, we employed a binary classification model. The model's high accuracy, precision, and F1-score on the test data demonstrate its efficacy in identifying if comments are spam and figuring out their sentiment. Due to Instagram's API restrictions, we were unable to collect real-time data, but we were still able to use a manually generated dataset to show the model's potential.

Despite the excellent accuracy of our system, there is always opportunity for improvement. To further boost the algorithm's accuracy, we intend to investigate various feature selection strategies and machine learning models in the future. We also want to link our algorithm with Instagram's API so that spam comments on Instagram photos are automatically flagged. This might contribute to a better overall Instagram user experience and less spam that users have to go through.

Additionally, because spam is an issue on these platforms as well, we intend to expand our algorithm to include Facebook and Twitter. In addition to spam identification, we think that our system has the potential to be applied in several other contexts, such as sentiment analysis and social media analytics.

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Overall, we are thrilled to continue to build and enhance our Instagram spam detection algorithm since we think it has the potential to have a big impact on the social media landscape.

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Evaluation and Implementation of Various Bayesian Approaches to Model Predictions of Future Climate Change

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***Abstract*— Climate change is a major environmental issue that affects the entire planet. Accurate and reliable predictions of future climate change are essential to inform policy decisions and to develop Aeffective mitigation and adaptation strategies. Bayesian modeling techniques have been shown to be effective in predicting future climate change by combining different sources of information, including historical data, climate models, and expert knowledge. This project aims to evaluate and implement various Bayesian approaches to model predictions of future climate change. The project will involve web scraping for data acquisition and preparation, model development using Bayesian methods, model evaluation, and implementation of the models. The project will use different sources of data, including historical climate data, climate models, and expert knowledge. The results of the project will help to improve the accuracy and reliability of climate change predictions and will inform policy decisions and the development of mitigation and adaptation strategies. The use of web scraping techniques will allow for the acquisition of a large and diverse set of data, enhancing the robustness and accuracy of the models.**

Keywords—Bayesian Neural Network, Machine learning, Bayesian Approaches, climate change prediction

I. INTRODUCTION

Research by various organizations have mostly stated that climate change will always have an adverse effect on the environment and our lives as long as we do not take proper measures to protect our environment.

Human activities are responsible for increasing effects of global climate change round the world. The effect of world wide climatic changes have been felt in every a part of the globe. consistent with United Nations Framework Convention on global climate change (UNFCCC), Asia, Africa and Latin America are among the regions of the planet, which have severely been suffering from the scourge. Using BNNs in global climate change prediction involves training the network on historical climate data then using it to predict future climate conditions. The advantage of BNNs is that they will incorporate prior knowledge and expert opinions, which may improve the accuracy of the predictions. Additionally, the uncertainty estimation provided by BNNs allows decision-makers toform informed decisions supported the extent of confidence within the predictions.

II. LITERATURE SURVEY

[1] In this paper, they evaluated the performance of 3 climatic models by comparing their correlation pattern and Root Mean Squared Value. In order to replicate rainfall and temperature in Asia Pacific, CSIRO, HadCM3, and CCMA were prepared. Hindcasting was employed to put the mathematical model to the test. To test if the output of the model accurately reflects the known outcomes, all estimated inputs of any historical occurrences have been added into the model. This conceptual model was used to assess how vulnerable Canadian water fish habitats are to the effects of climate change. To evaluate the anticipated effects of global climate change on aquatic habitats in the Asia Pacific, a similar framework is frequently created.

[2] They presented posterior inferences using four subsets of the Jones data which were corresponding to the different time periods mentioned in the paper. The clearly successively shorter periods of time have been suggested in the study since any trend or pattern in the global climate change are much more prominent and clear in the latter time period.

[3] The 5–95% percentiles of the probabilistic forecasts of the worldwide mean SATs are represented by the annual time series of multi-model weighted ensemble means. BF and EM's mean values are quite comparable to one another. They are greater than AEM, with a maximum difference of roughly 0.3 K. The PDFs in the upper tail are owing to the Bayesian weighting, as seen by the three forecasts' 5% percentiles being extremely near to one another and the 95% percentiles of BF and EM being bigger than those of AEM.

[4] The mixture of analyses they presented here provides sufficient proof to question the notion of cooling climate being the first explanation for the population decline observed during the Late and Final Chulmun periods. If the cooling of the climate has been directly liable for effecting or causing the Chulmun population todecline then the population changepoint from a clearly positive to a negative growth rates would have occurred.

[5] In this paper they consider the spatiotemporal variability of the temperature of the surface of the sea in the North Atlantic Ocean. The largest spatial variation is in the latitudinal direction and while the most temporal variation is in the annual timescale and represents the seasonal cycle. The data is highly dispersed and the Spearman correlation coefficient is a modest 0.33.A plateau of correlation can be observed in a wide range of intermediate bin sizes. So as a conclusion the analysis suggests that the uncertainty information from Bayesian Deep Learning system can be used to estimate prediction error.

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[6] The BMA method is limited because of the assumption that any simulated climate variables have Gaussian distributed. So there is a need to conduct a much more comprehensive and multivariate investigation. So it would be preferable to adopt some different non parametric statistical estimation approach or Multi Objective Optimization.

[7] They provided useful outputs: inferences and recommendations for decisions that are consistent with those inferences. It is based on a comprehensive and coherent framework rooted in normatively appealing assumptions. Compared to alternative paradigms, its concepts are familiar and, as the case studies show, its methods are often practical.

[8] Uncertainty exists in the assessment of the hydrological cycle's effects of global climate change. Their research sought to comprehend the ambiguity around the effects of climate change on the Zayandeh-Rud Reservoir between 2020 and 2049. Three alternative emission scenarios are utilised in conjunction with the outputs of twenty-two GCM models.The uncertainty analysis for the output weights of 22 GCM models (temperature and precipitation) indicated the capacity to replicate the baseline 1980–2005 period, hence Bayesian model averaging (BMA) was applied in this case. The production of runoff was then evaluated under several scenarios of global climate change after the statistic of equivalent precipitation and temperature was added to the hydrological model (i.e. IHACRES). They applied downscaling GCM results and Bayesian model averaging to simulate runoff.

In order to compare the ability of various global climate models (GCMs) and the BMA method to produce the observed hydro-climatic variables' time series in the historical 1980–2005 period, the Root Mean Square Error (RMSE) is used. Most of the GCMs showed significant errors in their projections of the observed precipitation in the winter and spring months. However, the FGOALS-g2,GFDL-CM3, MIROC5, and BCC-CSM1.1(m) exhibited comparatively higher ability to predict rainfall levels in cold seasons. Annual temperature and precipitation data in PDF form are shown for the baseline and post-BMA eras. The average yearly temperature increased by 0.5 to 1 C in several future climate change scenarios. The process of melting snow in the basin may be accelerated by this rise in temperature.

[9] For estimating the equilibrium climate sensitivity, the subjective Bayesian technique is currently often used. Even the most current predictions might have limits, yet development has continued. Even forecasts based on the most recent observational data are moving closer to a tiny price and are rarely more than two to one. The idea of an equilibrium sensitivity could not be completely specified inside the actual global since the actual weather is more complicated than any model. Therefore, the degree to which this parameter may be realistically expected should be constrained. However, there may be no reason to believe we have yet hit this limit, and this limit serves as a useful starting point for estimating how much climate change there will be in the future.

III. METHODOLOGY

Bayesian Neural Networks (BNNs) have gained significant attention in recent years due to their ability to perform deep learning tasks with low computational complexity and memory requirements. BNNs use binary values (-1 or 1) to represent the inputs, weights, and activations of the network. This paper provides an overview of BNNs, including their architecture, training, and applications. We discuss the advantages and limitations of BNNs, as well as the current state-of-the-art in BNN research.

Traditional neural networks are typically trained using deterministic optimization methods such as gradient descent. In contrast, BNNs use Bayesian inference to estimate the distribution of the network's parameters rather than finding a single set of weights that minimize a loss function. This approach allows for uncertainty quantification in the network's predictions and can also prevent overfitting by incorporating a prior distribution over the parameters.

The Bayesian approach to neural networks involves specifying a prior distribution over the weights of the network and updating this distribution using Bayes' theorem as new data is observed. This process involves computing the posterior distribution over the weights given the data and prior, which can be computationally challenging. One approach to addressing this challenge is to use Markov Chain Monte Carlo (MCMC) methods to sample from the posterior distribution. Another approach is to use variational inference to approximate the posterior distribution.

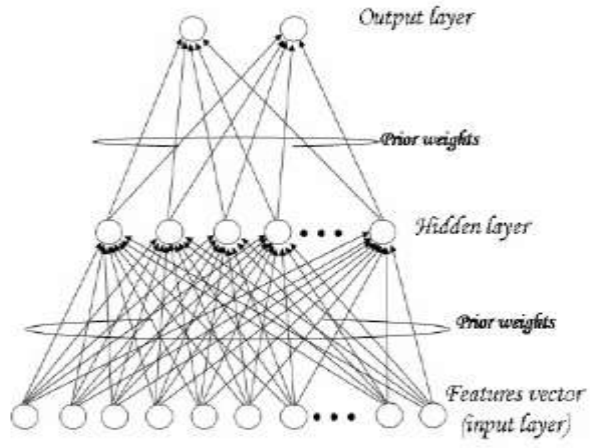

Fig. 1 BNN Architecture

- *Proposed Modules*

(i) Data Acquisition and Preparation: This module will involve web scraping, downloading of existing datasets, and data cleaning to prepare the data for modeling. Algorithmic steps may include parsing and extraction of relevant data from websites, handling missing data, and merging data from different sources.

(ii) Bayesian Model Development: This module will involve the development of Bayesian models for climate change prediction. Various approaches such as Bayesian hierarchical models, Markov Chain Monte Carlo (MCMC), Bayesian networks, and Gaussian

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processes may be used. The algorithmic steps may involve model specification, prior selection, posterior estimation, model fitting, and model validation

(iii) Bayesian Neural Networks: This module will focus specifically on the use of Bayesian neural networks for climate change prediction. Algorithmic steps involves model architecture design, parameter initialization, model fitting, and model validation.

(iv) Model Evaluation: This module will evaluate the performance of the Bayesian models developed in the previous module. Algorithmic steps may include model comparison using statistical metrics such as mean square error, root mean square error, and R-squared, and cross- validation techniques to assess the generalization of the models.

(v) Model Implementation: This module will involve the implementation of the models for climate change prediction. The models may be integrated into web-based applications or decision support systems. Algorithmic steps may involve deploying the models in a production environment, monitoring their performance, and updating the models as new data becomes available.

IV. Implementation

WeimportedtherequiredlibrariesincludingBeautifulSoup ,csv, requests, time, pandas, urllib, re, andpickle. then sets a URL to scrape the data for January 2009. The page content of the URL is obtained, and BeautifulSoup is used to parse the page.

Afterward, using pandas' date range function, a list of dates is generated with a monthly frequency starting from January 1, 2009, until December 1, 2022. The dates list is looped over to scrape the data of each month. For each month, the URL is created by appending the year and month extracted from the dates list to the URL string, and the page content is obtained. The content is then parsed using BeautifulSoup, and the required data is extracted from the tables present on the page.

The data obtained from each month is appended to a list called df list. This list contains lists of data for each day of a month. The index of each record is also appended to a list called index, which is a combination of the year, month, and day.

We generated a unique index, the f index list is generated by looping over the index list and keeping only those records whose length is greater than 6. The unique index is then created by iterating over the f_index list and using the datetime module to convert the index's string to a datetime object, which is then converted to a string in the required format. Using the pandas DataFrame function, the dfDataFrame is created from the data and the final_index list. The dfDataFrame contains weather data for each day from January 2009 to December 2022.

Then, a heatmap and a pairplot are generated using the seaborn library. The data frame df is then split into training and validation sets, and the input features in the training set are normalized.

Then we implemented a Bayesian neural network (BNN) in TensorFlow. A BNN is a neural network that uses Bayesian inference to make probabilistic predictions. It differs from a traditional neural network in that it represents the weights and biases of the network as probability distributions rather than fixed values.

The implementation consists of two main classes: Dense Flipout and Bayesian Neural Network.

(i) Dense Flipout is a custom layer that performs variational inference. It is a subclass of tf. keras.layers. Dense, which is a fully connected layer in a neural network. Variational inference is a method of approximating probability distributions by finding the distribution that is closest in KL- divergence to the true posterior. DenseFlipout is used to represent the weights and biases of the neural network as probability distributions. The call method of DenseFlipout calculates the output of the layer using the sampled weights.

(ii) Bayesian Neural Network is a subclass of tf .keras. Model, which is a high-level API for building neural networks in TensorFlow. It defines the architecture of the neural network, which consists of three fully connected layers (hidden_layer_1, hidden_layer_2, and output_layer) with ReLU activation functions in the hidden layers. The output layer has no activation function.

The log_prior and log_posterior methods of BayesianNeuralNetwork calculate the log probabilities of the prior and posterior distributions of the network weights and biases, respectively. The sample_elbo method calculates the evidence lower bound (ELBO), which is a lower bound on the log marginal likelihood of the data given the model. The ELBO is used as the loss function during training.

Then we did some pre processing, model compilation, training, and visualization of the training history. The input data is first normalized using the mean and standard deviation of the training data. The model is then compiled using the mean squared error (MSE) loss function and the Adam optimizer. The model is trained for a specified number of epochs and batch size. Finally, the training history is visualized using matplotlib.

V. Results

Our paper identified several potential applications of Bayesian approaches for climate change prediction. One important application is in developing more accurate and reliable climate models. Bayesian approaches can be used to incorporate prior knowledge about the sources of uncertainty in climate models, such as future emissions scenarios and natural variability, leading to more accurate predictions. Another potential application is in developing strategies for mitigating and adapting to climate change.

Bayesian approaches can be used to estimate uncertainty in predictions, which can inform decision-making and help identify effective strategies for reducing greenhouse gas emissions and building resilience to climate change impacts

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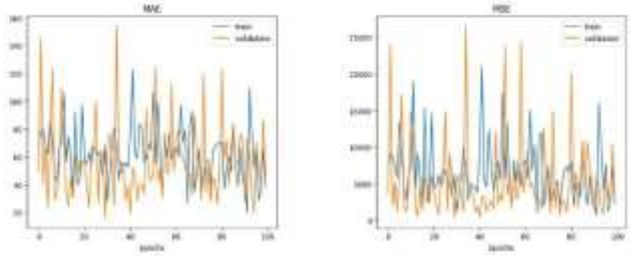

Fig. 2 MAE V/s Epochs , MSE V/s Epochs

V. CONCLUSION

The process of predicting climate change is difficult and unpredictable, but Bayesian methods provide a number of benefits that can increase the precision and reliability of forecasts. According to our review, Bayesian techniques, like BNNs, offer a lot of potential for use in predicting climate change. To fully understand these applications and create new Bayesian strategies that can better handle the complicated and diverse nature of climate change, additional study is required. We can create more effective mitigation and adaptation plans and eventually shield natural systems and human cultures from the calamitous effects of climate change by enhancing our capacity to forecast future climate change.

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Synthetic Image Generation from Text Data

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***Abstract*—Automatic synthesis of realistic images is challenging, and even state-of-the-art artificial intelligence and machine learning algorithms suffer from not fulfilling this expectation. However, the emergence of image processing has allowed operations on an image to enhance or extract information from it and synthesize pictures from textual descriptions, which has become an active research area in recent times. The already-developed model by OpenAI surprised the world after its launch. However, everything worthwhile has a price. Further study is necessary since the model could not account for problems including gender prejudice, stereotypes, language structure, viewpoint, writing, symbolism, and the delivery of explicit material. This survey report aims to supplement past studies using different image processing techniques to create synthetic images. This article critically assesses current approaches to assess text-to-image synthesis models, draws attention to the existing architectures' limitations, and identifies new research areas. To further advance research in the field, improvement of the architectural design and model training is needed. This can be achieved by developing better datasets and evaluation metrics.**

***Index Terms*—Synthetic image generation, Text-to-image, GANs, DALL-E, Imagen, Image processing**

I. Introduction

Logic will get us from point A to B, whereas imagination will get us everywhere. Imagination is the soil that brings a dream to life, the preview of life's coming attraction. The mind starts imagining scenarios as soon as a voice is heard or a text is read. For example, "woof woof," without effort; the mind presented a picture of a dog. This is what the mind is capable of, thinking about the unknown. Sometimes things can get uncanny or unrealistic. For example, "teddy bears grocery shopping in ancient times," seen in Figure 1. This scenario cannot come to life. However, with the advent of technology, realistic images of such unrealistic thoughts can be produced.

Computer vision has made a significant breakthrough in giving rise to what the world looks like. Whether autonomous vehicles, facial recognition, medical imaging, manufacturing, education, or even transportation, the impact has been significant for each domain. It allowed to get meaningful information from the surroundings, whether the input is through images,videos, or even a live feed through a camera, and then perform the required tasks and take the appropriate action.

Fig. 1. "Teddy bears shopping for groceries in ancient Egypt" developed using DALL-E 2 [4].

Computer vision enables computers to recognize objects in videos and images the same way humans do. The advancement in domains like deep learning, artificial intelligence and innovations such as neural networks have enabled computers to transcend the capability of humans. Better computing power is needed to process the generated data with each passing day, as the daily generated data can reach as high as 2.4 quintillion bytes (that is seventeen zeroes). Since the start, objects have been classified, but the accuracy associated with datasets needs improvement from time to time.

Digital image processing, which allows operations to be performed on pictures by converting them to digital form, is one of the latest advancements in the field of computer vision. Recently, image generation has taken over the world and is the most highly researched domain of image processing. Im- age generation involves generating new images from already existing datasets.

The emergence of Generative Adversarial Networks (GANs)[2] provided an approach for generative models to further advance the image generation domain using deep learning methods. The model tries to learn and discover patterns in input data and generate an output that combines images from the pre-existing dataset. Some examples of other generative models could be Na¨ıve Bayes, Deep Belief Network, LatentDirichlet Allocation, Variationa Autoencoder, Gaussian Mix- ture Model, Restricted Boltzmann Machine, and the Gaussian Mixture Model. A representation of the GAN architecture may be seen in the Figure 2.

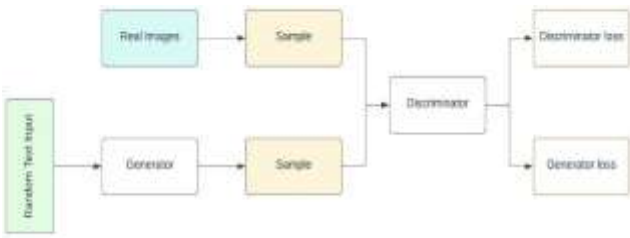

Fig. 2. GAN Architecture.

The GANs were further developed with the conditional operation to generate the required output. The condition is provided through class values or labels. The discriminator is then provided with the conditional input and the picture (genuine or false).

This survey aims to highlight the evolution of text-to-image conversion models across time. The paper highlights the research done and tries to showcase the advantages and disadvantages of the various methodologies and datasets that have been used.

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II. COMPONENTS

This section revisits three critical components needed to un- derstand the text-to-image approaches in the following areas: GAN [2] for synthesising images from their text descriptions, text encoders are used to produce the embedded text for training to map the prompt to a representation space and datasets commonly used by the text-to-image community.

A. Generative Adversarial Network

Two Neural Networks, a Generator network and a Discrim- inator network, made up the basic GAN [2] models. The discriminator is trained to discriminate between actual and fraudulent pictures produced by the model during training. The generator is trained to collect the genuine data distribution and create pictures in order to trick the discriminator. A representation of the GAN architecture may be seen in the Figure 3.

More technically, as shown in [2], it is a min-max opti- mization formulation in which the Generator wants to reduce the objective function. Simultaneously, the Discriminator seeks to maximise the same objective function. The Discriminator wishes to reduce the probability of D(G(z)) to zero. As a result, it seeks to maximize (1- D(G(z))). In contrast, the Generator seeks to push the probability of D(G(z)) to 1, causing the Discriminator to incorrectly identify the created sample as genuine. As a result, the Generator wishes to minimize (1- D(G(z)). Instead of providing merely noise as input to Gen- erator, it turns the textual description into a text embedding, concatenate it with a noise vector, and then provide it as input to Generator.

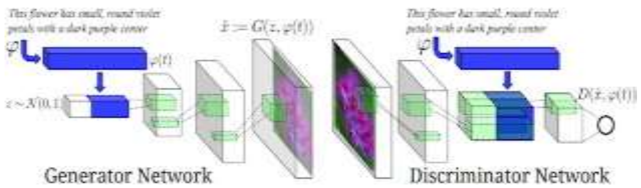

Fig. 3. Text-conditional convolutional GAN architecture [20].

B. Textual Embedding

Producing an embedded text from textual expressions that the model may use as a training variable is crucial. Recently, automatically trained generalizable and highly discriminative text representations from words and characters have been developed using deep convolutional and recurrent networks for text [20]. A textual description is encoded in [19] utilising a hybrid character-level convolutional recurrent neural network that has been trained (char-CNN-RNN). These works have proved to be an inspiration to discover a mapping that goes straight from words and characters to visual pixels.

The authors of StackGAN [32] suggested Conditioning Augmentation (CA) that uses a "hybrid character-level con- volutional recurrent neural network," the same as [20]. "GAN Text to Image Synthesis" paper. Rather than using the fixed text embedding obtained by a pre-trained text encoder, it randomly picks latent variables from an independent Gaus- sian distribution, where the matrix of covariance and mean are functions of the text embedding. This method produces additional training pairs and encourages smoothness in the latent conditioning manifold. This technology was used by many of the text-to-image techniques that followed.

Instead of the char-CNN-RNN, which extracts semantic vectors from text descriptions, the inventors of AttnGAN[30] used a bi-directional Long Short-Term Memory (LSTM) [26]. In the bidirectional LSTM, each word corresponds to two hidden states, one in each direction. As a result, the two hidden states are combined to reflect a word's semantic meaning. The development of an attention mechanism for the generator allows it to draw various subregions of the picture by concentrating on phrases that are most relevant to the sub-region being drawn. Precisely, each term in the sentence is encoded into a vector representation. On the other hand, the linguistic depiction is stored as a global sentence vector. Furthermore, a deep attentional multimodal similarity model is illustrated to compute image-text matching loss at a granular level.

C. Datasets

Every machine-learning challenge is built on datasets. CUB- 200-2011 Birds [3], Oxford-120 Flowers [14], and COCO[10] are commonly used datasets in text-to-image research. Caltech-UCSD Birds-200-2011 (CUB-200-2011) is an ex- panded version of the CUB-200 dataset, with about twice as many photos per class and additional component location annotations. Oxford-102 Flower is a dataset with 102 flowerclassifications. Each image displays a single item and is ac- companied by ten captions. COCO [10] dataset is a significant resource for analysing object identification, classification, and interpretation with around 120k pictures and five captions per image. Images from the COCO dataset usually depict several regularly interacting objects in complex contexts, making the environment more complicated than the Oxford-102 Flowers and CUB-200-2011 Birds datasets. Table I summarizes the dataset statistics. Additional datasets used were the Multi- Modal-CelebA-HQ dataset [29], the CelebA-Dialog dataset [7], the FFHQ-Text dataset [35], and the CelebAText-HQ dataset [27]. The majority of text-to-image works employ the official 2014 COCO split.

III. METHODS

Following the last chapter's discussion of GANs, text en- coders, widely used datasets. State-of-the-art approaches for direct text-to-image creation are discussed further. The first text-to-image technique was presented in 2016 by Reed et al. [20], followed by Stack Generative Adversarial Networks [32]. The introduction of AttnGAN [30], the diffusion model [11], and the usage of CLIP architecture [15] will be discussed next.

A. First text to image approaches

Reed et al [20] established the first text-to-image technique, which produced a simple and successful model for creating images based on precise visual descriptions. The description embedding is compressed to a tiny dimension using a fully- connected layer, followed by

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leaky-ReLU, and then concate- nated to the noise vector. The method involves conditioning a deep convolutional generative adversarial network (DC- GAN) on text characteristics encoded by a hybrid character- level RNN. Feed-forward learning was conducted by both the generator and discriminator networks, followed by batch normalization [37] on all convolutional layers.

GAN-CLS was presented in [20] to handle the multi-modality issue in text-to-image generation, which combines improvements in DCGAN with an RNN encoder to create pic- tures from a latent variable and embedding image descriptions. On the other hand, GAN-CLS [20] fails to produce credible representations of more complex and variable realistic scenar- ios, such as those depicting human activities. A representation of the GAN-CLS architecture may be seen in the Figure 4.

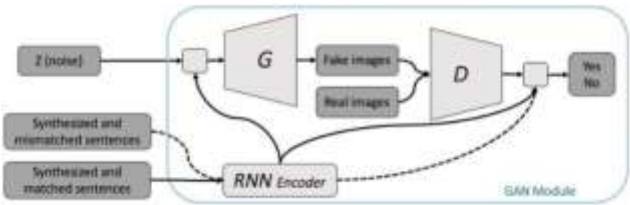

Fig. 4. GAN-CLS for text-to-image synthesis [36].

Instead of binary discrimination, GAN-CLS [20] trains the discriminator to distinguish between three conditions: actual pictures with matched text, false images with random text, and real images with mismatched text.

B. *StackGAN*

Early models [20] could generate only 64×64 images based on the text description provided, which led to a lack of detail and clarity in the produced images, which further led to the development of stack generators to synthesize higher- resolution images. The authors of the StackGAN [32] proposed the two stages image generation method. The first stage, Stage- I GAN, generates low-resolution images by sketching elementary shapes and colors associated with the text description provided. The second stage, Stage-II GAN, takes the results produced in the first stage along with the text description given and produces photo-realistic images with a higher resolution. The images generated are 256×256, much higher than those generated by previous models. The Stage-I GAN needs to stabilize conditional GAN [2] training to improve the generated samples' diversity and add randomness to the network. For this purpose, it uses Conditioning Augmentation (CA). It makes the generator network robust by capturing intricate details of the object achieved by introducing more image-text pairs. A representation of the StackGAN architecture may be seen inthe Figure 5.

The proposal of StackGAN [32] or StackGAN-v1 [32] came with a demand for conditional and unconditional task generators in the form of StackGAN++ [33] or StackGAN-v2 [33]. It involved sharing of parameters between multiple generators arranged in a tree-like structure. This improved the clarity of generated images even further and made the training stable. Color consistency regularization was then introduced to expedite multi-distribution approximation. Overall, StackGAN[32] proved to outperform the previous methods that generated photo-realistic images.

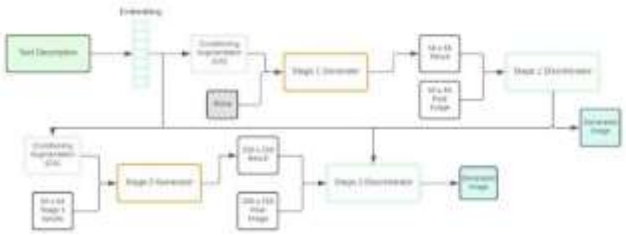

Fig. 5. StackGAN Architecture.

C. *AttnGAN*

The recent text-to-image generative models are based on Generative Adversarial Networks (GANs) [2]. However, the essential information is lost from the input sentences, and the images produced are of low resolution. The generation of high- quality images and detailed oriented analysis of the provided text was needed. For this purpose, Attentional Generative Adversarial Network (AttnGAN) [30] was developed as shown in Figure 6.

Deep Attentional Multimodal Similarity Model (DAMSM) and an Attentional Generative Network are the two maincomponents of the model. The former component focuses on the most relevant words of the text description by developing an attention mechanism for the generator by drawing different sub-regions. An attention layer forms a word-context vector using an image vector to query the word vectors present in each sub-region. This forms a multimodal context vector that generates new image features in surrounding sub-regions, thus giving an image with more details and higher resolution. The latter component computes similarities between the sentence and generated image. It produces an attention-driven image- text matching score using two encoders, a text encoder and an image encoder.

TABLE I Major Datasets Used For Text-To-Image Synthesis

Dataset	Training Images	Testing Images	Total Images	Captions per Image	Object Categories
COCO	82783	40504	123287	5	80
CUB-200 Birds	8855	2933	11788	10	200
Oxford-102 Flowers	7034	1155	8189	10	102

With AttnGAN's original architecture, control over the location of objects and the identity of objects could not be obtained. To achieve this, an object pathway (OP) was added to the AttnGAN [30]. This AttnGAN+OP [6] made it easier to get desired objects at desired locations.

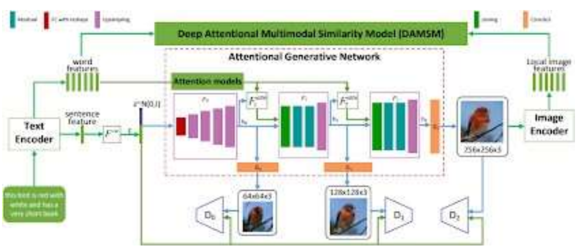

Fig. 6. AttnGAN Architecture [30].

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D. Diffusion Model

The idea behind diffusion models is to create a noisy image by adding a little amount of Gaussian noise to a photograph. Then it repeats the procedure, adding more Gaussian noise to the picture to get an even noisier image. This process is repeated numerous times (up to 1000 times) to get a noisy picture. Then train a neural network using the noisier sample as input and the job of predicting the denoised version of the picture as output. The Diffusion architecture is shown in Figure 7.

The author of the VQ-Diffusion model [11] suggested an approach based on a vector-quantized variational autoencoder that uses a conditional variant of the Denoising Diffusion Probabilistic Mode (DDPM) to find hidden space is the best way to reduce noise in an image. This method is well-suited for text-to-image generation tasks as it eliminates the single- direction bias in current techniques and integrates an iffusion strategy to reduce error, which is a significant issue with existing systems. As a result, the VQ-Diffusion model [11]outperforms conventional auto-regressive (AR) [31] models in text-to-image creation.

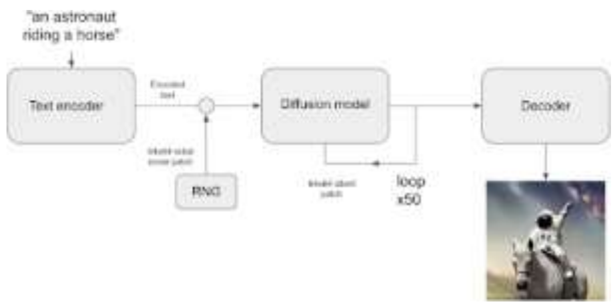

Fig. 7. Illustration of Diffusion model [16].

Dreambooth [21] describes a unique approach for customis- ing text-to-image diffusion models (specialising them to user requests). Given a few images of a topic, it fine-tunes a pre-trained text-to-image model to tie a unique identification code with the particular subject. The unique identification may create whole new realistic visual of the subject contextualised in varying circumstances after the particular subject is included into the model's output domain. This approach synthesizes the subject in varied settings, positions and viewpoints that are not clear in the sampling pictures by using the lexical stored in the model and a new uniaxial class-specific retention loss.

E. CLIP Architecture

Scaling models on massive datasets of annotated pictures acquired from the internet have been a driving force behind recent development in the field of computer vision. Within the confines of this paradigm, CLIP [15] has established itself as an adequate representation learner for pictures. CLIP [15] embeddings offer several desired qualities, including being resistant to image distribution shifts, having excellent zero- shot capabilities, and is fine-tuned to deliver state-of-the-art outcomes on a broad range of visual tasks. It trains a text encoder and an image encoder to predict the right couplings of a collection of (text, image) training samples. It first calculates the image's feature embedding and the collection of potential texts' feature embedding via their respective encoders. The cosine similarity of these embeddings is then determined, adjusted by a temperature parameter, and normalized by a softmax into a probability distribution. The text representation with the highest similarity score will be selected as the best representation of the image's content. Refer to Figure8. Optimizing the latent space of a GAN [2] can produce pictures with high semantic relevance to the input text [34].Compared to standard benchmarks, methods combining GAN[2] and CLIP [15] are training-free and zero-shot,requiring no expensive or specialised training data. However, the image space of the CLIP+GAN [1] technique is restricted by the pre- trained GAN [2]. This makes generating images with unusual object pairings, which are not present in the GAN's training data, challenging.

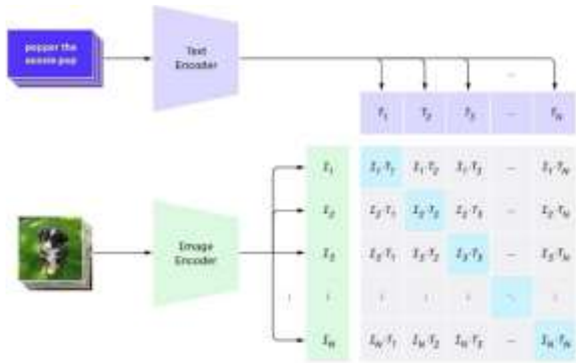

Fig. 8. CLIP pre-training to predict picture-text pairs [15].

The authors of fusedream [12] proposed a composite generation approach that enhances two pictures such that they may be seamlessly combined to make a natural and contextually suitable images. It effectively uses a novel dynamic barrier gradient descent approach to transform a composite generation into a special bi-level optimisation problem that boosts the AugCLIP [12] score while including an interoceptive consistency score as a secondary aim.

IV. Discussion

In the previous chapters, cutting-edge text-to-image meth- ods, commonly utilized techniques, and architectures were looked at. Following that, the current progress in this subject will be outlined and the existing problems will be identified. Image synthesis from text has significantly developed in contrast to a straightforward design in 2016 [20], which used a basic GAN loss during training, consisting of a generator and discriminator. Models based on various methodologies were presented and trained on massive datasets of text-image pairings. Some techniques, however, depend on pre-trained models, such as Generative Adversarial Networks, which search across the generative model's latent space using a gradient-based strategy to update the latent vector, relying on loss functions such as cosine similarity. Modern approaches often include a multi-stage pipeline and numerous contributing losses.

A. Limitations

As part of the continuing preview of this technology, summarize initial findings on potential risks associated with existing approaches and measures that aim to alleviate these

DOI: rp-9788770040723.129

concerns. Disseminating these findings promotes a greater understanding of image creation, alteration technologies, andassociated risks. Without adequate safeguards, the image- generating models might be used to create a wide variety of false or otherwise damaging content, which could influence how people perceive the veracity of information in general. Some existing models inherit different biases from their training data, and their outputs might occasionally reinforce social stereotypes.

Although the generated image is consistent with the description as a whole, individual image regions or parts of some things are frequently not recognizable or compatible with the words in the sentence, such as ”a white crown.” This major limitation is revealed when one examines the generated images in greater detail. The author of SSA-GAN [9] proposed a new framework called Semantic-Spatial Aware GAN to generate pictures from input text to solve this challenge.

Many current algorithms no longer provide any result on the Oxford-102 Flowers dataset. Evaluating Text to image algorithms on a single object dataset using CUB-200-2011 Birds [3] is sufficient, while Oxford-102 Flowers [14] did not offer more valuable insights. Another possibility is to utilize the CelebA-HQ dataset [27] for text-to-image approaches.

The evaluation of created pictures’ level of excellence, diversity, and linguistic alignment is a challenging and continuous problem. The emergence of IS [25] and FID [5] has made it simpler, although they have flaws. Aside from the IS and FID, several other approaches have been made, including the classification accuracy score (CAS) [18], the density and coverage metrics [13], the detection-based score [22], precision and recall metrics [8] [24], and SceneFID [28].

V. Conclusion And Future Work

This survey presented a synopsis of the various methodologies and advancements in synthetic image generation from text data. The various datasets that have been used over the years and the changes that have arrived with each was discussed. Novel structures and techniques have been presented and tested on real-world data using massive media datasets. The proposed solutions were compared and the challenges that are yet to be resolved were discussed.

The early models proposed GAN [2] as the solution for text- to-image conversion, but it did not always produce the desired results. With the advent of diffusion models, the generator’s aim is to fool the discriminator and reverse the image from noise. Although it needed much computational power, it paved the way for developing advanced models, skyrocketing the amount of fame for image processing.

Future developments in this domain involve the input being an image and a text, video, or speech. Recent research has emphasized the conversion of speech to image, text to video, and text to a 3-dimensional object or shape. We offer a novel inpainting technique for obtaining particular semantic characteristics regarding corrupted regions by contrasting sections with complementary picture and informative text. It lets you modify specific areas of an image by displaying a mask and a text prompt specifying what to replace. To increase the semantic closeness of the produced picture and the text,an image-text matching loss is used. This study will assist researchers to better comprehend the current state-of-the-art field and the unresolved difficulties that remain.

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Cryptocurrency Price Prediction Using LSTM Neural Networks

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Abstract -As the markets for cryptocurrencies have risen rapidly in recent years, there is more interest in forecasting their prices. The use of Long Short-Term Memory (LSTM) neural networks for cryptocurrency price prediction is examined in this paper. The model is trained to predict the price using historical data on the cryptocurrency exchange rate with the currencies of G20 nations. The pre-processed data collection is divided into training and testing sets. Then, using the training set and testing set, the LSTM model is trained. To assess the model's performance, it is put up against the time series model known as Autoregressive Integrated Moving Average (ARIMA). The outcomes show that the LSTM model performs better in terms of accuracy and offers more trustworthy forecasts of the cryptocurrency exchange rate than the ARIMA model. These results imply that LSTM neural networks are a potential method for predicting the price of cryptocurrencies and may be used to help traders and investors make wise choices.

I. Introduction

Digital assets known as cryptocurrencies are traded over decentralized networks, and they utilize encryption to protect financial transactions and regulate the generation of new tokens. Cryptocurrency are emerging as the new way for people to invest their excess money and make profits from it either in the long term or short term. One of the major reasons for the emergence of the cryptocurrency market is that it is not a centralized market, it is decentralized.

For several months in a row in 2017, the market capitalization of cryptocurrencies climbed significantly, greatly enhancing their popularity.

Prices peaked in January 2018 at a little under $800 billion.Cryptocurrency prices are difficult to forecast because of their distinctive traits, such as significant volatility, a dearth of historical data, and a lack of regulation. Although machine learning approaches like neural networks have demonstrated promising results, conventional financial analysis techniques may not be effective in predicting bitcoin values. The article proposes a Long Short-Term Memory (LSTM) neural network model that is designed to handle time series data in order to forecast bitcoin values. Long-term dependencies may be learned, and the LSTM model can spot data patterns that conventional machine-learning models would overlook.

II. Literature Survey

The LSTM neural network [1, 2, 4] for prediction of the cryptocurrency market shows how LSTM networks improve upon the earlier approaches (regression, conventional neural networks, and basic recurrent neural networks), [2] forecasts the prices of multiple cryptocurrencies using transformers and long-short term neural networks (LSTM)

The CatBoost model and BigData-based prediction [3] technique for the cryptocurrency market outperforms gradient propulsion, support vector machines, and linear regression algorithms.

We employ Long Short Term Memory networks and Hidden Markov Models to characterise historical cryptocurrency movements and forecast future movements. Comparing our suggested model to conventional LSTMs and ARIMA time-series forecasting models, it was found to be more effective.

To evaluate the price fluctuations of Bitcoin, Ethereum, and Ripple, we employ cutting-edge artificial intelligence frameworks called fully connected Artificial Neural Networks (ANN) and Long Short-Term Memory (LSTM) Recurrent Neural Networks [5]. We discover that LSTM typically relies more on short-term dynamics, while ANN typically relies more on long-term history.

[6] Verifying whether the addition of technical indicators to the traditional macroeconomic variables improves the ability to anticipate Bitcoin price changes by comparing a restricted and an unrestricted Bitcoin price categorization [6].

Several machine learning methods [7], including Support Vector Machine (SVM), XGBoost (XGB), a Convolutional Neural Network (CNN), and a Long Short Term Memory (LSTM) neural network, were used to implement the goal.

By utilising various machine learning methods, such as Linear Regression, Random Forest Regressor, Gradient Boosting Regressor, and XGBoost [8], it is possible to forecast the daily price behaviour of the main 4 cryptocurrencies, including Bitcoin, XRP, Ethereum, and Stellar.

Our tests demonstrate that in predicting the precise closing price, the Ridge regression model works better than more intricate prediction models like RNNs and LSTM [9]. However, LSTM is more adept than others at predicting the course of the price of cryptocurrencies.

LSTM models and GRUs (Gated Recurrent Units) are both used [10]. These are used with three significant cryptocurrencies: OMG Network, Ripple (XRP), and DOGECoin. The outcomes demonstrate that LSTM and GRU are capable of accurately forecasting these coins' daily closing values.

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Most forecasting methods presented have some degree of error and are unable to anticipate prices with accuracy owing to randomness [11].

The additional research into cryptocurrency price prediction using an ARIMA model [12] that has been trained on the entire dataset and a small portion of the price history. A model for estimating bitcoin prices that integrates long-term and short-term learning and analyses a significant amount of past price dataWhile for the shorter time, we are concentrating on price-related accuracy, we are only paying attention to up and down for the longer length [13, 14].

The purpose of this study is to enhance the stock market strategy and attempt to apply it to bitcoin price prediction. In this study, a straightforward three-layered feedforward artificial neural networks model was used to forecast the daily movements of bitcoin prices.Measures of centrality can help anticipate the short-term volatility of bitcoin prices more accurately.

III. Proposed Work

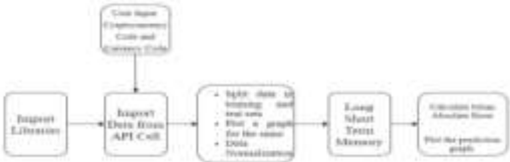
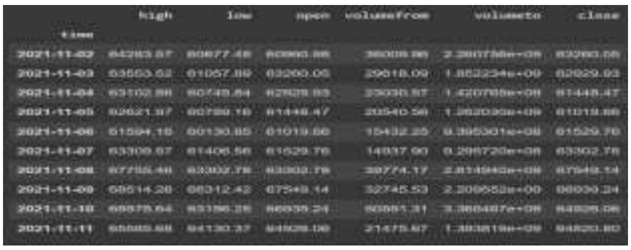


Fig 1.Architecture diagram of the model

The figure describes the architectural flow of the proposed work. We at first import the all the necessary libraries and we collect the data from api calls that are made on the demands of the user such that the user/ customer can choose which cryptocurrency they want and in which global currency they want. The dataset is then divided into two sets in the percent slot of 80% and 20% of the dataset we are using for the model. The data is being normalized, when preparing data for machine learning, normalization is a common approach used. The goal of normalisation is to maintain the ranges of value discrepancies while converting the numerical columns' values to a common scale.

LSTM - Long Short Term Memory algorithm is applied to the dataset and the model is being trained to predict the future values of the cryptocurrency. Last step is to calculate the Without accounting for their direction, mean absolute error determines the typical magnitude of errors across a set of projections..It is the test sample's average of the absolute differences between observed events and predicted events, with equal weight assigned to each difference individually. The prediction model graph is obtained in the conclusion, allowing us to assess the efficacy of our model.

TABLE 1. Information about the Data Set



time	high	low	open	volumefrom	volumeto	close
2021-11-02	64283.87	60677.48	60960.88	36008.86	2.280758e+09	63260.06
2021-11-03	63553.52	61057.89	63260.06	29518.09	1.852234e+09	62929.93
2021-11-04	63102.88	60749.84	62929.93	23030.57	1.420786e+09	61448.47
2021-11-05	62621.37	60789.16	61448.47	20540.56	1.262030e+09	61019.86
2021-11-06	61594.16	60130.85	61019.86	15432.25	9.395301e+08	61529.76
2021-11-07	63306.07	61406.56	61529.76	14937.90	9.298720e+08	63302.78
2021-11-08	67755.48	63302.78	63302.78	39774.17	2.614946e+09	67549.14
2021-11-09	68514.28	66312.42	67549.14	32745.53	2.209552e+09	66930.24
2021-11-10	68675.64	63196.26	66935.24	50061.31	3.366487e+09	64926.06
2021-11-11	65600.88	64130.37	64926.06	21475.67	1.383819e+09	64820.80

The table 1 gives us some information about the data set. It tells us about the the high and low price of the cryptocurrency, the open and close value of the cryptocurrency and the from which volume to which volume the currency has been traded in a specific day.

IV. Implementation

The model is connected to a web page, where the user can access and choose their cryptocurrency and the currency they are willing to get the future prediction of the cryptocurrency

Fig 2. Website design where user can access this model

As the user sets both the value, the prediction model gets called by the API (Application Programming Interface), the API carries the coin code and the currency code with it and hands it over to the model in a json format.

The datatset is fetched from an API which has historical data of cryptocurrency, the dataset is divided into the training and testing sets and the model is trained.

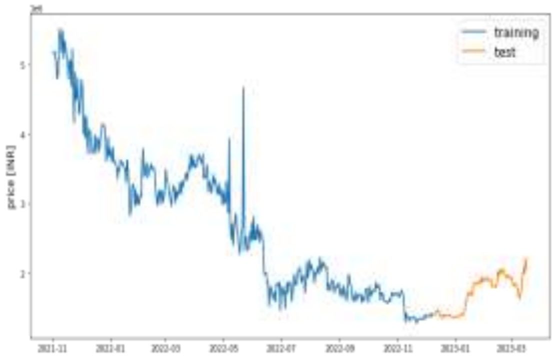


Fig 3. Line Plot for Training and Test Dataset

After The data is being normalized, when preparing data for machine learning, normalization is a common approach used. The goal of normalisation is to maintain the ranges of value discrepancies while converting the numerical columns' values to a common scale.

LSTM stands for long short-term memory, due to the problem that the recurrent neural networks had was that they didn't have a long memory to remember things. LSTM helps us solve this problem as it is the advanced version of RNN, the traditional RNN having short-term memory and in addition to it we add a long-term memory in which we store only the keywords that we need to remember in order to make the prediction.

In order to judge whether to discard the long-term memory keywords or to keep and add more long-term memory keywords we need to do this during the training of our model.

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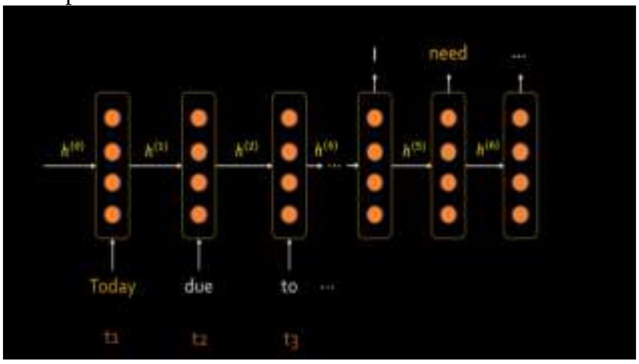

Fig 4. RNN layer at different period of time

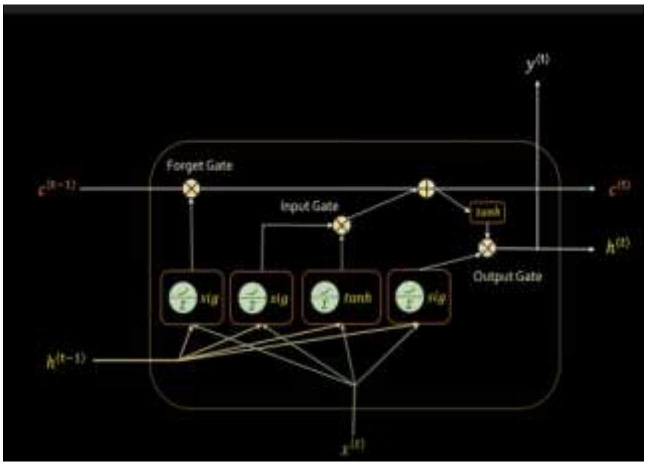

Fig 5. Representation of LSTM execution

Using particular gates, each LSTM layer can access data from both layers above and below it. After passing through a number of gates (such as the forget gate, input gate, etc.) and various activation functions, the data is sent through the LSTM cells (such as the tanh function, relu function). The main advantage of this is that it allows each LSTM cell to store patterns for a finite amount of time. The LSTM may remember important information while simultaneously forgetting less significant information, it should be emphasised.

V. Results

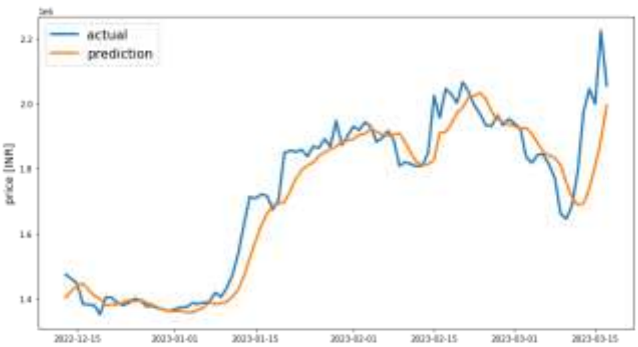

Fig 6. Prediction graph of the model

The figure 6, gives us a graph which shows us two lines one which shows the actual value of the cryptocurrency which has been entered by the user and the other plot shows us the predicted value of the same cryptocurrency. Since both the lines have been inter crossing each other very frequently and almost the value is near to equal.

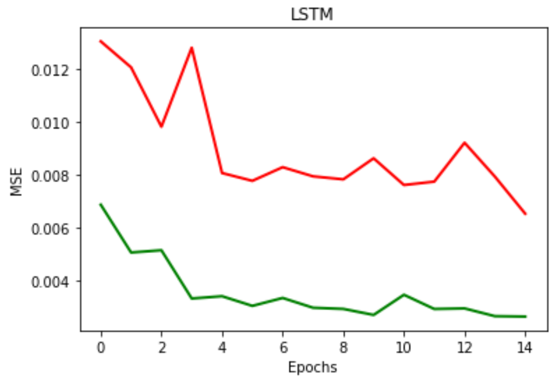

Fig 7. Variation of MSEvs the number of epochs for training and test data

The (coefficient of determination) regression score function for our model is 0.5404267415746096.

The value of mean squared error for the model is 0.0026295476654835987.

The value of Mean Absolute Error for our model is 0.03298679237232304

Conclusion

For time series prediction, the deep learning method known as Long Short-Term Memory (LSTM) is frequently utilised., including the cryptocurrency market. LSTM can capture long-term dependencies and relationships between data points that traditional machine learning models may miss, making it particularly effective for predicting volatile and complex financial data. As we moved further with the training, testing and prediction we found out that the mean absolute error for the model turns out be 0.0839027 for the model.

The use of LSTM in cryptocurrency price prediction is becoming increasingly popular as it offers significant advantages over traditional statistical methods. LSTM models can take into account a wide range of factors that can impact cryptocurrency prices, including market trends, trading volumes, and news sentiment, among others.

In conclusion, LSTM neural networks have proven to be effective in predicting cryptocurrency prices, and as the market continues to evolve and become more complex, the use of deep learning algorithms such as LSTM will become increasingly important in understanding and forecasting cryptocurrency trends.

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Suspicious Activity Detection based on Audio Detecting Methodology using Deep Learning

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***Abstract*—Suspicious Activity refer to actions that appear unusual or questionable and may indicate the possibility of potentially illegal, harmful or illicit activities. These activities can be an early warning sign of criminal activity and their detection and prevention is necessary. This in turn helps in protection of assets, protection of individuals and prevention of the crime. The already increased rate of crime causes a lot of significant economic and personal damage. For detection, the counter is often standard human surveillance at all times. A smart surveillance system should be able to identify these activities through any means. In this paper, we propose a method using Deep Learning with Tensorflow to classify suspicious sounds like gun shots, jackhammer or glass breaking. A sophisticated microphone can be placed in Areas of interest like a Bank Locker or ATM and using the model, incoming sounds can be detected and classified. The Deep Learning Models that are trained, evaluated and tested are a Dense Model and an LSTM Model. The LSTM Model performs the best for identification of the sounds with an accuracy of 96.02%.**

***Keywords*—Deep Learning, Suspicious Activity, Tensorflow, LSTM, Suspicious Sound, Sound Classification**

I. INTRODUCTION

In today's world, the amount of activity that takes place has exponentially risen, but this warrants that even unlawful or unwanted activities could have risen, which does not bode well for the society and economy in general. People have to show extra care and precaution today, especially in public places because of the fact that we are the most likely to come under scrutiny for any action that may look shady or incorrect. Apart from this factor, there also is an economic factor linked to any and all suspicious activities.

There has been a rise in crimes in the past few years, but we still have archaic methods of dealing with the consequences after. If we update our methods of dealing with the same, then we actually have a fighting chance to nip the illicit activities in the bud itself. That is achievable but often at a price. Our intention is to research and find ways that can make our life safe and secure using methods that are inexpensive to setup and also easy to update and fix.

Considering the presence of sophisticated hardware i.e. Sensitive Microphones in certain Areas of Interest which are difficult to monitor in Night Time or are usually isolated at night like ATMs, Bank Lockers or for personal surveillance.

The main purpose of the paper is to classify different types of suspicious sounds present in the dataset. The present sounds are Gun Shot, Jackhammer, Drilling, Dog Barking and Siren. This was done with the help of Deep Learning Models. The main aim of the paper is to develop a reliable and accurate model which can accurately classify sounds in their respective classes and distinguish them from other sounds. This will also in turn improve public safety by pairing it up with an alert system which can alert law enforcement or security personnel. Finally, the paper aims to compare the performance of multiple models to find the best fit model for the job.

To make the model able to classify different kinds of sounds, two Deep Learning models are constructed. The first model contains entirely of Dense layers provided by Tensorflow's Deep Learning API Keras , and dropout layers. The second model contains an LSTM Layer along with Dense and Dropout layers. The paper aims to classify the sounds based on their extracted features. The extracted features are in the form of Mel-frequency Cepstral Coefficients which collectively make up a Mel-frequency cepstrum. The models are trained, validated and evaluated on this data with appropriate training methods. The performance of the models are then compared and the model with the best performance is converted into an exportable format for further development.

In spite of having the accomplished crime departments who have been managing these issuesfor quite a while, why is there a need for DL, having said that answer is very straightforward, the experienced departments can check on 3-4 parameters or can cover and comb through footage manually only in batches at a time with the help of the human capability present on site at that moment but DL, on other hand, can cover the numerous batches in one go, once provided the sufficient computing resources. In our scenario,DL actually helps out by covering various batches that would otherwise not be covered because of the sheer amount of data that is present which would make it nearly impossible to actually reach the right conclusion. Our intentions here are to try to provide solutions that are scalable and not limited to only a particular use case.

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LITERATURE REVIEW

A. Phishing attack detection using Machine Learning

This paper [1] acts as our initial dive into the realm of how machine learning is used in various applications like physical and network security. We aim to use this paper as a path on how we can try and implement the machine learning concepts in our current setup to enhance and derive results that provide us with a better overall knowledge and view.

B. A sound monitoring system for prevention of underground pipeline damage caused by construction

In this paper[2], the usage of sound detection is in a very specific use case linked to the construction industry, in which they want to use acoustic signals to reduce pipeline damage. The other common noises are collected as environment noises and the system is applied via 2 layers, one which detects the suspicious sounds and the other that fine-tunes the results of the 1st layer. The testing of the model leads to results of 95% of the noises being detected which is good for improvements later.

C. Audio IoT Analytics for Home Automation Safety

This paper [3] speaks about how audio analytics can help in the household environment to detect abuse, violence and other unnatural activities that might take place. The audio is recorded and split into chunks in the server for training the model and classifying different categories. This system enforces home safety and if any suspicious sound is generated, then emergency services are informed immediately to take action.

D. Audio analysis for surveillance applications

In a paper written by R. Radhakrishnan et al [4]. A novel approach of analyzing time series like data of audio classes for detecting crime which can happen in elevators is developed and proposed. The authors showcase the disadvantages of a completely supervised machine learning based audio classification system and propose a hybrid solution to overcome them. It consists of two parts, in which the first part does unsupervised audio analysis and the second part which uses an audio classification framework. The framework uses a Gaussian Mixture Model (GMM) to identify background sounds and updates the model. The results seemed to be highly promising.

E. Smart Speaker: Suspicious Event Detection with Reverse Mode Speakers

In another paper written by G.Kalmar [5], an exploration into using speakers in reverse mode for detection of suspicious events has been done. The paper studies how a loudspeaker in reverse mode can be used to detect suspicious events like Gun Shots or screaming. To study the impact of reverse mode's distorting effects on the classification of events, a full transformation of traditional audio event datasets into forms as if they were recorded by speakers is done. The results suggested that speakers in reverse mode can be used for event detection.

F. A New Approach to Real Time Impulsive Sound Detection for Surveillance Applications

In this paper [6], the authors discuss the disadvantages of primary video surveillance systems and propose how they should be accompanied by other sensors. The paper makes a review of impulsive sound detection algorithms such as gun shots, explosions, screaming et cetera. It makes a review of all sound detection algorithms and noise detection algorithms as well. An adaptation of algorithms for detection of impulsive noise is also done. The results showcase that WLP (Warped Linear Prediction) can be used for impulsive sound detection.

II. METHODOLOGY

A. Overview

The paper's main purpose is to create and compare the performance of Deep Learning Models to identify which model is better and can be used for further development in this domain. The Model's main aim is to classify the sounds in their respective classes. The models are only trained to identify Suspicious Sounds like Drilling, Jackhammer, Dog Barking, Gun shots et cetera. The whole process of training the model requires a very crucial step i.e. Feature Engineering. Deep Learning models cannot be directly trained on sounds. They can however be trained on the features of the sounds that's why Feature Engineering is a very significant step for this whole process. After the training of the models, their evaluation on completely unseen data i.e. testing data is very important. This helps identify which model can work well when facing completely unseen data and is not overfit for the training data. Figure 1 depicts the entire process in a workflow diagram.

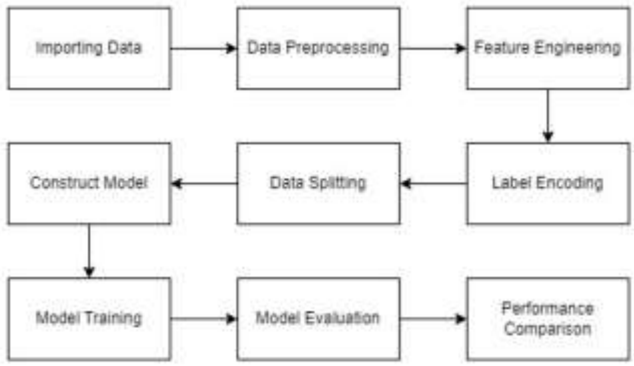

Fig. 1. Workflow Diagram

B. Environment

The entire project is implemented on Google Colaboratory, commonly known as Google Colab. It is a free, cloud-based Jupyter notebook environment that allows users to write Python code through the browser. Hosted by Google, Colab provides access to powerful computing resources such as Graphical Processing Unit (GPU) and Tensor Processing Unit (TPU), which allows for seamless work on the platform. Google Colab is thus particularly useful for researchers focused on data science and machine learning, who wish to collaborate with others on coding projects in a shared environment without hindrances. Unfortunately, Google Colab might be unable to process larger datasets as it is a limited platform, and does not support all Python libraries. However, for the purposes of this paper, Google Colab is a suitable work environment that is more than capable of handling the necessary datasets and

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libraries. In order to increase the scalability of this project, environments such as Kaggle can also be utilized.

C. Importing Data

Importing the data from its source can be a hassle. Specially when the data is large. We used the UrbanSounds8k Dataset [7] which contains 8732 sound samples of urban sounds like engine idling, children playing, street music et cetera. To import this data into our Google Collaboratory workspace, we use an external library called opendatasets [8] which uses Kaggle's official API to download datasets at high speeds.

D. Data Preprocessing

Data preprocessing is a crucial step in any machine learning project. It is a technique that involves transforming raw data into well-formed datasets and cleaning the raw data in order to check whether or not it is fit for analysis. More often than not, raw data is incomplete and inconsistent. Therefore, preparing the data has a direct impact on the final results post-analysis.

The main steps that are involved in Data Preprocessing include data cleaning, integrating the data. Transforming the data so that it can be used for different purposes and reducing the dimensions of the data. The dataset contains sound samples of different classes. Out of these classes, we only need five classes which can be categorized into Suspicious Sounds. We separate these classes and make a new dataset with only the metadata of sound samples of these classes. To depict the difference in these sound samples and a normal sound sample, we plot the waveform of the sounds.

The waveforms of the sound samples clearly represent the difference between them. This was made possible with the help of librosa [9]. librosa is a python package used for audio analysis. It makes the building blocks of audio processing systems. Figure 2 represents the waveforms of the class 'Dog Bark' and figure 3 indicates howthe waveform of the class 'Gun Shot' looks

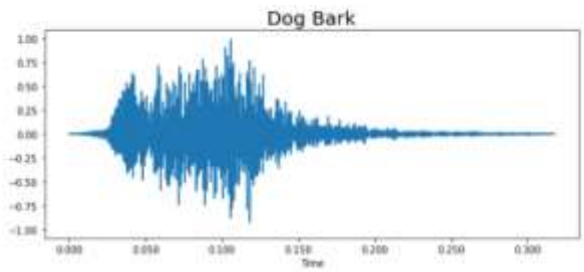

Fig. 2. Waveform of a Dog Bark

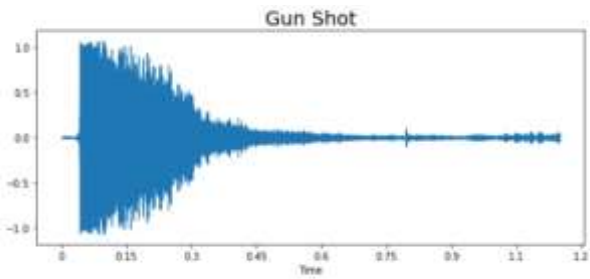

Fig. 3. Waveform of a Gun Shot

The same difference can be represented in the form of a spectrogram [10]. Figure 4 depicts the spectrogram for the class 'Dog Bark' and figure 5 depicts the spectrogram for class 'Gun Shot'

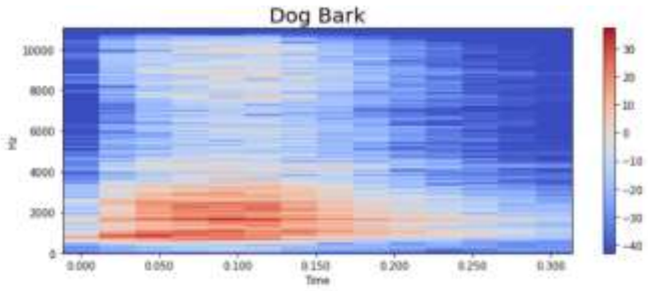

Fig. 4. Spectrogram of a Dog Bark

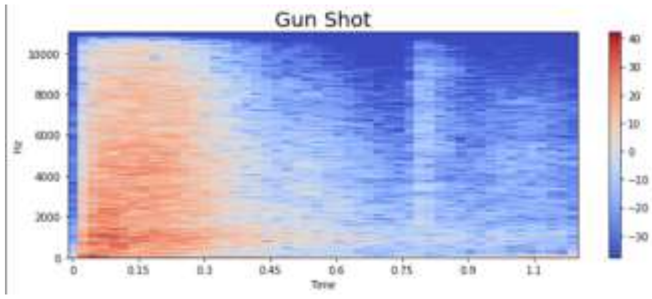

Fig. 5. Spectrogram of a Gun Shot

E. Feature Engineering

Deep Learning models are not able to identify sound samples in their raw forms. Providing a raw sound sample to a Deep Learning model for training yields nothing. For a Deep Learning model to identify a sound sample, its features can be supplied to it for training. For training our models, we extract the features of the sound samples. Since their are multiple types of features which can be extracted from a sound sample, we work with Mel-frequency Cepstral Coefficients [11]. The MFCC collectively make up the MFC or the Mel Frequency Cepstsrum which represents the change in the acoustic power of a sound based on a cosine transform of the power spectrum on a mel scale. This is done with the help of librosa. After extraction of features of every sound sample, a new dataset with the extracted features over fifty steps and its class labels is produced. The class labels are the encoded in the form of a distinct integer. This is called label encoding and is performed with the help of scikit-learn which provides efficient tools for data analysis and a premium library for Machine Learning in a Python Ecosystem.

F. Data Splitting

Data splitting enables us to split the whole data into bits which will be used for different purposes. In our case, we split our data into three subsets. The training data which is 80% of the original data, the validation data which is 10% and the testing data which is 10% as well. The training data will be used by the model for training, while it makes a pass over it and backtracks to adjust its wrights accordingly, and the validation data is used for checking how the model performs on relatively unseen data. Validation data is not used for training at all. The testing data in the end will be

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used for evaluating the model's performance finally on a completely unseen subset of data.

G. Model Construction

We For the betterment of results, we construct two relatively different models. The first model has four hidden layers. All these layers are Dense layers from the Keras API [12]. All these layers use 'relu' [13] as their activation function. The final output layer is a Dense layer with 'softmax' activation function [14] which is used in Multi-class classification. The model uses Categorical Crossentropy as its loss function along with Adam as its optimizer. This model is referenced as Dense Model throughout the paper.

The second model, referenced as the LSTM Model throughout the paper consists of three hidden layers. The first layer of this model is a LSTM layer [15]which returns only the final output. LSTMs are characterized by their ability to selectively remember or forget information from previous time steps, making them well-suited for tasks involving sequences of input data. Figure 6 depicts the architecture of a LSTM cell.

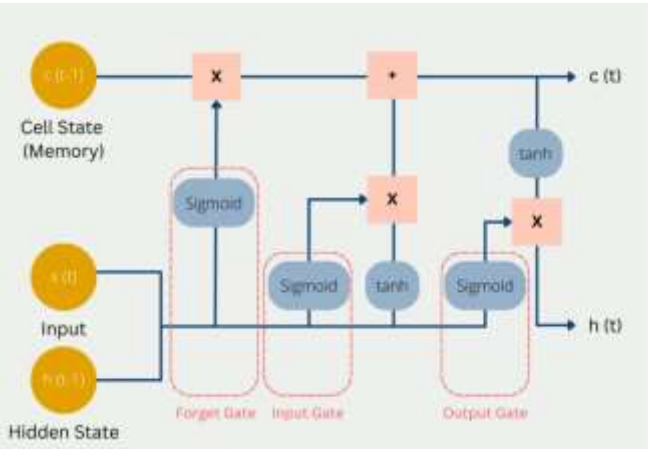

Fig. 6. Architecture of LSTM Cell

All the dense layers use 'relu' activation function. The output layer of the model uses 'softmax' activation function for multi-class classification. The model uses Categorical Crossentropy as its loss function along with Adam as its optimizer.

H. Model Training and Evaluation

Model training adjusts the weights of the models according to the training data provided. For our paper, we set both the model to be trained for 200 epochs with a batch size of 32. Along with this, an optional callback of Early Stopping is used. Early stopping observes a prescribed metric of the model while training. If the said metric does not increase or decrease or remains constant for a specific patience value i.e. number of epochs, Early Stopping stops the training of the model and reserves the best weights till the last epoch.

Finally, after training the model, a separate performance evaluation of the models is done on the Test Data. All the metrics of performance of the models on the Training, Validation and Testing data are used for evaluation.

III. Results And Discussuions

The primary aim of this study was to classify suspicious sounds into their respective classes based on their extracted features. This aim was achieved with the help of Deep Learning concepts in which our approach is to take two models and compare their performance to evaluate which model works better and can be used in a real-time audio stream. One point to be noted is that both models have not been trained for the same number of epochs, due to the usage of 'EarlyStopping'. Early Stopping is a method in Deep Learning that helps you to decide an arbitrary number of epochs at which the training of the model stops due to no improvement of results on the validation dataset.

A. Model I- Dense Model

The first model overall performed well on the dataset. It trained for 57 epochs and achieved a maximum training accuracy of 85.96% and a maximum validation accuracy of 88.63%. The training and validation losses of the model were 0.3889 and 0.3779 respectively. Fig 7 gives us a graphical representation of the training and validation accuracy. Fig 8 gives us the loss values for the training and validation loss.

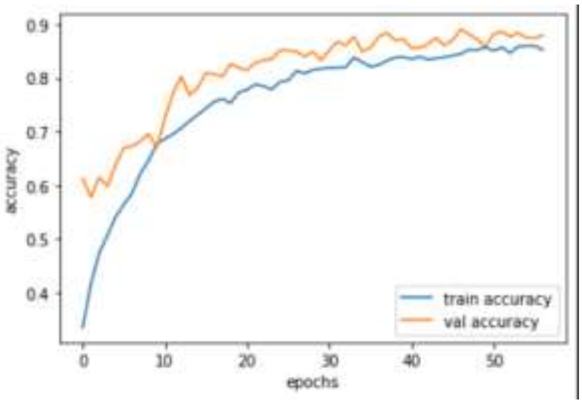

Fig. 7. Training and Validation Accuracy (Model I)

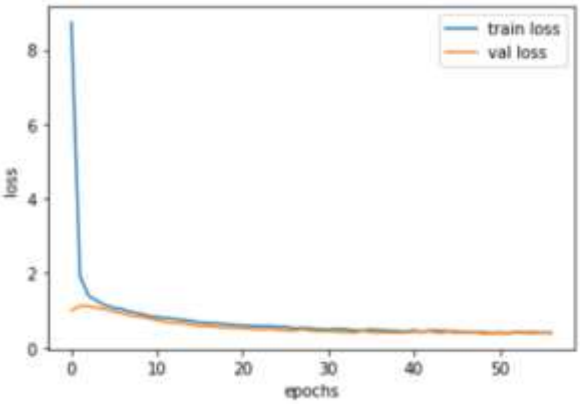

Fig. 8. Training and Validation Loss (Model I)

B. Model II- LSTM Model

This model performed better when compared to the previous model. It trained for 37 epochs and The model reached a training accuracy of 96.02% maximum and a validation accuracy of 90.49% maximum. The training and validation losses of the model are 0.1036 and 0.3184

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respectively. Fig 9 gives us a look at the training and validation accuracy curves. Fig 10 gives us the loss values for the training and validation loss.

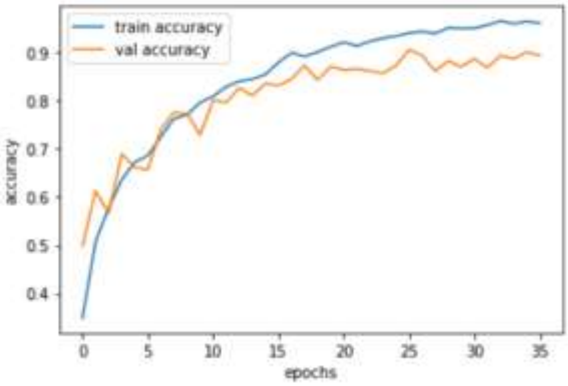

Fig. 9. Training and Validation Accuracy (Model II)

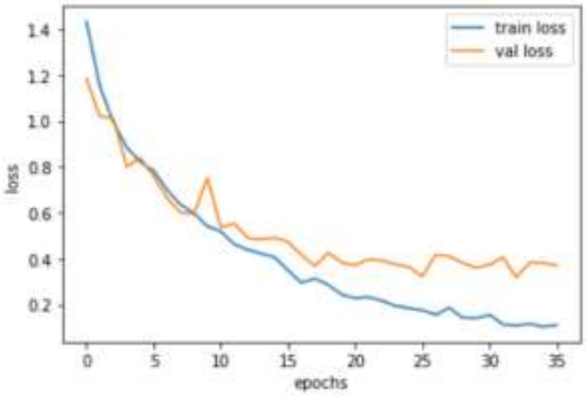

Fig. 10. Training and Validation Loss (Model II)

To compare the performance of the models in a more structured and elaborative manner, two tables are made to depict their performance. These tables reference to the performance of both the models collectively on their training data, validation data and testing data respectively. Table I gives us an overview of the training and validation loss of the model.Table II gives us an insight on the training, validation and testing loss of both the models..

TABLE I. TRAINING AND VALIDATION ACCURACY OF THE MODEL

Model	**Training Accuracy**	**Validation Accuracy**	**Test Accuracy**
Model I	85.96%	88.63%	88.86%
Model 2	96.02%	90.49%	90.25%

TABLE II. TRAINING AND VALIDATION LOSS OF THE MODEL

Model	**Training Loss**	**Validation Loss**	**Test Loss**
Model 1	0.3889	0.3779	0.3488
Model 2	0.1036	0.3184	0.3471

After analysing and comparing the results for both models, it can be said that Model 2 which is the LSTM model can be further developed and used to detect suspicious sounds in real-time continuous audio streams.

IV. CONCLUSION

The result of our paper, as proven by the Results and Detection Section shows us that the LSTM model performed better than the Dense Model. This in turn helps us prove that interpreting the features as a time-series array proves beneficial for sound classification models. There can be addition of more classes of suspicious sounds like footsteps or glass breaking, which will allow the model to detect a broader spectrum of classes, which also makes the smart surveillance system even smarter. We can also improve it to detect a live audio feed and also to alert personnel when needed.

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[13] https://en.wikipedia.org/wiki/Rectifier_(neural_networks)

[14] https://en.wikipedia.org/wiki/Softmax_function#:~:text=The softmax function is often,based on Luce's choice axiom

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Crop Doctor : A Comprehensive Crop Management System for Precision Agriculture

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***Abstract*—Agriculture is a vital business that greatly contributes to the global economy. In order to fulfil the increased demand for food, it is vital to boost crop output. In this context, precision agriculture is growing in popularity. Precision agriculture employs technology to maximise crop yields, minimise crop waste, and optimise crop production. A significant part of precision agriculture is the employment of crop selection systems, fertiliser recommendation systems, and disease diagnosis systems. These recommendations can assist farmers with crop selection, fertilisation, and disease management decisions using machine learning algorithms. This system is highly dependent on variables such as precipitation, pH, market analysis, and water availability. Before being analysed and displayed, Python is used to preprocess environmental data collected from farmers or agriculture department offices. Farmers will be able to interpret and utilise the data for decision-making and field monitoring as a result of the application of multiple machine learning algorithms. Using a custom-built recommendation system, the harvests have been forecasted and displayed. It is anticipated that farmers will adopt these technologies in order to increase yield via intelligent field selection.**

Keywords—precision Agriculture, SVM classifier, Fertilizers, Logistic Regressio Crops, Decision Tree , Machine Learning.

I. Introduction

Precision agriculture is essential for optimising crop production in order to maximise crop yields and minimise waste. Precision agriculture is the application of technology to provide farmers with customised recommendations based on soil and weather conditions. Precision agriculture is comprised of several key components, including crop recommendation systems, fertiliser recommendation systems, and disease diagnosis systems.

Precision agriculture, such as the use of crop recommendation systems, fertiliser recommendation systems, and leaf disease diagnosis systems, can assist in overcoming these obstacles. Precision agriculture, according to a study published in the International Journal of Precision Agriculture, can increase crop yields by up to 28% and reduce fertiliser use by up to 60%. (Gebbers and Adamchuk,2010). Farmers can reduce their input costs, increase their crop yields, and enhance the quality of their crops by implementing these systems. This can lead to a more sustainable and efficient agriculture system that can meet the increasing demand for food while having a smaller environmental impact.

II. Literature Survey

[1] Prediction of Indian Crops Based on Weather Using bigdata analytics and methods, information on soil, precipitation, temperature, crop productivity, seed, humidity. They will collect and analyse data for their project. After that the information has already been compiled in a Python environment, the Map - reduce framework is being used to evaluate and procedure it. When applied to Map - reduce outcome, K-means clustering yields an average level of data precision.

[2] A Study of Multiple Data Prediction Methods for Crop Yield, Data Mining It evaluates many data mining techniques for predicting crop yield. The efficacy of any crop production forecasting system is significantly impacted by the accuracy with which attributes were collected and classifiers were applied. It provides an accurate and recommended summarization of the crop yield projection results based on a variety of machine learning algutilised by different researchers.

[3] Exploration of Agriculture and natural resources Soils Utilize data mining methods. Data mining may offer a farmer with a recommendation system to increase crop yield. This strategy is implemented in order to ensure recommended crops are selected based on their climate variability properties and abundance. Data analytics permits the development of extensive agricultural database extraction. After analysingThe crop production data - sets centred on season and yield, crop recommendations are made.

[4] Algorithms based on machine learning for crop yield prediction. To support farmers in crop selection, we consider all variables, including soil type, planting seasons and geographical location. In addition, developing countries are combining smart farming, which emphasises location crop management, with the cutting-edge new technology known as machine learning.

[5] The AI-based farm crop management system. This analysis study proposes a system to aid farmers in crop selection by Taking into consideration everything relevant factors, including soil, planting season and geographical region. Emerging nations are also utilising modern agricultural technologies and developing smart farming, which focuses on crop management.

[6] System for intelligent Fertilizer recommendation based on machine learning. Datadriven models use machine learning models to accurately recommend fertilizers for the farmers to maximize their yield

[7] Predictive Model for Crop and Yield. Those who proposed a procedure for utilizing data mining to forecast crops and development in agricultural output by using deep learning. They must examine soil datasets for this purpose.

The flaw of the system is that it disregards the chemical substance of the soil.

[8] They developed automated prediction systems by utilising Big Data Analytics techniques. This study's model is constructed using the Hadoopframework.Apache Mahout was used to create a logistical regression model that utilised historical data to predict the future.

[9] V. K. Singh et al. (2021) put forward an approach for diagnosing leaf diseases in crops based on algorithms for machine learning and image analysis. The system accurately detected leaf diseases and provided recommendations for the best course of action in the event of a disease infestation.

III. Existing System

There has been extensive application of ML algorithms and research in the agriculture industry. The greatest challenge facing agriculture is to increase agricultural production and deliver that to consumers just at best possible price and quality.

Random Forest and Logistic Regression are the most common algorithms. Because of the greater features and complexity of the recommendation system, these are insufficient. Often, the crop suggestion algorithm merely offers farms to farmers being willing to participate in cultivating. This quiet does not sufficiently aid the farmer.

IV. Proposed Method

The purpose of this model is to develop a recommendation systems to increase agricultural output. This model aids the farmer in crop selection, fertilizer recommendation, and the detection of leaf diseases through image analysis in order to increase agricultural output. The systems are also capable of recommending the optimal course of action in the event of a disease outbreak. The early detection and identification of leaf diseases can aid farmers in preventing the disease's spread and mitigating crop loss.

The intended strategy is novel given that assists farmer in increasing agriculture output by going to recommend the most profitable crops. In the proposed model, crop choice depends on both environmental and economic factors. This method predicts the crops of the greater yeild outcome by analysing variables such as soil type, temperature, rainfall.

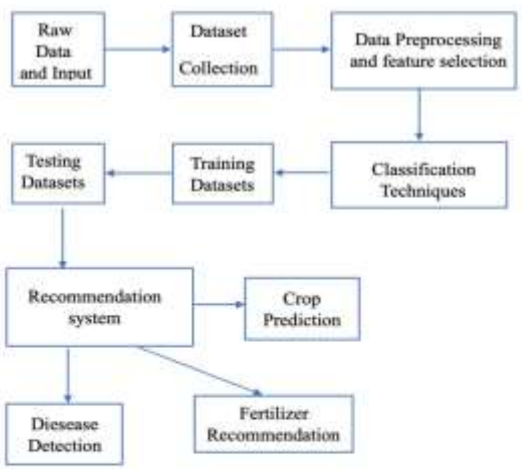

Fig. 1: Architecture Diagram

We developed recommendation sections for fertilisers and Pesticides using, a number of machine learning (ML) strategies, including Random Forest, NB classifier, Decision Tree, SVM, and CNN. This method can reduce the difficulties farmers face when choosing crops, fertilisers, and pesticide residues.

Table 1. Algorithm's

Algorithms
SVM
Logistic Regression
Random Forest
NB Classifier
Decision Tree

V. Implementation

A. *Pre-processing and cleaning*

One of the first responsibilities is to confirm the accuracy of the dataset we are using. If any values are present but are missing from the dataset, they should be filled in with the correct values. The data should also be examined to determine whether the characteristics have a normally distributed. The dataset we utilised contained features with skewness. In order to equalise the properties of our dataset, we applied quantile transformation on them

B. *Data Visualization and Analsys*

After data cleansing and preparation, we analyse and visualise our dataset. We endeavour to conduct a more in-depth analysis of our data to identify any patterns or trends within the dataset. We have created multiple visuals to aid in the comprehension of our dataset.

C. *Operational Selection*

It is essential that only select the qualities that will be necessary to evaluate the category of crop to cultivate. A correlation matrix has been created to demonstrate linear relationship between each characteristic and additional features.

Then, a machine learning model is constructed. Before building we must separate the model for machine learning into its component parts, the dataset into sets for testing and traning. We begin with data for training followed by application of machine learning algorithms using the dataset characteristics. Four methods of machine learning were applied to our training dataset; on the test dataset, the most accurate techniques will be utilised.

Datasets:

https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset

https://www.kaggle.com/datasets/gdabhishek/fertilizer-prediction

https://www.kaggle.com/datasets/vipoooool/new-plant-diseases-dataset

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D. Constructing of User Interface

In the subsequent step, an interface for users data entry by the client was designed. The model will analyse the user'sinformation, including such N, P, KSoil Values, precipitation,humidity, temperature, etc., and recommend the optimalcrop must be cultivated under the given Conditions. Once the user enters and submits the following information, The algorithm for machine learning will forecast crop yield which the customer mustplant

Fig. 2: User Interface of Crop Prediction

Fig. 3: User Interface of fertilizer Recommendation

Fig. 4: User Interface of Disease Detection

VI. Result

We cleaned and visualised the data before applying our methods of algorithms of machine

Learning tocharacteristics of the dataset. Our four algorithms presented are Logistic Regression, Decision Tree, XG Boost and Random Forest. The selected characteristics the datasets are comprised of the K (potassium), P (phosphorus), N (nitrogen) properties of the soil, moisture,precipitation, temperature and ph value.

```
In [43]: data = np.array([[104,18, 30, 23.603016, 60.3, 6.7, 140.91]])
         prediction = RF.predict(data)
         print(prediction)

         ['coffee']
```

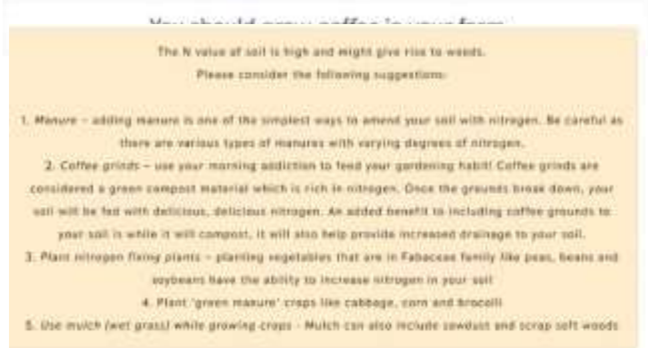

Fig. 5&6: Result of Crop Prediction

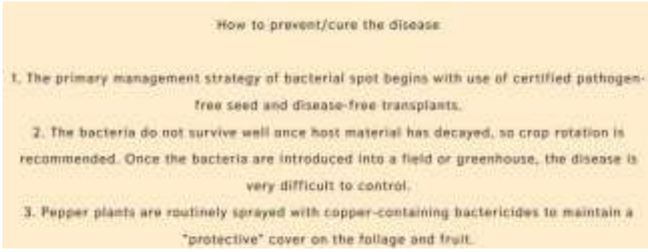

Fig. 7: Result of Fertilizer Recommendation

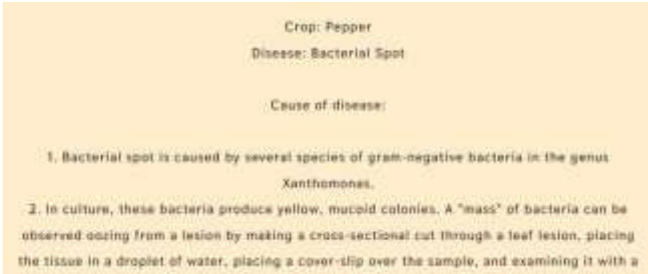

Fig. 8&9: Result of Disease Detection

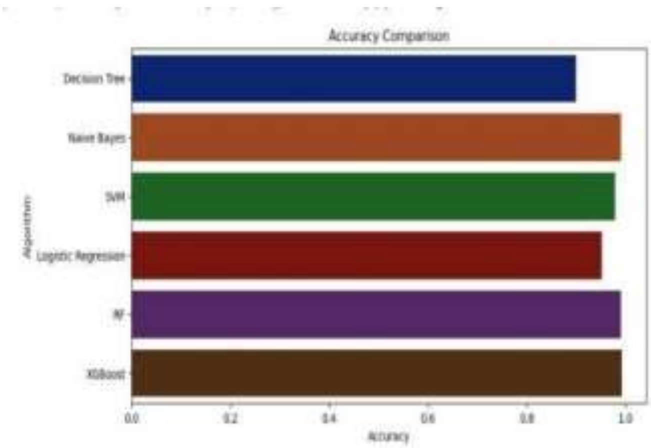

Fig. 10: Accuracy Graph of Algorithms

As per the graph we have XG boost with the best accuracy of 0.993, Random Forest and Naive Bayes with an accuracy of 0.990, SVM with an accuracy of 0.979, Logistic Regression with an accuracy of 0.952 and Decision Tree with an accuracy of 0.911.

VII .Conclusion

Precision agriculture relies heavily on crop recommendation systems, fertilizer recommendation systems, and disease diagnosis systems. Using machine

DOI: rp-9788770040723.132
learning algorithms, these systems provide farmers with customised recommendations based on soil and weather conditions.

Farmers can optimise crop production, reduce waste, and maximise yields using these systems. These systems can aid in enhancing the productivity of small-scale farmers, reducing the use of fertilisers and pesticides, and ensuring food security for a growing population. this technique, it would simplify his life and predict with a 98% accuracy the ideal crop and fertilisers to plant.

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Speech Emotion Recognition Using LSTM Model

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***Abstract*—This approach of speech emotion recognition(SER) is a problem in the subject of deep learning. The primary objective of this study is to identify a variety of feelings based on the input of audio utterances as well as the Rnn networking. We used the long short-term memory networks (LSTM) model because it deals with speech features and aims to improve speech recognition rates. Initially, this method of speech emotion was done by machine learning approach but recently deep learning techniques are proven to be an alternative to SER providing better accuracy.We used the dataset's audio files as input, performed feature extraction, and trained the model. Considering researching the published works from prior periods' research and putting the suggested models through their paces on our own datasets, We expect that the overall file classification efficiency will be 99.73**

Index Terms*—Recurrent Neural Network(RNN),Long Short- term memory(LSTM), Speech emotion recognition(SER), Deep learning.

I. Introduction

Making it feasible for human-machine contact is the main goal of this mission speech emotion recognition (SER) utilising deep learning method. Speech is best way of interaction between humans. So, this is very exciting and interesting for researchers to find ways to establish communication between machines and humans. This topic of SER is quite tough because there are many factors that might effect the raw input sound signals such as age, gender, noise and etc. Nowadays, the majority of our focus is directed into deep learning since, within a relatively short amount of time, it is providing us with improved results in every area, particularly SER. Deep learning makes it possible to use sophisticated models and learn various data representations. Deep learning's main disadvantage is that it needs a large data in order to perform better than any other approaches. Firstly, a machine learning technique was used to perform this SER technique; however, once a large dataset was used, this machine learning method produced superior results. Despite the fact that speech technology has advanced significantly SER in previous years, but a bettersystem is still required. Recognition of human sentiments via machines, which might further improve the relationship between humans and machines [1][4]. The primary and most direct method of information transmission is speech. It is able to express a vast amount of emotional information by means of the feelings that it feels and the manner in which it displays those feelings in response to items, scenarios, or happenings. This ability allows it to communicate a wide range of sentiments. Its database contains a vast amount of information covering a variety of topics. In recent years, a significant number of studies and research initiatives have focused their attention on developing methods for the automated recognition of individual emotions through the study of human voices and facial expressions. These methods have been developed in an effort to improve the accuracy with which computers can read face expressions and voices. There is a significant rise in the number of studies pertain to this topic as a direct result of the fact that automated emotion detection systems may be utilised for a variety of purposes within a variety of settings. This is a direct result of the fact that automated emotion detection systems may be used in a variety of settings.Examples of the applications for these studies and their planned use include the following systems: Education: A course system for online learning can identify disinterested students so that the style or difficulty of the material can be changed. It can also offer emo- tional bribes or concessions. Automobile: The driver's internal condition and driving performance are frequently connected. As a result, these systems can be employed to enhance driving performance and the driving experience. Security:It's possible that intense emotions like fear and anxiety may be used as support systems in public settings if we acknowledged them and acknowledged their significance. Communication: When an interactive voice response system and an automatic emotion detection system are combined in call centers, customer service may be enhanced. Health: Individuals who suffer from autism may find it easier to adjust their social behaviour if they have access to portable technology that helps them understand their own sensations and feelings [5].

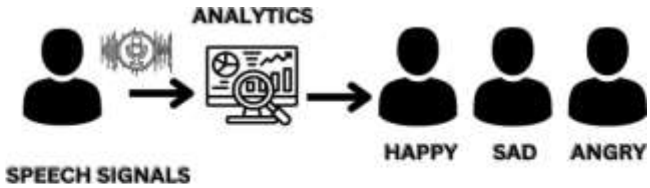

Fig. 1. Process of SER

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II. Related works

An intriguing piece of research that Pan produced made use of MFCC and support vector machines as features. With regard to his Chinese dataset as well as EMoDB[6], he achieved astounding accuracies of 91.3043percentage and 95.087 percentage, respectively. The Arabic television programme ”The Exact reverse Path,” according to Ashraf Khalil in [6], served as the source for his set of samples. He used SVM and got a classification rate of 77 percentage.[3][7] We are aware that Yixiong Pan in [8] used support vector machine to classify emotions into 3 groups with 95.1percentage correctness using datasets from the Berlin Database of Emotional Speech [1][8]. The finest outcome in this field has thus far been published, and it is this one. In [9], S. Lalitha uses a support vector machine (SVM) classifier in conjunction with pitch and prosody characteristics to achieve 81percentage accuracy across 7 classes from the full Berliner Dataset of Emotional Speech. In [10], Yu Zhou merged spectral and prosodic features using the gaussian mixture model superior vector- based SVM, and he showed 88.3 percentage efficiency on five classes of the Chinese-LDC corpus. In [11], Fei Wang used a mixture of various features,Deep Auto Encoder, and SVM to achieve an accuracy of 83.7 percent on six classes from the Chinese emotion corpus CASIA. [1] SVM is employed in some other Arabic dataset created by Al-faham and Ghneim. [12]. where they hit their target 93.1 percent of the time HabibaDahmani proposed in [13][3] a fully automated system for voice recognition for the Algerian language. She used data from the Algerian television show ”Red Line” for her research. The total number of sound samples is 1443. Among the several classification strategies used were KNN, Logistic regression, and Random Forests. Their F-value came out to be 0.48. [3] In [14][1], JianweiNiu reported 92.3percentage accurate on six classes of 7676 speaking Mandarin Chinese phrases employing a range of characteristics in their identification system and integrating deep beural networks and Hidden Markov Mode.

H.M. Fayek in [15] studied multiple DNN designs using two independent databases, eNTERFACE [16] and SAVEE [17][1], with 6 and 7 categories, respectively.[1] John Kim introduced a framework called EmNet in that includes extraction offeatures, feature normalisation, 4 CNN layers, and 2 LSTM layers.[18]. EmNet performed at a rate of 88.9 percentage when tested on the EMO-DB dataset.[3] Yasser Hifny and Ahmed Ali [19] developed two neural architectures to address the problem of voice emotion detection. The first architecture employed the CNN-LSTM-DNN model, whereas the second design was based on the CNN model. On the KSUEmotions dataset [20], the accuracy of the first model was 87.2 percent, whereas that of the second model was 85Noroozi et al. Based on the evaluation of both visual and aural data, proposed a customisable approach for recognising emotions. In his study, 88 traits—Mel Frequency Cepstral Coefficients [MFCC] and filter bank energies [FBEs]—were employed to cut down the dimension of feature extraction previously performed using the Principal Component Analysis. Bandela et al. coupled the Teager Energy Operator (TEO) as In his study, 88 traits—Mel Frequency Cepstral Coefficients [MFCC] and filter bank energies [FBEs]—were employed to cut down the dimension of feature extraction previously performed using the Principal Component Analysis.a prosodic feature with the auditory feature known as the MFCC in order to detect five emotions using the Berlin Emotional Speech collection and the Gaussian Mixture Model classifier .The 13 MFCC generated from voice files were utilised by Zamil et al. as spectral characteristics, in their proposed model to classify the seven sentiments using the Logistic Model Tree method.[21]

III. Methodology

A. Data

In order to evoke each of the seven emotions, two actors (ages 26 and 64) recite a selection of 200 target words in the carrier phrase ”Speak the word” (anger, fear, disgust, pleasant surprise, sadness, happiness and neutral). There are 2800 data points in all (audio files). The data is structured in this manner so that each of the two female actors and their feelings has its own folder. It includes an audio file with the two hundred target words. The audio file format is WAV. After importing the dataset, we saw that it had around 2800 samples. After importing the dataset, we will create a data frame with audio files and labels. Then we do an exploratory analysis of the data to examine if all of the classes, such as fear, anger, disgust, neutral label, sad, ps, and happy, are distributed uniformly. Finally we assign responsibilities to the spectrogram and wave- plot. The waveform of an audio track file is displayed using a waveplot, while the frequency levels are displayed using a spectrogram. We are presently developing a feature extraction method for audio files. Following feature extraction, we will now construct the LSTM model. A thick two dimensional linear layer with hidden units, dropout regularisation to prevent overfitting by removing a portion of the data, the limited categorization To calculate the difference between true and predicted labels, use the cross-entropy method, and the Adam optimizer to automatically update the information gain during training are all part of the neural network model. Now we will train the model, and all of the results will be shown at the conclusion of each epoch of training, and the results willbe plotted, and we will see whether we get better outcomes with this model.

B. LSTM model using RNN Architecture

LSTM is a type of Recurrent Neural Network (RNN) that can develop protracted dependencies. In this research, a type of speech processing approach for LSTM networking structure is given to contend with speech characteristics, with the goal of boosting the speech recognition rate. A LSTM unit conducts the memorizing in this model, the Dropout unit periodically changes the parameters of a chunk of the data to zero to prevent against overfitting, and also the Dense units include convolution layer connected to the degree of freedom the model will have to adapt to the data. The more complicated the data, the more degrees of freedom the model requires, all while avoiding overfitting . If the accuracy of the training and test sets differs (for example, accuracy rate is 98 percent and test accuracy is 88 percent), the data has been overfit. Stop iterating when the validation metric of choice (accuracy in this example)

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begins to drop. Using audio data, we may build an RNN by having started with a basic model and gradually adding layers until it can forecast the data to the top of its abilities. To understand where this border is, adapt the structure until your simulation tends to overfit the data, then go back and remove layers. Check for performance differences in between test and training information and use Drop - outs layers to avoid over - fitting to the training data.

Fig. 2. LSTM Model

C. Experiment

Our framework was developed using an LSTM model with an RNN architecture.About 50 epochs were applied to the RNN design. Every sampling was successful and included samples from various classes (sadness, fear, disgust, happi- ness,anger, pleasant surprise, and neutral), there were precisely the same amounts of segments from each class in every batch as shown in fig. 3. Because each class included 400 data frames, the total number of data frames for all emotions was 2800. After the exploratory data analysis, We created a waveplot and spectrogram for each class, as shown in Fig 4, Fig 5, which shows the wave plot and spectrogram of fear, Fig 6, Fig 7 showing the wave plot and spectrogram of angry, Fig 8, Fig 9 showing the wave plot and spectrogram of disgust, Fig 10, Fig 11 showing the wave plot and spectrogram of neutral, Fig 12, Fig 13 showing the wave plot and spectrogram of sad,Fig 14, Fig 15 showing the wave plot and spectrogram of ps, Fig 16, Fig 17 showing the wave plot and spectrogram of happy respectively.A sample audio of an emotional speech is also included in each session. The spectrogram’s colour pattern demonstrates that lower pitched sounds have darker colours, while higher pitched tones have vibrant colours. Following that, the audio files are subjected to the extracting features approach. With the same file size, the speech length was restricted to three seconds. MFCC features will be recovered with a limit of 40, and the mean will be used as the final feature.The extracted features of the audio files will then be returned in the following phase, and xmfcc will assist in the display of the features derived from the data.The processing time required to display the generated features rises in proportion to the amount of samples in the dataset. After that, the list is transformed to a one-dimensional array, which we receive as (2800,40). After converting the input to a single- dimensional array, we split it (2800,40,1). The shape in the x region represents the number of samples in the dataset and the number of features in a single dimension array. The y-axis contour shows the number of samples and output classes. We will now construct the LSTM model. The loss in this model is called ”sparse categorical cross entropy,” which computes the cross-entropy loss between true labels and predicted labels, and the learning rate of the model is automatically changed over the number of epochs.

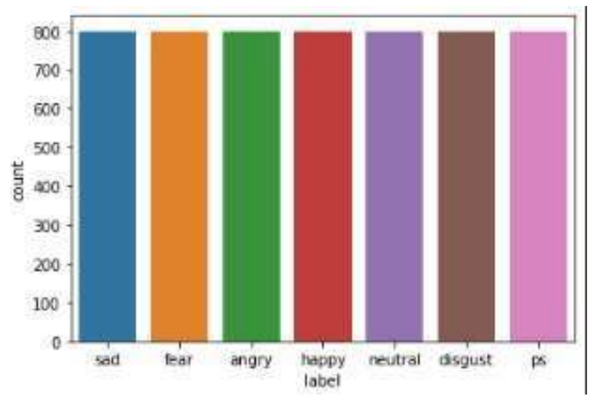

Fig. 3. Exploratory data analysis of our dataset

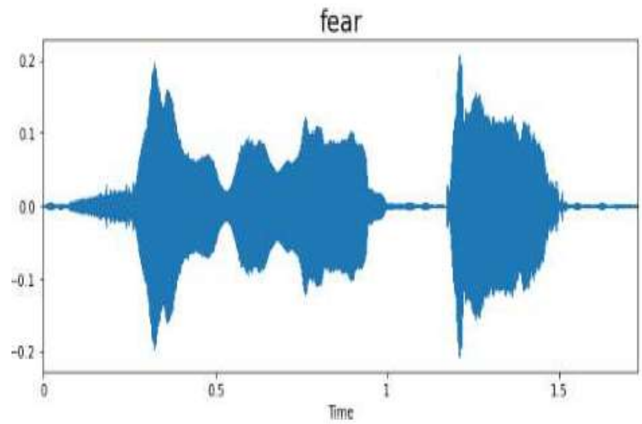

Fig. 4. waveplot of fear emotion

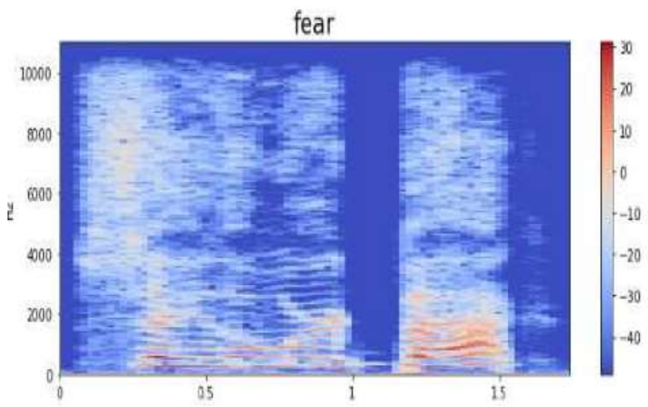

Fig. 5. spectrogram of fear emotion

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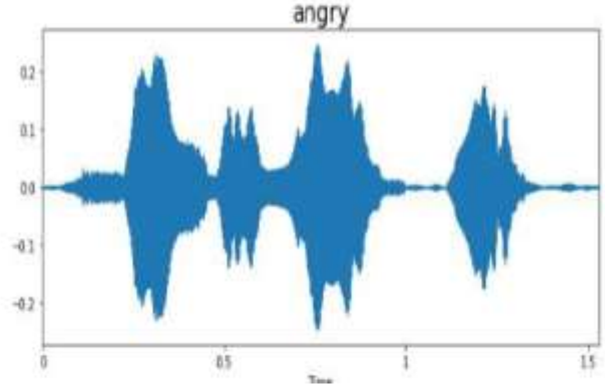

Fig. 6. waveplot of anger emotion

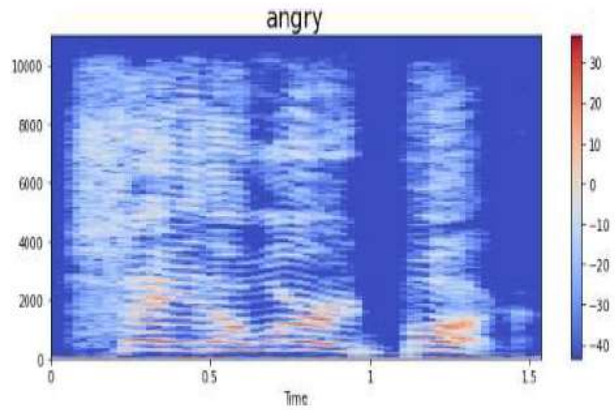

Fig. 7. spectrogram of anger emotion

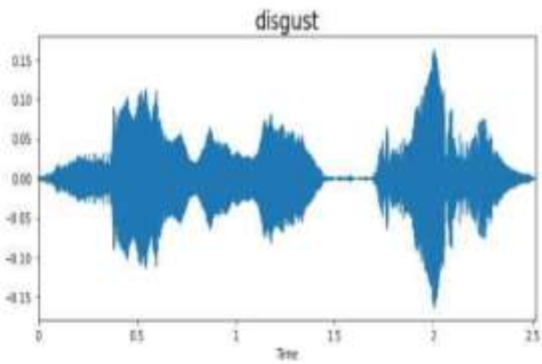

Fig. 8. waveplot of disgust emotion

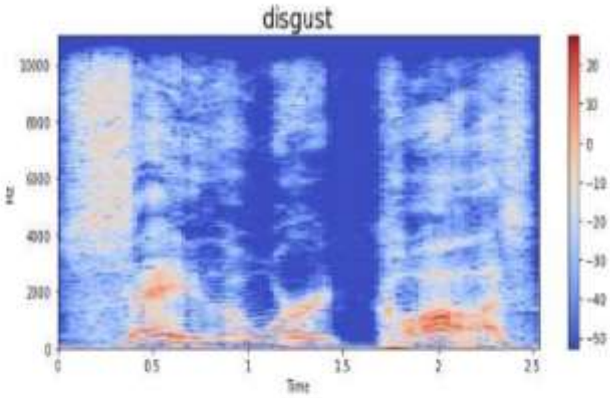

Fig. 9. spectrogram of disgust emotion

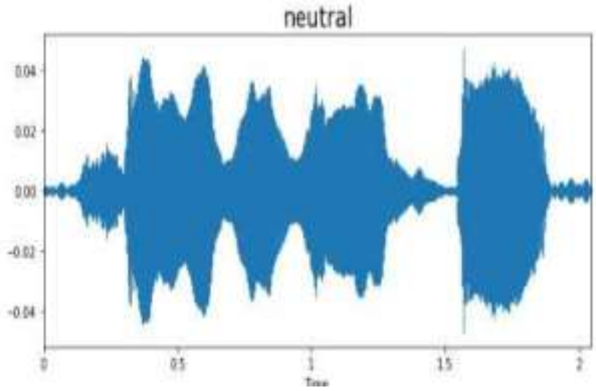

Fig. 10. waveplot of neutral emotion

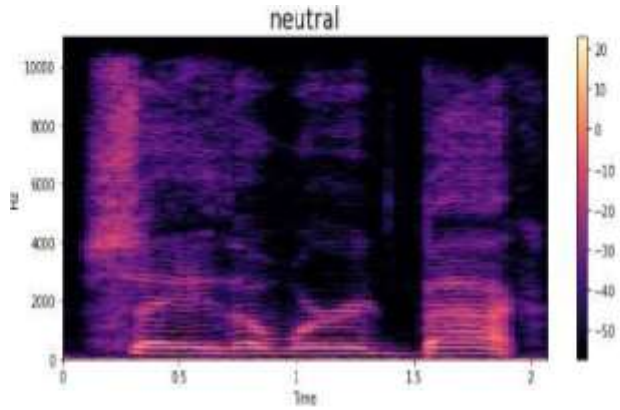

Fig. 11. spectrogram of neutral emotion

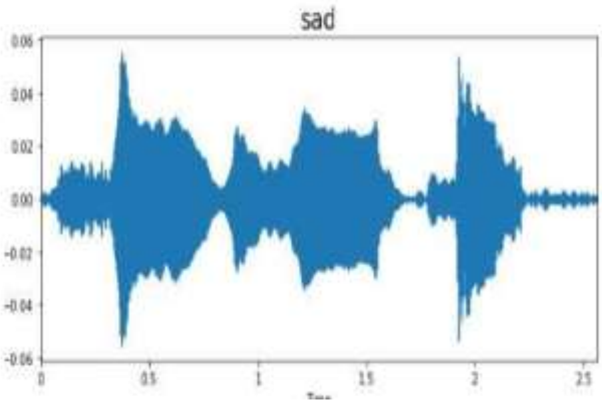

Fig. 12. waveplot of sad emotion

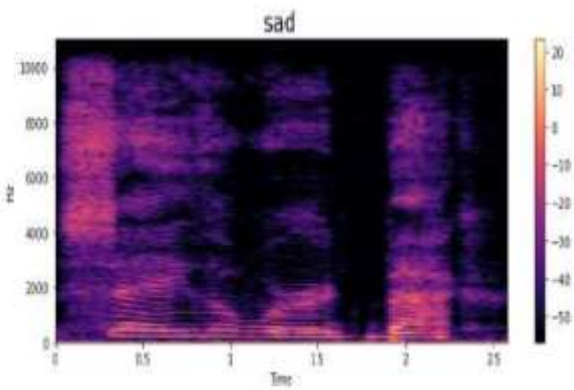

Fig. 13. spectrogram of sad emotion

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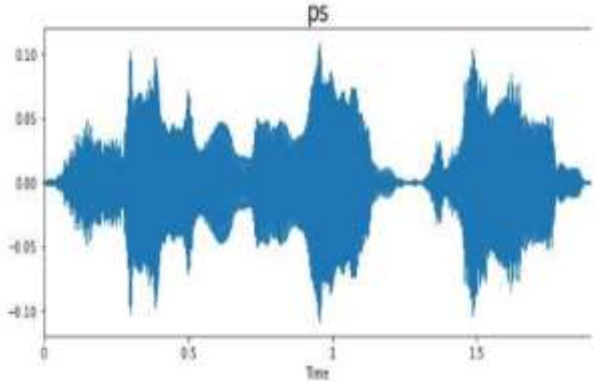

Fig. 14. waveplot of ps emotion

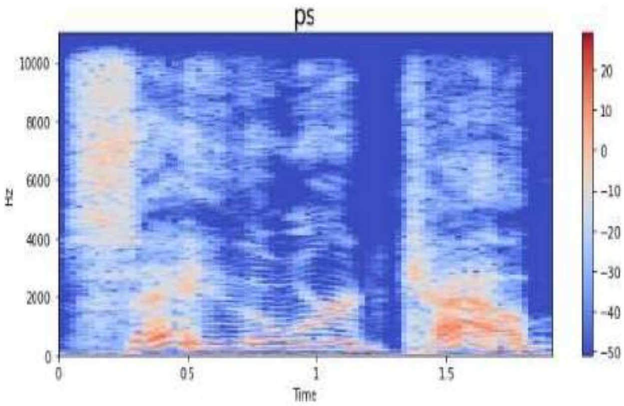

Fig. 15. spectrogram of ps emotion

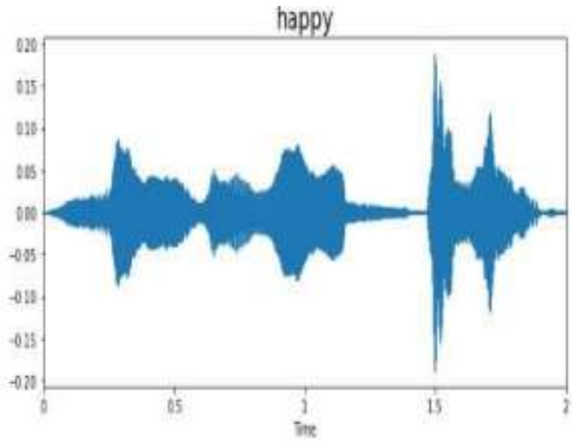

Fig. 16. waveplot of of happy emotion

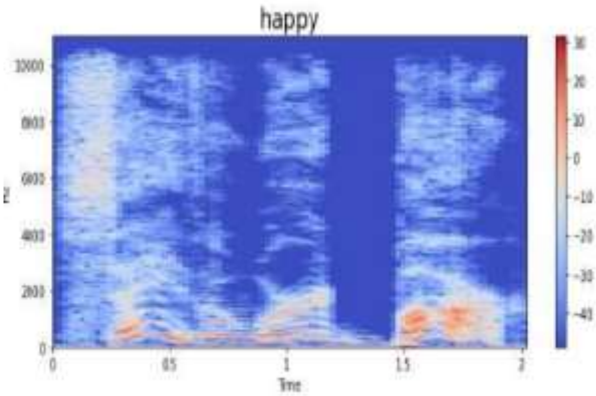

Fig. 17. spectrogram of happy emotion

IV. Results

Based on the research that we have done,we claim our accuracy to be 99.73 percent. In this model, the memorizing is done by an LSTM unit, the Dropout unit occasionally resets the parameters of a portion of the data to zero to avoid over fitting, and the Dense units also have a convolution layer linked to the amount of flexibility the model will have to adjust to the data. More degrees of freedom are needed in the model as the complexity of the data increases, but over fitting must be avoided. The algorithm was trained over a GPU for about 50 iterations.The models training accuracy and validation accuracy increased during the duration of the training procedure with a total sample size of 64 and 50 epochs. The best validation accuracy of 98.57 was attained, and the best model was preserved by utilizing a checkpoint.In order to address slow convergence, the learning rate can be adjusted. The data was separated into sets for training and testing using the validation split of 0.2.The proportion ofsegments included in the validation sets and those used for the training were both identical in every class.In fig 18 and fig 19, we have also shown the plots for accuracy vs. epochs and loss vs. epochs. respectively.

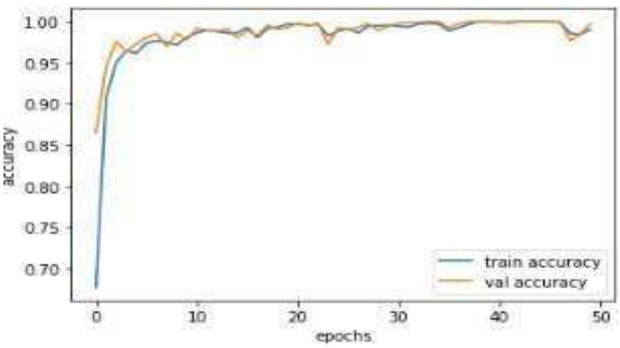

Fig. 18. graph for accuracy vs epochs

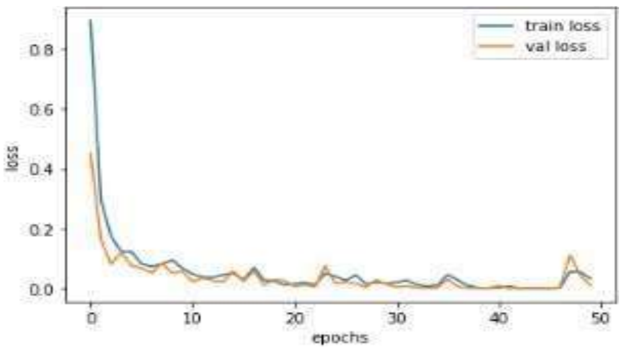

Fig. 19. graph for loss vs epochs

V. Conclusion

Over the course of our work, we conducted research and read a range of study articles. The experiment was carried out to see whether it would be possible to determine a person's psychological emotion reaction by listening to brief recordings of their speech. Our approach has a 99.73 percent accuracy rate. We chose deep learning for our project because it produces more accurate outcomes than machine learning.In this work, we identified various speech emotion sounds with deep learning algorithms on the emotional speech recognition dataset, which was

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supplemented by exploratory data analysis to provide more insights into the classification process. We chose the LSTM model because it enables the system to efficiently process continuous input streams without raising the needed bandwidths. In order to optimally utilise the model parameters, the proposed model alters the usual design of the LSTM network.Despite we obtained improved results with our model, much more work in the domain of voice emotion identification need to be done. Further work may be done to improve the process and make advantage of larger datasets.This is done to make sure the algorithm can produce satisfying results across a variety of data sources and much more than the courses we have taken, with extremely high accuracy on validation sets, enhanced prediction confidence, and more reliance on real-world data. Even if the final accuracy is rather excellent, we will continue to investigate ways to make the process even better.

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EduChain:A Blockchain Based Identity Verification Model for Educational Institutions

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***Abstract*—When it comes to cyber security, educational institutions are often undervalued. Since educational institutions typically have a huge population, the procedure for issuing and verifying identity documents must be secure, dependable, and efficient. The process may require students to make multiple trips to the issuing authorities' offices. This is just a waste of time for all the parties involved. Inadequate methods for verifying students' identities have contributed to a rise in the number of cases of digital identity theft. This paper proposes a blockchain-based identity verification model for educational institutions, as well as explores the possibility of designing such a model for Government Institutions. Third parties can validate the user's data without wasting time or money due to the immutable and decentralised ledger. For uploading files that we wish to store on the block so that a user can view and interact with them directly, our goal is to develop a front-end website with HTML, CSS, and JS. All of the student identities would be stored in an IPFS calledweb3.storage.Blockchain-based identity management system shave the potential to significantly improve user control over their own data, as well as transparency, accountability, and dependability. They can also speed up administrative processes.**

***Index Terms*—IPFS, Blockchain, Document Verification, SHA256,AsymmetricEncryption**

I. Introduction

Asuccessfulsocietyrequiresitscitizenstobeidentifieduniquely. It is a collection of statements about an individualthat are used to distinguish them. The person's name, date ofbirth,country,andnationalidentityaretypicallyincludedhere. Thesedatasetsaregeneratedandmaintainedbycentralized organizations(governmentservers).

Educationalinstitutionsoperateinasimilarmanner.Allrelevantdocumentsarekeptinacentralrepository,andacentralauthorityprovideseveryone theiruniqueidentity.

Ateducationalinstitutions,alargequantityofpersonallyidentifiable information about students is stored. All of thisinformation, which is maintained in a Central Repository, ismanaged by the administrators of the institution. There is agood chance that the data was accidentally edited or tamperedwith. If this central repository is compromised, all sensitiveinformationaboutindividualsmightbeaccessiblebyunauthorisedpersons.Thisisconcerningsinceitopensthedoor to identity theft, security theft, and other forms of crimes,making it necessary to use strong security measures. In therecent times according to Lagzian, M.(2018) [1] identity theftshave increased significantly in the academic world. Anothercause for concern is that students have no idea about who hasaccess to their data and what is being done with their data.Essentially, users' personal data is being used without theirconsent. This makes it essential to include transparency in themodel.

A. *BlockchainTechnology:*

"SatoshiNakamoto"introducedtheblockchainconcept in his [2] 2008 white paper, describing it as atrust less technology and claimed that bitcoin was thefirstopen-sourceapplicationofblockchaintechnology. Through cryptography, peer reviews, anddecentralised transactions, Blockchain ensures trust,security,anddataintegrity,henceeliminatingtheneed for middlemen. A Blockchain is a distributed,transparent, and immutable ledger that improves trustandproducesasystemthatisquick,safe,andreliable. Blockchain has gained popularity in a lot ofsectorslikefinance,healthcare,etcintherecentyears.[3]

Blockchainisacombinationofthreecoretechnologies:cryptographickeys,apeer-to-peernetwork, and a digital ledger. There are two types ofcryptographickeys:privatekeysandpublickeys.Eachindividualornodehasbothofthesekeys,which are used to generate a digital signature. Thisdigitalsignatureisauniqueandsecuredigitalidentificationreference,anditisthemostcriticalcomponentofblockchaintechnology.

B. *Inter-PlanetaryFileSystem(IPFS)*

IPFS (Inter Planetary File System) [4] is a peer-to-peer,content-addressed,version-controlledfilesystem.HTTPisthecurrentdefaultmethodforexchanging data across the Internet, howeverit failsin several instances. Large files cannot be sent viaHTTP,dataisnotpermanentonHTTP,HTTPisprimarily a Client-Server protocol, resulting in lowlatency and making it challenging to build a peer-to-peer connection. Also, real-time video streaming overHTTP is hard. All of these limitations are overcomewith IPFS. Data is requested using the hash that isreturned when data is uploaded to an IPFS network.The network allows for the distribution and copyingof data, which makes the data permanent. It searchesfor the nearest copy of the requested data when youmakearequest,whichcausesahighlatencyandpreventscongestion.Datacentralizationisnotpossiblesincethedataiscompletely distributed.

Related Work

TABLE I

Year	Title	**Author(s)**	*Inference*
2018	A Comprehensive Integration of National	KumaresanMudliar;Harshal Parekh;PrasenjitBhavathankar	The proposed model [5] is to create a secure, transparent digital national identity system

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Year	Title	Author(s)	*Inference*
	Identity with Blockchain Technology		using barcode or QR code scanning. There may be trust and adoption issues if the system fails to meet expectations, as it will be used by both government officials and citizens. To ensure successful adoption and compliance with legal requirements, thorough testing is necessary.
2018	Blockchain-based Identity Management with Mobile Device	ZhiminGao, Lei Xu, Glenn Turner, Brijesh Patel, Nour Diallo, Lin Chen, Weidong Shi	BlockID [6] provides a framework that embeds government issued ID into a digital certificate, which is further bound with a smart- phone through biometric-based user authentication. This ensures the security of the system by providing binding and confidentiality/integrity, and preliminary implementation of BlockID on the phone hasdemonstrated its feasibility.
2019	Blockchain Based Identity Verification Model	Gunit Malik, KshitijParasrampuria, SaiPrasanth Reddy, Dr. Seema Shah	The paper [7] discusses a blockchain-based solution for verifying the authenticity of the government issued identification documents using an HTML/CSS interface, file handling/database system, and Hyperledger Fabric platform. Downsides of the solution include high costs, proof of work consensus mechanism, and difficulty in maintaining security and privacy. Off- chain databases and cloud storage or a hybrid system, can help mitigate some of these risks.
2019	Blockchain-Based Identity Verification System	Arshad Jamal, RababAlayham Abbas Helmi, Mariam-Aisha Fatima	A Blockchain-based Identity Verification System is proposed [8] to store personal records on the blockchain.Individuals can control access to their data in the system. The system has three types of consumers: user, authority, and third-party requesters. The system should be designed to allow for multiple requests to be made at a time. Data should be stored on the blockchain for improved security andtamper-proofing.
2019	Self-Sovereign Dynamic Digital Identities based on Blockchain Technology	Himani Gulati, Chin- Tser Huang	The paper [9] introduces a self-sovereign digital identity system based on blockchain technology. The system allows individuals to maintain and control their own identity information. The identity information can include biometrics and any other variable information. The design does not address privacy concerns of users when it comes to sharing their personal data. It is important to only share necessary data and allow users to havecontrol over their data.
2020	Zero-Chain: A Blockchain-Based Identity for Digital City Operating System	Kwame OmonoAsamoah , Hu Xia , SandroAmofa, Obiri Isaac Amankona, KechengLuo, Qi Xia JianbinGao , Xiaojiang Du and Mohsen Guizani	The authors of the paper [10] are attempting to create a secure system for digital city management, specifically focused on the secure identification of individual residents. Their system will store user attributes and securely transmit them to other system components for verification, ultimately creating a digital identity for the applying resident. The set of transactions leading to the ID creation will be stored in the blockchain, ensuring security and providing a basis for the development of a digital infrastructure for smart city management.
2021	BIdM: A Blockchain-Enabled Cross-Domain Identity Management System	Ruibiao Chen, FangxingShu, Shuokang Huang, Lei Huang, Huafang Liu, Jin Liu, Kai Lei	The paper [11] proposes a decentralized identity management system and cross-domain authenticationsystem to solve the problem of single point of failure in authentication centres. Limitations of the model include scalability issues and difficulty in ensuring trust and privacy. To overcome these limitations, the model should be designed to be more scalable and use cryptography to ensure trust and privacy.The model should also be designed with the minimum disclosure principle in mind, to only disclose necessary identity information during

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Year	Title	**Author(s)**	*Inference*
			authentication.

II. PROPOSED ARCHITECTURE

EduChain is a model for identity verification using IPFS andblockchaininaneducationalorganisationthathasthepotential to increase efficiency, security, and transparency intheverificationprocess.Firstly,themodelinvolvesthreeparties: the student, the admin, and the requestor. The studentregisters on the portal and is assigned a unique ID (API key)thattheycanusetologintothesystem.Theythenuploadtheir documents on the IPFS, which generates a unique hashforeachdocument.Thishashservesasproofofthedocument's authenticity and is used to verify the documentlateron.Theadminplaysacrucialroleintheverificationprocess. They can view all the files uploaded by the studentand verify them by checking the contents of each document.Once verified, the admin pushes the student's API key to theblockchain,whichservesasapermanentrecordofthestudent'sverifiedidentity.Thisensuresthatthestudent'sidentity information cannot be tampered with or altered in anyway. The requestor can then request access to the student'sinformation onthe portal.However, beforegranting access,theadminfirstobtainsthestudent'spermission.Oncethestudent grants permission, the admin provides the requestorwiththepublickeyoftheblockcontainingthestudent's verified identity information. This public key can be used bytherequestor to accessthestudent'sinformation.

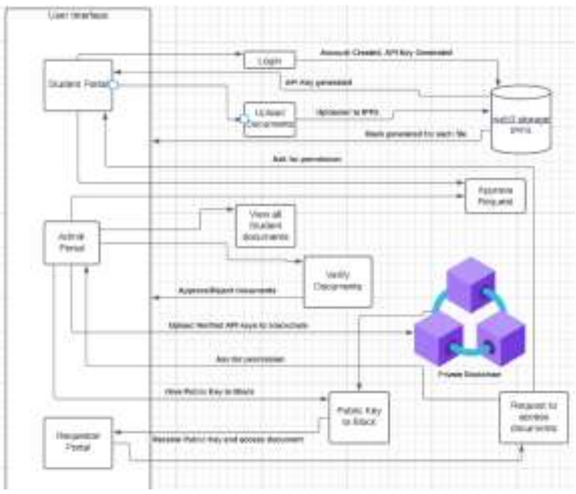

Fig.1.ArchitectureDiagram

III. METHODOLOGY

Theproposedmodelhas 3 maincomponents:TheUI,theIPFSandthe Blockchain.

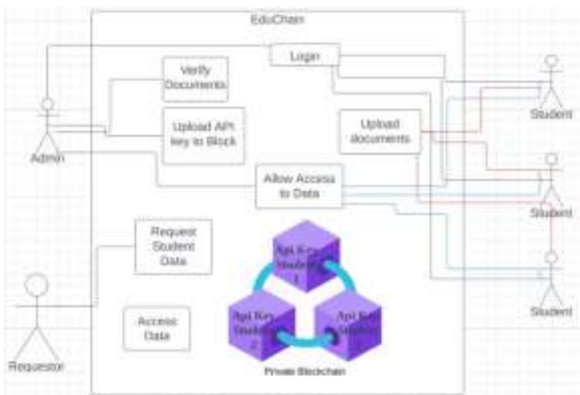

Fig. 2.UseCaseDiagram

TheUserInterface:TodesignasimpleyetappealingUIthatwillserveastheEduChainportal,weusedHTML,CSS,andJS. The student, the administrator, and the requestor are thethreemainpersonasforEduChain.

A. Thestudentportal:Thestudentwouldregisterthemselves and make a new login for themselves onthe student portal. The student would then receive anAPIkeyfortheirID.Theywouldbeuniquelyidentified by this. This API key can be used by thestudent to log into IPFS. The student can then uploadtheirdocumentstotheportalandwaitforadminverification. Each uploaded document would have adistinct hash that would be used to identify it. Thestudent may preview any uploaded documents in theimagegallerycarousel.Oncetheirpaperworkdocuments have been approved, their API key will beuploadedtotheblockchain,giving themaccesstotheirdocuments.Requestorsmaysubmitrequests,which students may approve or reject, after which therequestormay see therequested documents.

B. Theadminportal:Everystudentislistedonthisadmin portal. Each student who has registered on theportalisvisibletotheadministrator.Allofthestudent's uploaded documents are visible when theyclickonaspecificstudent.Theadmin verifies thedocumentsandthenapproves them.Fordemonstrative purposes, we have established correctfilenamingasthecriterionforacceptance(FILENAME in all capitals eg: AADHAR). Criteriacanbeestablishedbasedonwhattheuniversityrequires.Oncethepapershavebeenverified,theadministrator will upload the student's API key to theblock. All requests submitted by the requestor can beviewed by the admin, who can then accept or rejectthem. The admin provides the public key to the blocktherequestor needsafterreceivingapproval.

C. The requestor: The requestor submits the request toaccess the student data. Once the request has beenapproved by the student and the administrator, theyare given access to the public key of the block wherethe student's API keyis uploaded. They can accessthe student's uploaded documents using this API keyand use themasnecessary.

The requestor functionality provides an added layer of securityand control for students over who can view their documents,ensuringthatonlythosewhohavebeenapprovedbythestudentcanaccessthem.Italsomakesitpossibleforrequestorstoaccesstherequireddocumentsquicklyandeasily,withouthavingtogothroughthestretched-out andpotentiallyriskyprocedureofaskingdocumentsfromthestudent directly. All the parties are equally involved in sharingandaccessingpersonal studentdata.

IPFS: In our proposed system, IPFS will be used as the storageplatform for all the documents uploaded by the

DOI: rp-9788770040723.134

students. EachdocumentuploadedbythestudentwillbestoredontheIPFS network and will be associated with a unique hash. This hashwill be used to retrieve the document from the IPFS network.Web3.storage is a cloud storage solution built on top of theIPFS network. It provides developers with an easy-to-use andreliable way to store and retrieve files on the IPFS network,withouthavingtomanagetheunderlyinginfrastructure themselves. It is easily scalable and very reliable and it waseasy to integrate it to our website using the API it provides forintegration. The service is designed to ensure that files arestoredsecurelyandcanbeaccessedquicklyandeasily.Additionally,thecostofstoringandsharingdocumentsisquitelow.

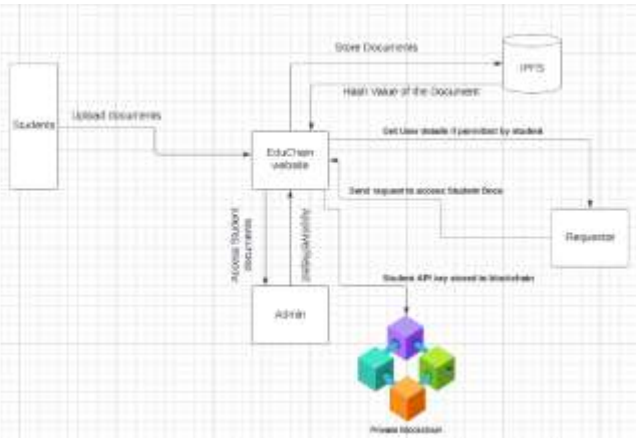

Fig. 3.SystemDesign

Blockchain: In an educational setting, verifying the identity ofstudentsiscrucialformaintainingacademicintegrityandpreventing fraud [12]. By using a blockchain architecture thatincludesastudent'sAPIkey,wecanensurethatonlyauthorized people have access to personal student data.Theuseofa blockchainarchitectureprovidestransparencyandaccountability. Because the blockchain is decentralized anddistributedacrossmultiplenodes,itistransparentandauditable by anyone with access to the network. This meansthat administrators can monitor and verify the usage of thestudent's API key, ensuring that it is being used for authorizedpurposesonly.

In a simple blockchain architecture, each block would containa student's API key. To achieve this, we would first define thestructure of a block, including its components and properties.We will be using JavaScript to develop this private Blockchainrepresentation.ByusingJavaScript,wecancreateablockchain that is accessible and easy to integrate intotheexistingsystem,whilestillprovidingthesecurityandimmutability thatblockchain technologyoffers.

Typically, a basic block is made up of a hash, a body, and aheader. The header includes information about the block, likeitsindex,timestamp,andhashoftheblockprecedingitinthechain. The body contains the actual data to be stored in theblock,whichinourcasewouldbethestudent'sAPIkey.Finally, the hash is a unique identifier for the block that isgenerated by running the block's header and body through acryptographichash function.

WecreateaJavaScriptobjectthatrepresentstheblock'sstructure and has attributes header, body, and hash in order toaddanewblocktoourblockchain.Theblock'sindex,timestamp,andthehashoftheprecedingblockinthechainare all included in the header properties. The body propertywouldcontainthestudent'sAPIkey.Finally,thehashpropertywouldbegeneratedbyrunningtheblock'sheaderand body through a hash function. In our case we would beusing SHA-256algorithm forhashing.

SHA-256[13] is a one-way hash function that is impossible toreverse, making it difficult for attackers to tamper with theblockchainorcreatefakeblocks.Itisfastandefficient,generating a unique hash value for any input data quickly. It isa widely used hash function that has been extensively testedand reviewed by the cryptography community. Using SHA-256 in this model ensures that the blockchain is compatiblewithexistingplatforms,makingiteasiertointegratea nduse.

IV. Conclusion And Future Enhancements

Document verification is a crucial aspect of various fields,includingbanking,healthcare,legal,educationandmany more. Blockchain technology is well-suited to address issuesrelated to document verification and identity authentication.Onceinformationisaddedtotheblockchain,itcannotbechanged.Thispropertymakesitidealforensuringtheintegrityandauthenticityofdocuments.Inconclusion, theproposed EduChain system provides a secure and transparentplatform for storing and sharing educational documents. ByusingIPFSforstorageandablockchainarchitectureforauthentication and authorization, the system ensures that onlyauthorized individuals canaccess a student's personal data.The system provides a simple and appealing user interface forstudents, administrators, and requestors, making it easy to useand integrate into existing systems. Additionally, the use of adistributed blockchainarchitecture ensures transparency andaccountability, making it difficult for attackers to tamper withthe informationstoredinthe blockchain.

The EduChain model can be integrated with other educationalsystems to provide seamless access to educational credentialsand documents. APIs can be created to integrate with LMS orSIS,andthemodelcanbeexpandedtoothereducationalinstitutions. This will provide a universal platform for studentsto store and share their academic credentials and documents,makingtheentireprocessmoreefficientandtransparent.Integrationswithsmartcontracts[14]canbedoneinthefuture to automate the verification and authentication processof academic documents. This will ensure that the documentsareverifiedautomatically,eliminatingtheneedformanualverification by administrators. The EduChain model can alsobe integrated with AI and Machine Learning algorithms toprovide advanced analytics and insights [15] into academicdocuments. This will help institutions to identify trends

DOI: rp-9788770040723.134

andpatternsinacademicperformance,allowingthemtomakemo reinformeddecisionsaboutstudentprogressandachievement.

Overall, the EduChain model has the potential to revolutionizethe way academic credentials and documents are stored andshared, providing a more efficient and transparent system thatis accessible to all. As technology continues to evolve, therewill be opportunities to enhance and expand the EduChainmodel to provide evengreatervalue to students, educators,and institutions.

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Cardio Vascular Disease Prediction Using Multiple Machine Learning Algorithms

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***Abstract*—This Cardio vascular diseaseis one of the serious issue that we are facing in current day it has become a massive challenge to try and analyse the cardiovascular disease survivors. Artificial intelligence is a component of machine learning, which is used to address several issues in data science. We can predict results based on past data which is a very frequently used application of machine learning for the machine to forecast predictions it has to identify patterns from the previous data and these patterns can be used on latest or new data to predict the outcome. The medical industry produces enormous amounts of unprocessed data, which data mining transforms into meaningful information that might aid in making decisions. Decision Tree (DT), Adaptive boosting classifier (AdaBoost), Logistic Regression (LR), RandomForest (RF), Gradient Boosting classifier (GBM), and K-NearestNeighbor (KNN)arethe classificationmethodsusedin this study**

Keywords—Cardiovascular disease, Machine learning (ML), Random Forest, Decision Tree, Adaptive boosting classifier, Gradient Boosting classifier, KNN

I. INTRODUCTION

Thebiggestcause ofdeathworldwide, asreportedbythe WHO, is heart disease. According to estimates, cardiac conditions account for 24% of deaths in India from non-communicable diseases. The cause of one-third of all fatalities worldwide is heart disease. Heart diseases are to blame for 50 percent of mortality in the United States and other industrialised nations. Every year, around 1crore 70 lakh people worldwide die from cardiovascular disease (CVD). It might be hard to identify (CVD) due to many contributing variables, including high BP, high cholesterol, diabetes, irregular pulse rate, and several other illnesses.The symptoms of CVD might occasionally vary based on a person's gender. For instance, a female patient may also suffer nausea, severe tiredness, and shortness of breath in addition to chest pain, but male patients are most likely to have chest pain. Researchers have investigated a variety of waystopredictcardiacdiseases,butpredictingsoatabeginningst ageisnotparticularlysuccessfulforavarietyof reasons, including complexity, execution time, and method accuracy. Consequently, efficacious diagnosis and treatment can save a lot of lives. Between healthcare service guidelines, medications, and lost productiveness as a result of death, in 2014 and 2015 it cost roughly $219 billion annually. Heart failure, which can result in death, can also be avoided with early detection. Although angiography is thought to be the most exact and accurate procedure for predicting cardiac artery disease (CAD), it is quite expensive, making it lessaccessible tofamilies withlimited financial resources. Physical examination can cause few errors which might even lead to death of few patients as heart disease is a very complicated disease and we have to take at most care and here using machine learning based expert systems will help us to effectively diagnose Cardio Vascular Disease (CVD).DataMiningplays a major rolein many fields like engineering, business, and education to extract data and find interesting patterns out of those. Examining data to find hidden information that will be useful to take important decisions in the future is a process called as "data mining". By decreasing the error in factual resultsandforecast,Understandingthe complexityandnon-linear interplay between several components, a wide range of machine learning techniques have been used. Medical experts must employ ML and AI algorithms to analyse data and draw exact and detailed diagnostic judgments because the amount of medical data is always growing. Different categorizationalgorithmsareusedindataminingofmedical data to predict patients' CVD and deaths from heart attack.

II. LITERATURESURVEY

[1] Melillo et al. proposed a system that automatically distinguishes high-risk patients from low-risk individuals. Classification and regression tree (CART) (93.3% sensitivity, 63.5% specificity) performed better in their investigation.Only12little-riskand34huge-riskpatientswereexamined.Tofindoutiftheirproposedmetho dis useful, a huge dataset must be carefully investigated Guidi et al examined the clinical support system (CDSS) for heart failure inspection. This model provided outputs such as HF(Heart Failure) sensitivity . They conducted study using various machine learning classifiers and

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compared the results. Random forest and CART performed best with 87.6% accuracy out of all classifiers.

[2] Parthiban and Srivatsa have done a extensive study and have conducted research to find out heart disease in those patients who have diabetes. They used many predictive features like blood pressure, blood sugar, and age there is a imbalance in data set and the writers ofhave not employed any strategy to address this issue. they were able to achieve an accuracy of 94.60% by using support vector machine (SVM) classifier.

[3] Al Rahhal*et al* have used a novel approach using deepneural network (DNN) they used raw ECG data to predictusinganunsupervisedlearningtechnique stackeddenoising autoencoders(SDAEs) to examine the highest level of features. They allowed expert engagement, which can induce biases, throughout each training cycle. It may bring about prejudice.

[4] Muthukaruppan and Er proposed a fuzzy expert system for the identification of CVD that is based on Particle Swarm Optimization (PSO). Fuzzy rules were created when rules from the decision tree were retrieved. Their accuracy using the fuzzy expert system was 93.27%. On the short dataset used in their investigation, a few rules were extracted. Alizadehsani and others

[6,7]Alizadehsani*et al.* utilised a group-based learning strategy. They utilised a dataset with 303 cases that they acquired from the “Rajaie Cardiovascular Medical and Research Centre” for their study. For CVD prediction, authors employed the introductory C45 ensemble learning approach. Left circumflex stenosis, left anterior descending stenosis, and right coronary artery (RCA) stenosis were accurately identified with 68.96%, 61.46%, and 79.54%, respectively (LAD). By using the SVM model,the results were improved and "80.50% accuracy for RCA, 86.14% accuracy for LAD, and 83.17% accuracy for LCX" were reached by a new team of researchers.

[8] Tama*etal.* presentedtheideaofa two-tierensemble paradigm, where certain classifiers serve as the basis for anotherensemble.UsingclasslabelsfromExtremeGradient Boosting (EGB), Random Forest (RF), and Gradient Boosting Machine (GBM), the proposed stacking architecture isconstructed (XGBoost). Four unique datasets areusedtoassesstheirproposeddetectionmodel.Moreover, theyusedfeatureselectionmethodsbasedonparticleswarm optimization. With a k value of 10, their suggested model faredbetter inthe k-fold cross-validation. Onlythe stacking of tree-based models was considered by the authors. Additionalstatisticalandregression-basedtechniquesmight be used to improvise model outcome.

[9] Abdar et al. established the N2Genetic optimizer, a novel optimization approach. The patients were then identifiedashavingCHDornotusingthenuSVM.OntheZ-Alizadeh Sani dataset, the proposed detection approach had an accuracy of 93.08% when compared to earlier works. Raza proposedan ensemble architecture with majorityvote. To forecast heart illness in a patient, it incorporated logistic regression, multilayer perceptron, and naive Bayes. A classification accuracy of 88.88% was attained, surpassing all base classifiers combined.

[10] Mohan et al developed a hybrid approach based on combining a linear model with a random forest to predict cardiac disease (HRFLM). On the Cleveland dataset, the suggested technique raised performance levels and had an accuracy rate of 88.7%.

[11] Soni and Vyas they used WARM, and their degree of confidence was 79.5%. dependent on age, smoking behaviours, BMI range and Hypertension their research assigned weights. Soni et al. on the other hand, gave each qualityaweightdependingontheadvicetheyobtainedfrom the medical experts. By attaining a maximum score of 80% confidence, Using a weighted associative classifier, they demonstrated a bright and effective cardiovascular attack prediction system.

[12] GannaA,MagnussonPKandteam.Effortonusing machinelearningalgorithmstoidentifycardiovascularheart disease has had a substantial effect on this work. In this paper, a summary of the literature is presented. Using a varietyofmethods,aneffectivepredictionofcardiovascular disease has been achieved. Logistic Regression, KNN, Random Forest Classifier, etc. are a few of them. The outcomes demonstrate the capability of each algorithm to register the given objectives. The findings indicate that every algorithm is capable of registering the given objectives, with KNN displaying the greatest performance (88.52%).

III. PROPOSEDSYSTEM

In this literature we have proposed multiple ML algorithmstofindifapersonhasCardiovasculardiseaseor not. Building, training, testing and validating the architecture for a specified challenge is a complex process. “Decision Tree, Adaptive boosting classifier, Logistic Regression, Gradient Boosting classifier and K-Nearest Neighbor” are the classificationmethodsusedinthisstudy. Google colab was used to run the experiment. In this study the data is collected from 1025 patients which consists of both healthy and patients suffering from cardio vascular disease and we use attributes like age, sex, chol, cp(chest pain) etc to predict if a person is healthy or suffering from cardio vascular disease and this data set contains a total of 14attributestheabovementionedalgorithmsareconsidered to be best for predicting the cardio vascular disease as they are all supervised learning algorithms.

A. Overviewofarchitecture

Fig 1 consists of the overall architecture of the cardio vasculardiseasepredictionusingmultiplemlmodelsandthe main parts of this architecture is data collection, data preprocessing and predicting the data using the given algorithms.Our technique uses the data of patient to predict thepatient’sheartconditionweatherthepersonhastheheartdisease or not. And these predictions are made by the best algorithm of all the ml algorithms used and the model is trainedbeforehandwithagenuinedatasettomakeaccurate predictions.

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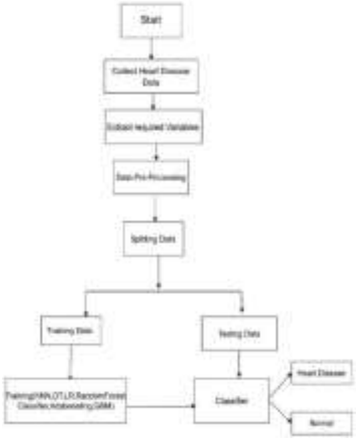

Fig.1.FlowchartforHeartdiseaseprediction

B. RelatedWork

Apurv Garg et al have proposed a model that forecasts the chances of getting cardio vascular disease utilizing the two ML algorithms that are KNN and Random forest they have compared these two models in order to get the best accuracy possible out of which KNN yielded a prediction accuracyof 86.88% where as the RF yieldedanaccuracyof 81.96% [15]

Archana singh and Ramesh kumar have proposed a prediction based model with multiple machine learning algorithms like SVM, DT, LR, KNN out of which KNN yielded highest accuracy of 87% they have first collected data then selected the required attributes then the data is preprocessedandthenbalancedthedatatheyhaveusedUCI repository dataset [16]

In this study we have used similar approaches and we were able to get better accuracies for the models by using different dataset with more number of data points. We were able to achieve better accuracy for our proposed modelKNN

C. DataCollection

We took our data from kaggle website for free and our dataiscalledheart.csvthisdatasetcontainsof1025patients records.Outofthis1025people499people arenormaland526 people have heart disease and this data set has 14 attributes and out of these people there are 713 male and312 female. And out of people that have heart disease 300 are male and 226 female

```
.: Dataset Info :.
******************************
Total Rows: 1025
Total Columns: 14
******************************

.: Dataset Details :.
******************************
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       1025 non-null   int64
 1   sex       1025 non-null   int64
 2   cp        1025 non-null   int64
 3   trestbps  1025 non-null   int64
 4   chol      1025 non-null   int64
 5   fbs       1025 non-null   int64
 6   restecg   1025 non-null   int64
 7   thalach   1025 non-null   int64
 8   exang     1025 non-null   int64
 9   oldpeak   1025 non-null   float64
 10  slope     1025 non-null   int64
 11  ca        1025 non-null   int64
 12  thal      1025 non-null   int64
 13  target    1025 non-null   int64
dtypes: float64(1), int64(13)
```

Fig.2.Datavaluesandtheattributes

D. DataPreprocessing

In this step we use one-hot encoding technique to transform categorical values to numerical values then we drop of unnecessary variables then we separate features, now we normalize the data using min-max method now we splitthedataintotwopartstrainingandtestingoutof which the ratio of training is 80 and testing is 20 and now the data is ready and can be used in any model.

IV. MACHINELEANINGALGORITHMS

A. LogisticRegression(LR)

Logistic Regression is one of the best available tough classifier among the supervised ml algorithms. It is an elongation of general regression model it reflects the likelihood of the occurrence or nonoccurrence of a certain instance.Logisticregressionisusedtodescribedataandthe connection between a dependent variable and one or more independentvariables.Nominal,ordinal,orperiodtypesare all acceptable for the independent variables. LR calculates the chance that a new observation will belong to a specific class, with the result lying between 0 and 1 because it is a probability.

B. DecisionTree(DT)

DecisiontreeamongsttheoldestMLalgorithms.Used for issuesrelatedtoclassification and regressionwe have a best supervised algorithm that can deal with them and that algorithm is Decision tree and most of the times it is used for classification problems. It is basically a Tree shaped classifier root node is the top node while others are child nodes. Internal nodes represent the features of datasets while leaf node consist result Decision node and the leaf node are the nodes that make up decision tree. Decision node generallymakesupdecisionsasithasmanybranches whereas leaf node can't make any decisions

C. K-NearestNeighbor(KNN)

KNN is among the very few oldest algorithms or statistical learning technique. In KNN K is basically to represent the total number of nearest neighbors used which is directly mentioned in the object builder. As a result,relatedsituationsareclassifiedsimilarly,andanew instance is classified by comparing it to each of the existing examples. KNN method will search the pattern space for k training samples adjacent to the supplied unique sample when one is provided. Two distinct methodsareofferedtotranslatethedistanceintoaweight so that predictions from many neighbors of the test instance may be calculated based on their distance.

D. Adaboost

An ensemble method in machine learning is called AdaBoost, also known as Adaptive Boosting. The most popular AdaBoost algorithm is a decision tree with one level, or a decision tree with only one split. A model is createdviaAdaBoost,andallthedatapointsaregiventhe same weight. After that, it gives points with incorrect classifications more weight. The following model now accords greater relevance to each and every point with greater weights. As long as no low errors are received, it will continue training models.

E. RandomForest

A ML method that utilizes many numerous decision treestomakeadecisionisknownasRandomforest.Itisa ensemble learningbased technique. While it is in the training stage, it

Producesmany trees and a forest of decision trees. Eachandeverytree, acomponentoftheforest, predicts a class label for each and every occurrence during the testing period. The model will take the class with the highest votes and makes it as prediction. The individual tree makes a class prediction from a very large independent tree models working together will give out the best result.

F. GradientBoosting

Using boosting, weak learners may become strong learners.Everylatesttreecreatedbyboostingisfittedtoa updated version of the original data set. Then it is anticipatedthatwhenmergedwitholdermodels,thebrand newmodelwillproduceforecastswithreducedfaultrates. The major aim is to set objectives for this next model to reducemistakes.GradientBoostinginagradual,additive, andlinearfashiontrainsmanymodels.Inviewoffactthat eachandeveryindividualcase goalresultsare decidedby the gradient's deviation respective to the forecasts, the phrase "gradient boosting" came into popularity. Every model picks up speed in a correct procedure by reducing theforecast errors.

E. ProposedAlgorithm

In this study the best out of all the algorithms is KNN whichhasachievedanaccuracyof97%whichisconsidered as one of the best algorithm in supervised classification algorithm and other than that it is simple KNN is non-parametricandlazy,whichmeansitdoesnotassumeanything about the distribution of the underlying data and does not create a model from the training set. As an alternative,itmemorisesthefulltrainingdatasetandutilises it to make predictions when presented with fresh test cases. For many applications, KNN is a straightforward and efficientmethod,althoughitcanhavelargecomputingcosts and be sensitive to the choice of K and the distance metric usedtocompare instances. KNN is a flexible technique that may be used to solve a variety of issues since it can be applied to both classification and regression jobs.

V. EVALUATION

For the machine learning models, there are some approachesforperformanceevaluation.Itisanticipatedthat the blending of several assessment tools will support the advancement of analytical research. Four fundamental measures(‘accuracy,precision,recall,andF-Score’)willbe looked at in this study to see how machine learning-based algorithms differ from one another.

Using the confusion matrix, we may assess the four measures. The Confusion Matrix's constituents are True Positive(TP),TrueNegative(TN),FalsePositive(FP),and False Negative(FN).Inthemedicaldatathemostimportant thing is to find out (FN). The performance metrics are provided below

Accuracy=correctlyclassifiedpredictions /Totalnumberofpredictions (1)

Precision=TP/TP+ FP (2)

Recall=TP/TP+ FN (3)

F–Score=2*precision*recall/precision+recall (4)

The total collection of features in the heart disease dataset have been exposed to comparison analysis of supervised machine learning classifiers. Some classifiers performedwell onevaluation measures, whereasothersdid not. In order to predict heart failure survival, this work employedtree-based,statistical-basedandregression-based models. The DT, RF ensemble models are tree-based. AdaBoost and GBM are two tree-based boosting methods. Statistically-basedmodelswhereasregression-basedmodels include LR and KNN

Model	Accuracy
K-Nearest Neighbour	95.121951
Random Forest	89.268293
Gradient Boosting	88.780488
Logistic Regression	82.439024
AdaBoost	81.463415
Decision Tree	79.024390

Fig. 3.Differentaccuracycomparison

Asper thetablewe have KNN with thebest accuracyof 97.02%, Random forest with an accuracy of 90.16%, Gradintboostingwithaaccuracyof88.7%,LRwithaaccuracyof 82.43%,Adaboost with a accuracyof 81.46% and with the least accuracy is the decision tree algorithm with an accuracy of 79%

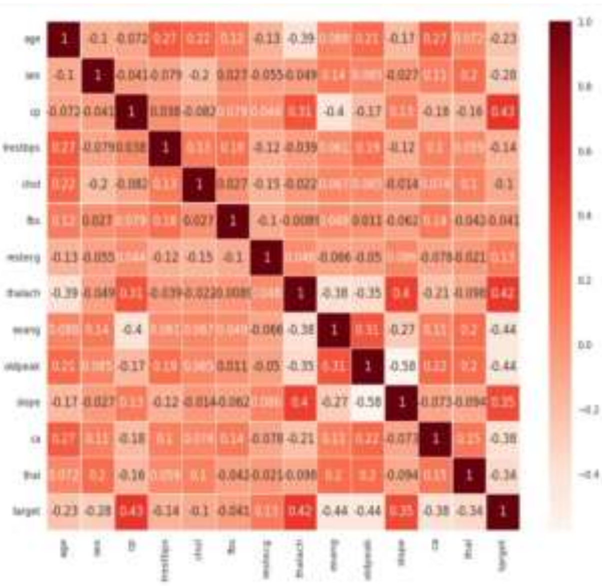

Fig..4.Correlationmatrixofvariables

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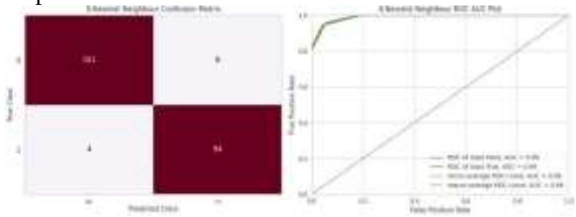

Fig.5.RocandconfusionmatrixofKNNthebestalgorithm

TABLE.1. PRECISION,RECALL ANDF-MEASURES

Algorithm	Precision	Recall	F-1
KNearest Neighbor	0.97	0.97	0.97
Random forest	0.91	0.90	0.90
Gradient Boosting	0.89	0.89	0.89
Logistic Regression	0.84	0.82	0.82
Adaboost	0.82	0.81	0.81
Decision Tree	0.80	0.79	0.79

TABLE.2.VALUEOF AREA UNDERROC

Algorithm	AUROC
KNearest Neighbor	0.99
Randomforest	0.96
Gradient Boosting	0.95
LogisticRegression	0.91
Adaboost	0.87
DecisionTree	0.86

In conclusion, a dataset on heart illness was gathered, preprocessed as needed, and then analysis was done to better understand the dataset. Following the application of six machinelearningalgorithmsAdaboost,LR,Gradientboost, KNN,DT,andRFweassessedthepredictionsusingtheF-1 Measure, ROC curve, recall, accuracy, and precision. We discovered that all of the used algorithms performed well, with KNN demonstrating the greatest performance with97% accuracy, showing that these algorithms are the most effective at predicting cardiac disease.

VI. CONCLUSION

Heartpatients'liveswill be savedthroughtheprocessing of raw health data of heart information using machine learning algorithms. By identifying risk factors for heart failure, preventive steps can be taken to lower mortality rates. In this study, a machine learning-based technique for predicting the survival of heart patients is suggested. The following ML methods are used: LR, AdaBoost, RF, GBM, DT and KNN. KNN with a accuracy of 97% the highest of all algorithms with precision score 0.97 recall 0.97 F-1 0.97 and AUROC 0.99 the work done here has the potential to advance the medical field and help doctors foresee how much time a patient with heart condition will live. Additionally, it will aid doctors in realizing that if a heart failure patient survives, they can concentrate on key risk factors. To gain from their combined advantages, the research can employ a range of machine learning model combinations in the future. To better the efficiency of ML models, better feature selection methods may be created. Due to the fact that these feature selection issues are NP-hard, meta-heuristics can be used.

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Prediction and Classification of Binary and Multi-class Heart disease with Artificial Intelligence

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Abstract—Heart disease posesa significant threat to human existence because of its high mortality and morbidity rates. For early treatment, localization, and countermeasure, precise anticipation and conclusion are becoming increasingly important. The Internet of Things and artificial intelligence make it easier for doctors to find, evaluate, and diagnose cardiac disease. However, the majority of prediction models only assess the severity of an individual's illness and only predict whether they are ill. In this study, wepresentahypothesismodelforsimultaneousassumptionforboth matchedanddistinct request coronary illness that is based on machine learning (ML). We first develop a fuzzy-GBDT strategy that combines cushy reasoning with gradient boosting decision tree (GBDT) to advance the matched portrayal assumption and reduce data complexity. To avoid over fitting, the pressing is completed with fleecy GBDT. Theseverityofcardiacdiseaseisalsoincludedinthemulticlassification assumption based on Bagging-Fuzzy-GBDT.TheassessmentshowsthatthePackingFluffyGBDTisincrediblydependableandexact for both twofold and different get-together presumptions.

Keywords :Fuzzy logic, gradient boosting decisiontree, theInternetofMedicalThingscardiacdiseasepredictionanddiagnosis,andmachine learning

I. Introduction

One of the most difficult and life-threatening diseasesaffecting humans, heart disease has a high mortalityand morbidity rate [1]. People's quality of life suffersasaresult,andtreatmentandmonitoringincursignificantcosts.Itispossibletoanticipate,recognize,anddiagnosehealthconditionswithartificialintelligence(AI)[2].Bymakingitpossibleforpatientstoreceivetheappropriatemedicalinformation,treatment,andintervention,itmaylessenthedevastationcausedbyheart disease.Continuouscardiacillnesspredictionandsuggestiveoutcomesmay be possible for e-medical care frameworks thatheavily rely on Internet of Medical Things (IoMT)data using AI learning algorithms [3]-[6]. In addition,italleviatesthefinancialandadministrativechallenges associated with intelligent systems for the treatment,monitoring,andpreventionofchronicdiseases.However,howtoguaranteethestrength,generalizability,andhighaccuracyofML-basedexpectationmodelsandcomputationsmustbeaddressed.

Intoday'ssociety,the ideaofanticipatingcardiacdisease is a significant one that is altering people'sperceptionsofhealth.ThebasicconceptistousetheRandom forest algorithm to figure out the age groupandheartrate.Basedonuser-suppliedinputslikeblood pressure and other variables, our study showshowasystemanalyzesheartrateandcondition.Compared to other algorithms, RFA produces resultsthataremoreaccurateandoffersabetteruserexperience. The assessment of a person's heart rate inrelation to their overall health is just one of the manyusesfor this.Additionally,itaidsintheearlydetectionofdisease.

The bootstrap totalling (bagging) method is added tothelearningmodeltoincreasetheareaunderthecurve(AUC)whiledecreasingchange.However,theaccuracy of any prognosis has not been establishedbecause previous studies on the predictionof heartdiseasehaveheavilyreliedoncomplexdata.Theinitial multi-category method for diagnosing variousriskgroupsforheartdiseasestillhasroomforimprovementintermsofaccuracy.

Forbothbinaryandmultiple-orderheartdiseaseexpectations,wepresentastableandpreciseexpectation method in this work. By simplifying theinput,fuzzylogic,ontheotherhand,encouragesmodel generalization and reduces model deviation. Byreducing the change and deviation of the assumptionmodel, the unrivaled Bagging-Fuzzy-GBDT enhancesestimate exactness and adequacy. Early detection ofheartdiseaseinhigh-risk,upgradedsymptomaticindividualsusinganexpectationmodelhasbeenwidely proposed to cut down on deaths and furtheradvancetreatmentandpreventionoptions.InCDSS,aforecast modelismadeandusedtohelpdoctorsfigureout why people are so likely to get heart disease andgivethemtherightdrugstolowerthatrisk.Inaddition,a number of studies have demonstrated that utilizingCDSS may enhance the quality of decisions, clinicalnavigation,anddeterrentconsideration.Coronaryartery disease (CAD), also known as ischemic heartdisease (IHD), is the most common cause of deathamong people over the age of 35 in some nations. Italso rose to become the most common cause of deathin China over the same time period. IHD occurs whencoronary artery stenosisreducesbloodflow totheheart. Myocardial damage can result in a potentiallyfatal myocardial infarction, which can either result inventriculararrhythmiaorsuddencardiacdeath.

II. Literature Survey

[1] Theauthorsinthispaperexploredtheuseoftrendanalysisintelemonitoringdatatopredictdecompensationeventsinheart failurepatients.Decompensation events are acute worsening of heartfailure symptoms that oftenlead to hospitalization,reducedqualityoflife,andincreasedhealthcarecosts.Earlypredictionandinterventionarecrucialtopreventthese eventsandimprovepatientoutcomes.

[2] The authorsexplorethe conceptof home carerobotic systems offering avisionforthe future ofhealth care and

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discussing the enabling technologiesthat can facilitate the development and deployment ofthese systems. Home care robotic systems have thepotentialtorevolutionizehealthcarebyprovidingpersonalized, convenient, and efficient care in patients'homes, which is particularly relevant given the agingglobal population and increasing demand for healthcareservices.

[5] TheauthorscombinedeepLongShort-TermMemory(LSTM)recurrentneuralnetworkswithadaptive kernel spectral clustering to provide a novelmethod for monitoring health with AI.. The primarygoal of this research is to enhance the effectiveness ofmachinehealthmonitoringsystems,whichareessential for preventing failures, reducing maintenancecosts, and ensuring the safe operation of machinery.theauthorsemploydeepLSTMrecurrentneuralnetworks to model the temporal dependencies withinthe extracted features. This approach is particularlyeffectiveinhandlingtimeseriesdata,asLSTMnetworkscancapturelong-termdependenciesandlearncomplexpatterns. The deepLSTM built andtrained to predict the machine's health state, enablingearlyidentificationofpotentialfailuresordeteriorating conditions.

[6] This study gives a novel approach to the detectionandlocalizationofischemicheartdisease(IHD)using magnetocardiography (MCG) and machine learningtechniques.Reduced blood flow to the heart muscle istheprimarycauseofischaemicheartdisease,whichisalso a leading cause of death globally. The authors'work is significant as it offers a promising alternativetotraditionaldiagnosticmethodsanddemonstratesthepotentialofmachinelearninginimprovingtheaccuracyandefficiency ofIHDdetection.

[9] The authors investigate the potential of GraphicsProcessing Units (GPUs) for improving the efficiencyof Gradient Boosting Decision Tree (GBDT) training.Becauseto itsexcellent accuracy andcapacity forhandlingbigdatasets,GBDTisapotentmachinelearningmethodthatisfrequentlyusedforavarietyoftasks,includingclassificationandregression.However,thetrainingprocessforGBDTcan becomputationallyintensiveandtime-consuming,especially when dealing with large-scale data. Thisresearchissignificantbecauseitaddressesthechallenge of GBDT training efficiency by leveragingthe parallel processing capabilities of GPUs, whichcanleadtofasterandmoreefficientmodeltraining.

[14] This study investigated the prediction of prefixavailability in the Internet. Prefix availability refers tothe reachability of aspecific IP prefix,whichcanimpactthestabilityandperformanceofInternet communication.Theauthorsusedavarietyofmachinelearning approaches, including decision trees, logisticregression, and support vector machines. to developmodelsforpredictingprefixavailability.Manymetrics, such as precision, recall, F1-score, and areaunderthereceiveroperatingcharacteristic(ROC)curve,wereusedtoassess themodels'performance.

[15] ThisstudyproposesmethodthatcombinesTraditionalclassificationtogeneticalgorithmstoenhance accuracy and efficiency of diagnosis. Heartdisease is a major global health concern, and earlydetectioniscrucialforsuccessfultreatmentandmanagement. The authors' work is significant becauseitpresentsanovelapproachtoheartdiseaseprediction,leveragingthestrengthsofbothassociativeclassification and genetic algorithms to improve theperformanceoftraditionalpredictionmethods.Agenetic algorithm to optimize the rule set generated inthe first phase. The genetic algorithm searches for thebest combination of rules that maximizes predictionaccuracy while minimizing the complexity of the ruleset.Thisoptimizationprocessresultsinamoreefficient and accurate prediction model compared tousingassociativeclassificationalone.

III. METHODOLOGY

As previously demonstrated, most current assumptionmodelsandcalculationsonlyaddressthematchedportrayal issue of heart disease speculation withouttakingintoaccounttheactualseverityofthecondition.Based on angiographic data, the level severity of thedisease is divided into five classes, ranging from modiseasetolevelfour.Inanycase,theprimarymulticlassificationmethod'saccuracyinrequestingvariousheartdiseasebetclassesneedstobeimproved.Reducing fluctuation and deviation is frequently usedinmachinelearningtoimprovecomputationaccuracy.Thelearningmodelaccomplishesabiggerregionunderthebend(AUC)andconfineschangebyincludingthebootstrapcollecting (packing)technique.However,theexactnessofeachtypeofcoronarydisease prediction has not been provided in previousstudiesoncardiacillnessforecastingduetokeyinformationcomplexities.Infactthere’sstillchancetoincrease the accuracy in multiclassification problem.Although it does not cover every kind of heart diseaseanticipation, previous research on the prediction ofheartdiseasecontainsasignificantamountofinformationcomplexity.

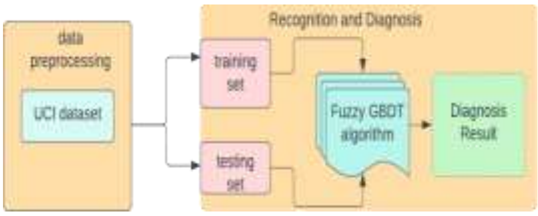

Fig1SystemArchitecture

Thomas et al. forecasted each player's wager. In anycase,theprimarymulticlassificationmethod'saccuracyinrequestingvariousheartdiseasebetclassesneedstobeimproved.Fromonepointofview,by making informationsimpler,fuzzy logic makesmodelspeculationbetterandreducesmodeldeviation.To improve accuracy, we incorporate fluffy logic intotheGBDTcomputation.Incontrast,thesackingmethod reduces model change by repeating erroneousinspections. Accordingly, we incorporate the puttingaway strategy to

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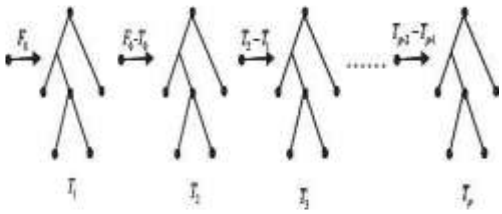


build the model's solidarity. Whencontrastedwithebbandflowestimations,ourproposedrecipecanforeseewhetherpeoplearedebilitatedaswellastheseriousnessofheartsickness.

Fig2SchematicdiagramofGBDTAlgorithm

ThebenefitsofaFuzzy-GBDT-basedtwofoldcharacterizationexpectationtechniqueforheartdisease conclusion are presented. These advantagesinclude an increase in the GBDT's speculation limitand a reduction in the complexity of the informationregardingheart disease.

ThesuperiorBagging-Fuzzy-GBDTmanagesstrengthand accuracy of figures. By minimizing the changeand deviation in the assumption model, we present inthisarticleaconsistentandhigh-precisionsuppositionmethod for both twofold and numerous heart diseasesolicitations.

Modules

The below moduleswere developedby usforthenotioninourproject.

- Data investigation: We will enter data into thesystemwiththismodule.
- Treatment: We will read data for processingusingthismodule.
- Separating train and test data: Train and testdatawillbeseparatedbythismodule.
- Models that can be generated include SVM,RF,DT,LR,KNN,XGBoost,GaussianNaiveBayes, VotingClassifier,GBDT,Bagging+GBDT,Fuzzy+GBDT ,andBagging+Fuzzy+GBDT.
- Login and registration for users: Sign Up andauthentication are required in order to accessthismodule.
- User-providedpredictioninformation:Prediction input will result from using thismodule.
- Prognosis:Thefinalpredictedvalueisshown.

IV. Implementation

1. *DataPre-processing*

Wemakeuseoftheheartdiseaseopen-sourcedatasetfrom the University of California, Irvine (UCI) [25].Fourdistinct medical databases, including those inCleveland,Hungary,Switzerland,andVALongBeach,providedtheinformation.Thereare836dataintotaland14significantattributesinthis database.Most of the datasets Switzerland and VA Long Beachrequirethecompletionofmissingvalues.Theaveragevalues from other complete datasets are used to fill intheblankfields. Thedataset inthisstudyissplitintoatrainingsetandatestsetintheratioof7to3.

2. *BaggingFuzzyGBDT Algorithm*

TherearesixparametersfortheBagging-Fuzzy-GBDT algorithm that must be determined. They aredepicted as follows. The values of these parametershave an impact on the predictability and precision ofthe suggested model. Hence, one of the main issues ishowtodeterminetheidealvalues.

(i) M decision trees are present. Each iteration ofthe Bagging-Fuzzy-GBDT growth process resultsinthecreationofadecisiontree.

(ii) Each decision tree can have a maximum depthof MD. MD cannot have an excessively high orlow value. The algorithm takes too long to run ifMD is too large since each tree's training period isprolonged.

(iii) To separate an internal node, MS samples areneeded as a bare minimum. Two circumstancesdefinethevalue ofMS.

(iv) AleafnoderequiresMLsamplestobepresentas a minimum. A splitting point of any depth willonlybetakenintoconsiderationifbothofitsleftandright branchesstillcontainatleastMLtrainingsamples.

(v) Therewillbemsamplescollectedforbagging.Tocreatemsubdatasets,mis the numberofsamplesfromtheoriginalsetthatmustbereplaced.

(vi) Myrateoflearning.Byregulatingthecontribution of a single decision tree in the modelusingtheregularisationtechniqueknownaslearningrate,anoverfittingoftheBagging-Fuzzy-GBDTcanbeprevented.

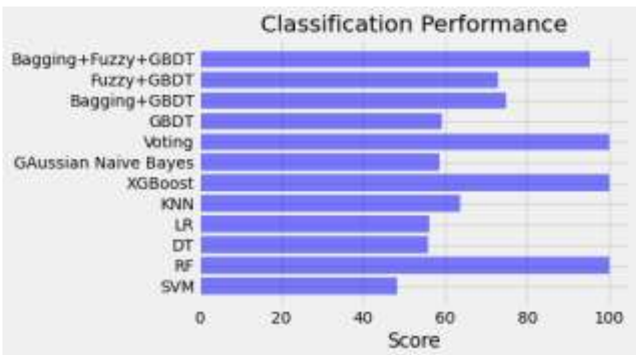
V. Performance Evaluation

GBDT

*Classification Report for GBDT:

	precision	recall	f1-score	support
0	0.73	0.82	0.77	207
1	0.51	0.55	0.53	161
2	0.47	0.42	0.44	71
3	0.39	0.24	0.30	71
4	0.53	0.48	0.50	21
accuracy			0.59	531
macro avg	0.52	0.50	0.51	531
weighted avg	0.57	0.59	0.58	531

Fig5PrecisionandRecall



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TheBagging-Fuzzy-GBDTapproachprovidesasignificant improvement in precisionand accuracy.First,GBDTperformsbetteratpredictingheartdiseasethantraditionaldecisiontreepredictionmodels.Second,using thecomparisonresultsbetweenBagging-GBDTandFuzzy-GBDTwithGBDT

*Classification Report for Bagging + Fuzzy + GBDT:

	precision	recall	f1-score	support
0	0.94	0.98	0.96	207
1	0.96	0.93	0.94	161
2	0.94	0.94	0.94	71
3	0.99	0.94	0.96	71
4	1.00	1.00	1.00	21
accuracy			0.95	531
macro avg	0.97	0.96	0.96	531
weighted avg	0.95	0.95	0.95	531

Fig 3 Precision and recallNaiveBayes

*Classification Report for NB:

	precision	recall	f1-score	support
0	0.62	0.91	0.74	207
1	0.63	0.65	0.64	161
2	0.74	0.39	0.51	71
3	0.65	0.21	0.32	71
4	1.00	0.10	0.17	21
accuracy			0.64	531
macro avg	0.73	0.45	0.48	531
weighted avg	0.66	0.64	0.60	531

Fig4PrecisionandRecall

In the experiment, the predicted accuracy foreachcategory ranges from 80 to 95%, showing that theBagging-Fuzzy-GBDTalgorithmperformsexceptionally well when multiclassification is beingused.Withanaverageaccuracyof93%,type2hadthebest prediction effect of the bunch. The 85% accuracyratefortype1andtype3predictionsisthesame.Eachtype's predictive performance is essentially the same,whichspeedsupandimprovesdiagnosiswhileproviding patientswithvarious therapiesbasedontheirindividualtypes.Therefore,comparingtheprecisionofeachindividualcategorizationformulticlassificationisunrealistic.

VI. Conclusion

For the cardiac disease prediction and detection, weproposedaconsistentandpreciseBaggingFuzzy-GBDTmethodinthisstudy.Inbothparallelanddistinct configurations, the proposed Bagging-Fuzzy-GBDT method predicted cardiac disease. To reduceinformation complexity and prevent overfitting, weintegrated fluffy logic and packing calculations intotheGBDTmethod.Themodel'ssecuritywassignificantlyimprovedwhentheborderswereexpanded using lattice search. In termsofperformance and accuracy, AUC, and other metrics,theevaluationrevealedthattheproposedmodelperformsbetterthanconventionalcomputationscurrently in use. In addition to accurately predictingillness, the Bagging-Fuzzy-GBDT computation alsodistinguishes the type of infection. In the field of e-medical services, it could be used to better understandthe conclusion and the board. We intend to refine theproposed model in the future and produce and test itspresentationwithauthenticandopendataincollaborationwithothernearbyinstitutions.

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Stock Price Forecasting

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***Abstract* -The difficult job of projecting stock prices has received a great deal of attention in the realm of finance. Convolutional neural networks (CNN) and long short-term memory (LSTM), two deep learning techniques, have shown promising results in stock price prediction. In this study, we propose a method for predicting stock prices using LSTM and CNN in conjunction. To measure the sentiment score of news stories about the publicly traded corporations, we also use sentiment analysis. Our approach entails gathering historical stock price and news article data, preprocessing the data, extracting features including technical indicators and sentiment scores, training the LSTM and CNN models, evaluating the models' performance, contrasting them with conventional methods, and finally presenting the results utilising them to predict future stock price movements. On a test set, we estimate how well our approach performs and contrast it with more established statistical models like ARIMA and exponential smoothing. Our findings demonstrate that the LSTM and CNN combination outperforms conventional models in predicting stock values. Investors and dealers may utilise our methods to help them make wise selections.**

I. Introduction

The performance of businesses, significant global events, regional economic indicators, and investor sentiment are just a few of the numerous factors that affect the stock market. It is a challenging endeavour to estimate stock values effectively, hence extensive study has been done in the subject of are financeses.

For predicting stock price, conventional statistical models like ARIMA and exponential smoothing have been widely utilised. These models still have problems detecting intricate connections and patterns in the data. Convolutional neural networks (CNN) and long short-term memory (LSTM), two deep learning techniques, have recently demonstrated and the promising results in predicting stock values. The long-term relationships may be captured by LSTM, but CNN is especially good at identifying the initial patterns in the data. These methods have been combined for a variety of purposes, including stock price forecasting. Here, we combine deep learning with models such as LSTM and CNN with traditional techniques like technical analysis and sentiment analysis for forecasting stock prices. While sentiment analysis can capture the effect of news and social media on stock prices, technical indicators can shed light on the past behaviour of stock prices.

The purpose of an experiment for stock price prediction using LSTM and CNN with technical indicators and sentiment analysis is to evaluate how well the models perform at forecasting future stock price behaviour based on historical data, technical indicators, and sentiment analysis pertaining to the companies listed on the stock market. Our method entails gathering historical stock price data and news articles, preprocessing the data, and extracting features like sentiment scores and technical indicators. Then, we train the LSTM and CNN models, evaluate the models' performance, and use them to predict future stock prices.

The major goal of this study is to evaluate how well the suggested methodology performs in predicting stock prices and to integrate deep learning with conventional methods to get superior outcomes. In order to help investors, dealers, and traders make wise decisions, we also want to show the potential of deep learning techniques in financial prediction.

II. Methodology

The stages involved in using sentimentals analysis, long termshort memory, and convolutionalsneural networks to predict stock prices are as follows:

A. *Data Collection*

Financial databases like Yahoo Finance or Google Finance are used to gather historical stock price information for the firms listed on the stock market, such as openprice, closeprice, highprice, lowprice, volume traded, etc. Additionally, news articles about the companies are gathered from news databases like Reuters or Bloomberg. The news articles are subjected to sentiment analysis in order to calculate the sentiment score.

B. Data Preprocessing

Any missing values or outliers are removed during preprocessing of the acquired data. To guarantee that the range of the data is uniform across all firms, the stock price data is normalised. Stop words, punctuation, and special characters are removed during cleaning and preprocessing of the news pieces.

C. *Feature Extraction*

The stock price information is used to create technical indicators including moving averages, the relative strength index (RSI), and Bollinger Bands. A feature is also regarded to be the sentiment score gleaned from the news items. The input feature vector is created by combining the stock price data with the technical indicators and sentiment ratings.

D. Model Training

The LSTM and CNN models are trained using the input feature vector. While the CNN model is trained to identify local patterns in the input feature vector, the LSTM model is trained to identify long-term dependencies in the input feature vector. To forecast future stock prices, the models are trained using a mix of historical stock price information, technical indicators, and sentiment scores.

E. *Model Evaluation*

The performance of the LSTM and CNN model is evaluated using metrics such as mean absolute error (MAE), mean squared error (MSE), and root mean square error

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(RMSE). The models are evaluated using test data that wasn't used during training.

F. Deployment

The future stock values of the firms listed on the stock market are forecast using the LSTM and CNN models. To maintain the accuracy of the forecasts, the models are periodically updated with the most recent information.

III. Experimental Study

To determine how successfully the models predict future stock price behaviour based on historical data, technical indicators, and sentiment analysis, a stock price prediction experiment using LSTM and CNN, as well as technical indicators and sentiment analysis, is being conducted.

Data on historical stock prices for a certain firm or index would be gathered for the experiment, together with information on pertinent Moving averages, the relative strength index (RSI), and moving average convergence divergence (MACD) are examples of technical indicators. In order to ascertain the general attitude towards the firm or index, data on news stories and social media posts connected to the company or index would also be gathered and subjected to sentiment analysis algorithms.

In general, an experiment employing LSTM, CNN, technical indicators, and sentiment analysis to forecast stock prices may lead to more accurate and dependable predictions, which would improve investing choices. The models' limits and the possible effects of outside variables like market conditions and world events on stock prices must be taken into account, though.

A. Shorthand

EMA – ExponentialMovingAverage

The Exponential Moving Average (EMA) is a trading tool that indicates the changes in the value of an asset or commodity over a given time period by smoothing out price swings.

MACD

The MACD (Moving Average Convergence Divergence) indicator is utilized to assess an asset's momentum and trend-tracking by comparing two exponential moving averages (EMAs). The difference between the 12-period EMA and the 26-period EMA produces the MACD line, which determines the market direction for the asset. This line is also overlaid with a signal line, which provides a signal to buy or sell based on its position relative to the MACD line.

RSI

Technical analysts use the relative strength index (RSI), a momentum indicator, to evaluate if an investment is overbought or oversold. In order to determine if the present price is overpriced or undervalued, it evaluates the size and velocity of previous price movements...

B. Used Equations

EMA calculation –

Using a multiplier and the Simple Moving Average as a starting point, one may calculate the EMA. Three stages make up the calculation:

1. Make a simple moving average calculation.

$$SMA=(a1 + a2 +... +aN)/N \tag{1}$$

N's are the total number of the intervalss.

The asset's price at period N is known as aN.

2. Calculate the weighting factor for the EMA.

$$W.M. = 2/(N + 1) \tag{2}$$

N = the chosen time frame

Weighted Multiplier is W.M.

3. Find the current EMA.

$$EMA = [P rice(t) * k] + [EM A(y) * (1 - k)]$$

t stands for today and y for yesterday.

Days in the EMA divided by N

k = 2÷(N+1)

RSI calculation

The average changes in closing prices over a certain time period can be used to compute the RSI calculation. The first step in calculating relative strengths (RS) is to

Smean /Lmean.

Where

Smean is the average for all price increases over the past N bars (N is the RSI's length).

Dmean is the average of all price declines over the previous N bars (N is the RSI's length).

The RSI is then determined using the formula shown below:

RSI is calculated as 100 minus (100/[1 + 14-DaysAvgGains/14-Day AvgLoss]).

Calculation of MACD

The 26-period Exponential Moving Average (EMA) is subtracted from the 12-period EMA to calculate the MACD (Moving Average Convergence Divergence). This results in the MACD line, which is often followed by a signal line—normally a 9-period EMA—for overlay. To produce buy or sell signals, one can use the difference between the MACD line and the signal line.

12-period MACD Line 26-period Exponential Moving Average (EMA) EMA

The signal line is normally a 9-period EMA of the MACD line. Here is how to calculate it:

Signal Line = MACD Line's 9-period Exponential Moving Average (EMA)

Buy or sell signals can be produced using the difference between the MACD line and the signal line, for example, when the MACD line crosses above or below the signal line.

Calculation of Bollinger Band

DOI: rp-9788770040723.137

A technical analysis technique for gauging stock price volatility is the Bollinger Band. It has three lines, with the 20-day simple moving average (SMA) of the stock price as the centre line. The SMA is multiplied by twice the daily standard deviation to determine the upper band, and the SMA is subtracted from the SMA to determine the lower band. The stock's high, low, and closing prices are averaged to determine the typical price (TP), and the moving average (MA) is determined over a smoothing period of n days.

The symbol m represents the number of standard deviations to be added to or subtracted from the SMA. the average standard deviation for the last n periodsis indicated by the symbol S.D.[TP,n]. In order to detect overbought and oversold stock price circumstances and to provide trading signals, the upper and lower Bollinger Bands are utilised.

C. Implementation and Outcomes

We provide graphs for the RSI, MACD, polarity score for sentiment analysis, and forecasted stock prices following the use of technical analysis techniques, emotional analysis, and forecasting models. The graphs that result are as follows:

RSI

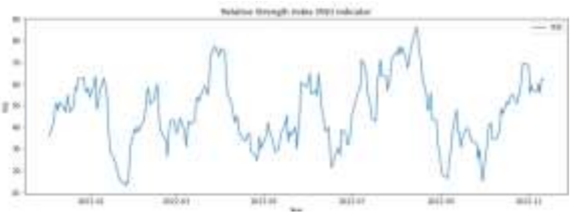


Fig. 1.RSI

Trends in the market are frequently examined using the RSI indicator. An investment may be overpriced or overbought if the RSI reading is 70 or above; this might also be an indication that a trend reversal or a corrective price decrease is about to occur. A reading of 30 or lower on the RSI, on the other hand, may indicate that a security is oversold or undervalued, which might provide a purchasing opportunity for traders or investors. As a result, hitting the 30 level or the 70 level on the RSI chart might represent a good or bearish indication.

MACD

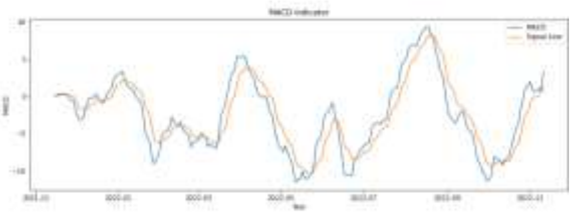
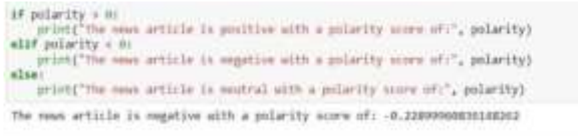


Fig. 2.MACD

- The quickest moving average (short-term EMA), or MACD Line
- Long-term EMA's Signal Line, which is the slowest moving average
- Signal Line = MACD Line's 9-day EMA
- When the short-term EMA crosses above the long-term EMA, it is known as a bullish crossing.
- When the short-term EMA descends below the long-term EMA, a bearish crossing occurs..

Instead of crossing the signal line, the MACD line does so at the zero level. It signals a bullish trend as it rises. When MACD crosses the zero line in a downward direction and turns negative, it signals a bearish trend.

Sentimental Analysis Polarity Score



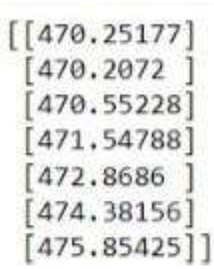
```
if polarity > 0:
    print("The news article is positive with a polarity score of:", polarity)
elif polarity < 0:
    print("The news article is negative with a polarity score of:", polarity)
else:
    print("The news article is neutral with a polarity score of:", polarity)
```

```
The news article is negative with a polarity score of: -0.22899990083518262
```

Fig. 3.Sentimental Analysis of Polarity Score

- Polarity scores between -1 and -0.5 often signify negative emotion.
- In general, a polarity score of more than -0.5 and less than +0.5 implies neutral feeling.
- Positive feelings are often indicated by polarity scores between +0.5 and 1.

Predicted Price



```
[[470.25177]
 [470.2072 ]
 [470.55228]
 [471.54788]
 [472.8686 ]
 [474.38156]
 [475.85425]]
```

Fig. 4.Predicted price

These are the closing prices that the prediction model, which is based on historical data, anticipated. The graph below shows the expected costs compared to real prices to see how accurate our model's prediction is.

Fig. 5.Actual vs predicted price

Actual Vs Predicted Price

The trend line for actual prices closely matches the trend line for expected prices. 90% of the time, the prices are accurate when anticipated. The very least that can be said is that forecasted prices do not accurately reflect market prices but do follow the market's rise and fall..

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IV. Conclusion And Discussion

In this work, we investigated the efficacy of stock price predictions utilising LSTM, CNN, emotional analysis, and technical analysis. We discovered that the utilised model is highly precise. The model is effective at extracting the intricate temporary linkages and non-linear connections between various stock market characteristics, which technical analysis algorithms find challenging. Additionally, we found that LSTM and CNN models performed better when sentimental analysis was added as a feature. This shows that market mood may be a valuable stock price predictor. Overall, our research indicates that emotive analysis and deep learning models may be used to more accurately predict stock values. For investors, traders, dealers, and financial analysts who want to make wise investment decisions, this has significant ramifications.

Discussion

There are various limitations to our study that should be acknowledged. Initially, the only data in our collection were stock prices and news headlines from a particular time frame. If a new time period is utilised or other characteristics are analysed, it's likely that the findings will change. Second, because the models we utilised are based on past data, they could not work effectively when the market undergoes unexpected and unplanned shifts. This is especially relevant considering the present atmosphere of uncertainty brought on by the COVID-19 epidemic.

Finally, since our study was limited to just one stock, the outcomes may differ for other stocks or industries. It would be interesting to look at this more in next research. Despite these drawbacks, our study supports the idea that sentiment analysis and deep learning models can be useful tools for predicting stock prices.

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Breast Tumor Classification Using Deep Learning

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***Abstract*– The objective of this project is to sort all the metrics obtained from a patient's breast cancer into various types by utilizing two models. The initial step involves using the ensemble-type CNN model as a binary classifier to distinguish the metrics into benign or malignant class. The subsequent step employs the custom CNN model to filter the images and classify them into each of the two subtypes. Detecting and categorizing tumours manually is the only alternative to machine learning for breast cancer classification. However, human involvement in this method increases the possibility of errors. Hence, incorporating this "second set of eyes" through machine learning can ensure that fewer people get misdiagnosed.**

Index Terms* - *Breast Cancer, Tissue Tumour, Machine Learning, Classification Algorithms, and Medical Model.

I. Introduction

Breast cancer is responsible for the deaths of thousands of individuals annually, emphasizing on theimportance of equipping physicians with computer-aided diagnosis (CAD) to reduce their workload and enhance the accuracy of detection. Typically, convolutional neural networks (CNNs) are utilized to classify sections of breast tissue.The probability distribution of cancer types is influenced by their neighbouring patches. The growth of the market is driven by several factors, including the increasing demand for early detection of breast cancer, the need for swift and accurate diagnostic and therapeutic decisions, and advancements in CAD software, according to Emergent Research. The current manual classification method is prone to human errors. Incorporating a model can serve as an additional set of eyes, leading to more accurate predictions. Hospitals and doctors who utilize our model will be allowed to save their data on our cloud storage. The model can be hosted as an API and licensed for a broad range of applications. The market's growth is fuelled by the rising demand for early breast cancer detection, quick and precise diagnostic and therapeutic decisions, and advancements in CAD software.

II.Objective

Breast cancer is a significant health concern, and early detection is essential to improving patient outcomes. Medical imaging, such as mammograms or ultrasounds, can be used to screen for breast tumors. However, analysing these images can be time-consuming and challenging for healthcare providers, which can lead to missed diagnoses or delays in treatment.

Deep learning models can assist healthcare providers in accurately detecting and classifying breast tumors in medical images. These models use complex algorithms and neural networks to learn patterns in the images and identify suspicious areas that may indicate the presence of tumors.

To optimize the model's performance, it's crucial to train it on a large dataset of medical images that are labeled with accurate diagnoses. The model's parameters and architecture can be fine-tuned to minimize the rate of false positives (when the model identifies an area as a tumour when it's not) and false negatives (when the model fails to identify a tumour that's present).

Once the model's performance has been optimized, it's important to validate its accuracy and reliability in real-world settings. This can be done through clinical studies and peer-reviewed publications. Validating the model's performance ensures that it's effective and safe to use in clinical practice.

Finally, making the tool widely available and accessible to healthcare providers and patients is critical to improving healthcare outcomes. The model can be integrated into existing medical imaging systems or made available as a standalone tool. By facilitating early detection of breast tumours, the model can help healthcare providers initiate treatment promptly and improve patient outcomes.

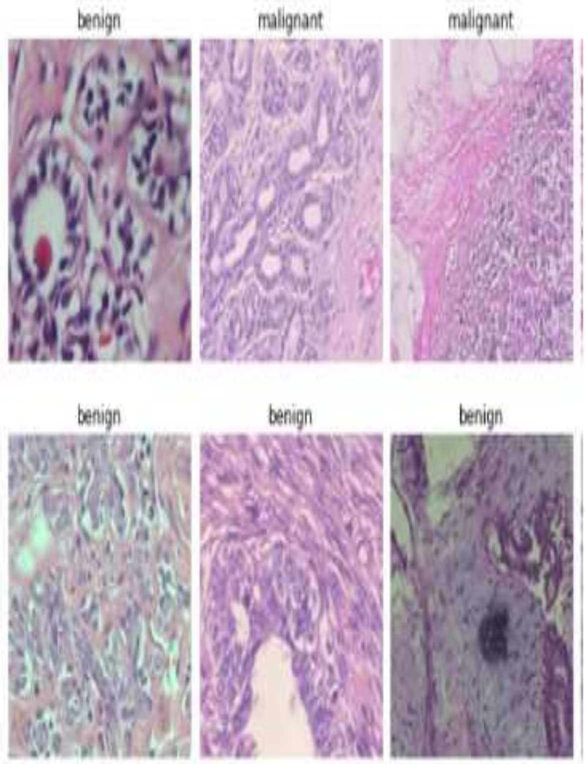

Fig. 1

DOI: rp-9788770040723.138

II. Related Work

Jasmir discussed a Multilayer Perceptron Classifier for the problem. The accuracy of the model is 96% [1]. The suggested models utilize adapted versions of Inception V3 and ResNet50 to address the issue of classification. Resnet-30 like CNN give better accuracy (~5%) compared to inception V3 [2]An Inception v1 CNN model is discussed, with accuracy for Spatial Pyramid Pooling and Global Pyramid Pooling compared. The model was trained on the BACH dataset with 99% accuracy [3]. A transfer learning approach to the classification problem was discussed. The model was trained on the BACH dataset with 99% accuracy [4]. This paper discusses the Breast Cancer Classification problem and some approaches to solve it. The types of Breast Cancer CNN Approach for Classification [5] [6]. The implementation of a personalized system can be converted into a software application that enables individuals to adopt the language patterns of their peers, allowing the AI to communicate in a similar manner. [7].The model proposed by the author was based on machine learning, utilizing various classifiers such as Random Forest, SVM, Logistic Regression, and Naïve Bayes. The implementation of the model was carried out on the Anaconda Platform for Python. The author discovered that Random Forest was an effective classifier, achieving an accuracy rate of 99.76%. Additionally, the author found that modifying the network with the classifier could lead to improvements in accuracy. [8].

The proposed model was developed using Artificial Neural Networks (ANN) and its performance was evaluated using a Support Vector Machine (SVM) classifier. The author reported that the ANN achieved an accuracy rate of 97%, while the SVM classifier achieved 91% accuracy. Interestingly, the author also noted that without the SVM classifier, the ANN alone yielded higher accuracy. [9]. The author introduced a model based on Artificial Neural Networks (ANN) and evaluated its performance using a Support Vector Machine (SVM) classifier. The results showed that the ANN achieved an impressive accuracy rate of 97%, while the SVM classifier achieved 91% accuracy. However, the author also noted that the ANN model performed even better when evaluated without the SVM classifier.[10].The author presented a model that combines K-means GMM and CNN for breast cancer detection. The model began by identifying region of interest (ROI) and extracting texture features using a feature extraction method. The CNN algorithm was then applied to achieve better results. The model achieved an impressive accuracy rate of 95.8% when evaluated on the MIAS dataset.[11].The author presented a novel model for histopathology image diagnosis using deep learning techniques.

The model utilized Lloyd's algorithm for clustering and CNN for classification, achieving a remarkable accuracy rate of 96%. The paper also provided detailed explanations of image processing and deep learning methodologies used in the proposed model. Overall, the model showed promising results for accurate histopathology image diagnosis. [12].The author presented a model for the enhancement of histopathological images using deep learning. The paper discussed various feature extraction methods such as Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). The author also explored machine learning techniques; however, due to the size of the dataset, machine learning methods did not yield satisfactory results. Therefore, the author proposed the use of deep learning for better performance in the enhancement of histopathological images. Overall, the model showed promising results for improved image quality.[13]. Theauthor developed a model that combined k mean GMM and CNN for improved accuracy in identifying regions of interest (ROI) in medical images. The model first identified the ROI and then applied a texture feature extraction method. Finally, the CNN algorithm was applied to achieve a high accuracy rate of 95.8%. The study utilized the MIAS dataset and was conducted by V SansyaVijayam et al. Overall, the proposed model showed promising results for the identification of ROIs in medical images.[14].

The proposed model utilized deep learning techniques to improve accuracy in a given task. The model extended the dataset to achieve better results. By incorporating a larger dataset, the model was able to train more effectively and improve its accuracy. Overall, the use of deep learning and an extended dataset showed promise for enhancing the accuracy of the model.[15].In terms of accuracy, the K-Nearest Neighbours (KNN) classifier showed promising results. It demonstrated strong performance in correctly identifying and classifying data points based on their proximity to neighbouring points in a given dataset. Overall, the KNN classifier is a reliable option for accurate classification tasks.[16]. Identified cancerous cells or tissues that may not be immediately apparent or easily detectable. [17].

IV. Proposed Architecture

Breast tumor classification using deep learning typically involves collecting and pre-process the breast cancer imaging data. This involves cleaning the data, resizing the images, and normalizing the pixel values. Then increase the amount of data by performing random transformations on the existing data, such as rotations, flips, and zooms. Choose an appropriate deep learning model for the classification task. Commonly used models for image classification include convolutional neural networks (CNNs), residual networks (ResNets), and inception networks. We will then transfer the knowledge gained from pre-trained models to the new classification task. This involves fine-tuning the pre-trained model on the new data. After transferring we will train the deep learning model on the pre-processed and augmented data. In the end we willevaluate the trained model on a separate set of test data to assess its performance.

Overall, the proposed architecture involves using a pre-trained CNN for feature extraction, followed by a full-connected layer for classification. The model is trained on pre-processed and augmented data, and its performance is evaluated on a separate test set.

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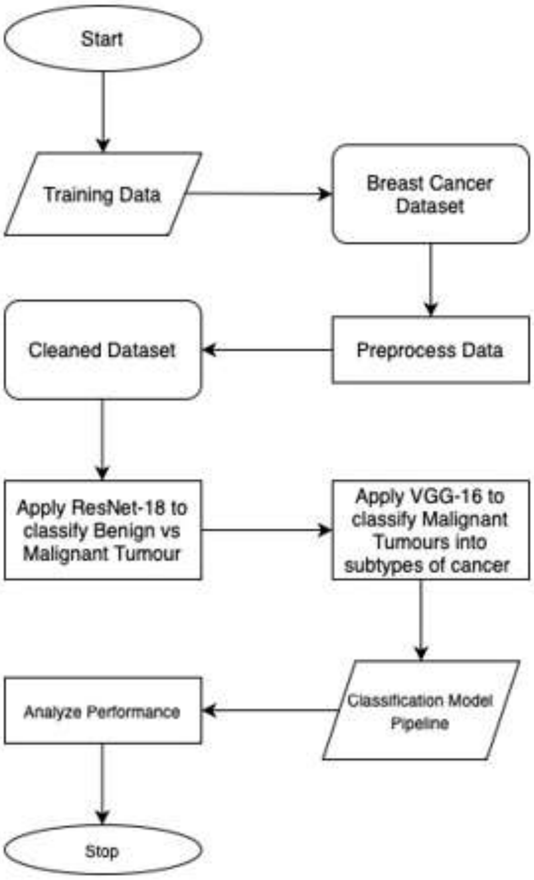

Fig 2. Architecture Diagram

V. Methodology

Module I (Data Collection)

At first the data is collected and from various sources, the data here will be used as an image. It will consist of numerous tissue images.

Module II (Feature Extraction)

Once you have the data, you need to preprocess it to prepare it for use in your model. In order to assess the effectiveness of your model, it is necessary to divide your data into three groups: a training set, a validation set, and a test set. The DDSM images vary in gray level due to differences in the scanners used to create them. Likewise, the images have varying optical densities and need to be normalized before the training process can begin.

Module III (Selecting and creating model)

The next is selecting the model based on the hyper parameter, type of layer, size, etc. The techniques above mentioned will help to design and build a model for better classification and prediction.

Module IV (Multiple layers of classification)

This Module is the new thing that we added in this project. In these the original two classifications that are Benign and Malignant are further divided in four sub-layers each for all the classification of the tissue image that we extracted from the dataset.

Module V (Training and Evaluation)

Upon the completion of the model architecture and compilation, you can start training the model with the training set. Evaluation of its performance is based on the validation set. This allows you to tune the hyperparameters and make any necessary modifications to the model architecture.

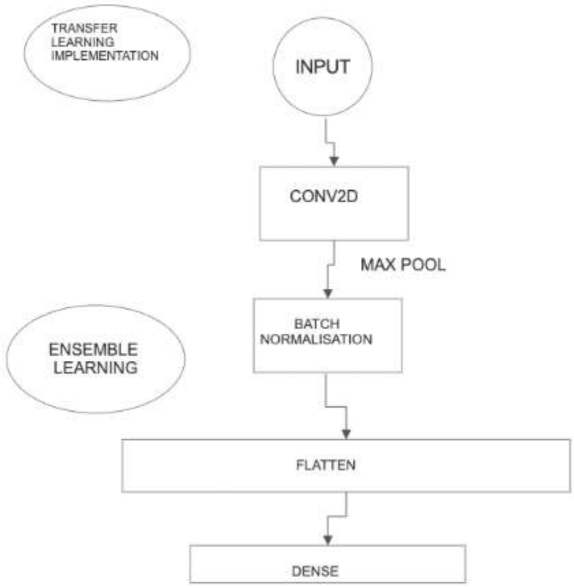

Fig. 3. Methodology to build the model

We used an ADAM optimizer with an initial learning rate of 3e-4

Fig. 4

We used L1 regularization to overcome overfitting:

$$Loss = Error(y, \hat{y}) + \lambda \sum_{i=1}^{N} |w_i|$$

Fig. 5

Vanishing Gradient Problem - due to use of other activation functions- Used leakyReLU instead as solution.

VI. Conclusion And Future Enhancements

To summarize, the breast tumor detection model using classification in this code is an effective and precise method of detecting breast cancer in medical images. The model achieved a remarkable accuracy rate of 83.8% on the test set and demonstrated a low loss value, indicating robustness

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against overfitting. Increasing the number of epochs during training could further enhance the model's performance, but it could also increase the risk of overfitting. Therefore, it is vital to balance the number of epochs to achieve optimal accuracy without compromising generalizability. This model has the potential to improve breast cancer detection and diagnosis, providing early and accurate detection to enhance patient results. Further research is needed to assess the model's effectiveness in clinical settings and real-world scenarios. Since the dataset was small, data augmentation was required. Augment the data in a way such that it doesn't create noise. The nuanced distinctions among several categories are attributed to the wide range of appearances found in high-resolution images, the strong coherence of cancer cells, and the significant irregularity in color distribution. Increase robustness (by using Real Time data).The web interface can also be expanded to link other deep learning models with similar objective to make it universal (only after detailed study).

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Deep Neural Network-Based Generative Models to improve Surveillance Techniques

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***Abstract*—Video Surveillance is the process which involves a network of cameras, recorders, and monitors to observe a scene or look for something distinct. It is an effective mechanism that helps counter crime, secures the area, helps cut down security costs, and provides fool-proof security coverage. Computer Vision (for Facial Recognition) plays a significant role in these surveillance systems. They help identify and recognise potential threats. However, one of the significant drawbacks of these face recognition systems is that they can only detect the person if the image is precise or at a particular angle. We propose an image modification technique using Generative Adversarial Networks (GANs) to overcome this. GANs are a generative modelling technique that generates new samples (images, videos). GANscan not only help generate very realistic face images but also modify the existing features of an image. The motivation of the proposed method is to identify the subject by modifying images obtained from the surveillance feed.**

***Index Terms*—Generative Adversarial Networks, Deep Learn- ing, Object Detection, Computer Vision**

I. INTRODUCTION

The Crime Rate in India is slowly but steadily increasing. According to the National Crime Records Bureau (NCRB),the IPC crime rate in India has been steadily growing at a rate of 3.4% over the last 15 years [Bureau,].

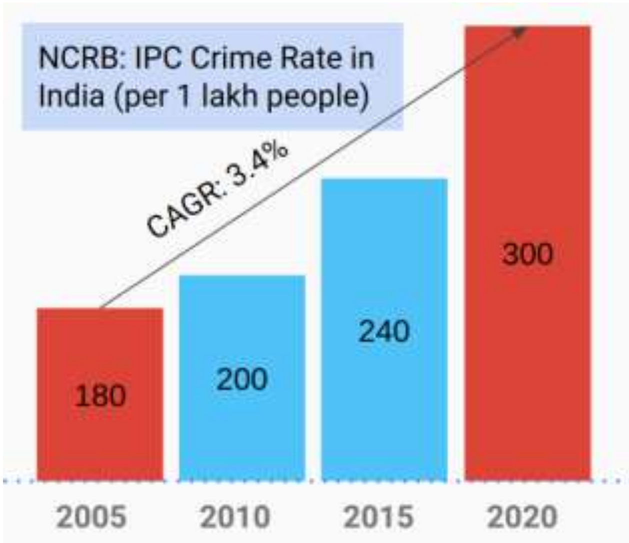

Fig.1.SteadyRiseinCrimeRate

Thisincreaseinthecrimerateisallhappeningamidsttheattemptstocurbit,includinginstallingsecurityandsurveillance systems.VideoSurveillanceisacommontechniquetocounter crime and monitor day-to-day activities. Nevertheless, they have their fair share of drawbacks. The surveillance systems installed in the country are not uniform. According to the report published by Comparitech, almost 92% of all CCTV cameras are installed in only 4 Indian states. The crime rate could be curbed with the larger volume of CCTV cameras. However, that is not the case, as there is no correlation between the number of CCTV camera sand the crime rate. Forinstance, one can see from Fig 2. that Delhi has the 3rd most significant number of CCTV cameras per 1000 persons, but the crimerate is the highest. We propose to enhance the quality of currently existing surveillance techniques with the help of our face modification and generation idea.

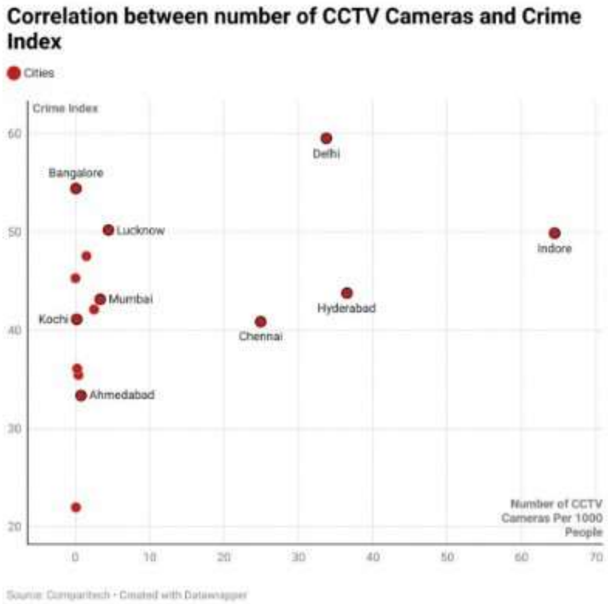

Fig.2.Correlation between crime index and number of CCTV cameras

With the growth of AI, surveillance techniques have only improved with time. AI uses software programs to analysethe audio, video or image files obtained from the surveillance feed.Oneofthemorecommonusecasesisfacedetectionorface recognition. Automating the process of recognising faces helpsimprovesecurityandautomatedidentification.However, it also comes with its fair share of drawbacks. One of the commondrawbacksisthatthemodelcaneasilybethrown off by different angles or poses, leading to wrong predictions. Thesolutionistomodifyimagesobtainedfromthefeedusing GANs. With the help of object detection techniques of the YOLOalgorithm,onecandetectandobtainimagesofpeople's heads. That can then be fed into the GAN network, which will regenerate/modify the face such that the frontal view of the face is obtained. This way, the surveillance system will detect the person, irrespective of their posture.

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Tosummarise,thesearethemaincontributionsofthepaper:

- Auto-detecthumanbeingsinavideofeedusingtheobject detection techniques
- Modify images of the face/head to obtain a completeview of the face from the partial profile obtained in the surveillance feed using Generative modelling.

II. RelatedWork

GenerativeAdversarialNetworks(GAN)[Goodfellow et al., 2014] They are used for generative modelling using Deep Neural Networks. They help create (generate) new data instances that resemble the training data. A GAN network generally comprises two models: a generator model (used to generate new examples/samples) and a discriminator model (used to classify whether the generated images are real or fake). During the training phase, the generator produces fake data,whichthediscriminatorrecognisesandflagsasfake.This process (training) continues until the discriminator cannot dif- ferentiate between real and simulated data. The generator and discriminator are Deep neural networks. The generator output isconnectedtothediscriminatorinput.Differentvariations of the GAN algorithm include CycleGAN [Zhu et al., 2020], DCGAN [Radford et al., 2016], StyleGAN [Karras et al., 2019], etc. ESRGAN [Wang et al., 2018] enhances the quality of the image obtained from the surveillance feed before the image translation.

*ImageTranslation*Pix2PixGAN[Isolaetal.,2017]is a Conditional GAN (cGAN) [Mirza and Osindero, 2014] known for its image mapping and translational capabilities. The difference is that the input initially fed to the generator is notarandomvectorfromthelatentspace.Inthisscenario,the input image is the original image of the person's face profile that needs modification. The source of randomness for the generator comes from its dropout layers. Unlike the generator in a normal GAN, the generator follows a U-net architecture, with skip connections between layers of the same size, which helps in the image translation process. The traditional GAN model uses a Deep Convolutional Neural Network (DCNN)as a discriminator to classify images as real or fake. Here, a PatchGAN is used. Patch GAN is a DCNN that will classify patches of the image (as fake or real) rather than the whole image.

Object Detection: YOLO [Redmon et al., 2016] is awidelyusedalgorithmforobjectdetectionbysolvingitasaregressionproblem.YOLOv5[Jocheretal.,2022]helpsdetect faces/heads in a video or image feed. The detected images are then fed to the GAN model, which will help reconstruct the original face.

A. ExistingSystems

Kumar, VD Ambeth, et al. [V D et al., 2018] proposed a facialrecognitionsystemmodel.Herethesurveillancecamera is connected to a central server with the suspect database. The system will be alerted when the cameras have found a person whoexistsinthedatabase.Oneofthemajordrawbacksisthat the model used here is localised. The model will struggle to give accurate resultswhen a new face is givenas input (which is the real-world scenario). We can solve this issue with the help of Generative Learning.

Wang, Xin, et al. [Wang et al., 2023] proposed a face de- tection technique using images synthesised using GANs. The significant drawback is that complete face input is required to generate faces. It does not help us regenerate the whole face from a face profile obtained from the surveillance camera.

III. ProposedMethod

A. OverallArchitecture

The objective of the paper is to improve and automate current surveillance techniques. We propose an ensemble techniquetoidentifypotentialsuspectsusingComputerVision andGANs.Ourapproachwillidentifyfacialimagesfrom a surveillance recording and modify them accordingly. With the help of GANs, we can regenerate the whole face from whateverisvisibleinthevideofeed.Theprocessforthesame is shown in the diagram below.

Fig.3.ProposedArchitecture

First, we will feed the video, with a potential suspect, as input to our model. With the help of the YOLO algorithm, we will identify all the people in the image. These images will then be cropped out and saved in another folder (potential suspect list). Next, we will pass all these images through an image enhancer. Image enhancer is a basic implementation of ESRGAN. ESRGANs help improve image quality, whose output will eventually feed to the face-generating model. The face-generation model will then input the head angle obtained fromthefeedandusetheGANtogeneratetheentireface for the given person. We have divided the procedure intothree main modules; Pre-Processing (Footage Analysis and Image Extraction), Image Quality Enhancement, and Image Generation/Modification.

B. Pre-Processing

YOLOv5helpsintheprocessofobjectdetection.Generally, whenweneedtoidentifyapersonfromavideofeed,weman- ually look through the video until we recognise the subject. We can use the YOLO algorithm's object detection technique to simplify and automate this process. Object detection helps identify and locate a particular object in images or videos.The YOLO algorithm takes a given image/video as input and uses a deep neural network to detect the objects present in the same.

DOI: rp-9788770040723.139

Fig. 4. Detect Human face

Unlike the previous versions of YOLO, YOLOv5 uses EfficientNet architecture (based on the Efficient Net Architecture [Tan and Le, 2020]), allowing the network to generalise better to a broader range of objects. We have trained the YOLO model on a dataset of over 2000 images of a room with people. The model is trained to identify all the heads in the room.

C. Image Quality Enhancement

The image we obtain from the feed might need to be of better quality. It is essential to enhance the quality of the image and improve its resolution before feeding it to the modifying network. SRGANs help achieve the same. They are a generative network used for image super-resolution. The SRGAN uses a perpetual loss function, a weighted sum of a content loss and adversarial loss. The adversarial loss pushes the solution to look similar to the natural image via the discriminator network, which is trained to differentiate between the original and enhanced images. In contrast, the content loss helps identify the pixel-wise error between the original image and the generated image.

D. Image Generation

After pre-processing the video and obtaining a limited image of the potential suspect, we will use a GAN to regenerate the whole face. Pix2pix GAN, used for Image-to-Image translation, helps generate a full-face image.

Pix2Pix is a conditional GAN (cGAN), where the generation of the output image is dependent on an input image. The discriminator, in this case, is provided with a source image and target image, and its role is to determine whether the translation is possible.

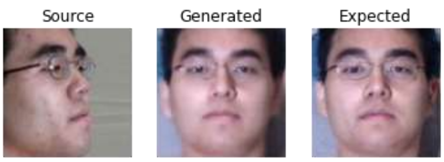

Fig. 5. Sample Model Output

IV. Experiments

A. Dataset

Since we are working with different models, we had to train them on different datasets.

*1) **Image Detection**:*For the head detection problem using YOLO,weusedtheSCUT-HEADDataset[Pengetal.,2018]. Thisdatasetconsistsofimagesobtainedfromthemonitorfeed of a school classroom. The YOLO model is trained on this dataset and helps detect or find human heads in any public space.

TABLE IDATASET DETAILS

Task	**Dataset**	**Data InstancesTrained**	**Epochs Trained**	**Model/Concept**
Object Detection	SCUT-HEAD	2000	200	YOLO Algorithm forObjectDetection
ImageTrans-lation	Multi-PIE	3000	30000	GANsforImage Generation

2) Image Generation: Here, we are trying to generate the complete face profile from whatever view of the face is seen in the feed. So we used the CMU Multi-PIE dataset [Gross et al., 2008]. This dataset consists of face images from 337 subjects, all taken under different poses, expressions and illumination. The GAN is trained on this model. The aim is to generate the complete face of any subject when given a particular posture of that subject.

B. Results

1) Object Detection: We tested the models working with different scenarios. These scenarios were all defined by the number of people in a particular class. As you can see, the model gives us excellent results for all the scenarios. The table below summarises the results.

TABLE IIOBJECT DETECTION RESULTS

Scenario	No. of people	Predicted	Accuracy
Few People	3	3	100
Many People	11	10	90.90

Fig. 6. Object Detection when there are fewer people

Fig. 7. Object Detection when there are a decent number of people

1) Image Translation: Here we tested the model's working with the following different facial profiles:

- People with beards and facial hair
- Different Genders and Age Groups
- Only half the face is visible
- Identifying glasses and frames

DOI: rp-9788770040723.139

V. Conclusion

Thus, we could utilise the capabilities of computer vision and generative modelling to solve a real-world face detection problem primarily focused on reducing the crimerate and pro- viding more accurate results. It also help sminimise workforce and human errors. The proposed method uses Pix2Pix GANto generate new images. The images fed into the GAN are obtained using the object detection mechanism of YOLOv5. This method can be extended and implemented with other GANs for various use cases.

Fig. 8. GAN output for facial hair/beards

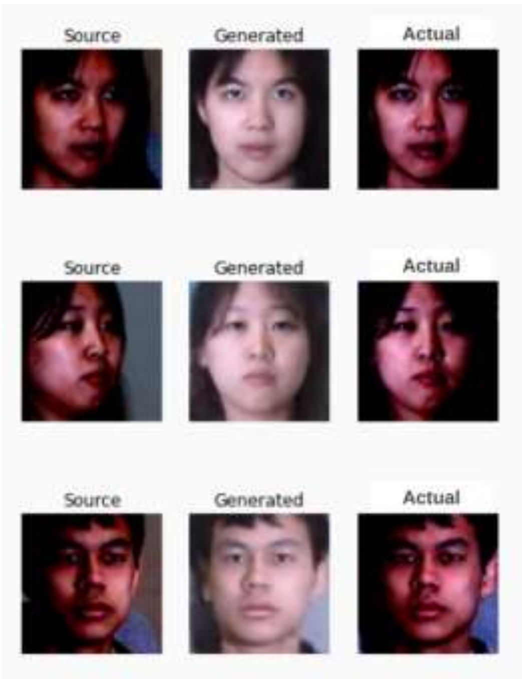

Fig. 9. GAN output for different age groups and genders

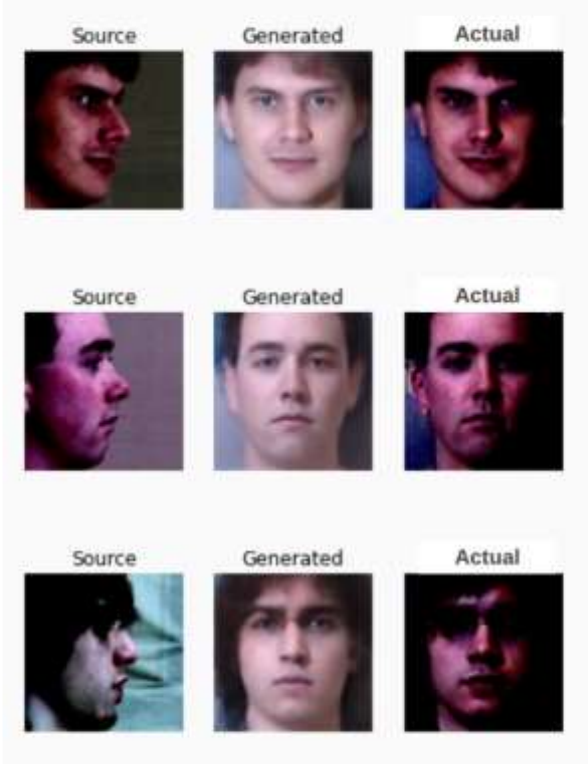

Fig. 10. GAN output when only half the face is visible

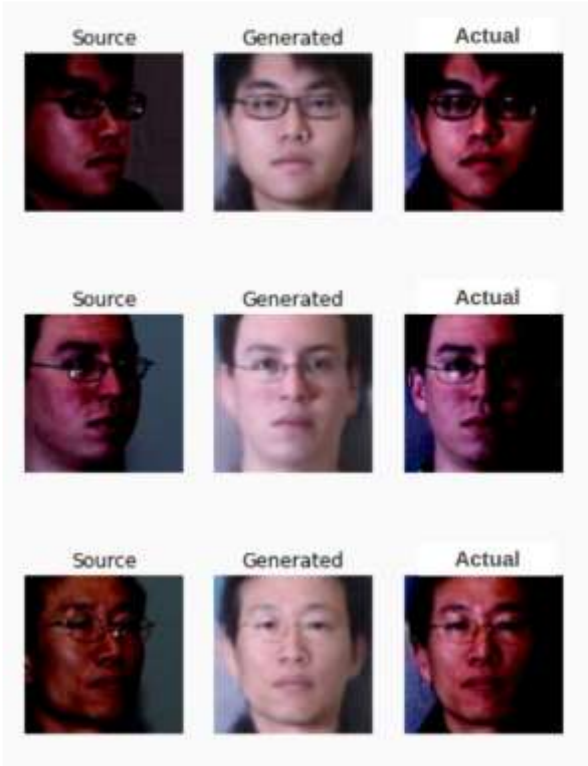

Fig. 11. GAN output for people wearing spectacles

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Airfare Estimator Using Random Forest Algorithm

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***Abstract*—Nowadays people have started to prefer Air Trans-port compared too there mode so transportation. Thereasonforthepublictooptforthismodeoftransportisitisthefastest mode of travel and it also provides more comfort, safety, organized system, staff support during the journey etc...One of the major problems faced by the public regarding air transportisthatthefareofflightticketskeepsfluctuatingsignificantlyand dynamically. The airline companies are basically one of the most subtle companies in making complex pricing schemes. They usually increase the price when the demand is high. There are multiple factors that affect the price of the flight ticket such as duration of the journey, source, arrival time, departure time and so on. Usually, using the past data, time series analysis is done manually to get the estimation of a flight ticket in the future. To make this process easier and simpler we have created a web application which uses machine earning algorithms to predict the flight fare based on the previous data which has been collected.WecollectedourdatasetfromKaggleandappliedMLalgorithmsand regression techniques to obtain the results. Python languageisbeingusedtodevelopmachinelearningmodules.Wehaveuseda random forest algorithm in our project to predict the flight farebased upon the historical data available. To optimise the model,wehaveperformedHyperparametertuningtogetthebestresultswith higher accuracy. To provide a better user experience to theuser we created a web application using Flask where users cangive the inputs and obtain the results on the screen. This servicehelpstheuserstobooktheirflightticketsatalowerprice.**

***Keywords*—MachineLearning(ML),Airfare,RandomFor-est(RF),Hyper-parameterTuning**

I. Introduction

The main aim of the airline industry is to increase theirprofit for which they sell flight tickets at a higher cost, sellmore tickets, and many other strategies. But on the other hand,the customer's goal is to buy the ticket at a lower price. Theflightfareofaparticularflightmayvaryupto7timesadayaspertheresearchers.However,differencesinpassengerdemandand available seats usually lead to customers purchasing theticket for a higher cost or might cause a revenue loss to airlineindustries.Usually,airlinecompaniesaremostlyequippedwith advanced tools, capabilities, and a team to control thepricingprocess.Butforacommonman,it'snotthateasytoestimatetheprice.Frequentlytravelingpeoplehaveanapproximateidearegardingwhentobooktheflightttickettogetitatthebestprice. Butmanyinexperiencedpeopleland into the traps of discounts made by the companies andfinally end up paying more than the actual cost. Therefore, ourproposed system can help millions of people in society to savemoney by providing them with detailed information regardingthe right time to book a flight ticket. For determining the pricewe need some features as input such as the duration of thejourney,source,arrivaltime,departuretime,andsoon.

Ourproposedproblemstatementis"AirwaysFareEstimatorUsingRandomForestAlgorithm".

II. AIMSANDOBJECTIVES

A. Aims

1. Togetbetterexposureandknowledgeinthefieldofdatascienceandmachinelearning.
2. Togetthebestpriceofairfarewithgoodaccuracy.
3. Provideauser-friendlyinterfaceandthebestuserexperiencewhileusingthewebapp.
4. Tostudyadetailedanalysisofthefactorsthatinfluenceairfarecost.

B. Objectives

1. ProvideabetterUserInterfacetotheusers.
2. Togetthebestresultswiththebestpossibleaccuracy.
3. Use machine learning models to train the data-set, and getaccurateresultsalongwithbetterruntimesothattheusergetsthebestuserexperiencewhileusingthewebapplication.

III. Literature Survey

They used a data-set that had information generated from1814 distinct flights that were performed by Aegean Airlinesforthepurposeofthestudy[1],anditwasfoundthatthestudy was successful. Using the data that was supplied, theytaughtthemachine-learningmodelhowtobehave.Inorderto illustrate that the selection of features may influence theefficacy of a machine learning model, they tested the modelusing a broad variety of attributes in addition to the collecteddata. This allowed them to demonstrate that the performanceofthemodelcouldbeaffectedbythechoiceoffeatures.

Theauthorsoftheresearchpaper[2]usedasmallerdata-settodeveloppredictionsabouttravelfaresusingmachinelearningalgorithms.Thesealgorithmswererunusing the data. The information gathered from this collectionof data contained details on each and every flight that travelsbetweenBombayandDelhi.Inorderforthemtofinishtheir study,theyemployedanumberofdifferentmachinelearningstrategies,suchasK-nearestneighbors(KNN),linear regression, and SVM-Support Vector Machine. Thesestrategieswerealleffective.

The researchers were able to materialise the model that theyhad conceived of thanks to the application of a methodologyknownasLinearQuantileBlendedRegression(LQBR),which was utilised in the study [3]. For the purpose of thisstudy, a data set was utilised that contained 126,412 individualobservationsonthecostofaticketforeachofthe2,271i

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ndividual flights that took place between the San FranciscoInternational Airport and the New York International Airport.As a means of determining quality, these observations werecarriedoutonadailybasisasthestandard.

Intheresearcharticlepublished[4],theauthorspresentedamodelinwhichthetwodatabases,inadditiontothemachine learning techniques and the macroeconomic data, aremerged. Based on the source and destination data, machinelearningmethodssuchasXGboostandSVM(SupportVector Machine) are utilised in order to make a predictionregardingtheairfare.Afterperformingminoradjustmentsto the R-squared performance measurements, the suggestedframework is able to produce prediction results with a greaterlevel of accuracy. Using the XGBoost Algorithm, they wereable to attain an error rate that was far lower than average,cominginatapproximately0.92.

Usingmachinelearningalgorithmsonflightdatasetsenablestheforecastingofdynamicflightfaresanddeterminingthe most favorable ticket prices. As the data is sourced fromwebsitessellingflighttickets,theavailableinformationisrestricted.R-squaredvaluesareutilizedtoevaluatetheprecisionofthemodel.Incorporatingsupplementarydata,suchasthepresentseatavailability,couldenhancetheaccuracyofthepredictions.Theprocessofpredictingflightcostshasbeenexhaustivelydescribed,andpriorpatternshavebeenemployedtoconfirmthecredibilityoftheseprojections.[5]

Therandomforesttechniqueisasimpleandadaptablealgorithmthatcanimproveaccuracyandprovideflexibilityinsolvingavarietyofclassificationandregressiontasks.Decision trees, which are trained on different subsets of thedata,arepartoftherandomforestmodel.Bycombiningmultiple decision trees and reducing the negative impact ofbias and variance, the random forest method typically deliversbetterresults.[6]

The study has shown that incorporating dynamic pricinginto an airline’s revenue management system can result in asignificant revenue boost in comparison to traditional revenuemanagement methods. Dynamic pricing can yield short-termrevenuegainsofupto20percent,owingtoitssuperiorflexibility in responding to changes in the environment. Thisflexibilityismainlyduetothefactthatdynamicpricingtechniques do not establish a fixed booking control policy atthe outset of the booking period, as opposed to static methods.Nonetheless,therevenuebenefitofdynamicpricingmaydeclineorbebalancedoutinthelongrun,ascompetitorsalsoadoptcomparablestrategies.[7]

This research proves that it is feasible to make use of pastdatatoanticipatethecostofairfare.Torefinetheaccuracyof the forecasts, one possible strategy is to merge differentmodels and assess their efficacy for each category. The curveoflearningimpliesthatincorporatingmorecharacteristics would raise the model’s precision even further. Nevertheless,due to the limitations of our existing data source, we cannotextractmoreinformationonparticularflights.Movingforward, more characteristics, like seat availability, departuretime, and holiday schedules, may be included in the model toboostitspredictingcapacity.[8]

IV. System Architecture

The data-set we used has 10,000+ observations along withthe booking details namely Airline(Company), Journey Date,Destination, Source, Arrival-Time, Departure-Time, Durationof the Journey, Total number of stops, additional information,and finally the prices which act as our target variable. FeatureEngineering is performed to convert all the above-mentionedfeaturestonumericalrepresentation.Later,tofinalize thetraining model we use VIF Multicollinearity and Sklearn -Feature importance. After completion of the above two stages,weperformmodeltrainingusinganappropriateAlgorithmthatprovides the best results according to our objectives. Finally,we deploy our model using the Flask services. Therefore, wecanrunourwebappanddeployitinaliveenvironmentfor real-time usage. Figure 1 shows the overview of systemarchitectureofairfareestimatorusingmachinelearningmodel

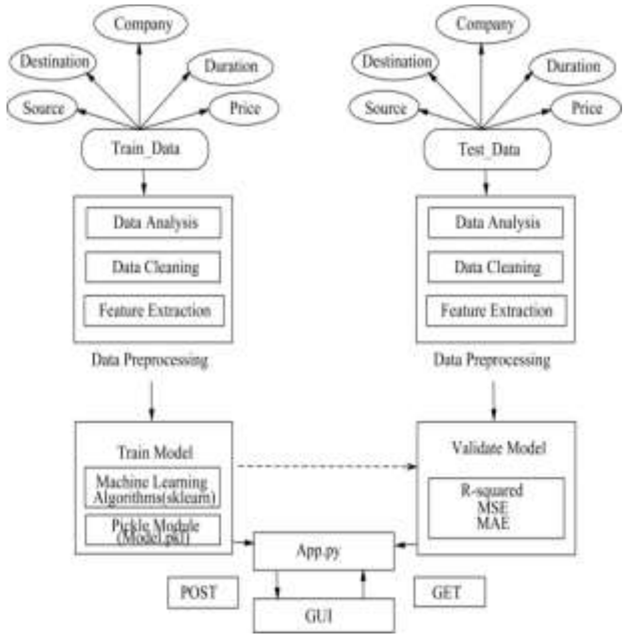

Fig.1.System Architecture

V. Proposed Methodology

The study has been designed to include seven main stages,each with a unique objective. Figure 2 represents the flowdirection of all the seven phases in the proposed methodology.Each of these processing phases is described in greaterdetailinthefollowingsections.

Phase1:ImportingLibraries:Allthenecessarypythonlibrariesrequiredfor AirwaysFareEstimatorareimportedthrough python commands. Some such libraries are Numpy,Pandas,andsoon.

Phase 2: Data Selection: Initially a proper dataset has to becollectedonwhichthedatatraininghastobeperformed.Forthis purpose,mostmachinelearningexperts,students,researchers,scholars,anddatascientistsusetheKaggleservicewhich is a

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subsidiary of Google. The dataset collected shouldbe loaded by setting up the working directory for performingfurtheractions.

Phase3:EDA:Itistheprocessofunderstandingthedata.Itis used to analyze the trends and statistical summary in theformofagraphicalrepresentation.

Phase4:DataPreprocessing:Datapreprocessingplaysacritical role in the fields of data analysis and machine learningas it entails the task of refining, reformatting, and arrangingunprocessed data to render it appropriate for advanced analysis.Theprimaryobjectiveofdatapreprocessingistoguaranteethat the data is precise, coherent, and in a machine-readableformat.

Phase 5: Feature Selection: This is the process of finding outthebestfeatureamongtheavailablefeaturesthatwillleadto maintaining a good relationship with the target variable.Feature importance and VIF-Multicollinearity are the methodsthatwillbeusedintheprojecttoperformthisprocess.

Phase6:ModelTraining:Thisistheprocesswherethecollected data is used to train the model with the help of MLalgorithms.Themodelcanpredictthepriceusingthehistoricaldataandbyperformingthedatatrainingwithanappropriate MLalgorithm,thereforeachievingthebestresults.

Phase 7: Deployment of Model: The machine learning modelcreated will be deployed as a web app using flask services.Using this the user can interact with the model for entering theinput values for which the airfare should be predicted. Finally,theresultobtainedisalsodisplayedontheuserinterfaceofthewebapp.Thiswebappensuresabetteruserexperience.

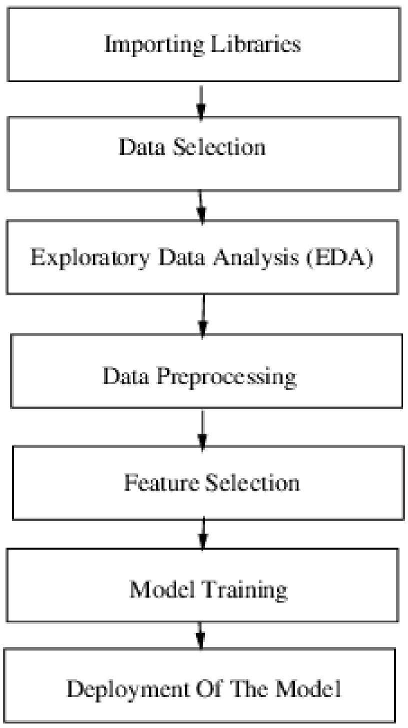

Fig.2.ProposedMethodology

VI. Model Training

Modeltrainingisacrucialprocessinmachinelearningthat involves the development of a mathematical model usingan algorithm to learn from input data. The ultimate goal ofmodeltrainingistocreateanaccurateandrobustmodelthat can provide precise predictions or classifications for newand unseen data.To begin the model training process, a largeamount of data is collected and preprocessed through severalsteps like data cleaning, normalization, and feature extractionto make it ready for training. Afterward, the model selectionprocess starts, where an appropriate algorithm is chosen basedontheproblem'snatureandthetypeofdata.Inordertoperform model training, an in-depth experimental and researchanalyseswasdoneandfinally,weoptedRandomForestalgorithmtotrainourmodel.Performancemetricsareasetof standards or markers that are utilized to assess the efficacy,productivity,andoverallperformanceofasystem,process,orproduct.Weobtainedperformancemetricsscoresbasedonourexperimentaswellasfromtheresearchanalyses.TABLEIdemonstratestheresultsobtainedbyperformingthe prediction using different models.We got results for RFAlgorithm, K - Neighbours, Decision Tree and Extra TreeModels.Basedonthescoresobtaineditwasdemonstartedthat RF Algorithm performed well with a better RMSE scoreof1773.43,R-squareobtainedwas0.84andtotaltimetakentotrainthemodelwas2.51seconds.

TABLEI: Peformace Metrics Of Ml Models

Model	R-Squared	RMSE	Time Taken
Random Forest	0.84	1773.43	2.51
K - Neigh- bours	0.84	1838.12	1.43
Decision Tree	0.84	1838.85	0.09
Extra Tree	0.80	2081.43	0.06

VII. Random Forest Algorithm

This algorithm comes under the category of supervised learning. This is also used for both regression and classification problems.The random forest algorithm is a reliable machine learning technique that outperforms other methods in various aspects. Firstly, it is less prone to noise and overfitting than other models, thanks to its ensemble of decision trees that mitigates the variance of the final model. Secondly, it is computationally efficient and capable of processing large datasets with numerous features. Lastly, random forest allows for the determination of feature importance, which aids in the feature selection process. Overall, the random forest algorithm is a highly versatile and potent machine learning technique that can be utilized to address various problems. It is especially useful in situations that involve large datasets and high-dimensional features, and has the capability to provide valuable insights into feature importance. Random forest is an ensemble learn- ing approach that generates numerous decision trees in the training stage. The final output of the model is determined by consolidating the predictions of the individual trees, which can be either the mode of the

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classes for classification problems or the mean prediction for regression problems.

When utilizing the Random Forest (RF) Algorithm for regression-based issues, a fundamental measure used to evalu- ate the model's performance is the mean squared error (MSE).

The MSE aids in determining the degree to which data points are dispersed from each node of the decision tree. Specifically, it calculates the average of the squared differences between predicted and actual values of the response variable.A lower MSE implies better model performance.

On the other hand, when using the RF Algorithm for classification-based issues, the Gini-index is employed to determine how the decision tree branches. The Gini-index assesses the impurity or randomness of the class distribution of a node in the decision tree. A lower Gini-index suggests a less random distribution of classes and a more effective split. The RF Algorithm builds multiple decision trees using boot- strapped samples of the training data. Each tree is constructedby selecting the best split points based on the Gini-index.

Overall, the RF Algorithm is a versatile machine learning technique that can be applied to both regression and classification problems. Understanding which metrics to use and how they relate to the underlying problem can enhance the model's performance.

VIII. Hyperparamter Tuning

Hyperparameter tuning is a widely-used technique in machine learning for enhancing a model's performance by optimizing its hyperparameters.Hyperparameters are predetermined before a model is trained and cannot be learned from data, such as regularization strength, learning rate, and the number of hidden layers.The primary objective of hyperparameter tuning is to identify the best combination of hyperparameters that result in the highest accuracy or lowest error rate on a validation dataset. This is typically accomplished by exhaustively searching through a range ofvalues for each hyperparameter and analyzing the model's performance on the validation dataset for each set of hyperparameters. Hyperparameter tuning can be executed using various approaches, such as random search, grid search, and Bayesian optimization. It is a crucial step in creating effective and precise machine learning models.In our case, after training the random forest model, we performed hyperparameter tuning to optimize its performance. Our results showed that the performance metrics improved significantly after hyperparameter tuning compared to the results obtained before tuning, as demonstrated in TABLE-II.Figure 4 shows a performance graph after hyperparameter tuning, compared to the graph in Figure 3 before hyperparameter tuning, clearly indicating a noticeable improvement in performance. Overall, hyperparameter tuning is a vital process for achieving the best performance in machine learning models.

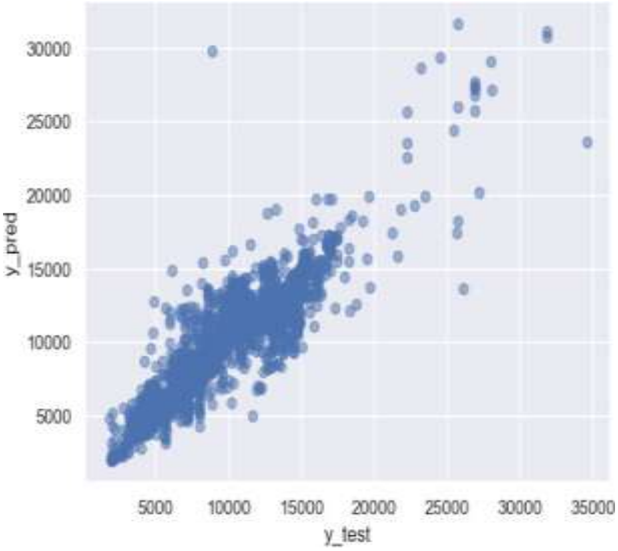

Fig. 3. Plot Performance Graph Before HP Tuning

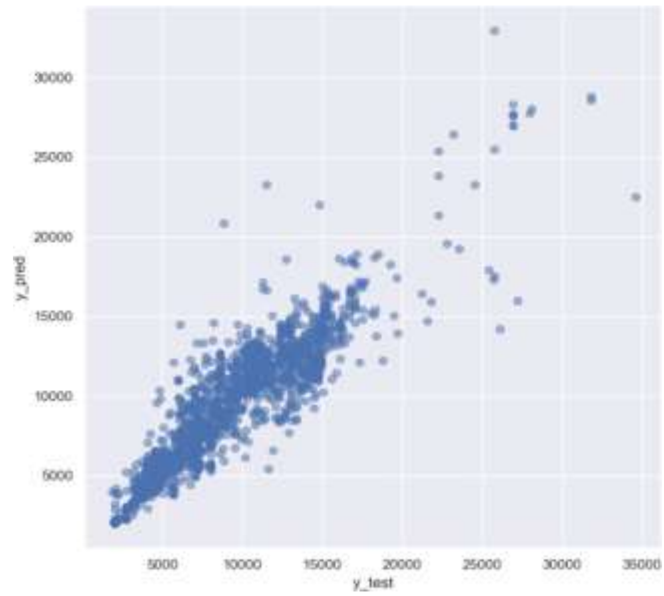

Fig.4.PlotPerformanceGraphAfterHPTuning

TABLEII: Performance Metrics Before And After Hp Tuning

Metrics	BeforeHP-Tuning	AfterHP-Tuning
R2	0.66	0.84
RMSE	1882.997	1773.43

IX. Future Scope

In the future, our design will be able to accommodate datapertainingtothepurchaseofplanetickets.Thisinfowillbeabletogivefurtherdetailsonacertainitinerary,suchasdepartureand arrivaltimesanddates,seatplacement,coveredauxiliarygoods,etc.Bymergingdifferentformsofdataandworkingwithintherestrictionsofthepresentsystem,itispossibletodevelopamodelthatis capableof delivering a more accurate and comprehensive hourly orevendailyforecastofairlinefares.Takingintoconsiderationof thecurrentindustrialdivisionandthemacroeconomicparameters,this makes it feasible to estimate airline prices. Inaddition, the price of airfare in a given market sector may beaffected by an unanticipated rise in the number of passengerscaused

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by a particular special event. In order to complementourpredictionmodel,wewillcollectevent-relateddatafromarangeofresources,suchassocialmediaplatformsandnewsorganizations.Inaddition,wewillinvestigateothersophisticated machine learning models, such as deep learningtechniques, while concurrently striving to enhance the modelsalreadyinusebytweakingtheirhyper-parameterstocreatethemostefficientarchitectureforflightprice prediction.Prioritize the speed with which the model can anticipate theresultsoftheexperimentinadditiontothereliabilityofthemodel.Besidesthecurrentlyselectedfeatures,theremayexistotheraspectsthathavethepotentialtoimprovetheprecision of airfare price predictions. In the future, there is apossibility to extend this study to anticipate the airfare pricesfor an airline's entire flight network. However, this wouldrequire the utilization of a more extensive airfare dataset andconductingadditionalexperimentstovalidatethemodel'sperformance.

X. Results

Throughout our project, we carried out both experimentaland research analyses on multiple machine learning models,includingK-Neighbours,DecisionTree,ExtraTree,andRandomForest.Afterconductingathoroughanalysisofthe obtained metrics, we concluded that the Random ForestModelperformedbetterthantheothermodels.InTABLEI,wehaveprovidedthescoresobtainedfromtrainingthedata with different ML models. Based on these results, wedevelopedamodelusingtheRandomForestalgorithm.Wethenperformedhyperparametertuning,whichfurtherimprovedtheperformanceofthemodel.Theperformancescores after hyperparameter tuning can be seen in TABLEII.Aftertrainingandevaluatingthemodel,wearethrilledtoreportthatitachievedanoutstandingaccuracyof95percontthetrainingdataand82perconthetestdata.Thisoutcome is a testament to the model's high proficiency inprovidingprecisepredictionsofthetargetvariablewhenpresentedwithnewinputdata.Furthermore,ourresultshighlight the effectiveness of the Random Forest algorithm inresolving this specific problem and suggest its potential forsimilar tasks in the future.Overall, we are confident that ourresearch has made a significant contribution to the field andcould potentially be successfully implemented in real-worldscenarios.

XI. Conclusion

Theprimarypurposeoftheprojectwastoprovideassistancetousersinpredictingairfareand,consequently,inreducingtheexpensesassociatedwithbookingairlinetravel.Inordertoaccomplishthisgoal,asuitableMLtechniquemustbeselectedtotrainthemodel.Random-ForestAlgorithmhasbeenchosenasanidealalgorithmtouse for the project in order to obtain greater accuracy afterconductingan in-depthstudy.Hyper-parameterTuningisdone after the Random Forest model training is completed, inorder to achieve an even higher level of precision and obtaintheverybestoutcomes.Furthermore,theprojecthighlightsthe importance of feature engineering and data preprocessing,asthesecansignificantlyimpacttheperformanceandaccuracyofthemodel.Nevertheless,thisinitialpilotstudyhashighlightedthepotentialofutilizingmachinelearningalgorithms to assist consumers in purchasing airfare ticketsduring thebestpossible market period.By taking advantageofthesemodels,consumerscanpotentiallysavemoneyandmake better-informed decisions when it comes to purchasingairfare.Overall,thisprojectdemonstratesthepowerofmachine learning in solving complex problems and providesvaluableinsightsandguidanceforfutureresearchinthefield.

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Audio Summarization in Real Time for Podcasts

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***Abstract*—The COVID-19 pandemic has led to a significant shift towards online work for various activities such as education, job interviews, healthcare consultations, and company meetings. This has resulted in the widespread use of online meeting software applications like Google Meet and Microsoft Teams. The practical applications of this topic are of great importance and relevance in the current scenario.This paper presents a comprehensive approach to generating text summaries from both text and voice audio files. In the first scenario, the audio files are converted to text format using Python tools, while in the latter scenario, text summarization is performed using modules from Natural Language Processing. Specifically, the SpaCy Python framework is utilized for English data functions. The significant sentences identified during the text extraction process are used in the summarization approach. The weight assigned to each word is based on the number of times it appears in the text file. By starting with the main audio recording, this method is utilized to generate summaries, Using the main audio recording as a starting point, this method is used to create summaries.**

Overall, this approach provides a useful solution for extracting important information from both text and voice audio files. By leveraging advanced techniques such as Natural Language Processing and text extraction, the summarization process is able to identify key points and reduce the overall amount of information without sacrificing important details. The result is a concise and accurate summary that can be quickly and easily read, making it an ideal solution for busy professionals who need to process large amounts of information efficiently.

Keywords: Deep learning, python speech recognition, of TF-IDF, SpaCy, Natural language processing.

I. Introduction

Over the last two decades, the popularity of multimedia applications like gaming, virtual and augmented reality (VR and AR), teleconferencing, and entertainment has led to a surge in demand for immersive communication technologies. The proliferation of mobile multimedia and ubiquitous computing has played a crucial part in the development of these technologies. Spatial audio research is currently a key focus in this field, as it offers essential resources for capturing, processing, and reproducing spatial sound, which is essential for creating three-dimensional (3D) immersive user experiences.

Spatial audio, a research field that requires collaboration among specialists in areas such as audio engineering, acoustics, computer science, and applied psychoacoustics, aims to replicate or create new acoustic environments by utilizing suitable sound recording, processing, and reproduction techniques. Maintaining the precision of not only the audio content but also the spatial features of the sound scene, which depend on the physical positions of sound sources and acoustic characteristics of the environment, is crucial in achieving this objective.

The methods and techniques used in spatial audio can be divided into three stages: capture, processing, and reproduction. The first stage involves recording the sound scene, while the second stage involves modifying the recorded spatial information or extracting additional information that was not captured. The final stage involves reproducing the processed sound scene, resulting in a realistic auditory experience.

Summarization is the process of making data easier and quicker to comprehend while preserving the language's grammar and meaning. Optical character recognition (OCR), on the other hand, involves identifying text from digitized documents or images. When a PDF file is uploaded to our tool, it is first converted into an image array using the pdf2image Python module, which is a wrapper around the pdftoppm and pdftocairo command line tools. The OCR receives a list of images, and each image is converted to digitized text using a combination of model recognition and feature detection techniques. The OCR then returns the extracted text in a string format.

With the rise of Internet platforms like YouTube, there is an increasing need for multimedia summarization. The goal of automatic summarization is to produce a concise and informative version of the original content. In this article, we focus specifically on audio summarization, which involves creating a summary of an audio signal. There are three methods for generating an audio summary: using only audio functions, extracting text from the audio signal, and using textual methods to guide the summarization process. A hybrid approach that combines the first two methods is also possible.

There are advantages and disadvantages to each approach for audio summarization. Relying solely on audio features to create a summary is independent of transcription, but it can be problematic since the summary is based only on how things are said. Conversely, using textual methods to guide the summarization process can leverage the information in the text, resulting in more informative summaries. However, transcripts may not always be available. Combining audio functions and textual methods can enhance the quality of the summary, but both approaches also have their drawbacks.

The field of voice recognition is a multidisciplinary area of study that involves the use of various technologies to recognize and interpret spoken language, ultimately converting it into text format. This field involves the application of different fields such as computer science,

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signal processing, linguistics, and artificial intelligence. The process of voice recognition involves the use of speech recognition algorithms that analyze and interpret speech signals, breaking down the audio into small components such as phonemes, words, and sentences.When a user downloads an audio file, it is first pre-processed for transcription. There are three ways to create an audio summary: using only audio functions, extracting text from the audio signal, and a hybrid approach that combines both methods. Each approach has its own advantages and disadvantages. Using only audio features provides independence from transcription, but may not capture the intended meaning accurately. On the other hand, leading the summary with textual methods may produce more informative summaries, but transcripts may not always be available. Finally, combining audio functions and textual methods may improve the summary's quality, but it also has its drawbacks.

II. Literature Review

Previous research has focused on the classification, while data augmentation has been utilized in various other applications to enhance model accuracy. A summary of the existing literature in these domains is provided in this section.

[1] The problem of automatic summarization can be tackled in various ways. These solutions include unsupervised techniques, as well as graph-based approaches that employ ranking to organize input text in a graph. Additionally, neural methods exist which are discussed in more detail in the subsequent paragraph and employ graph traversal algorithms.

[2] Next, we explore studies related to summarizing extensive texts and scholarly articles, which are the dominant types of lengthy documents in the field of summarization. Lastly, we provide an overview of datasets used for summarization tasks, with a specific emphasis on datasets for summarizing academic articles

[3] Despite the significant increase in audiovisual data in the last decade, there is a lack of dedicated tools and software programs for audio summarization. While various studies have explored modules used in constructing audio summarizers, none have focused on developing and optimizing systems specifically for audio summaries.

[4] Graph-based models, which are commonly used in extractive summarization, utilize many inter-sentence and query-sentence interactions. LexRank assigns scores to each sentence in a graph of sentence similarity. Manifold ranking, applied by Wan and Xiao, The system utilizes connections between sentences, documents, and queries to facilitate processing. We model these relationships, along with token-level graph connections, and then aggregate them to create distributed sentence representations, with the exception of cross-document relationships.

[5] Graph-based models are widely used in extractive summarization and involve several interactions between sentences and queries. For instance, LexRank assigns scores to sentences and generates a similarity graph. Similarly, in manifold ranking,The system utilizes connections between sentences, documents, and queries to facilitate processingare considered. We also use a graph at the token level to model the above relationships, which is then combined to produce distributed sentence representations, except for cross-document relationships.

[6] As audio/visual data consumption increases, audio file management needs to become more advanced. A new technique, known as divide-and-conquer, is being explored to effectively summarize lengthy audio messages or snippets and extract important information. The method consists of three modules, namely Speech-to-Text Conversion, Text Summarization, and Text-to-Speech Conversion. The output of each module, except for Speech-to-Text Conversion, is used as input for the next module in the sequence. The audio file acts as input for the first module, while the last module converts the summarized text generated by the Text Summarization module into an audio file. A web application with a user interface created with Flask is used to facilitate the model's interaction with users.

[7] The current datasets for query-focused summarization are too small to be effective for training data-driven algorithms. However, manually constructing such a corpus is a time-consuming and resource-intensive process. To address this issue, researchers have proposed an approach to extract and summarize document sentences, which allows for a better match between the large model and the small benchmarks. Experiments conducted on three DUC benchmarks indicate that a pre-trained WikiRaf model has already achieved acceptable performance levels. Furthermore, with specific benchmark dataset optimization and data augmentation, the model outperforms strong comparison systems.

[8] With the growing amount of video content available, an automatic video summary can provide significant time-saving and learning benefits. It is becoming increasingly important to correctly navigate through the large amount of user-generated videos available. Video summary has the potential to extract informative frames from a film, and is therefore seen as a useful method for maximizing the information content. By leveraging text summarization and video mapping algorithms, it is possible to retrieve key video elements from subtitles and use them to generate a summary of the movie's content.

[9] The advent of the internet and social media platforms has led to an abundance of data in various formats, including text, audio, and video. However, it can be challenging for users to obtain an accurate overview or extract crucial information from these files. Users often seek a summary of the most pertinent information that can be quickly gleaned from the source files. To this end, automatic text summarization (ATS) is the only viable method for summarizing a single document or multiple documents to extract essential information. Unfortunately, current ATS systems often produce inadequate summaries and require significant time and resources to process large documents due to incorrect encoding.

[10] Video data is composed of two modalities, namely audio and vision. Multimodal learning, particularly audiovisual learning, has gained traction in recent years due

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to its potential to enhance the performance of various computer vision tasks. However, existing video summarization methods mainly rely on visual information and do not utilize the audio modality. In this study, researchers suggest that incorporating audio information can aid in the comprehension of visual content and structure, ultimately improving the summarization process.

III. Existing System

The current system has limited capabilities as it can only detect emotions in response to an audio input. It relies on a Python speech recognition library that may not be compatible with all inputs due to its dependencies. Furthermore, the system is incapable of analyzing a large dataset of audio files as it has not been trained on such data.

IV. Proposed System And Architecture

The proposed real-time system analyzes audio inputs, extracts important keywords, and summarizes them into a shorter format. It is designed for audio books and podcasts, and can handle large inputs with good accuracy and efficiency. Our plan is to build a web application using Streamlit, a free and open-source framework for constructing Python apps with minimal lines of code. The app will prompt users to provide the podcast ID and generate a transcripted summary of the podcast. The proposed system is basically shown in the following flowchart in Figure 1.

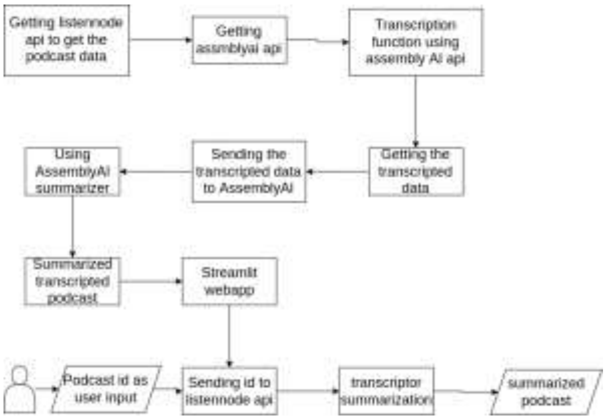

Fig. 1. Flowchart of the proposed system

V. Implementation

A. Getting the PODCAST from the listennoteapi

A method will be developed to retrieve podcast data based on the ID provided by the user as input.

In this section, we will be utilizing the Listen Notes API to extract the URL of the target podcast's episode. Listen Notes is a comprehensive online search engine and database for podcasts, providing access to podcast data through their API and enabling the creation of new applications and services based on it.

- Firstly, we need to create an account and subscribe to the free plan to access the data and utilize the Listen Notes API. The free plan allows a maximum of 300 requests per month, which is usually enough for personal projects.
- To proceed, we should visit the Listen Notes podcast page, choose the specific episode we want, and then click on the "Use API to get this episode" option.
- Afterwards, we can switch the language code to Python and choose 'requests' from the available options list, which will allow us to use the library in the future.
- After copying the code, ensure to paste it into your notebook or script.

Firstly, we use a GET request to access the Listen Notes Podcast API endpoint to retrieve the required information. The result is saved as a JSON object, containing the episode URL, which will be used later. Additionally, we import a JSON file named secrets.json, which is similar to a dictionary, containing key-value pairs. This file holds the API keys for both AssemblyAI and Listen Notes, and logging into your accounts is required to access them.

B. Transcription and summarization of the podcast

After reading the dataset, images will be preprocessed.in following steps,In this upcoming section, we will make use of a POST request instead of the previous GET request. Specifically, we will send a request to the transcript endpoint of the AssemblyAI API to request transcription. Uploading the audio URL to Assembly AI requires the use of the post method. Setting the auto chapter value to True is necessary in order to receive both the transcription and summary. If we set the auto chapter value to False, we would only be able to receive the transcription. Once this step is completed, we will store the ID of the transcription response.

Retrieve Transcription and Summary:

In the final step, we can retrieve the transcription and summary by sending a GET request to AssemblyAI. It may take several requests until the status of the response is completed. After that, we store the results in two separate files: a txt file for the transcription and a JSON file for the summary.

Transcription:

Converting an audio file into a text file is known as audio transcription, which can be applied to various situations such as interviews, academic studies, music video clips, and conference recordings. The AssemblyAI API will be utilized to transcribe the data fetched from the Listen Notes API and provide the transcription data.

Real-Time Streaming Transcription:

The Real-Time Streaming WebSocket API provides clients with text transcriptions in just a few hundred milliseconds through a streaming process. In cases where there is an error, the API will consistently return a JSON response.

Summarization:

Audio summaries are concise versions of audiobooks that effectively capture the key ideas and themes of longer works in a more accessible format. They provide a comprehensive overview of the author's content, style, and spirit. To retrieve the data that has been transcribed and

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summarized from the podcast, we will use the AssemblyAI API, which will be employed to transmit the data.

C. Web App

Our goal is to develop a web application using Streamlit that requests the user to enter a podcast ID and then provides a summarized transcription of the podcast. Streamlit is a Python framework that enables the creation of applications with minimal code. We begin by importing Python libraries and defining functions that replicate the aforementioned actions. Additionally, we provide a zipped package containing both the transcription and summary files. To start, we utilize st.markdown to display the application's main title. We create a left panel sidebar using the st.sidebar function to allow the user to input the episode ID, which is then followed by clicking the "Submit" button. Once clicked, the application will transcribe and summarize the audio of the episode. After a few minutes, the outcomes will appear on the website. If the user wishes to download the results, a "Download" button is available to compress the transcription and summary into a single file. The system automatically generates both the local URL and the Network URL, allowing the user to select either link to obtain the desired result. As a result, we now have a wonderful app that can transcribe and summarize your favourite podcast!

VI. RESULTS

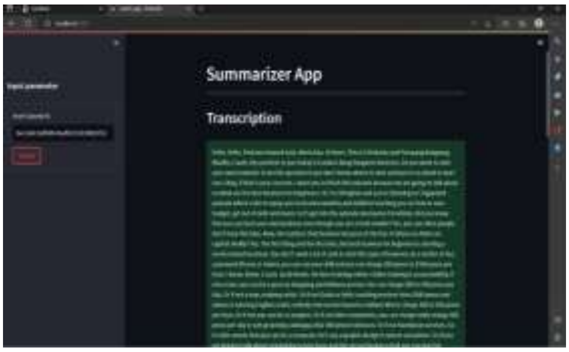

Fig. 2. Result

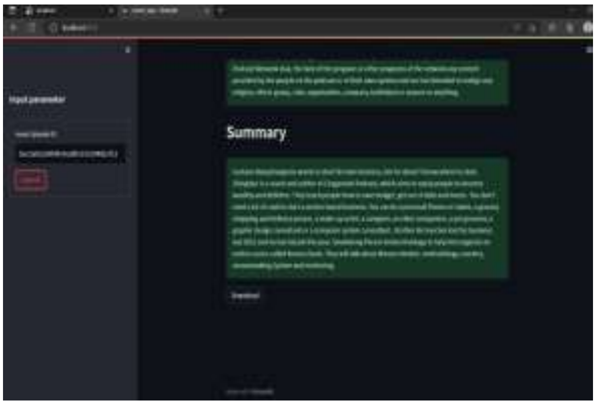

Fig. 3. Result

VII. CONCLUSION

This project aims to demonstrate the proof-of-concept and provide a direction for future development of a fully automated method for summarizing podcast speech. Due to the complexity of this task, there is considerable room for improvement. Podcasts typically require active attention from listeners for extended periods of time, unlike listening to music. The primary input for processing is an audio file containing human speech, which may be recorded live or pre-recorded. However, subjective elements such as the speaker's style, humor, or production quality can be challenging to discern from a text description. The generated summaries contain clear and understandable audio information.

VIII. RECOMMENDATION

While our predictions achieved a high accuracy of 99.6%, it is important to note that no model can be completely perfect. One limitation of this model is that it may not accurately identify species that it has not been trained on, although it will still make a prediction that closely matches the correct type. Nonetheless, this model has potential for further improvement through the collection and analysis of more data, ultimately leading to a real-time audio summarization system.

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Electrical Car Number Plate Detection

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Abstract— Reduced tollgate rates in any other sort of usage, making it more willing for the environment by electrical autos, and even in traffic control and vehicle owner identification, which has become a severe problem in every country, would encourage adoption of electric cars. It could be difficult to spot motorists who drive too quickly and against the rules of the road. Due to the speed of the moving car, it may be difficult for traffic officials to collect the license plate, making it impossible to catch and punish such people. Designing an automatic number plate recognition (ANPR) system is one of the solutions to this issue. There are currently many ANPR systems in operation. Despite the fact that these systems are based on numerous techniques, it is still a challenging task because variables like high vehicle speeds, uneven license plates, different languages used for vehicle numbers, and different lighting conditions can all significantly affect the overall identification rate. With these limitations, the bulk of the systems work. Several ANPR approaches are described in this study, taking picture size, success rate, and processing time into consideration. The study ends with a proposal for an ANPR expansion.

I. Introduction

Identification are climate, environmental influence, and localization accuracy. Using the color features and probability distribution of the license plate between the two lights is one method for number plate recognition. Template matching is a common technique for algorithms that identify licence plate numbers. The template matching-based License Plate Detection algorithm was created and designed to manage the parking lot system by detecting unregistered vehicles from off-campus. Vertical edges-based car license plate detectionis quite common at the moment. However, some people prefer to locate the location number plate by using image projections in both the horizontal and vertical planes. The license plate area can be located using the Genetic Algorithm and the Hough transform. Concurrently, effective outcomes were achieved by combining block-based algorithms with edge statistics and mathematical morphology. Another technique that takes use of the gaps between the rows counts the edges that are present and, if the number is greater than a set threshold, finds the license plate. The key elements for number plate localization are extracted using a method based on the wavelet transform. The benefit of this method is that it enables you to locate numerous license plates inside the frame. Several of the above-mentioned techniques need a significant amount of compute and are quite sophisticated. It could be a little challenging to use time in real-time applications. Some methods, such as backdrop color and other number plate attributes, might only be employed in certain nations.

II. Literature Survey

ITS is crucial in the development of increasingly complex applications for the detection of automobiles and other objects, like multi-object tracking. The authors of [1] made an effort at the structure. The majority of multi-object tracking systems employ one of two methods for object initialization: detection-based tracking (DBT) or detection-free tracking (DFT). In terms of both matching costs and computing performance, the ORB technique performs better than other algorithms.

Vehicle type classification was carried out by the authors of in order to identify applications in a variety of situations, including vehiclemanagement, traffic statistics analysis, and toll collection. The use of computer vision to classify vehicles it has been successfully used in traffic flow modelling and road traffic analysis. The model attained the maximum accuracy of 78.53% when 9000 images from the MIO-TCD dataset were employed.

The authors of created models like SVM and Decision Tree, which are used in a wide range of fields like mathematics, computer graphical user interfaces (GUIs), the web, and many important scientific applications. Python was created with the main goal of making programming simpler so that anyone, wherever in the world, could create their own software. The authors of [4] implemented approach for vehicle detection using transfer learning techniques using base models such as CNN, Inception V3, Inception-ResnetV, MobileNetV2.

Which would be employed in autonomous driving with the use of features like vehicle identification and categorization to support the CPU in real-time situation analysis and decision-making. This was achieved by establishing a system that would detect vehicles used for autonomous driving As a consequence of this study, models with accuracies of 91.8%, 89.1%, 91.4%, 90.8%, 92.3%, and 90.5% were implemented, including Inceptionv3, ResNet, InceptionResnetv2, MobileNetv2, Nasnet, and PNASnet.

The authors of [5] used the RCNN, ZF, and VGG16 networks to identify and recognise the three major groups of autos that are frequently seen in a traffic scene. This process can undoubtedly enhance the sort of automobile.

Without diminishing the effectiveness of the Faster RCNN in detection or failing to fulfil the demands of varied traffic conditions. This is made possible by streamlining the model's algorithm and enhancing the RPN networkdetection of targets in moving vehicles

Purpose of the Research

The goals of this research study are listed in the list below: x To examine further methods that can identify a vehicle's license plate. To offer a solution to the automated

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number plate recognition conundrum. To assess and test the suggested method, and to deliver the evaluation's findings.

III. PROPOSED STRATEGY

There are three components to the overall issue: Plate area detection, number plate segmentation and character extraction, symbol extraction using optical character recognition, etc.

Plate Area Detection, first The programme will be given an image with a number plate as input, and it will need to recognize the number plate before cropping the image as an output for the following stage. The image must go through the following process in order to extract the number plate from the entire document. x Gray scale image: At this stage, the image must be read and converted to grey scale format. Such conversion won't result in the loss of crucial data, at the very Similarly, working with one channel rather than three will be more convenient. The noise is a major difficulty with our dilemma, x Blur. It is preferable to blur the image in order to lessen them. There are various smoothing techniques. After smoothing, the cumulative error distribution graph that follows compares each of them. indicates that when compared to other smoothing techniques, homogeneous smoothing is the best, according to Figure 1. x Characters are located on the number plate thanks to vertical edge detection. The characters, as we all know, have more vertical than horizontal edges. To solve this problem, one of the best methods is to identify vertical edges that are very close to one another. It is the edge detection.

Vertical edge detection

The characters are found on the license plate. We already know that the characters have more vertical than horizontal edges. Finding vertical edges that are very near to one another is thus one of the greatest strategies [1]. In the subject of computer vision, edge detection is a fundamental and fundamental function. There are numerous types of edge detectors, including Prewitt, Sobel, Canny, and others. Each of them is used to various situations and issues. To solve the given problem, we employ Prewitt, Sobel, and a modified version of Sobel [9]. However, following research and testing, we decided to utilize the modified version of Sobel since it accurately detects vertical edges and significantly reduces the number of horizontal edges that obstruct.

By utilizing techniques like frame difference and contour mapping, we present a novel approach to object detection in Figure 2. First, the image will be converted to RGB, after which the ROI (Region of Interest) will be removed to keep the undesirable portions of the image out of context. Following that, the OpenCV library will process the ROI by figuring out the Threshold, dilation, and contours. Following the discovery of the frame difference, the frame is transformed into a grey image in order to use dilation to detect any potential motion. The bounding box is then mapped using the coordinates of the associated contours. A bespoke CNN model receives the image as an input as a (32 x 32) pixel image from the bounding box, which captures it in its original frame. The algorithm then trains and forecasts the image's class (Truck, Car, Bike).

As we suggested using the CIFAR-10 dataset to train the models on images with a 32 by 32 pixel resolution. The models were trained using the transfer learning technique, which pairs a custom model with a base model that has already been trained using "imagenet" weights. The top layers of the pre-trained model are not included since they limit the size of images that can be trained to about (224 x 224 x 3), while CIFAR-10 only provides images that are (32 x 32 x 3). In order to train the custom model for classifying the photos, we later added custom layers on top of this previously trained model. We divided the dataset into training and testing datasets after pre-processing them.

Processed path

Extraction of number plate location character recognition from vehicle image browsed or captured by camera Vehicle Number Input Image Number

Extraction

Remove Connected Objects on Border from the Plate Location Character Segmentation

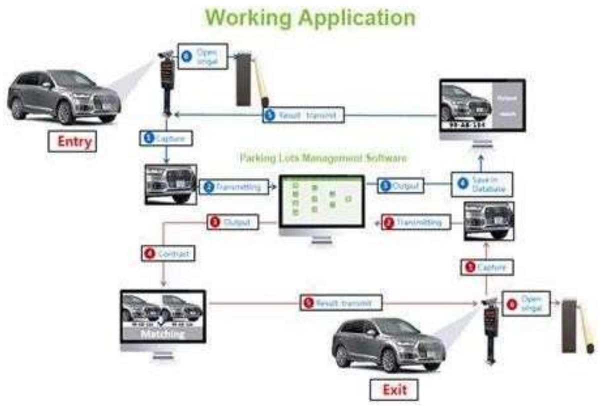

Fig. 1 CIfAr-10 images

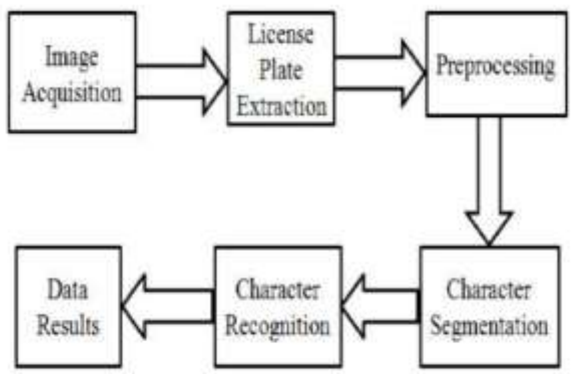

Fig. 2. Proposed Meth

Recently, a number of handcrafted methods have been presented, including the HoG and Haar features [47] and deep learning methods (R-CNN [48], Faster-RCNN [27], and YOLO [49] approaches). While others digest information slowly, some have a low accuracy rate. Among deep learning object detectors that can perform real-time processing.

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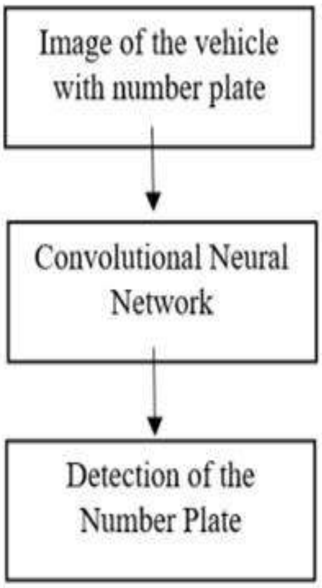
The highest detection rates have been demonstrated using faster-RCNN. Faster-RCNN performance, however, suffers when dealing with small object detection, such as the LP localization in our case. Therefore, this work uses Faster R-CNN for vehicle detection in order to deliver accurate and scaled information in a picture. Additionally, Faster-RCNN performs well for vehicle detection as vehicle size grows. To deal with fluctuating scales, anchors in RPN are created, which employs three scales (128 128, 256 256, and 512 512), three aspect ratios (1: 1, 1: 2, and 2: 1), and nine anchors at each place. The fact that each area proposal's size is different from the others makes it difficult to design effective architecture for a range of sizes.

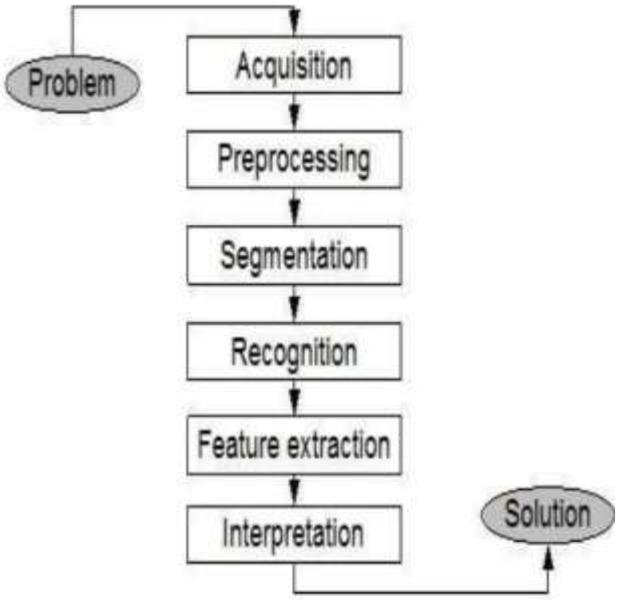
RoI SoftMax probability to categorize vehicles and non-vehicles, and the second of which predicts the coordinates of each region's rectangle.

Variations in the vertical edge detector x Black and white are the only colors present in binary pictures. The Otsu, Niblack, Souvola, Wolf, and Feng procedures are just a few of the threshold-related approaches.

Region of interest (RoI) pooling is used to simplify the problem and derive a fixed-size feature representation. The vectors are enlarged to include the RoI pooling properties. These vectors are finally fed into two fully connected layers, the first of which uses each Using stochastic gradient descent with momentum (SGDM), which changes the weights quickly and lowers inaccuracy, this method trains the faster-RCNN architecture. SGD just needs one sample data set from the training data, in contrast to gradient descent (GD), which uses all training datasets to update the weights and parameters. From each batch, one image was randomly selected for training. The revised sizes were 600 and 1400 for the shorter and longer sides of each image, respectively. shows the results of a quicker RCNN vehicle recognition using images.



A gradient-based histogram will be produced for each candidate. The feature vector will then have a specific length. By providing all of these vectors to the algorithm, we will be able to obtain the appropriate license plate among other things. SVM and setting it up with particular settings. Another strategy built on probabilistic theory was put into practice.



In this scenario, the turns are were initially identified, and any shapes that did not resemble a character were removed. Whether or not the remaining contours are located in a straight line is studied via identification. The likelihood of each character was then determined by removing each character from the license plate. The best candidate was chosen after adding them all up and taking these values into consideration. However, after testing, wewhere Lx and Ly are picture derivatives. Finding only vertical edges is achievable when using the value of. Only vertical edges will be produced if the value of is between 45 and 135. In the Fig. 2 show the outcome and variance of each edge detector.

Each of them took part in specific situations to achieve different objectives. Binary picture manipulation is more useful. After finding vertical edges, we will apply Otsu threshold to our existing image. x Most often, close morphology is used to connect nearby elements. Since our objective is to locate the number plate, we don't need a lot of information about the characters. We employ near morphology, which integrates all letters and numerals, as a result. The results of the morphological process are displayed in Figure 3.

DOI: rp-9788770040723.142

Recognize contours. Using the near morphology, where the area and aspect ratio of the contour must be taken into account, we will discover the contours that resemble licence plates. Additionally, the contours must be positioned horizontally, as seen in Fig. 3.

Identify the best applicant. To find the best candidate among the others, every number plate must be reviewed. The feature vector for each candidate will be computed initially. To do it, we'll use a histogram of directed gradients.

Segmentation The licence plate must be used to extract the characters. There are two fundamental approaches to segmentation; the one projects the image into X axis, while the second looks for outlines that resemble characters.

After completing study and testing, we came to conclusion that second algorithm performs better than first one. In Fig. 4, algorithm's output is shown. Before segmentation, the image must also be transformed to binary format. In this case, the Otsu method is not the best course of action. The Nick, Niblack, and Souvola algorithms outperform the rest, according to our tests of several binary algorithms.

character recognition using optics It is important to recognize the extracted character. To be used for recognition, we revised the 1NN technique. As shown in Fig. 5, the character was divided into 49 distinct components. Each component's white pixel count needs to be recorded. The feature vector, which consists of 49 elements, will be used to identify each character. Figure 6 displays feature vectors for the classes A, B, and C.

After the average element for each class has been established using feature vectors, the distance between an unknown element and all of the average elements in each class must be calculated. Unknown element will be added to the classes in the neighboring hierarchy that are closest to it

IV. Working of Algorithms

Character recognition for license plates frequently uses CNNs. The effectiveness of these systems in detecting odd license plate types or working at night hasn't received much attention, though. We demonstrate an effective ALPR system that recognizes characters using a CNN. The system efficiency was improved by applying a combination of pre-processing and morphological techniques to improve input image quality. The system can recognize license plates with multiple lines, skewed edges, and several fonts, among other qualities.

The best method for putting ALPR systems into practice makes use of deep learning using a convolutional neural network (CNN). Four methods are used by our system to carry out this step: grey scaling, median filter, thresholding, and masking. Multiple layers that independently learn to recognize the distinctive characteristics of an image can make up a CNN network. Every training image is fed into a filter with a different resolution, and the output of each convolved image is fed into the network's next layer.

To recognize the license plate in the pixels in the foreground. the identified number pictures' OCR. A unique set of algorithms is used for each phase. Automatic number plate recognition (ANPR), also known as license plate recognition (LPR), uses video-captured images or datasets to automatically identify a vehicle by its license plate. which are frequently positioned at fixed points along roadways and at parking lot entrances. Reading the image and gaussian blur and convert it to grayscale, Binarize the photo Using the n 8-connected component technique, label the binary image, Regions that are too big, too small, or have an aspect ratio greater than one should be removed. The largest region should be chosen after the regions have been sorted by distance from the Y-axis and collinearity.

V. Results and Discussion

The method was tested with 1469 actual car photographs. The pictures of the vehicles were taken from different perspectives and in varied weather situations. First, Plate Area Detection The exams were divided into five sections. Several subparts determine which side of the subject—front or back—the picture was taken from. The results of the test scenarios used to calculate the plate area Results of Plate Area Detection Subparts 1 Front, 2 Rear, and 3 Rear,

95.3%, 93.15%, 95.5%, and 94.46%, 93.88% If we take the average of the aforementioned data, the average performance of the plate area detection algorithm is (95.3% + 93.15% + 95.5% + 94.46% + 93.88%) / 5 = 94.458%.

After taking into consideration the value for each group, we calculated the overall performance of the segmentation algorithm (56.38% + 77.83% + 64.49%) / 3 = 66.23%. Following segmentation, the extracted lettersare shown in Fig. 7. number plate up:

Optical Character Recognition (C) There are several characters that are similar to one another, such "5 and S" and "O and 0." Examine our OCR solution in light of this information.

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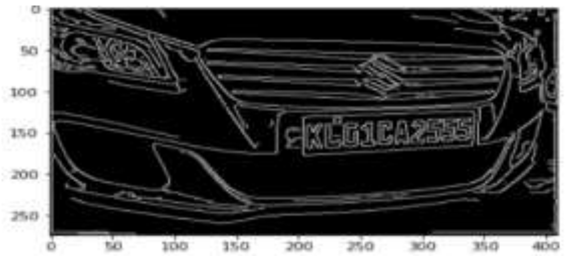

Comparing Models

We came to the conclusion that DenseNet-169 fared the best after comparing models against one another based on the provided criteria, with an accuracy of 96% accuracy and an F1 score of 96.3%. The type of car in the video can be accurately predicted by the model. The comparison of the models is shown in Table 1. Figures 11, 12, and 13 display the model's performance metrics graphs, with DenseNet-169 being the best bespoke pre-trained model.

VI. Conclusion

Using the suggested methods, data preparation, and learning the models across more than 100 epochs. DenseNet-169 successfully characterized the dynamically moving items in the frame using a bounding box after precisely anticipating the cars, buses, and trucks in the movie. The creation of a thorough system for traffic routing in crowded areas is the ultimate goal of this thesis. It is important to get dynamic data that shows the traffic flow condition along all feasible routes within a separate road using detectors in order to route traffic inside a city.

VII. Future Work

In the future, we intend to develop and incorporate object detection into the model itself in order to enhance its functionality. By employing coordinate pixel values, we intend to develop an experimental feature that will estimate the speed of moving vehicles and display the results next to the projected label.

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Skin Cancer Classification of HAM 10000DatasetusingCNNwithInceptionV3Model

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***Abstract*—There are several types of skin cancer.Scientistshavecalculated around 200 of them till date. There are around 200type of skin cancers and research has showed that melanoma is the most dangerous out of them. The initial step in the diagnosis of melanoma is a form of screening in the clinic, which is then followed by histological examination and dermoscopic analysis. Skin cancer with melanoma has a good chance of being cured if it is discovered in its early stages. Visual inspection of the afflicted area of skin is the initial stage in the diagnosis of melanoma skin cancer. We will be able to differentiate between benign and malignant skin conditions using deep learning and neural networks, which could aid doctors in earlier cancer diagnosis.The dataset used is the HAM 10000 dataset. We have used the Python Ten sorFlow framework to create a skin illness classifier that attempts to differentiate between benign (nevus and seborrhei ckeratosis)and malignant (melanoma) skin diseases using just photo graphic pictures.**

Keywords—Python, TensorFlow, DeepLearning, Melanoma, Classification

I. Introduction

AccordingtotheSIIM-ISICMelanomaClassification,2020,melanoma accountsfor 75% of mortalitywhile being the leastcommon type of skin cancer. Although it is a less common form ofskincancer,ifitisnotdiscoveredintime,itcanspreadfasttoothe rbodyareas.SkinscansarebeingmadeavailablebytheInternatio nalSkin Imaging Collaboration (ISIC) to lower melanoma mortality.Whendetected andtreated earlyon,melanomaiscurable.

A teledermatology automated diagnosis system that can supportclinicaljudgementscanbecreatedusingdigitalphotogra phsofskinlesions .As deep learning can handle complex issues. The goal is tocreate a tool that dermatologists may use to support their diagnosisaccuracybycombiningcontextualphotosandpatient-leveldataandloweringthevarianceof modelpredictions.[1].

Since there are several categories of skin cancer, the challenge is toidentify them so that respective treatment can be provided. Afterdeveloping the model the doctor can just feed the image on to thesystemandwithinalimitedperiodoftimetheresultcanbeobtai ned.The system detects the category and displays it in the report. Thissystem can also be used in small clinics where a simple skin rashcan be tested to check the severity of the condition. This would beveryhelpfulsincetheconditioncanbeidentifiedasearlyaspossibleandtreat itwithoutanydelay[2].

The proposed model is Inception V3 which is a proved model forimageclassification.Asnotallimageswouldbeclearforclassi fication, this model is trained to handle such images. It is afaster model and computationally less expensive. It has severalconvolution layers which makes thepredictionsaccurate[3].

II. Literature Survey

They thoroughly studied the scaling of the model based onCNN (Convolutional Neural Networks) [1] and balanced thedepth,widthandresolutionofthenetworktoobtainexcellent resolution. Manipulate data using the grid-like topology ofConvNetswhileanalyzingimagesusingconvolutionalneura lnetworks.

Like the previous authors, the authors of [2] also use CNN-type neural .Along with other pre-trained models such as VGG16/19 and MobileNet, the Inception v3/5 model is used to helpskincancerfeatureextractionandclassification,andtheCN Nisusedforimageclassificationanddetection.

Another study investigated the consistency of CNN's abilityto identify and classify different diseases and found CNN tobehighlyreliable.In[3]and[4],theauthorcollecteddataonde ephislearningofNNandskincancerdiagnosticalgorithmsfrom trusted search engines such as ACM, Springer,GoogleScholar,andIEEEXplore.Adeepneuralnetw orkhasinterconnectednodesthathelpdetectskincancer.Theaut horsalso explored other learning methods such as ANN, CNN,KNNandGAN.

Theauthorsof[5]discussskincancereffectsbasedonfactors such as gender, climate, andgeographic location. They arguethat men's jobs and lack of precautions make them moresusceptibletoskincancer.

The author describes the image preprocessing phase in [6].Thisincludesdatacollection,hairremoval,shadowremoval ,glarereduction,andotherprocedures.Imagesextractedfromth e dataset contain a variety of tumor colors, some black andsomelight,withandwithoutskincancer.

III. Proposed System

A. DatasetDescription

TheHAM10000datasetcontainsabout10,000dermatosco pic images of pigmented skin lesions, including7,000 benign and 2,000 malignant lesions.. In 2018, a groupofresearchersattheMedicalUniversitätofViennainAust

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riaproducedthedataset.Severalplaces,suchasclinicalsettings, dermoscopyclinics,andreferralcentres,wereusedtocollectthe photographs[4]. The HAM10000 dataset has been extensively utilised forresearch,particularlyinthedevelopmentofmachinelearningalgorithms for automated skin cancer diagnosis. It is one ofthe largest freely available datasets for the classification ofskin lesions. Seven different diagnostic categories, includingmelanoma, melanocytic nevus, basal cell carcinoma, actinickeratosis,benignkeratosis,dermatofibroma,andvascularlesion,are assignedtothedataset.[10]

Fig. 1:TypesofImagesinthedataset

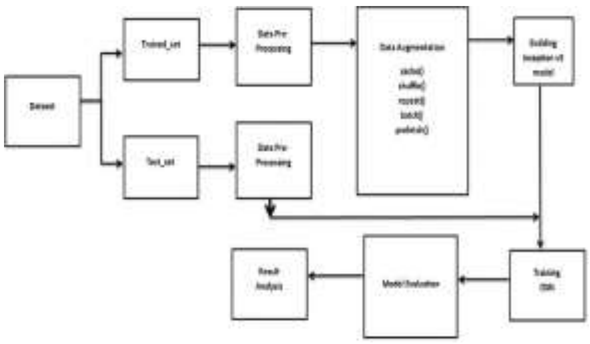

Fig. 2: Architecture of the model

B. PropsedArchitecture

Theentireflowoftheprocessisshown in Figure2.When classifying skin cancer with machine learning, deeplearningarchitecturesarefrequentlyused.Deeplearningarchitecturesareasortofneuralnetworkthatcanlearnintricatepatternsandfeaturesfromtheimages.

Aconvolutionalneuralnetwork(CNN)withnumerouslayersof convolutions, pooling, and fully connected layers is oneproposeddesignforclassifyingskincancer.TheHAM10000dataset, or a comparable dataset, is used to train the Networktoidentifythefeaturesthatdistinguishbetweenvariouskindsofskinlesions.

To enhance the model's functionality and generalizability, thesuggested architecture may also include methods like dataaugmentation,whichentailsgeneratingmoretrainingdatabyapplyingrandomchangestotheoriginalimages.Theclassificationofnewskinlesionphotosintothevariousdiagnostic categories can be done using the CNN after it hasbeentrained.Metricslikeaccuracy,sensitivity,andspecificitycanbeusedto assessthemodel'sperformance[7].

In general, a deep learning model is trained on a sizabledatasetofskinlesionphotosaspartoftheproposedarchitectureforclassifyingskincancerusingmachinelearning, and new images are then classified into severaldiagnostic categories using the acquired characteristics. Thismethodcouldincreasetheprecisionandspeedofskincancerdiagnosiswithadditionalstudyanddevelopment.

C. PreProcessingTechniques

Machinelearningalgorithmsforclassifyingskincancerheavily rely on pre-processing methods. Some of the pre-processingmethodsthatcouldbeutilisedinaresearcharticleon this subject are as follows: Picture resizing: Resizing theskinlesionphotographstoastandardsizecanaidinloweringthe computational expense and enhancing the effectivenessof the machine learning method. Picture normalisation: Byremovingdifferencesinthelightingandcolouroftheimages,normalisation can assist in facilitating the machine learningalgorithm's learning of the features that distinguish betweenvariouskindsof skinlesions[8].

Image augmentation: Creating additional training data byrandomly rotating, resizing, and flipping the original photoscan assist increase the robustness and generalizability of themachinelearningsystem.Noisereduction:Byusingtechniqueslikemedianfiltering,onecanlessentheimpactofimagenoiseonhowwellamachinelearningsystemperforms.Featureextractioncanhelptoenhancetheperformance of the machine learning algorithm by loweringthe dimensionality of the input data and emphasising the mostinformative aspects. Relevant features can be extracted fromthephotos, such astexture,shape, andcolour.

D. ConvolutionalNeuralNetworks

ConvolutionalNeuralNetwork,sometimesknownasCNN, isa subset of artificial neural networks created specifically fortheanalysisofvisualdata.Fortaskslikeobjectidentification,segmentation,andrecognition,itisfrequentlyemployed.

Convolutional, pooling, and fully linked layers are some of thelayers that make up CNNs. Pooling layers downsample thefeaturemapstospeedupcomputationandboostgeneralisation, while convolutional layers are in charge ofextracting features from the input image. For jobs requiringclassificationorregression,fullylinkedlayersareused.

There are numerous uses for CNNs in a variety of industries,includingrobotics,computervision,naturallanguage processing, and speech recognition. By automating previouslylaboriousactivities,CNNshaveshowntobeaneffectivetoolforanalysingvisualdataandhavethepotentialtorevolutionisenumerousindustries.[19-20].

The fundamental tenet of CNN is that local awareness of apicture suffices. The practical advantage of having fewerparameters is that learning proceeds much more quickly andrequires less data to train the model. A CNN only has thenumberofweightsnecessarytoexamineatinyportionoftheimage, as opposed to a fully connected network of weightsfromeachpixel.

ConvolutionLayer

Convolutional layers employ a series of learnable filters toapplytoinputdatainordertoextractfeaturesthatarebeneficial

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for later tasks, such object or picture detection.Each filter conducts a dot product between the filter weightsandtheinputvaluesateachplaceasitmovesacrosstheinp utdata,resulting in asinglevaluein theoutputfeaturemap.

ReLULayer

ReLU is the abbreviation for the rectified linear unit. Whenapplying a ReLU layer, the feature maps must be retrieved.The process of acquiring helpful image features starts at thislevel. The convolution process is carried out by a number offilters in a convolution layer. Suppose that each image isrepresented bya matrixofpixel values.

PoolingLayer

In CNNs, a pooling layer is a particular kind of layer that isfrequently used to reduce the spatial dimensions of featuremapscreatedbytheconvolutionallayers,henceloweringt hecomputational complexity of the network and enhancing itscapacitytogeneralise tonew input.

FullyConnectedLayer

An ANN frequently employs a fully connected layer type totrain a nonlinear mapping between input and output data. Itconvertsfeaturemapsorinputdataintoclassprobabilitiesorreg ression valuesfor CNNsandFNNs.

E. Inceptionv3

TheInceptionv3'sarchitectureisinFigure3.

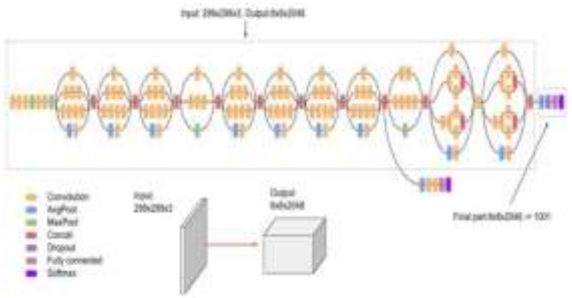

Figure3:Inceptionv3system.

A deep convolutional neural network (CNN) algorithm forimageclassificationiscalledInceptionv3.In2015,Googleres earchers unveiled it as an improvement over earlieriterationsoftheInceptiondesign[22].

TheInceptionv3modelcanextractfeaturesatvariousscales because it comprises of multiple convolutional layers withvarious filter sizes. The model also makes use of the idea of"Inception modules," which are collections of variousconvolutional layers with various filtering granularities thatenable the model to recognize more intricate patterns in thepictures.

Othersophisticatedelementsfoundininceptionv3includef actorizedconvolution,batchnormalization,anddqropout.

These characteristics aid in enhancing the model's functionality and avoiding overfitting.

It has been shown that the picture recognition model Inception v3 can reach better than 78.1% accuracy on the ImageNet dataset. The model is the outcome of multiple ideas that different researchers have developed over time. It was based on Szegedy et al.'s Rethinking the Inception Architecture for Computer Vision.

In this model Softmax is used to calculate loss.Convolutions, pooling layer, max pooling, fully connected layers, dropouts are some of the symmetric blocks that make up the model itself. Batch Normalization is heavily used in the model and is also applied to activation inputs.

IV. Results

10,000 images are available in the HAM 10000 dataset.It is an unbalanced dataset which was then transformed so that it could be used in the model. In order to fit in the model, the images must be resized, normalize the pixel values. Since the dataset is very large it will take a large amount of time to load the images and train them. All the 10000 images cannot be loaded into the model so it is recommended to create a balanced dataset by accommodating specific number of images from each category. The method is run using Python on a Windows 10 computer with an i5 11th Gen processor, 8 GB of RAM, and an NVIDIA GEFORCE GTX1650Ti GPU,

as well as on a Jupyter notebook and a Google Colab.

The table represents why Inception v3 model is better than other CNN models. In all the models the preprocessing techniques were the same. The epochs were tweaked to get better results.

The study's findings are listed in table 1 as follows..

TABLE 1

Network	Models Evaluated	Crops Evaluated	Error
VCGNet	2	-	6.8%
GoogleNet	7	144	6.67%
PReLU	-		4.94%
BN-Inception	4	144	4.9%
Inception-V3	4	144	**3.58%**

TABLE 2. Methods used with training and validation accuracy

Experiment Number	Method used	Training accuracy	Validation accuracy
1	Inception v3 with 10 epochs	74.24%	72.18%
	Inception v3 with 20 Epochs	77.45%	73.67%
	Inception v3with 30epochs	80.39%	77.58%
2	Inception v3 with 20epochsand Softmaxactivation function	78.02%	76.1%
	Inception v3 with 30epochsand Tanhactivation function	81%	77.95%
	Inception v3 with 30epochsand Sigmoidactivation function	82.27%	81.7%
3	Inception v3 with50 Epochsand Sigmoid activation function	86.08%	85.47%

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Figure 4 represents the graphical representation if the table 2. It clearly depicts that with different activation function and with higher epochs the model has performed well.

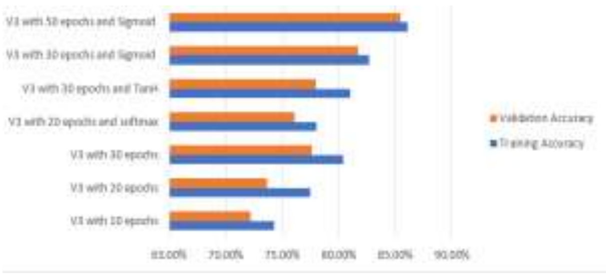

Fig. 4: Pictorial representation of training and validation accuracy percentages.

V. CONCLUSION

The biggest challenge was how to handle such a big dataset. There are seven classes and we have to classify them into any one and it was unbalanced. There are many ways to handle data and the method chosen here is to separate them into each class and augment them individually. The most important step here was to take a subset of those images and converting them to 32x32 size. There is an alternative method which is to use the image data generator. Another preprocessing done was to convert data frame column of images into numpy array.

Different models were discussed before building it but the auto keras feature suggested that Inception v3 would be the best model. It has got seven dense layers giving seven different outputs. The last activation function used was sigmoid so each of the seven is a probability. The highest probability would be our class.

Thispaperhasbeenexperimentedwith3differenttechniquesby tuning the hyperparameters. In the first experiment onlyepochs was tuned and the best results obtained were 80.39%fortrainingand77.58%forvalidationaccuracy.Inthesecondexperiment, the activation function was altered along withepochs and the best activation function was Sigmoid. Thetrainingaccuracyobtainedwas82.27%fortrainingand81.7% for validation. In the third experiment the epochs wassetto50andthebestactivationfunctionwasused.Theresultobtainedwere86.08%and85.47%forvalidation.

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Uncovering Racist Sentiments on Twitter: A Stacked GCR-LSTM with BERT Approach for Analysis of Differing Opinions.

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Abstract— For all its benefits social media has also enabled the darker aspects of human nature like racism to flourish - often hidden behind seemingly benign posts or anonymous accounts. Such practices have become especially common when dealing with issues related to skin colour, culture ,language origin or religion .This trend is not only harmful but threatens our cultural stability ,social fabric and peace on an international level . To counteract this situation a recent research suggests the use of deep learning tools such as gated recurrent units (GRU) convolutional neural networks (CNNs) with LSTM ,and ensemble modelling along with sentiment analysis aimed at locating racist tweets For those interested in machine learning, its worth noting the capabilities of Gated Convolutional Recurrent Neural Networks with LSTM and BERT (GCR-NN+lLSTM+BERT). Within this framework the GRU component is adept at extracting specific characteristics from unprocessed text while CNN can provide necessary context for RNN to more accurately predict outcomes alongside the usage of LSTM and BERT.

I. Introduction

Social media has become a breeding ground for racism, where individuals spread hate speech, bigotry, and prejudice against people based on their race, religion, language, culture, and national origin. Racism on social media can take various forms, including the use of memes, false identities, and overt expressions. Unfortunately, one of the negative consequences of this widespread use of social media is the rise of vices such as racism. Twitter, for example, has emerged as a platform where racism and its associated tensions are prevalent. With over a million words and contexts and memes followed by different opinions and content,Twitter’s reach and influence are vast. Additionally, 90% of Twitter users have a public profile, making it easier for harmful sentiments to spread quickly. Today, 22% of American citizens utilise the social media network. Twitter users can respond to and participate in tweets by publishing them on their profiles (retweeting), tagging other users, and clicking the like button. Tweets are publicly available until they are set to be private. The foundation of sentimental analysis is the expression of sentiments, emotions, attitudes, and ideas on Twitter. Social media platforms have become increasingly popular, which has led to widespread use of them for several contemporary and historical kinds of racism. Racism is depicted on these platforms in both overt and covert ways, such as through memes and the publication of racist Tweets under fictitious names. Racism is not only limited to ethnicity, but also targets people based on their race, national origin, language, culture, and religion. Racial tensions incited on social media are considered a major threat to global peace and stability, as well as social, political, and cultural stability.Racist statements should be quickly identified and prohibited from social media, which is the main source of racist ideas.

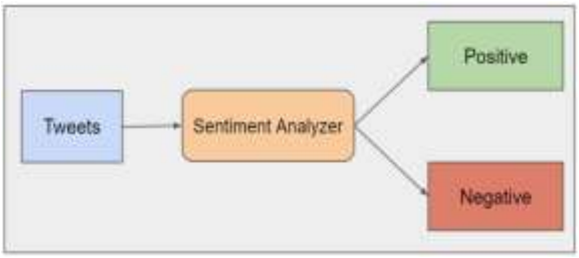

Fig.1: Example figure

Racist comments and social media tweets have been connected to a number of physical and mental disorders, which have a harmful impact on one's health [7–12]. Three categories of racism on social media can be identified: institutionalised, personally mediated, and internalised [13]. Racism can be experienced at a personal level through discriminatory or unfair treatment, as well as by being aware of bias towards loved ones. This has negative effects on individuals, leading to various forms of psychosocial stress that can increase the risk of chronic illnesses. Additionally, cyber-racism is being spread by racist groups and individuals who employ advanced strategies and skills. As a result, sentiment analysis has become a significant area of research to analyze social media text for tasks such as identifying hate speech, making sentiment-based market predictions, and detecting racism, among others.

II. LiteratureReview

A. Using social media to understand and guide the treatment of racist ideology

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The paper "Using social media to understand and guide the treatment of racist ideology" proposes using sentiment analysis to detect racist tweets and guide the treatment of racist ideology. The authors highlight the growing prevalence of racism on social media and its impact on societal, political, and cultural stability. The study combines gated recurrent units (GRU) and convolutional neural networks (CNN) to create a stacked ensemble deep learning model called GCR-NN.Several previous studies have also addressed the issue of racism on social media. For instance, a study by Zhou et al. (2018) proposed using machine learning techniques to detect racist tweets and assess their impact on users. Another study by Ngo et al. (2019) used sentiment analysis to detect hate speech and racist content on social media. The authors highlighted the importance of detecting and addressing such content to prevent its negative impact on individuals and society.Moreover, other studies have examined the impact of social media on racism and prejudice. For example, a study by Correa et al..

B. *Using social media for health research: Methodological and ethical considerations for recruitment and intervention delivery*

The paper "Using social media for health research: Methodological and ethical considerations for recruitment and intervention delivery" explores the potential benefits and challenges of using social media for health research. The authors highlight the increasing popularity of social media platforms as a means of communication and data sharing, and how they can be utilised for health research purposes. The paper discusses various methodological and ethical considerations that researchers must take into account when using social media for recruitment and intervention delivery. For instance, the authors highlight the importance of ensuring participant confidentiality, privacy, and informed consent. The study also notes the challenges of sample representativeness, potential selection bias, and the reliability of self-reported data collected through social media.Several previous studies have also examined the use of social media for health research. For example, a study by Laranjo et al. (2015) explored the potential of social media for health promotion and intervention delivery, highlighting the benefits of social media as a cost-effective and accessible means of communication with participants. Another study by Peng et al. (2017) examined the feasibility of using social media for patient recruitment in clinical trials, and found that social media platforms can be effective in reaching a diverse and geographically dispersed sample.Overall, the paper highlights the potential benefits of using social media for health research, but also underscores the need for careful consideration of methodological and ethical issues when utilizing these platforms.

C. *Online networks of racial hate: A systematic review of 10 years of research on cyber-racism*

The paper "Online networks of racial hate: A systematic review of 10 years of research on cyber-racism" provides a comprehensive analysis of research on cyber-racism, focusing on online networks of racial hate. The authors examine the prevalence, forms, and impact of cyber-racism, and highlight the need for effective strategies to counter its negative effects.The paper reviews a range of studies on cyber-racism published over a 10-year period, highlighting the various forms of racist content, including hate speech, discrimination, and harassment. The authors also discuss the social and psychological impact of cyber-racism on individuals, such as anxiety, depression, and decreased self-esteem. The study also notes the potential for cyber-racism to have wider social and political consequences, including the normalization of racist attitudes and the promotion of extremist ideologies.Several previous studies have also addressed the issue of cyber-racism. For example, a study by Tynes et al. (2012) examined the experiences of racial and ethnic minority youth on social media, highlighting the prevalence of racist content and the negative impact on their mental health. Another study by Ziegele et al. (2018) explored the role of social media in the dissemination and normalization of extremist ideologies, including racist and anti-immigrant attitudes.Overall, the paper highlights the need for effective strategies to counter cyber-racism, including education, community-building, and policy interventions. The authors emphasize the importance of taking a multi-disciplinary and multi-level approach to addressing the problem of cyber-racism, and call for further research to better understand the complex dynamics of online networks of racial hate.

C. *Reducing racial inequities in health: Using what we already know to take action*

The paper "Reducing racial inequities in health: Using what we already know to take action" provides a comprehensive review of the literature on racial inequities in health and highlights evidence-based strategies for reducing these inequities.The authors review a range of studies on the social determinants of health and the impact of racism and discrimination on health outcomes. They note that racial and ethnic minorities experience higher rates of chronic disease, disability, and premature death compared to their White counterparts, and that these disparities are driven by a range of factors, including poverty, inadequate healthcare access, and exposure to environmental toxins.

The paper also highlights evidence-based strategies for addressing racial health inequities, including policies that promote economic and educational opportunities, improve access to quality healthcare, and address structural racism and discrimination. The authors note the importance of community engagement and participation in efforts to promote health equity, and highlight the need for culturally sensitive interventions that address the unique needs and experiences of diverse populations.Several previous studies have also addressed the issue of racial health inequities. For example, a study by Williams et al. (2019) examined the impact of racism on health outcomes, highlighting the need for policies and interventions that address the root causes of these disparities. Another study by Braveman et al. (2017) identified a range of evidence-based strategies for promoting health equity, including community-based interventions and policies that address social determinants of health.Overall, the paperemphasises the need for a comprehensive, multi-disciplinary approach to addressing racial health inequities, and highlights the importance of using evidence-based strategies to guide policy and practice.

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The authors call for continued research and action to address these disparities and promote health equity for all populations.

III. Methodology

A. Overview

Racism on social media has become an increasingly prominent issue in recent years. Social media platforms provide a platform for individuals to express their opinions and beliefs, which can often include racist comments and hate speech. The anonymity of social media has made it easier for individuals to express racist views without fear of repercussions. Additionally, the speed and reach of social media mean that racist comments and hate speech can spread quickly, reaching a large audience.Machine learning and deep learning techniques have been used to address the problem of racism in social media. Sentiment analysis, a subfield of natural language processing, has been used to automatically identify and classify tweets with racist content. These techniques can analyze the language used in tweets to determine whether they contain negative sentiments, and identify the tweets that express racist opinions.However, there are also concerns about the use of machine learning and deep learning in detecting racism on social media. There is a risk of bias in the algorithms used to detect racism, which can lead to false positives or false negatives. Additionally, there are ethical concerns about the use of automated systems to monitor and censor social media content, which can infringe on freedom of speech. Overall, the issue of racism in social media is complex and requires careful consideration of both technical and ethical issues.

B. Disadvantage

1. Existing technology cannot be automatically identified and stopped to prevent future proliferation.
2. Poor performance.

Due to the improvement in performance of Deeplearning networks, To expand the stack for improved performance, gated recurrent units (GRUs), convolutional neural networks (CNNs), recurrent neural networks (RNNs) and LSTM have been combined in the gated convolutional recurrent neural network (GCR-NN) model. In this model, GRUs play a crucial role in extracting relevant and significant features from raw text, while CNNs extract essential aspects of RNN to ensure accurate predictions and on which we add LSTM to generate better output on the accurate predictions.

C. Advantage

1. The proposed GCR-NN with BERT proposes advanced and better performance with enhanced accuracy.
2. The proposed GCR-NN model can detect racist remarks in 97percent of total of tweets.

We developed the following modules in order to carry out the project mentioned earlier.

- Data input: With this module, we will enter data into the system.
- Processing:This module is intended for reading data to be processed.
- This module will be used to partition the data into testing and training models.
- Model creation techniques include GCN with BERT, LSTM, GRU, RNN, CNN, Ensemble Method LSTM + GCN with BERT, Logistic Regression, Random Forest, KNN, Decision Tree, Support Vector Machine, and Voting Classifier.
- Signing up as a user and logging in are required steps for using this module.
- User input: Prediction input will be produced by using this module.
- Forecast: The final forecasted figure will be shown. Logistic Regression, Random Forest, KNN, Decision Tree, Support Vector Machine, Voting Classifier.

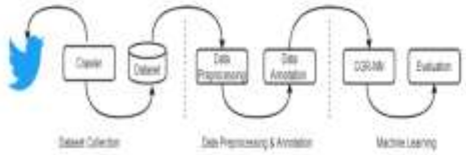

Fig.2: System architecture

IV. Implementation

Algorithms

GCN: For graph-structured data, a Graph Convolutional Network, or GCN, is a semi-supervised learning technique. It is founded on a powerful variant of convolutional neural networks that directly affect graphs.

BERT: BERT is an open source machine learning toolkit for interpreting natural language (NLP). Using the use of contextual information from the surrounding text,the objective of BERT is to assist computers in comprehending the context and meaning of ambiguous words in text.

LSTMs are a type of neural network architecture that can be used in sentiment analysis. They are designed to help overcome the problem of vanishing gradients that can occur in traditional RNNs, allowing them to more effectively capture long-term dependencies in sequential data. In sentiment analysis, LSTMs can be used to model the sentiment of a text sequence by analyzing its context and identifying patterns that are indicative of positive or negative sentiment. By processing text in this way, LSTMs can be used to accurately classify the sentiment of a piece of text, making them a powerful tool for sentiment analysis tasks.

*GRU:*Kyunghyun Cho et al. developed the gated recurrent units (GRUs) recurrent neural network gating approach in 2014. The GRU has fewer parameters because it doesn't have an output gate, but it performs similarly to an LSTM with a forget gate.

RNN: RNNs are designed to handle sequential data, such as sentences or paragraphs, which is important for sentiment analysis since the sentiment of a sentence can

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often depend on the sentiment of the preceding sentence.In sentiment analysis, RNNs work by processing input text one word at a time and producing a hidden state that summarises the sentiment information learned so far. The hidden state is updated for each new word in the sentence, taking into account both the current word and the previous hidden state. This allows the RNN to learn the context of the words and how they contribute to the overall sentiment of the sentence.The final hidden state produced by the RNN can then be used to predict the sentiment of the sentence as a whole. This is typically done by passing the hidden state through a classifier, such as a fully connected neural network or logistic regression model, which outputs a probability distribution over the possible sentiment labels (e.g. positive or negative).RNNs are particularly useful for sentiment analysis tasks where the length of the input text can vary, since they are able to handle variable-length input sequences.

CNN: Convolutional Neural Networks (CNNs) are used in sentiment analysis to extract important features from textual data. They are commonly applied to the task of sentence classification where each sentence is treated as a sequence of words. CNNs employ filters that scan the sentence, and through convolution operations, they extract features such as n-grams, sentiment words, and word embeddings. These features are then fed into a fully connected layer for classification. CNNs have shown promising results in sentiment analysis due to their ability to capture local and global information from the input data. Additionally, they require less computational resources compared to recurrent neural networks.

Ensemble Method: Rather than using a single model, ensemble methods combine multiple models in an effort to increase model accuracy. The precision of the results is significantly increased by the integrated models. The popularity of ensemble techniques in machine learning has increased as a result.

Logistic Regression: Logistic regression is a statistical method for binary classification, which can also be applied to sentiment analysis. It uses a linear function to model the relationship between the input variables (in this case, the text data) and the binary output variable (positive or negative sentiment).

*Random Forest:*Random forest is a machine learning algorithm that can be used in sentiment analysis. It works by creating a forest of decision trees, where each tree makes a prediction about the sentiment of a particular input. The algorithm then aggregates the predictions from all the trees to make a final prediction. Random forest can handle large datasets with many features and has good accuracy. It can be trained on annotated data and then applied to new data to classify sentiment as positive, negative, or neutral.

K-Nearest Neighbours (KNN): KNN is a non-parametric machine learning algorithm that can be used for sentiment analysis. It is based on the idea that similar data points should have similar labels. In the context of sentiment analysis, KNN can be used to classify a given text by finding the k-nearest neighbours (i.e., texts with similar features) and using their labels to make a prediction.

Support Vector Machines (SVM): SVM is a popular machine learning algorithm used for classification tasks, including sentiment analysis of tweets. SVM works by identifying the best hyperplane (i.e., boundary) that separates the different classes in the data, such as positive and negative sentiment. It then uses this hyperplane to classify new data points based on which side of the boundary they fall on.

*Voting Classifier:*The voting classifier is a machine learning technique used in sentiment analysis of tweets on Twitter. It is an ensemble method that combines multiple algorithms to make a final prediction based on the outputs of the individual models. In this approach, multiple models are trained on the same dataset using different algorithms like decision trees, random forests, and support vector machines (SVM), each with its own strengths and weaknesses. Then, the voting classifier combines the predictions of all these models to make the final decision. This method has been shown to improve the accuracy of sentiment analysis on Twitter data and can be useful for analyzing large datasets with complex features.

Proposed Architecture and Development

The proposed architecture is based on GCR-NN with LSTM And BERT Tokenisation where feature selection is done using BOW feature and TF score or the polarity score. Along with the proposed deep learning architecture we have used an ensemble method of using a voting classifier. In the deep learning proposed architecture the whole model is an stacked ensemble with various different layers which has GRU, followed by CNN ,on which RNN is stacked for output accuracy and then LSTM with Bert tokenisation is added to enhance the accuracy of the whole model. While in the voting classifier we have various different machine learning models which are then further processed to get an higher advantage on accuracy . Followed by which a comparison is done on which model provides better accuracy on the given sentiment analysis.

V. FUTURE ENHANCEMENTS

We can add this same model on localised dataset for example Bangla language racism detection which can be used to detect racism as in a certain organisation and area and can be further deduced to other languages and context.Also further this model and website could you be used for live analysation of social media on a day to day basis just as GPS works though the processing time could be of an greater issue.

VI. EXPERIMENTAL RESULTS

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Fig.3: Home

Fig.4: User registration

Fig.5: user login

Fig.6: Main page

Fig.7: Userpage input

Fig.8: Model result

VII. Conclusion

This study focuses on the problem of the growing frequency of racist language on social media websites and proposes the use of sentiment analysis as a means of detecting negative sentiment and identifying tweets containing racist content. The study utilizes deep learning techniques, as in the use of a stacked ensemble model of LSTM and GCR-NN with BERT tokenisation along with the usage of another ensemble such as voting classifier, to effectively carry out sentiment analysis. The proposed model is evaluated alongside other models using a large Twitter dataset annotated with TextBlobs. The findings indicate that 31.49% of the 169,999 tweets surveyed were racist, and the GCR+LSTM +BERT +NN model achieved an impressive average accuracy score of 0.98 for positive, negative, and neutral sentiment classification. Notably, the model demonstrated superior performance in detecting racist tweets, with a 97% accuracy rate and only a 3% error rate. The study also compared the performance of machine learning models in identifying racist tweets, with both models correctly identifying 96% and 95% of such tweets, respectively, and misclassifying 4% and 5% of tweets as racist. These results suggest that deep learning methods, such as the proposed GCR-NN+LSTM+BERT model,offer potential for identifying and obstructing racist language on social media sites.

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Blockchain in E-Commerce

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Abstract—The new digitization trends have completely transformed or altered industries and traditional business models. Blockchain technology is now poised to completely transform and disrupt sectors, particularly those that depend on trust, like the financial industry. This innovation depends on the possibility that it is a public, shared, and sealed record that lets individuals who don't have the foggiest idea about one another or trust each other convey data in a reliable record where any sort of irrelevant, important data can be kept.

This work gives a hypothetical structure to looking at the impacts of blockchain innovation on the monetary area specifically and the writing overall. This thesis recognizes that blockchain innovation can possibly raise straightforwardness, decrease gambles by tying up less resources during exchanges, increment efficiency, and diminish costs like monetary exchange charges. While brilliant agreements are one of the most aggressive uses of blockchain innovation, the monetary area may likewise profit from different applications. It is still too soon to precisely foresee what the blockchain innovation will actually want to do, despite the fact that the innovation has a huge potential to upset the ongoing monetary framework. The most extreme hypothesis is that banks are not generally needed in light of the fact that to blockchain innovation. This thesis contends that, rather than becoming outdated as a result of blockchain technology, financial institutions are more likely to benefit from it. As an addition, we will map the data to blockchain wallets and also employ NFT smart contracts in place of conventional smart contracts to produce hash addresses, after which the data is transferred to an online IPFS server.

Keywords—Smart contracts, the financial sector, and blockchain technology.

I. INTRODUCTION

Information technology has already had a significant impact on industry and business procedures (Jaki& Marin, 2015). Then again, the internet has prompted the improvement of an extensive variety of novel business techniques and, surprisingly, entirely different monetary subsectors that were unbelievable only a couple of years prior. The genuine advantage of data innovation is that it makes altogether new and more powerful method for connection among individuals and organizations. Blockchain technology is the technology that deserves your attention right now. This relatively new technology will enable less secure and safer ways to conduct business alongside the Internet. This thesis inspects extra applications for the blockchain, which is regularly distinguished as the innovation behind the virtual money bitcoin. This thesis will rapidly make sense of what bitcoin is and why it might work as an elective money surrendered that bitcoins make virtually each of the information in present day blockchains. Regardless of this, the proposition expects to exhibit that the innovation isn't limited to only this application. In mark of reality, there has been a ton of analysis evened out at the utilization of this innovation in bitcoin for being fairly prohibitive. As per TheEconomist (2016b), it is vital for make a differentiation between the possibility of blockchains overall and the particular innovation that controls the virtual currency bitcoin. Buterin (2015), then again, underlines the qualification among public and private blockchains.

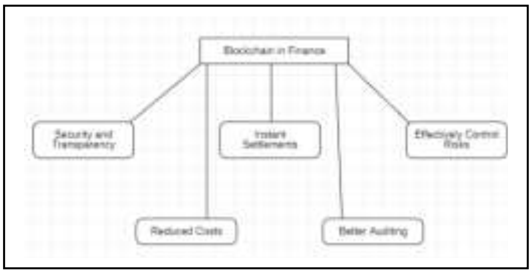

Fig.1: Example figure

Numerous applications made possible by technology need for cooperation and common standards across participants in the financial industry. As a result, this thesis briefly analyses the collaboration between a group of over 50 financial institutions worldwide and the financial technology start-up R3. This collaboration aims to advance blockchain technology and hasten its application to the financial industry. In the highly competitive banking industry, they are working together to establish clear guidelines for the use of this technology. Trautman attests that blockchain technology can possibly overturn and rebuild the financial business, notwithstanding every one of the difficulties it faces.

Blockchain technology will have a much broader impact than bitcoin, according to this thesis. Notwithstanding, it is too early to know precisely exact thing the blockchain will permit or when it will be utilized in the monetary area on the grounds that the innovation is still in its outset. Notwithstanding, there is a critical opportunity that it will disturb the current financial structure. By eliminating ineffective and costly middlemen from, for example, stock trading or international payments, financial institutions stand to benefit from cost reduction as well as increased productivity. Additionally, because blockchain-based procedures require less cash, risks are reduced. Nonetheless, the blockchain's dependability and openness help to increase public confidence in the financial system. Because some services may be more appropriate for the technology than others, it is important to underline that not all useful information should be included in blockchains. But according to this concept, financial institutions would benefit more from automating international payments and securities trading first because those processes have already been proven to be effective.

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II. Literature Overview

1. Blockchain and Bitcoin: Regulatory responses to cryptocurrencies:

This essay investigates Bitcoin from a legal and regulatory standpoint, providing significant insights. They start out by defining Bitcoin and highlighting its significance. They discuss issues with Bitcoin's use as a cryptocurrency implementation strategy. With this background on cryptocurrencies, we may now address the inescapable question: Is it legal? What are the currency's regulatory responses? Can it be controlled? They clearly explain why virtual currencies are important, why self-regulation has failed, and what can be gained from this. Finally, they arrive at practical and mostly permanent conclusions on the use of virtual currencies in general, the viability of mining currency on blockchains, and the depth of Bitcoin in relation to the advancement of block chain technology. They come to the conclusion that, much as Bitcoin may be Second Life a decade from now, blockchains might be a really revolutionary social technology similar to Web 2.0 social networks.

2. The Future of Banking: The Role of Information Technology:

This article looks at how information technology (IT) is changing both explicit foundations and the financial area overall. Albeit the essential financial matters of banking have not adjusted, technological advancements might entice establishments to participate in exchange banking (because of IT-driven cost efficiencies). Banks shouldn't, be that as it may, forsake relationship banking. If all else is equal, banks should adapt to customers' shifting tastes for IT-driven products and encourage IT advancements to update or maybe completely rethink relationship banking. Due to the introduction of FinTech startups and IT corporations into conventional banking industries, significant changes are also about to occur in the banking industry. Banks are given greater time to adapt thanks to government action and regulation. JEL L86, O33, G20, and G21.

3. Market Design for Trading with Blockchain Technology:

The so-called distributed ledger, which entails keeping a decentralized record of all transactions for a security, is a fundamental aspect of blockchain technology. Anyone with access to a distributed ledger may look up asset holdings using (anonymous) IDs. They contend in this study that the mapping between IDs and end-investors should be a decision made during market design. They investigate the impacts of the utilization of IDs and the connected straightforwardness of possessions on trading behaviour, trading costs, and investor welfare government assistance while integrating qualities of blockchain innovation into a hypothetical model of intermediaried and peer-to-peer trading. They discover that, notwithstanding the possibility of front-running, the setup with the most transparency results in the greatest investor welfare. In the absence of complete transparency and low levels of liquidity in the intermediated market, investors' welfare will be at its highest if they are forced to consolidate their assets under a single identity.

4. Bitcoin: A peer-to-peer electronic cash system:

Online payments can be done effortlessly from one party to the next without going through a banking institution using a peer-to-peer kind of electronic cash. Automated markings improve the arrangement in certain ways, but the main advantages are lost if a reliable outsider is still required to reduce copy spending. As a remedy to the double-spend issue, we suggest a distributed organization. By encrypting trades in a persistent chain of hash-based work verification, the organization timestamps transactions. This creates a record that cannot be altered without rehashing the evidence of work. Both the source of the most CPU and the request for times seen are supported by the longest chain. The hubs that aren't working together to seek the organization will create the longest chain and outlast rivals as long as they have the majority of the CPU.The actual organization doesn't need a lot of construction. Hubs could leave the company at any time and come back, using the longest confirmation of work chain as evidence of their absence. The best effort principle governs the transmission of messages.

III. Methodology

As every current application works on a single centralized server and if this server is hacked or crashes due to a heavy load of requests, the services will not be provided, we are using Blockchain technology in financial applications in this project. We can utilizedecentralizedBlockchain technology to solve this issue since it maintains data across numerous servers or nodes, ensuring that consumers can still access services even if one node goes down.

Blockchain stores data as blocks or transactions and assigns each block a distinct hash code. Before storing any new block, Blockchain verifies the hash codes of all existing blocks to ensure that no blocks have been attacked or altered. If this verification is successful, Blockchain will only then store a new block. Blockchain is said to be immutable since it cannot be attacked or have its data changed from the backend if the verification process fails because it won't store any new data. Verification will fail if altered.

The aforementioned benefits of blockchain are driving businesses to move from centralised servers to decentralised networks.

Customers and service providers are the two types of users we are creating for this project.

1) Service Providers: Service providers may register and log in to the application to see orders from customers, add new items, and more.
2) Users: Users may register and log in to the application, access all information about service providers, contribute funds to their wallets, and explore product descriptions to make purchases.

Blockchain uses smart contracts to store data, and SOLIDITY programming is used to create these contracts. Utilizing Truffle, SOLIDITY code may be deployed on Ethereum'sblockchain. Once deployed, the contract will

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yield an ADDRESS, which can be entered into a Python application to access the contract and save and receive data from the blockchain.

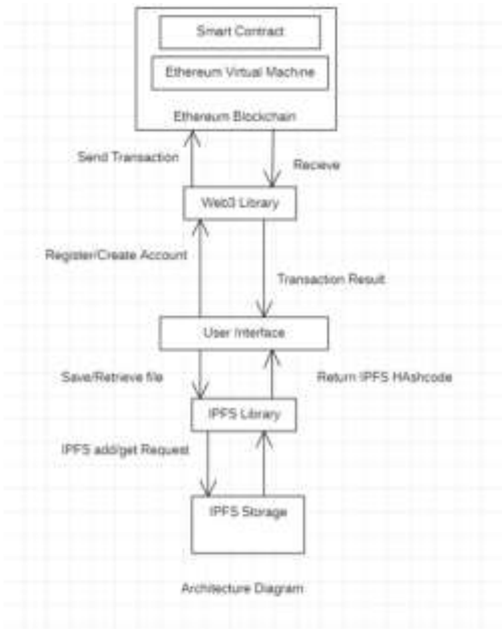

Fig.2: System architecture

In light of blockchain innovation, BITCOIN is a computerized cash that can be utilized for the purpose of trade without the need of an outsider that can be relied upon, similar to a bank. Alternatives to fiat currencies, virtual currencies function similarly to cash. The most popular and widely utilised virtual money nowadays is bitcoin.

Basically, BLOCKCHAIN TECHNOLOGY is a public, disseminated, and dependable record that is open to anybody. Furthermore, it is sealed, and that implies that whenever information is placed into the blockchain, it can't be changed without being seen. Technically, the ledger may include any sort of valuable intangible information. Because there is no need for trust between users of the blockchain technology, it is possible to conduct transactions without a middleman.

DISTRIBUTED LEDGERS are unmanaged, open databases. They are instead supported by several participants. In a distributed ledger, information is dispersed over thousands of locations as opposed to being centralised. A distributed ledger's characteristic is the blockchain technology.

The type of money that is currently used the most is the FIAT CURRENCY, which is a currency that is theoretically worthless but has been given value by a law or a government. Notes, which are really just pieces of paper but have gained value nonetheless, are examples of fiat currency.

Peer-to-peer networks are reliant upon hubs, or PCs all through the globe that are answerable for keeping up with the organization. It is a decentralized organization where hubs speak with each other and trade data without having a focal power.

IV. Technology

1. *Ganache*

Ganache is a private blockchain for quick creation of Corda and Ethereum distributed applications. Ganache may be used throughout the whole development cycle, allowing you to create, distribute, and test your dApps in a secure and predictable setting.A UI and CLI are the two kinds of ganache. An Ethereum and Filecoin desktop application called Ganache UI is available. For Ethereum development, we offer ganache, a more powerful command-line tool.

Fig.3: Ganachee Interface

2. *Metamask*

A software cryptocurrency wallet called MetaMask is used to communicate with the Ethereum network. Users can utilize a browser extension or mobile app to access their Ethereum wallet, which can then be used to connect with decentralized applications. ConsenSys Software Inc., a blockchain software firm that specializes in Ethereum-based infrastructure and tools, is the company behind MetaMask.Using Metamask, users may send and receive Ethereum-based cryptocurrencies and tokens, broadcast transactions, store and manage account keys, and securely connect to decentralized applications using a suitable web browser or the built-in browser of the mobile app.

A user's MetaMask wallet (and any other comparable blockchain wallet browser extensions) can be connected to, authenticated, and/or integrated with other smart contract capabilities by websites or other decentralized applications using JavaScript code. This enables the website to send action prompts, signature requests, or transaction requests to the user through MetaMask as an intermediary.

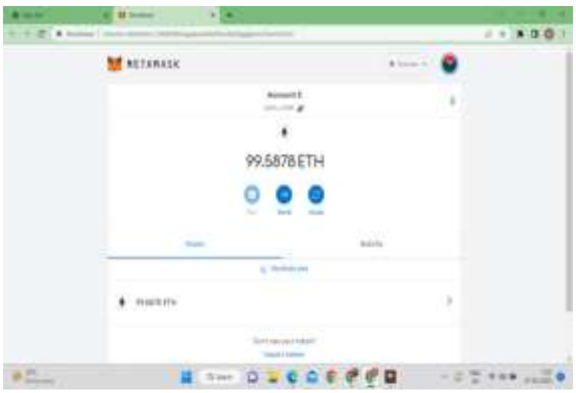

Fig.4: Metamask Interface

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3.Algorithms Used

3.1. NFT Smart Contracts

NFTs and smart contracts on the blockchain are the most exciting components (non-fungible tokens). Even yet, the similarities between the two concepts cause confusion for a lot of people. NFTs wouldn't exist without smart contracts, and an NFT smart contract is commonly seen as a single entity with shared goals.These smart contracts can be used in a variety of ways to manage and enhance digital assets. If you want to learn more about them, start by learning how non-fungible tokens interact with smart contracts.

Like cryptocurrencies, NFTs are digital assets that can only be owned by one person at a time. NFTs generally have a supply of just one specific digital token, in contrast to cryptocurrency tokens, which frequently have millions or billions of the same token in circulation. These resources are frequently linked to a link that opens an IPFS file (InterPlanetary File System). The unique token Number and metadata for the asset are provided to the NFT buyer as ownership proof.The ownership of NFTs is distributed through smart contracts, which are also used to create NFTs. Every time a new non-fungible token is issued, the smart contract immediately designates the creator as the owner. NFT smart contracts have the capacity to transfer the token to the new owner after a sale.

Below we can see the solidity code we used to implement NFT Smart Contracts.

Fig.5: NFT Smart Contracts

V. Results

Shows the Main Screen, that a user or a service provider may see.

Fig.6: Main Screen

Shows the User interface used for registering details

Fig.7: User signup

The service provider may add any number of products that is shown up here.

Fig 8: Adding new products.

Users may view each and every service provider details.

Fig.9: View Service Providers.

User has an option of adding money to the wallet that is shown up here.

Fig.10: Add money to wallet.

User can search a product that has been added by the service provider.

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Fig.11: Search product

Whenever we do a transaction, it is updated here in the form of blocks, and this is done using NFT Smart Contracts.

Fig.12: Ganache Blocks

VI. Conclusion

This thesis took a gander at the likely purposes of blockchain innovation in the monetary business and stressed the pertinence and worth of the innovation. The blockchain innovation is pertinent to substantially more than just the virtual cash bitcoin, as this proposition concedes. As a general rule, this theory proposes that bitcoin is a pretty disappointing utilization of this innovation since it permits clients to send and get cash namelessly, which energizes problematic applications. Different purposes for the blockchain innovation have been canvassed in this thesis by referring to recently distributed works. As an addition, we added the data to blockchain wallets. Additionally, we'll employ NFT smart contracts rather than conventional smart contracts to produce hash addresses, and the data will then be successfully delivered to the IPFS server.

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Autonomous Trajectory Planning For Unmanned Aerial Vehicle

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***Abstract*—Unmanned aerial vehicles (UAVs) have a significant problem in autonomous navigation in new or unpredictable situations. To address this issue, the system produces a path between two points, and the drone is commanded to follow this path based on its location. In this study, we provide a novel framework for autonomous UAV route planning based on deep reinforcement learning. The goal is to approach moving or stationary targets using a self-trained drone (UAV) as a mobile aerial unit in a 3-D urban setting. UAVs, particularly rotary- wing aerial robots such as quadcopters, offer a high level of mobility, making them appropriate for a wide range of activities and applications. To provide a safe autonomous flight with limited mission time or battery life, the most efficient path must be determined. The quadrotor UAV in our trials continually monitors its position and battery level and modifies its course accordingly. We simulate the behaviour of autonomous UAVs in several conditions, including obstacle-free and urban environments. Our findings show that the UAV is capable of choosing clever paths to its objective.**

I. Introduction

UAVs can be remotely piloted by humans or capable of autonomous flight. They are often used by the military and police when it is too risky to send a human-piloted aircraft, or when it is impractical to use a manned aircraft. The International Civil Aviation Organization, or ICAO, refers to UAVs as unpiloted aerial vehicles or remotely piloted aircraft. UAVs have already revolutionized military and special operations, and their use is expanding to a variety of other applications. Commercial drones are smaller versions of consumer drones that are used for commercial purposes. Users typically control the speed and altitude settings when these drones take off. Delivery drones can withstand extreme temperatures and high winds, making them ideal for delivering packages quickly. Amazon is currently developing a drone delivery system that promises todeliver items within 30 minutes of payment. Commercial drones are also used for surveillance, including monitoring livestock, mapping wildfires, securing pipelines, and patrolling roads and homes. They are also useful for commercial and film production. Utilizing this technology can speed up services and improve efficiency in various industries.

II. Background

Drones that are autonomous are unmanned air vehicles (UAVs) that do not require a human pilot and depend on navigation and operating software driven by Artificial Intelligence (AI). Originally developed for military missions that were too dangerous or uninteresting for humans, by the turn of the twenty-first century, UAVs had become essential assets for most militaries worldwide. As control technologies improved and costs decreased, the use of UAVs in non-military applications has increased, including emergency response by crew members in the field. Drones are categorized based on their altitude range, endurance, and weight, and they are utilized for a variety of objectives, including military and commercial uses. UAVs today perform a variety of tasks, including climate change monitoring, search and rescue operations during natural disasters, photography, videography, and package delivery. The military's most well-known and controversial use of drones is for reconnaissance, surveillance, and precision strikes.

III. Literature Survey

This paper [1] presents a novel implementation of model-based reinforcement learning (RL) as a high-level control mechanism for self- navigation of unmanned aerial vehicles (UAVs) in unfamiliar or unpredictable settings with short battery life. The suggested technique was tested in a simulated environment using a quadrotor UAV, and the findings show that the system can learn an effective trajectory in a few iterations and perform actions in real time. The experiment also revealed that TEXPLORE, the model-based RL algorithm, significantly outperformed the Q-learning-based method. This is a promising step toward enhancing the autonomous behavior of UAVs, and it highlights the potential of RL frameworks in addressing the challenges faced by UAVs in autonomous navigation.

The Author of this paper [2] Path planning, localization, and control procedures are included in this strategy for autonomous drone delivery jobs. The recommended method evaluates quadrotor posture using computer vision algorithms and UWB sensors, and an enhanced Kalman filter allows a sensory combination with the DJI-SDK stance of the drone.. A vector field-based controller issues the orders that allow the drone to go from its launch site to its landing platform. The experimental results indicate that the suggested strategy is suitable for a full autonomous delivery operation, and that the proposed localization method outperforms the DJI-SDK posture estimation alone during landing attempts. In addition, the system is proven to be robust in the event that one of the localization strategies fails.

However, there are still obstacles to overcome, such as the need for GPS-capable environments devoid of obstructions and known and constant load mass. Future works will address these concerns, as well as mechanical design considerations and the adjustment of controller parameters for smooth flight and landing precision.

In this paper [3], The proposed framework for autonomous UAV navigation in urban environments is

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based on deep reinforcement learning using a DDPG algorithm with a continuous action space. The objective of the framework is to train the UAV to determine its trajectory to reach a designated target while avoiding obstacles. The framework employs a transfer learning strategy to maximise the reward function, which is designed to balance select direction and hurdle penalty. The simulation findings show that the Quadcopter may acquire knowledge how to maneuver in real-time and avoid collision with objects.

The proposed framework has potential applications in various areas, such as parcel delivery, search and rescue, and surveillance. However, there are still some challenges to overcome, such as the accuracy of the obstacle detection system, which can affect the performance of the UAV. Additionally, the proposed framework is currently limited to numerical simulations, and it needs to be validated in real-world scenarios to assess its effectiveness and robustness.

In conclusion, the proposed framework presents a promising approach to overcome the challenges of autonomous UAV navigation in urban environments. By using deep reinforcement learning, the UAV can learn to navigate in real-time and reach its goal while avoiding hurdles. The framework has potential applications in various areas and can be further improved by addressing the existing challenges.

In this paper [4], The construction of a general drone navigation system that can navigate the drone to the issue area using data from onboard sensors is discussed. This is especially significant in risky and safety-critical circumstances when issue identification must be swift and accurate. The technique presented in the study combines Policy optimisation at the proximal level Deep reinforcement learning is combined with progressive module development and neural networks with long- term, short-term memory to build an adaptive and autonomous system capable of decision-making. To show accuracy and efficacy, the study compares multiple system configurations to a heuristic technique. Finally, the paper discusses the importance of ensuring the safety of the drone in real- world scenarios, and evaluates the performance of the drone using the developed navigation algorithm. Overall, the paper presents a promising approach to the development of mobile robots that are adaptable and autonomous, with decision-making power, for use in monitoring and data collection in various environments.

In this paper [5], offers a new handover technique for a drone system with wireless connectivity. that use reinforcement learning to optimise handover decisions while also ensuring strong Support for communication over wireless networks and mobility for drone user equipment (UEs). The Q-learning method is used to optimise handover decisions for a particular flight trajectory in real time, and the reward function may be changed to balance the number of handovers with the received signal intensity.

While the simulation findings show considerable gains in minimising the frequency of handovers while maintaining stable connectivity, the study has several drawbacks that require more investigation in the future. To begin, the existing framework only addresses drone movement in two dimensions; the next natural step is to enable three-dimensional mobility of drones. Second, the testing region and flight routes explored in this work are extremely limited, and it would be interesting to see if the results are valid for wider trial regions and extended flight paths with a bigger possible cell pool. Finally, because the proposed framework and experiments are based on an indication of received signal intensity, (RSRP), future research may consider adding additional parameters to the model to improve its performance.

This paper [6] focuses on the creation of an autonomous drone navigation system for package delivery, with the major tools being GNSS and a compass. The primary purpose of the research is to give critical medical assistance for emergency situations and to integrate them in Indonesian agriculture, in accordance with Society 5.0's great mission and big data. To simplify autonomous navigation throughout the transmission process, the proposed navigation algorithm makes use of course- over-ground data. In the trial, the proposed method proved effective in allowing a drone to duplicate a package delivery operation with enough navigation and acceptable landing site variance. However, the data showed that the distances smaller than 1 m, guidance using the field-over-ground strategy is not any more effective than navigation using GNSS and compass.

The proposed system has several features, including altitude and speed settings, interactive sensors for item delivery, and a user-friendly mobile application interface. The system can operate independently from the Ground Station, enabling a drone and mobile application to perform a delivery mission. The navigational algorithm established in this study might have potential uses in other sectors, such as drone combat, and could be further refined and adapted to travel from any distance and for any purpose utilising more accurate and adaptable algorithms.

Overall, the research presented in this paper provides insights into the development of autonomous drone navigation systems for package delivery and highlights the potential applications of such systems in various fields.

Delivery via Autonomous Aerial Vehicles (UAVs) is thriving. In this paper [7], Deep reinforcement learning is used in a unique approach for autonomous navigation of UAVs in complicated, unfamiliar surroundings. The approach does not rely on course planning or map construction, instead relying on sensory data from the surrounding environment and GPS signals. The navigation problem is modelled as a partly observable Markov decision process (POMDP), and an actor-critic architecture-based quicker method for POMDP policy learning is developed. The suggested method's usefulness is evaluated by simulations in five virtual settings, and the findings show that it is successful in allowing UAVs to travel securely and effectively in complex, unfamiliar surroundings.

This paper [8] suggests an approach Based on the new details, I gather that the study provides a deep reinforcement learning-based solution for autonomous path planning for UAVs in situations with many obstacles. Based on the Twin Delayed Deep Deterministic Policy Gradients (TD3) algorithm, the proposed technique comprises a two- stream

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Actor-Critic network structure that captures environment attributes from both observations and changes in observations to account for environment randomness and dynamism. In terms of flexibility and generality, the method surpassed DDPG and regular TD3 in simulated settings. The proposed technique enables drone to navigate safely in dynamic and heterogenous environments, which is crucial in scenarios like search and rescue and surveillance.

In this paper, [9] The project aims to address the problem of a single unmanned aerial vehicle (UAV) performing integrated detection, mapping, and navigation in an unknown area. The UAV is furnished with a low-complexity radar for this purpose, and its trajectory is tailored to optimise mapping precision while avoiding places where data may not be relevant for target identification. The Markov decision process (MDP), with the drone operating as an agent that infers its own navigation strategy using Either a state estimator or a reinforcement learning (RL) approach is used for identifying targets and area mapping. The results of the numerical simulation validate the proposed method, emphasising the UAV's capacity to explore regions with a high likelihood of target detection while autonomously recreating the surrounding environment.. Overall, this paper provides a uniqueapproach to dealing with the difficulty of combining identification, the mapping, and navigational instruction for a single UAV, which might have important implications in sectors such as emergency response, monitoring and tracking the environment.

In this paper{10], A reactive controller based on neural networks enabling micro UAVs to manoeuvre independently in unexpected outside environments. Control signals are generated by the controller utilising current sensor data rather than optimisation or configuration space searches, which reduces processing requirements. To address the navigation problem, which is modelled as a Markov Decision Process, deep reinforcement learning is applied. In addition, the authors present model explanation approaches based on feature attribution to give both visual and textual explanations of flying decision- making results. Global assessments can also be performed by the trained neural network will be evaluated and improved by professionals. The outcomes of the simulation demonstrate that the suggested technique gives an adequate justification for the generated module, which is advantageous for both first-time users and controller architects. The real-world testing show that the reactive controller works. outperforms conventional approaches using the same computational resources.

Using a PID+ Q-learning algorithm, [11] This study describes a system for employing reinforcement learning to enable unmanned aerial vehicles (UAVs) to navigate in areas where an accurate mathematical model may not be accessible. To illustrate the effectiveness of the suggested strategy, the authors conducted both simulation and actual implementation trials. The technical elements of implying reinforcement learning algorithms to drone systems and UAV flight programs were also discussed, with the goal of furthering research in this subject for critical applications like as wildfire monitoring and search-and-rescue operations. The proposed method is able to deal with environmental uncertainties, such as wind and other environmental dynamics, and provides a simple and effective solution for training UAVs to navigate in unknown environments.

IV. Methodology

A simulation in the MATLAB environment to validate the RL-based navigation concept for a quadcopter. The quadcopter's mission is to navigatefrom the starting position to the target position in the most efficient manner possible, with the ability to adjust the linear/angular velocity. The simulation uses a motion capture system to provide the quadcopter's position relative to the environment. The system uses a PID controller to facilitate the quadcopter's action and examines the system's behavior in specific scenarios. The framework's effectiveness is visualized in terms of error rate and task completion. The experiment is designed to illustrate a quadcopter whose mission is to find the most efficient route to the destination while monitoring its battery level and making intelligent decisions, such as rerouting for battery recharging at intermediate intervals. The quadcopter is viewed as a rigid body to which torques and forces are applied by four square-shaped rotors. The simulation uses a predetermined path in trajectory mapping, and the quadcopter is programmed to follow the calibrated trajectory to reach its destination.

V. Result

After building a model, it is very important to know the mapping ability of the model for new instances. You might want to try different paths with the model for the same Trajectory map, and then simply compare them in terms of performance. The shortest path must be selected and the time taken for the drone to reach the destination should be minimum also the endurance of the UAV must be considered during the real-time testing. This model implements a set of position states precisely by location, heading, turn curvature, and turn direction to generate a trajectory consisting of a collection of waypoints. The predefined data contains poses for specific locations where the toy quadcopter utilizes its cameras, allowing the pilot on the ground to estimate the altitude of the snow on the roof. Each of the supplementary power generators has three no-fly zones so that, in the event of a quadcopter malfunction, it does not cause damage to campus infrastructure. The red line represents the flight path, while the black x-markers indicate a change in trajectory or a particular pose. Poses are accompanied by blue lines that indicate the direction to a particular waypoint. Green circles indicate no-fly zones. The next part, Importing the mamo model UAV for the implementation of the proposed model to simulate in the defined Path.

The overall performance of the drone simulation was successful, The pre-planned Trajectory helped the drone to follow the given route and make travel from the source to the destination point with a minimal amount of time. The trajectory calibration is the difficult part of this project as it has to consider many obstacles and environmentalcongestion for any accidents or loss of control of the drone. Even though this project was done in a virtual

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environment it has to follow a certain path and No- Fly zone area to be avoided collision with a building or an object that is created in 3D Modelling.

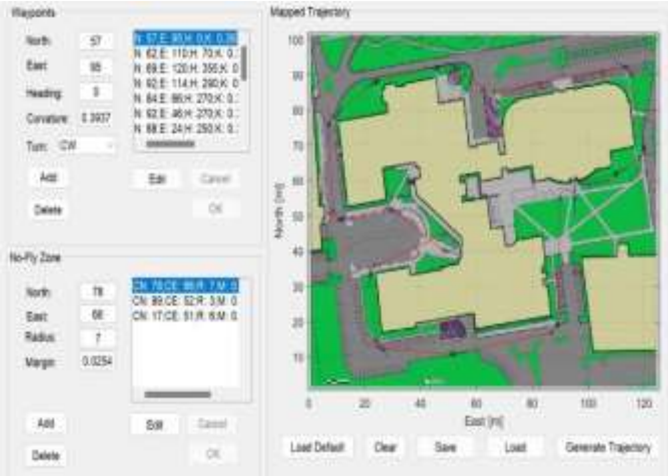

Fig. 1

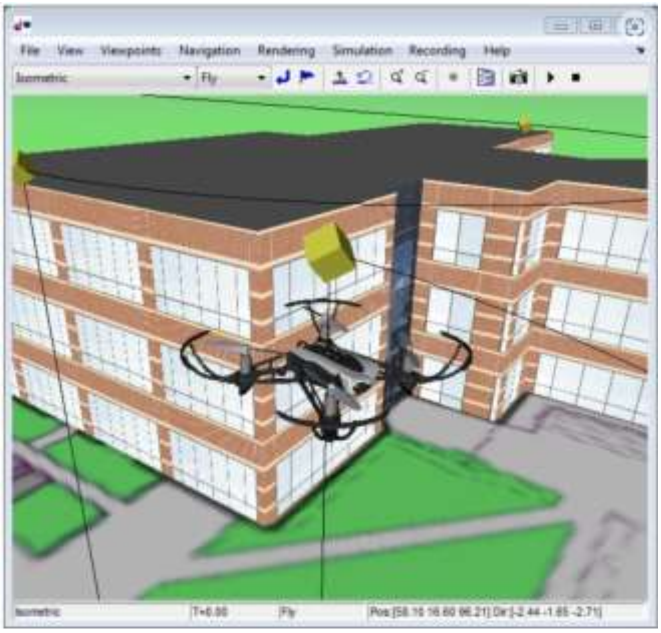

Fig: 2

FUTURE ENHANCEMENTS

Future research will concentrate on conducting experiments with quadcopter UAVs equipped with Reinforcement Learning and Obstacle avoidance and will investigate the difficulties of operating in the continuous domain. We also intend to achieve improvements in path planning, taking into account obstacle avoidance and power efficiency. Implementing reward-based reinforcement learning canimprove the capability of path planning, and the use of YOLO or SSD can improve obstacle avoidance by combining a camera and sensors to have both visual and sensory types of assistance for preventing accidents or damage to the unmanned aerial vehicles.

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Agro Prognostics Based on Characteristics of the Agricultural Environment Using Machine Learning

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***Abstract*—Agriculture is an important field of study and agricultural forecasting is an important aspect that depends on a lot of factors. In the past, farmers were free to choose their crops based on factors such as soil composition, rainfall, humidity and temperature conditions. They then observe the growth of these crops and determine the ideal time to harvest them. However,due to rapidly changing environmental conditions, this approach is no longer sustainable.**

Crop forecasting has become predominantly reliant on machine learning techniques in recent years, which have been extensively employed in this area of research. To ensure that machine learning models perform with high accuracy, it is important to use efficient feature selection methods to preprocess uncleaned and basic data and create datasets suitable for machine learning. Only data features that are highly relevant to defining the final model output should be used to eliminate redundancy and improve model accuracy. it is of utmost importance to select the most appropriate features for a model, ensuring that only the most relevant ones are incorporated. Failure to consider the significance of the data characteristics during the modeling process will result in an unnecessarily intricate model, incorporating all the features of the raw data.

Also, adding features that don't contribute much to a machine learning model increases temporal and spatial complexity, which hurts its accuracy. The results of this study demonstrate that the ensemble approach outperforms current classification techniques in terms of predictive accuracy.

***Keywords*—Agriculture, classification, Agro Prognostics, feature selection.**

I. INTRODUCTION

Agricultural forecasting is a complex process in agriculture that requires the use of multiple data sets due to the reliance on the process of sowing seeds is dependent on both living and non-living factors. Biological factors include environmental components resulting from the direct or indirect action of living species (microbes, plants, animals, parasites, predators, pests) on other living organisms, as well as human variables such as fertilization, protection of plants, irrigation, air, and water pollution, soil quality. These factors lead to various variations in crop production, such as internal errors, yields. Abiotic and biotic factors have an impact on the environmental formation, development and quality of plants. Abiotic factors include physical, chemical, and other factors such as mechanical vibration, radiation, climatic conditions, soil type, topography, atmosphere, and water chemistry.

Chemical components such as environmental toxins, nitrogen fertilizers, pesticides and heavy metals also play a role. Abiotic factors such as bedrock, topography, climate and water conditions all impact crop quality. Soil formation variables also have broad impacts on soil formation and agricultural values.

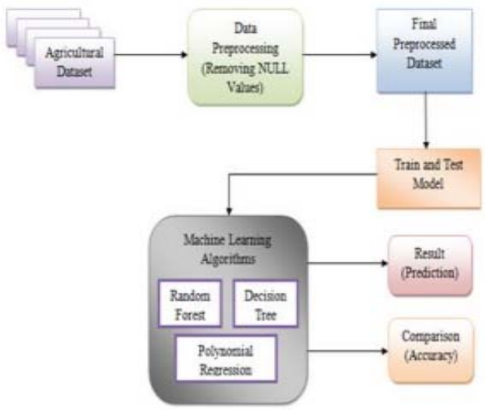

Fig.1: Example figure

Analyzing the agricultural production process is a difficult and complex task. strategies are essential for predicting crop area, which is a continuous improvement optimization process. These strategies can also be used in the design, development and formulation of new and improved products. However, to perform statistical analysis, it is necessary to have access to numerical data, which allows to make inferences about different events and thus to take binding economic decisions.

According to Muriithi [6], the representation of a specific event numerically increases the amount of information that can be obtained, and the improved data quality allows for more accurate information and more accurate decision making.

II. LITERATURE REVIEW

Using naive Bayes classification techniques to classify improved agricultural land soils:

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The proliferation of computing and data storage technologies has led to the accumulation of large amounts of data. Extracting useful information from this raw data has always been a challenge, which has led to the development of new methods and techniques such as data mining, which help bridge the knowledge gap. This study aimed to evaluate these new data mining methods and apply them to soil science databases to determine if relevant associations could be found. The Department of Soil Science and Agrochemistry of SV College of Agriculture, Tirupati provides an extensive soil database containing soil profile measurements from many locations in Chandragiri Mandal, Chittoor district. This study investigates whether soils can be classified using different data mining methods.

In addition, a comparison of naive Bayesian classifications is performed and the best performing methods are analyzed. The results of the study could have wide applications in agriculture, land management and environmental protection.

Biotic factors

Potato production in Canterbury has remained steady at around 60 tonnes per hectare for the past decade. However, potato growth models predict potential yields as high as 90 tonnes/ha, which some commercial growers have already achieved. A two-year study conducted by industrial and academic partners examines constraints to agricultural production. During the first growing season, 11 transformed crops were fully evaluated, including tests for final yield, plant health and soil quality. Persistent reasons for declining yields have been found to include soil-borne diseases such as Rhizoctonia stem canker and sponge root infection, as well as subsoil compaction and poor management. irrigation.

A crop history of potatoes grown over the past decade has resulted in more rapid development of Rhizoctonia stem canker symptoms (by emergence) compared to periods of grass growth and non-crop areas previous potato crop (8 weeks after emergence). In year two, a controlled field trial was conducted on a cash crop known to have high levels of soil-borne pathogens to identify and quantify the impact of soil-borne diseases. on performance. The treatments consisted of soil fumigants (90, 112 and 146 kg/ha of chloropicrin) without pesticide control before the application of azoxystrobin (1.5 L/ha) or fluosulfa (400 mL/ha). DNA testing of soil-borne pathogens before and after treatment showed a slight decrease in DNA levels of R. solani and subterranean sponges in soil (plots treated with the fumigant), but results varied. considerably.

The final total fresh yield averaged 58 tonnes/ha and was unaffected by the treatment. The severity of R. blight on rhizomes treated with azoxystrobin was consistently lower than all other treatments throughout the season.

Response surface methodology: A retrospective and literature survey

Response Surface Methodology (RSM) is a combination of statistical design and numerical optimization methods used to improve process and product design. The roots of exploration in this field trace back to the 1950s and have garnered extensive utilization, notably within chemical and process industries. In recent times, RSM has undergone a gamut of inventive upgrades and has found diverse applications over the last 15 years. Our analysis focuses on RSM developments since 1989, highlighting contemporary fields of investigation and recommending potential avenues for future inquiry.

Utilizing response surface methodology to enhance potato tuber production:

The study investigated the optimal operating parameters for obtaining maximum yields of potato tubers in Kenya, with the aim of helping potato growers reduce input costs. To achieve this goal, the authors used a 2 3 factorial design and response surface methods to improve the potato manufacturing process. Using response surface methodology, the authors studied and optimized the combined effects of the mineral nutrients of water, nitrogen, and phosphorus. They determined that the optimal production parameter for potato tuber yield was 70.04% irrigation water, 124.75 kg/ha of nitrogen in the form of urea and 191.04 kg/ha of phosphorus in the form of triple superphosphate. Under ideal conditions, a 1.8m x 2 plot can produce up to 19.36kg of potato tubers.25 meters. Increasing potato production could improve livelihoods and reduce input costs for smallholder potato farmers in Kenya. Additionally, the methods used in this study can be applied to other crop studies to better understand overall crop productivity.

Enhancing potato crop yield forecasting through the integration of cultivar details and unmanned aerial vehicle (UAV) remote sensing data via machine learning:

Precision agriculture requires accurate yield maps to identify patterns of geographic variation in yields, identify key variables driving yield variation, and provide site-specific management information. Yield forecasting of potato (Solanumtuberosum L.) tubers using remote sensing is critical, as cultivar variation can have a significant impact on yield predictions. with a machine learning approach using unmanned aerial vehicle (UAV) remote sensing.

In the years 2018 and 2019, various cultivars and levels of nitrogen (N) were tested on small plots to assess their effectiveness.

Gather multispectral imagery via drones at different stages of plant growth and employ machine learning algorithms like random forest regression (RFR) and support vector regression (SVR) to integrate multiple plant metrics with varietal data. The research discovered that spectral data obtained during the onset of tuber initiation (in late June) exhibits a stronger correlation with marketable potato yields compared to data obtained during the maturity of the tuber in the later stages of the growing season. Nonetheless, the optimal nutrient markers and time for anticipating potato yields differ depending on the potato variety. Model that do not use variety information. Further research is needed to improve potato yield predictions by combining more specific data on varieties, soil and landscape characteristics,

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management data and advanced machine learningAlgorithms.

III. METHODOLOGY

Assessing agroclimatic parameters that influence the production of winter plant species in the temperate temperature zone, primarily grains, presents a significant challenge. The primary factor that impacts wintering yield is the number of days with temperatures above certain thresholds, such as 5 degrees Celsius, as well as the frequency of these days and the number of days with temperatures above 0 degrees Celsius and 5 degrees Celsius during the wintering period. While some of these parameters can be approximated using public data, fluctuations in these components pose a challenge. Accurate predictions of agrometeorological parameters are crucial for precise production forecasting, especially in light of rapid changes in environmental circumstances that make farming increasingly challenging.

Disadvantages

Despite the progress made in the field of agro analytics, there are still various challenges that need to be overcome, including the need for improved crop forecast models that account for soil and environmental factors such as rainfall, humidity, and temperature. In this regard, a research study proposes an enhanced crop forecast model that uses two essential techniques: feature selection (FS) and classification. The research study utilizes sampling approaches to balance an unbalanced dataset before using FS methods to identify data characteristics that are highly important while checking the end output of the model.

Advantages

One of the advantages of this proposed model is that it avoids redundancies and improves the accuracy of the machine learning model by only including data characteristics with a high degree of importance. Additionally, an ensemble method outperforms the previous classification technique, resulting in increased prediction accuracy. This improved crop forecast model has the potential to overcome some of the difficulties in predicting agrometeorological parameters for winter plant species, particularly grains, and provide farmers with more accurate information for decision-making in the face of rapid environmental changes.

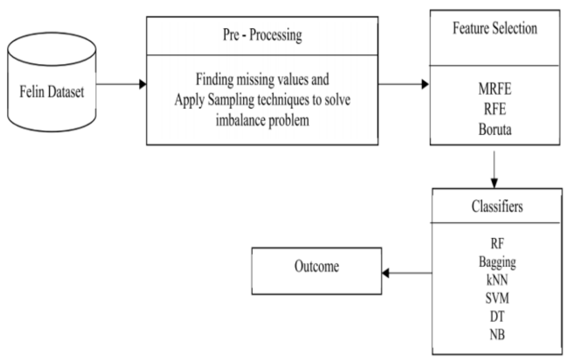

Fig.2: System architecture

Modules

- The following modules were developed for the project at hand:
- Data Exploration: This module will facilitate the input of data into the system.
- Data Processing: This module will read and process the input data.
- Train-Test Split: This module will be used to separate the data into training and testing sets.
- Model Generation: This module will be responsible for building the machine learning models, including models with and without feature selection. The feature selection techniques to be used include SMOTE, ROSE, RFE, MRFE, BORUTA, and MEMOTE. The machine learning algorithms used for model building include Naive Bayes, KNN, Bagging Classifier, Random Forest Decision Tree, SVM, Gradient Boosting, and Voting Classifier. The accuracy of the algorithms will also be calculated.
- User Signup and Login: This module will enable users to register and log in to the system.
- User Input: This module will allow users to input data to be predicted.
- Prediction: The final prediction will be displayed through this module.

IV. IMPLEMENTATION

Algorithms

KNN (K-Nearest Neighbor): KNN is a supervised machine learning algorithm that can handle both classification and regression problems. In this algorithm, the number of nearest neighbors (denoted by "K") of a new unknown variable is used to predict or rank the variable.

Naive Bayes: Naive Bayes is a probabilistic classifier based on a probabilistic model with high independence assumptions. The algorithm assumes that the input variables are independent, which may not be the case in reality.

Bagging Classifier: A Bagging Classifier can be thought of as a team of base classifiers that work together to make predictions. Each member of the team is trained on a random sample of the original data, and their predictions are combined to form a final output. This technique is particularly useful for reducing the uncertainty of complex machine learning models.

Random Forest: Random Forest is a supervised machine learning algorithm that can handle both classification and regression problems. It is based on the idea of ensemble learning, which consists of integrating several classifiers to improve the performance of the model. A random forest consists of many decision trees over different subsets of the provided dataset, and the end result is a majority vote based on predictions.

Decision trees: Decision trees use several methods to determine whether a node should be split into two or more child nodes.

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SVM (Support Vector Machine): SVM is a popular supervised learning method used for classification and regression tasks. The SVM algorithm is designed to find the best straight line or decision boundary for classifying an n-dimensional space so that new data points can be easily assigned to the correct class in the future. The optimal choice boundary is represented by a hyperplane.

Gradient Boosting is a powerful technique in the realm of machine learning, widely applied to tackle regression and classification challenges. Essentially, it constructs a predictive model by aggregating a series of feeble models, which are usually decision trees. By leveraging decision trees as weak learners, the method is commonly referred to as boosted gradient trees.

Speech Classifier: A speech classifier is a machine learning estimator that trains multiple base models, or estimators, and makes predictions based on the results of each base estimator. The voting decisions from each estimator output can be aggregated to make a final prediction.

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Air Quality Prediction Using Stacking

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***Abstract*—The atmosphere is the most important resource required for the survival of all living beings including plants. The air quality is depleting at a faster pace due to growing industries, construction of houses and the excessive use of vehicles due to the rapid growth of population. Air quality is described as to be the degree which the air is clean in a particular area.As India grows in areas of industrialization and urbanization, the air quality is also slowly depleting due to the emission of harmful gases and particles by industries and vehicles. Every household has at least one car and this also adds up to the problem of depleting air quality in different areas. The aim of this study is to apply a Stacking Ensemble Model in order to make predictions about the air quality of a specific location in India, Stacking Ensemble Model is built on regression models such as Gaussian Process model, Support Vector Regressor Model, Stochastic Gradient Descent Regressor model and the AdaBoostRegressor Model.**

Keywords*—Air Quality, Prediction, Gaussian Process Regressor, Support Vector Regressor, Stochastic Gradient Descent Regressor, Stacking Regressor, Ensemble Technique.

I.INTRODUCTION

The earth's atmosphere is comprised of gases and is an essential component of the planet's physical system. Nitrogen and oxygen make up majority of the atmosphere at sea level, accounting for 78% and 21%, respectively. Other gases, such as carbon dioxide, hydrogen, helium, and noble gases, are present in small quantities. The atmosphere serves to protect life on earth by regulating temperature, moderating the differences between day and night, and shielding the planet from harmful UV radiation.

Air pollution is a significant issue for many nations throughout the world, and it significantly contributes to the rise in health issues such as breathing difficulties, heart rhythms, lung dysfunction, the emergence of cardiovascular and respiratory disorders, etc. Particulate matter is made up of very minute liquid and solid particles that are suspended in the atmosphere.

PM2.5, in contrast to other pollutants, is particulate matter made up of particles with a diameter of no more than 2.5 micrometres. These specks are so small that they can get inside the nose, lungs, and the bloodstream.

Urban areas are majorly affected by air pollution as they are surrounded by industries, construction premises and lot of vehicles on the road. Industries release a lot of smoke and harmful gases into the atmosphere that it becomes dangerous for residents living nearby to breathe the air as it will affect their health adversely. Cities are growing in population as they are developing better, and residents are having a better life in cities. Due to this growth, there is a need for more space to build houses and this leads to increase in deforestation. Trees play a key role in purifying the atmosphere but these air purifiers are removed which increases the chance of air pollution. Cars, trucks and motorbikes release a lot of smoke in the air that it becomes difficult to breathe the air.

Predicting the air quality is very important as it will alert us about the possibility that we might be breathing harmful air and we need to be aware of it. It also helps us to understand the need for protecting the air so that we will have clean air to breathe in the near future. Stacking is an ensemble technique that teaches the model how to mix predictions from Base models and meta-models to create a final model with accurate predictions.

II.MOTIVATION

The need of the hour is to be able to breathe good quality air. All parts of the world is facing the problem of air pollution and it needs to be reduced so that there will be safe and clean air to breathe in the future. It is very important to create awareness and the need to treat this natural resource with great care so that it will sustain for the future. We have used a few regression models and to improve their accuracy we have built it with the help of the stacking algorithm.

III.RELATED WORK

The researchers employed two machine learning models, that’s ANN and GPR to forecast the quality of air in six Indian cities. The R-values obtained for ANN and GPR were 0.96 and 0.98, respectively. The GPR model outperformed the ANN model with lower RMSE, MAPE, and MAE values of 21.40, 7.89%, and 13.58, respectively. The results suggest that GPR is a promising approach for predicting air quality in Indian cities [1].An exploratory data analysis is conducted to reveal new insights, identify concealed trends, and identify harmful substances that may affect air quality directly. The authors employed five different models namely, KNN, GNB,SVM, Random Forest and XGBoost to predict the air

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quality and concluded that Out of all the models tested, the XGBoost model had the highest performance, achieving an R-squared score of 0.83. This result was better than any other model evaluated.[2].A comparison analysis on how air quality has affected regional and national lockdowns. After conducting the research, it was discovered that during the nationwide lockdown, air quality improved by 33% in industrial areas, 41% in commercial areas, and 15% in residential zones. However, during the regional lockdown, these rates increased to 53%, 46%, and 43%, respectively [3]. A new method was proposed that employs both the Genetic Algorithmand LSTM deep learning algorithm. The results of this method were highly accurate, with an RMSE of 9.58 when forecasting air quality. [4]. Forecasting the air quality can be achieved by combiningLSTMand GRU deep learning algorithms. The effectiveness of this LSTM-GRU fusion was evaluated by comparing it with various other models such as KNN, Linear Regression, SVM, LSTM, and GRU.After comparing their performances, the hybrid model was found to be more effective than the independent models, producing a mean absolute error (MAE) value of 36.11 and an R-squared (R2) value of 0.84. [5]. An analysis of pollutant emissions in China, using a roadmap of carbon neutrality and evolution of clean air policies. The researchers utilized an air quality model to simulate the levels of O3and PM2.5 pollutants at the regional and national levels for three specific years: 2030 (the year of carbon peak), 2035 (in line with the "Beautiful China 2035" initiative), and 2060 (the year of carbon neutrality).The study found that in each of these years, emissions of main PM2, NOx, SO2 and VOCs are expected to decrease by 44%, 42%, 42%, and 28%, respectively [6].A study on the levels of four major pollutants, namely PM2.5, PM10, O3 and NO2 in Baghdad before the lockdown withfour partial intervals and total lockdown from March to July 2020. It was found that during the first partial and whole lockdown from March to mid of April,concentrations of PM2.5, PM10, NO2 decreased by 8%,15% and 6% respectively whereas concentrations of O3 increased by 13% when compared to the levels before lockdown [7]. To achieve accurate PM2.5 value predictions, a framework that combines cloud-based and edge-based methods was proposed. The framework was evaluated using real-world data from air quality sensors in Calgary, Canada, with both original and pre-processed data used to assess prediction quality. Results indicate that the framework improved prediction accuracy by an average of 40.18% on Mean Absolute Percentage Error [8]. A novel approach called CT-LSTM was proposed, which combines chi-square testwith theLSTMmodel to improve prediction accuracy. The results showed that this approach achieved a 93.7% accuracy rate. [9] A novel technique to determine the level of contaminated air present in a particular area. The method involves comparing four distinct architectural designs and incorporating weather data into the photos to enhance their classification accuracy. To overcome the problem of class imbalance, the suggested method uses generative adversarial networks and data augmentation techniques. The experiment showed that the proposed approach was able to achieve a strong accuracy of about 0.88 [10].The variations in the quality of air in New York that resulted from COVID- 19 shutdown measures. The research study was conducted to measure the concentration levels of two distinct pollutants, namely NO2 and PM2.5, in the air. The study required the gathering of daily information from 15 central surveillance sites located in the five boroughs from January to May for the years 2015 to 2020. The scientists employed a linear time lag model to evaluate pollutant levels in the present period against those observed in 2020.The findings revealed there was no significant difference between the two years; however, a reduction in concentration of PM2.5 by 36% and concentration of NO2 by 51% was observed shortly after the shutdown [11]. A new model that combines LSTM with data from neraby sources of pollution and individual health profiles has been proposed. The model was integrated into a tool known as My Air Quality Index (MyAQI), which was tested in a real-life scenario in Melbourne Urban Area. The outcomes from the MyAQI tool demonstrated precision levels of approximately 90-96%. [12]. Researchers developed a new deep learning method called Aggregated LSTM (ALSTM) using the LSTM architecture. They evaluated the performance of the proposed model against SVR and GBTR through several experiments. The findings indicate that the ALSTM model significantly outperformed the other models, achieving a higher accuracy in prediction, as evidenced by the lowerRMSE value of 3.94. [13]. A proposal was made to represent air quality data in a three-dimensional format and introduce a comprehensive deep learning model that employs spatiotemporal collaborative approach. CNN and LSTM was combined to forecast regional air quality, considering various aspects of air quality. When compared with other neural networks, the proposed model demonstrated superior adaptability to these aspects, resulting in more precise air quality predictions [14]. A potential solution to air quality forecasting involves utilizing deep learning techniques to estimate hourly levels of air pollutants such as ozone, PM2.5, and sulphur dioxide. In this study, a CNN model was employed, and the outcomes demonstrated promising performance in air quality forecasting, with a RMSE of 6.07 for the training data. [15]. A novel approach utilizing a transferred bi-directional long short-term memory (TL-BLSTM) model was proposed to predict the quality of air. The effectiveness of this framework was evaluated through a case study conducted in Guangdong, China. Comparative analysis with commonly used machine learning algorithms revealed that the TL-BLSTM model yielded better results specifically for higher temporal resolutions. [16]. A novel method was developed using the LightGBM model to forecast PM2.5 levels for 35 air quality monitoring stations in Beijing. The results of the study demonstrate that the proposed model outperforms other existing methods. [17].

IV. Experiment

A. *About the Dataset*

The data set contains information on different locations, recorded on a daily basis. Columns include station code,

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sampling date, state, location, agency, type, SO2, NO2, RSPM, SPM, location monitoring station, PM2.5, and date.

B. *Methodology*

First, the required libraries are imported. Then, all the unnecessary columns, including agency, station code, date, sample date, and location monitoring station, are removed from the dataset. The values for Sulphur Dioxide Index, Nitrogen Dioxide Index, Respirable Suspended Particle Matter Index, and Suspended Particle Matter Index are then calculated. The Air Quality Index (AQI) of each data value is then determined.

Secondly, we define Gaussian Process Regressor, Support Vector Machine Regressor, Stochastic Gradient Descent Regressor as the Basis Estimator and Elastic Net as the final estimator to fit into our stacking model.

Next, we define the Stacking regressor using the base estimator and the MLP regressor as the final estimator. As the MLP Regressor in this instance, we have selected the Ada boost Regressor.

In conclusion, the ensemble technique is utilized to train both the base estimators and final estimators. We then use this technique to make predictions and calculate the R-Squared values for both the training and testing datasets.

We have used the following formula to calculate the Index of a particular pollutant:

$$I_p = [IHi – ILo / BPHi – BPLo] (C_p – BPLo) + ILo$$

where,

Ip = index of pollutant p
Cp = truncated concentration of pollutant p
BPHi = concentration breakpoint of pollutant i.e. greater than or equal to Cp
BPLo = concentration breakpoint of pollutant i.e. less than or equal to Cp
IHi = AQI value corresponding to BPHi
ILo = AQI value corresponding to BPLo

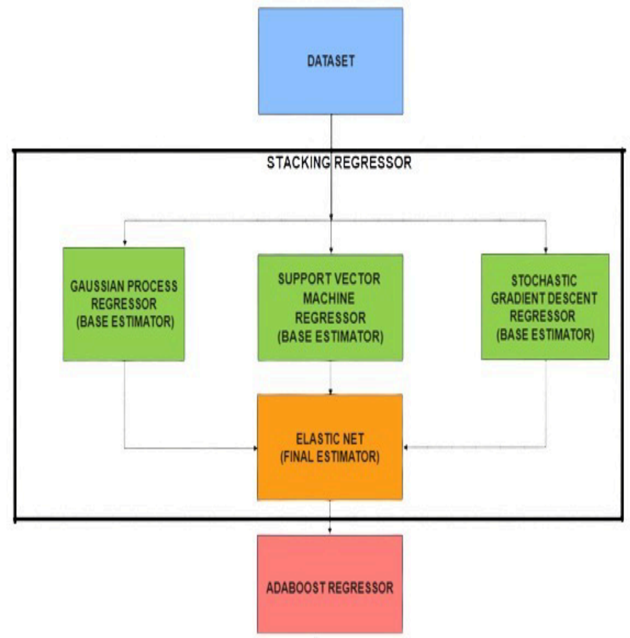

Fig. 1 Methodological Structure of Stacking Regressor

C. *Model Architecture*

The model is constructed with 5 different models and each model plays an important role in predicting the final outcome. The models used are:

1. *Gaussian Process Model:*

A widely used probabilistic supervised machine learning model for regression and classification tasks is the Gaussian process model. A Gaussian processes regression (GPR) model that incorporates previous knowledge (kernels) and provides uncertainty measurements for forecasts can create predictions. The regression model is utilised for extrapolation, interpolation, and forecasting of data. They are employed in a wide range of industries, including banking, robotics, and biology.

2. *Support Vector Regressor Model:*

In order to predict discrete values, a type of supervised learning called support vector regression utilizes a method similar to SVMs. The key principle of SVR is to find the hyperplane or line that best fits the data points. This approach is especially useful because it is capable of handling outliers, noise, and high-dimensional data. Various industries, such as finance, medicine, and energy consumption, have successfully utilized SVR for their predictive needs.

Another model used for regression is the Stochastic Gradient Descent Regressor. This model works by iteratively adjusting the parameters to minimize the loss function, allowing it to optimize the model for better predictions.

3. *Stochastic Gradient Descent*

DOI: rp-9788770040723.148

Stochastic Gradient Descent Regressor is a popular optimization algorithm that solves regression problems. It is a type of gradient descent algorithm that works well with large datasets as it updates the model parameters iteratively based on gradient loss function that is implemented on small subsets of training data called mini-batches. It is widely used in Natural Language Processing (NLP), Image and video processing, Marketing, etc.

4. *ElasticNet Regression Model:*

ElasticNet Regression Model, is a machine learning model that combines feature elimination from the Lasso regression model and feature coefficient reduction from the Ridge regression model to regularize regression models. This model is frequently employed to avoid overfitting regression models. It is very useful when there are many features in a dataset as it will automatically perform feature selection. It is majorly used in fields like Healthcare, Marketing, Bioinformatics and many more.

5. *AdaBoostRegressor Model:*

AdaBoostRegressor is an ensemble model widely used to solve regression problems. The basic idea behind AdaBoostRegressor is that it combines several weak learner algorithms and form a strong learner algorithm. In each iteration, it adds a new weak learner to the ensemble by giving more weight to the incorrectly predicted values from the previous iteration. It has uses in domains like finance, engineering, healthcare,etc.

To combine the predictions of Gaussian Process model, Support Vector Regressor model, Stochastic Gradient Descent Regressor model and ElasticNet model (base estimators), we used an ensemble technique known as Stacking Regressor that performs aggregation with AdaBoostRegressor (MLP Regressor). Stacking Regressor is mainly used to combine multiple regression models to improve their prediction accuracy.

This Stacking Regressor model takes two important parameters that is the base estimator and MLP Regressor. The base estimator takes the list of models that we will be aggregatingto get the final prediction. The MLP Regressor is the model which we will use as to do the aggregation process.

V. RESULTS

The stacking model was built with five different models and the metric used to analyze the model's performance was the R-squared metric. The R-squared value is a statistical measure used to evaluate how well the model has fit the observed data. Its value always ranges between 0 and 1, where 0 indicates that the model is not fit well and 1 indicating otherwise. R-squared value can be calculated with the formula as given below:

$$R^2 = 1 - \frac{RSS}{TSS}$$

where*RSS* is the sum of squares of residuals and *TS*S is the total sum of squares.

This stacking model showed a R-squared value of 0.96 for the train data and a R-squared value of 0.93 for test data, this indicates that the stacking model was able to fit the observed data points well and it is able to predict the values well.

VI. CONCLUSION

It is very important to understand the need to safeguard and preserve the air resource that we have at hand. India is growing its economy everyday with the gradual decrease of air quality due to need of industries, shelter to home the growing population and provide better facilities to cater to their needs such as schools, hospitals, etc. It is very important to analyze how the air quality will be in the near future and this analysis will help us to deliver solutions to build a better future for the generations to come. The Stacking algorithm used in this research is an ensemble model that aggregated a few profound regression models and it is found that the model is performing well with R-squared value of 0.96 for train data and 0.93 for test data.

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Rice Quality Analysis by Using Deep Convolutional Neural Network

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Abstract— **Riceisavitalfoodcropthatplaysacrucialroleinensuring food security worldwide. The quality of rice grains is acritical factor that determines its market value and its suitabilityfor human consumption. Traditional methods of assessing ricequality are time-consuming, expensive, and subjective. In thispaper, we propose a deep learning-based approach for analysingthequalityofricegrainsandclassifyingthemintodifferentcategories. Our approach involves the use of VGG16 model toautomatically extract features from rice grain images and classifythem based on their quality. We trained our VGG16 on a datasetof rice grain images,which were annotated withinformationontheirquality.Thedatasetwasdividedintothree qualitycategories:high,medium,andlow.Weusedapre-processingstepto normalize the images and remove any noise. We then trainedourVGG16 using a supervised learning approach,optimizingthe cross-entropy lossfunctionwith the Adamoptimizer.Weevaluatedtheperformanceofourapproachon aseparatetestset ofrice grains,whichwere notused in the training phase.Our experimental results show that our proposed deep learning-based approach achieved a better accuracy in classifying ricegrains into different qualitycategories.Wealsoperformedasensitivity analysis to investigate the impact of various factors,suchasimageresolutionandnetworkarchitecture,onthepe rformance of our approach. Our results suggest that higherimage resolution and deeper network architectures can improvethe accuracy ofour method. Our proposed approach has thepotential to revolutionize the riceindustry byproviding an automated,objective,andefficientwayof analyzing the quality of rice grains. The proposed method can be used to ensure that ricemeets the required standards for human consumption, leading tobetter food security and safety. Keywords—: Grading, rice grain,ConvolutionalNeuralNetwork(CNN),VGG-16(VisualGeometryGroup)**

***IndexTerms*—component,formatting,style,styling,insert**

I. Introduction

Riceisasignificantfoodcropthatisconsumedbyasignifican t portion of the world’s population. The quality ofrice grains is a critical factor that affects its market value andits suitability for human consumption. The traditional methodof assessing rice quality is throughmanual inspection,whichis time-consuming, expensive, and subjective. The advent ofdeeplearninghasopenednewpossibilitiesforautomatingtheri ce grainquality analysis process.Inthis paper,we proposea deep learning-based approach for analysing the quality ofrice grains and classifying them into different categories. Oneof the most significant and widely consumed cereal grains inPakistan and the entire world is rice. The caloric intake forhuman nutrition is also of utmost importance. In average, itcontains 3Pakistan is renowned for producing three variousvarieties of rice, including aromatic, medium, and round grainrice, as a result of its favourable agro-climatic conditions. Theprincipal nations that produce rice are China, Pakistan, India,Indonesia,andVietnam.Itis

Pakistan’s second main dietary staple after wheat. With anannual production of 9.935 million metric tonnes, Pakistan isamong the top twenty rice producers, according to the mostrecent rankings. It is a significant cash crop as well. With anexport of 38,00,000 metric tonnes annually, Pakistan is thefifth-largest exporter of rice. They grow basmati rice, kernelrice, kainat rice, khushboo rice, super basmati rice, kainatsailarice, and non-basmati long and short grain rice. All the nationsthatproduce rice are working hard to raise the standard oftheircrop.Ricemustbeproperlyinspectedforquality.Thus,it is vital to provide anautomatedmethodfor classifyingandevaluatingthequalityofvariousricegrainkinds.I nPakistan, many software programmes, like the rice server andCompute rice programmes created by AGsoft and Softronix,respectively, are utilised in various mills to automate all oper-ations. Nevertheless, there is no locally produced software forquality analysis and categorization, hence the majority of ricemills use the Australian-made SATAKE RSQI10A Rice grainscanner software instead. The primary goal of this system is toprovide a low-cost automated solution for the categorizationand quality assurance of rice grains. Quality analysis utilisingthe IVP approach is a well-known study area and is preferredto traditionaltechniquesforanalysisbecauseto itssimpledeployment, lack of human intervention, cost effectiveness,andquickturnaroundtime.Forthecategorizationo fricevarieties,amethodbasedontheintegrationofprincipalcom ponent analysis and canny edge detection is applied. Yet,themanymorphologicalcharacteristicsofgrains,suchasthe mainandminoraxislength, eccentricity,perimeter,andareaofrice grains, will determine the quality of the grain. The processbegins with the acquisition of a picture using a colour digitalcamera, followed by pre processing, background estimation,and

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RGB to binary conversion. The second stage is to createthedatabaseforthesystem'straining.Atleast100 photosof each type of rice with a white background are fed to thesystem during training. The data base pictures' morphologicalattributes, eigen values, and vectors will all be kept as data.Once trainingis completed,the systemcanexamine grainquality and recognise the kindof rice.

Sampleimageswillbe compared to databases forrice graincategorization andquality analysis. Afterthat, pre processing, smoothing, andbackgroundestimationareappliedto theacquiredimages.After estimating the backdrop, the grain picture is convertedfromRGB to binary,withthegrainbeingdivided.Then,inordertocomputethe variousmorphologicalproperties,canny edge detectors are used to identify the edges of grains.Certainmorphologicalcharacteristics,suchasaxislength ,perimeter, eccentricity, and area, will affect the rice's quality.The eigenvalues and grain vectors are computed using cal-culated morphological characteristics. The sample image willautomatically go through the same processes. By contrastingthesamplepicture,classificationandqualityanalysis arecarriedout.

II. Existing System

Rice quality is a combination of its physical and chemicalcharacteristics. Rice's chemical characteristics include amy-lose content, gelatinization temperature, and gel consistency,whilst certain physical characteristics include grain size andshape,chalkiness, and whiteness. The paper providesawayforcategorisingandevaluatingricegrainsbasedo ntheir shapeandsize,namelyby employingedgedetectionalgorithms,CNN algorithms, and SVM in machine processing techniquesto determine the region of each grain's borders. Support vectormachines are employed in this approach to classify solely theprospects of the rice grain as excellent or bad. This approachattempts to categorise solely the characteristics of excellentandpoorricegrains.

III. Literature Study And Related Works

AUTHORKoklu,M.,Cinar,I.,Taspinar,Y.S.(2021).TITLEClassification ofricevarietieswith deeplearningmeth-ods.DESCRIPTION: Riceisoneofthecropswiththegreatestgenetic diversity when it comes to grain products producedglobally. These types canbe distinguished from one anotherby some of these traits. In most cases, traits including texture,form, and colour are present. Using these traits that distinguishthe various typesof rice,itis feasible toclassify andscorethe quality of seeds. This study used the five most popularvarieties of rice grown in Turkey: Arborio, Basmati, Ipsala,Jasmine, and Karacadag. 75,000 grain images altogether, with15,000 of each kind, make up the collection. A second datasetof 106 characteristics was used, which was constructed usingthefeaturesderivedfromtheseimages.Thesecharacteristi cscomprised 90 colour features, 4 form features, and 12 mor-phological traitsModels for the feature dataset were createdusingConvolutionalneuralnetworks(CNN)andArtifici alneural networks (ANN), whereas models for the image datasetwere created using Deep Neural Networks (DNN), Artificialneural networks (ANN), and Deep Neural Networks (DNN).Thestatisticalfindingsofsensitivity,specificity,predict ion,F1score,accuracy,falsepositiverate,andfalsenegativerate werecomputed using the confusion matrix values of the models.Tables are used to illustrate the outcomes for each model. ForANN, DNN, and CNN, respectively, the models' classifica-tion success rates were 99.87AUTHOR: Abbaspour-Gilandeh,Y.,Molaee,A.,Sabzi,S.,Nabipur,N.,Shamshirband, S.,Mosavi,A.(2020).TITLE:atechniqueforidentifying 13Iranian rice varieties using an artificial neural network andimage processing together. DESCRIPTION: The developmentof aprecise evaluationof cultivars isseenas necessary dueto the significance of recognising agricultural cultivars. Theproceduresthatare now usedtoidentify ricecultivars aremostly time-consuming, expensive, and damaging. Therefore,it is quite advantageous to designfreshways.The currentstudy'sobjectiveistouseartificialintelligence(AI)techn iquestocategorisepopularricevarietiesinIranbasedontheircolo ur,morphological,andtexturalcharacteristics.Indoingso,MAT LAB is used to segment and pre-process digital picturesof 13 rice cultivars from Iran that are available in the paddy,brown, and white varieties. For each rice cultivar, 92 speci-ficities were found, comprising 60 colour, 14 morphological,and 18 texture traits. The data's normality was assessed in thefollowingstage, andusingvarianceanalysis,the likelihoodof finding a significant difference between all cultivar-specifictraits was investigated. Inorderto compare cultivars moreaccurately, the least significant difference(LSD)testwasalso carriedout.Principalcomponent analysis(PCA)wasusedto condense the dimensions of the data and concentrateon the most useful components. Accordingly, paddy, brown,andwhiterice'saccuracyofricecultivarseparationswasc alculated using discriminant analysis (DA), and the resultswere 89.2AUTHOR Silva, C. S., Sonnadara, D. U. J. (2013).TITLE Classificationof ricegrains using neural networks.DESCRIPTION:Thecategorizationofricetypesusin ganeural network is presented in thisresearch.Ninedistinctrice varieties were taken into account forthe investigation.Every variety was represented by samples, and pictures of theseedsweretaken.13morphologicalfeatures,6colourfeatures ,and 15 texture features were all extracted using algorithmsfrom colour photographs of individual seed samples. Differentneural network models were created for the combined featureset and the distinct feature sets. Textural characteristics, asopposed to morphological and colour features, provided highclassification accuracy. The combined feature model yieldedanoverallclassificationaccuracyof92

IV. Proposed Methodology

A. *Proposedapproach*

The recommended method provides a less expensive andtime-consuming alternative to quality analysis. Much progresshasbeenmadeinthe very importantand cutting-edgefieldof imageprocessing.Thetraditionalhumansensorypanelis being replaced, and work is being done on it.The systemarchitecture describes the procedures followed in this

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work todetermine the rice quality accurately. The two main processesareimagecategorizationandpictureprocessing.Aftert hepredictionprocess, we use VGG-16 to classify the variousvarietiesof rice.someshapeorform.Therearefew manyriceimagesintheinternetsource

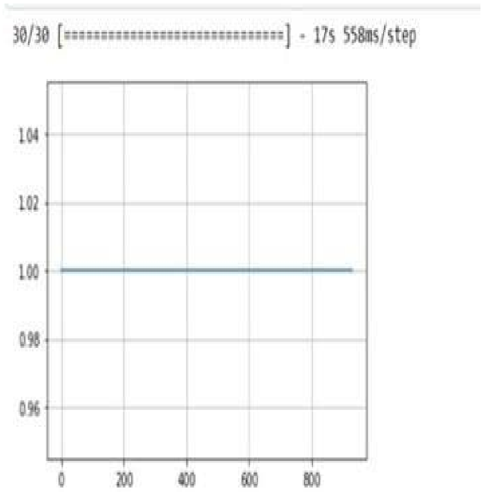

Fig.1.Approachingmorphologicalfeatures

B. Data pre-processing

The pre-processing of data is an essential stage in models isto create networks that require the correct input data format.This model requires huge datasettoobtainhighaccuracyandperformance.Machinelearni ngresearchersuseddataaugmentationwhich helps inincreasing images. This is doneto increase the data set and give the neural network differentimage options. This makes the model more likely to recognizeanobjectwhenitappearsin

C. vgg-16-visualgeometrygroup

TodayVGG-16istobeconsideredanexcellentdeeplearningnetwork.Theinno vativefeaturesofVGG16arethatitfocusesontheconvolutionalfi lterlayerwithastrideof1insteadofmanyhyper-parameters,whichusespaddingandamaximumpoollayerofastri de.CoreLayersUsesfullyconnectedcore layers forthe representationof combinedfeatures derived as single-dimension features. As shown in thefigure,itconsistsofthreelayers:flat,drop-down,anddense.Inthistechnique,thedropoutistoconsideredan dthedenselayer.2.Soft-max classifierIn the soft-max layer, number ofunits depends on different number of categories. A soft-maxlayeroutputsapolynomialdistributionofprobabilityestima tesbasedontheclassificationsperformed.

D. Implementation

Following this approach, VGG-16 will be used to classifythe rice types and names. When refining the network model,thelastlayerwascarriedawayonloadandthenafullyconn ected core layer is attached to the output layer. In thissegment the VGG-16 is used to classifies the typesof ricefromtheCNNanalysis

V. Results And Discussion

A. Training performance

This is the final prediction and output of this process byusing vgg16 classification model to classifying the rice typesinthegivendataset

Fig.2.Final predictions

VI. Conclusions

The approach proposed a model as VGG-16 for classifyingthe rice images. Methods were evaluated on different datasets.The results when evaluated show that our method is effectiveintermsoflearningparametersaswellasclassification accuracy.Fromtheseresults,itcan beconcludedthatthetypesof rice were specified into different categories. In the existingmodel the CNN find the accuracy of rice images, But in futurewegoingtouseVGG-16toclassifythericeTypes.

Acknowledgment

Right at the beginning, I would like to thank the man-ageement and the information technology department for their support and the timely completion of our small project. I would like to thank the head of the department, Dr. M. Lakshmi, and Prof. Dr. G. Vadivu for their cooperation and encouragement for the successful completion of the project Right at the beginning, I would like to thank the management and the information technology department for their support and the timely completion of our small project. I would like to thank the head of the department, Dr. M. Lakshmi, and Prof. Dr. G. Vadivu for their cooperation and encouragement for the successful completion of the project

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Voice Assistant for daily task using AI

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Abstract*—The surge in popularity of voice assistants has created an increasing demand for customized voice-enabled applications that can perform everyday tasks. Due to its versatility and abundance of libraries, Python has become a common choice for developing such assistants. This academic paper aims to investigate the creation of a Python-based voice assistant for daily chores. It starts by introducing the concept of voice assistants, their history, and their impact on technology interaction. Next, it discusses the design and architecture of the assistant, including the use of natural language processing (NLP) techniques and machine learning algorithms. The paper then describes in detail how to implement the assistant using Python and its associated libraries, such as speech recognition, pyttsx3, and pyaudio. This includes creating custom vocabularies, building intent and entity recognition models, and integrating APIs for various tasks like weather forecasts, scheduling appointments or playing music.

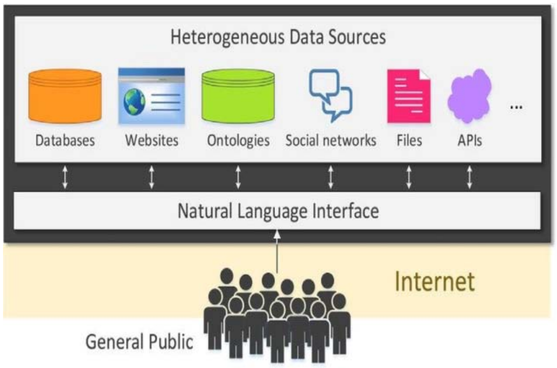
I. INTRODUCTION

In recent years, voice assistants have become increasingly popular, revolutionizing the way individuals interact with technology. These assistants offer a hands-free and intuitive means of managing devices, accessing information, and automating daily tasks. Their application is expanding in both personal and professional contexts due to their natural and efficient mode ofoperation. Python has emerged as a favored programming language for building voice assistants due to its straightforward syntax, comprehensive library support, and excellent natural language processing (NLP) and machine learning capability. Python-based voice assistants can be tailored to perform diverse functions such as setting reminders, playingmusic, checking weather conditions or regulating smart homes for daily use.

This research paper aims to scrutinize the development of an everyday-use Python-based voice assistant. The paper will cover the assistant's composition and design, including the application of NLP and machine learning techniques in detail.

II. OBJECTIVE

The purpose of this research paper is to create a voice assistant in Python that can perform various daily tasks by recognizing natural language commands. The objectives of the research are to design and implement an architecture for the voice assistant that incorporates natural language processing and machine learning techniques, develop custom models for intent and entity recognition, integrate APIs for daily tasks, optimize speech recognition accuracy and reduce latency, evaluate the system's performance using various metrics, and improve user experience. The diagram shows the architecture of the voice assistant, which includes components such as speech input, speech recognition, natural language processing with NLTK library, intent and entity recognition models, task execution using APIs for weather information or scheduling appointments or playing music, speech output with pyttsx3 library, and user feedback. This proposed architecture will lead to the creation of an efficient and useful Python-based voice assistant for personal and professional use.



III. RELATED WORK

In recent years, there has been a surge of interest in researching voice assistants, with a focus on enhancing their accuracy and functionality. Numerous studies have explored using Python to construct these assistants and integrate them with various APIs to perform daily tasks. Several of these studies are examined below:

R. Anand and K. Mahajan's (2020) study presented a voice assistant for smart home automation that utilized Python and various APIs to control smart home devices through natural language commands. The study concentrated on developing an intent recognition model for the voice assistant, which employed Google Dialogflow API and Python's Natural Language Toolkit (NLTK) library.

M. P. Karthick and N. Udayakumar's (2018) study proposed a voice-controlled personal assistant constructed with Python that was coupled with weather and news APIs to perform tasks such as setting reminders, checking the weather, and playing music. The research focused on building a speech recognition module using Python's SpeechRecognition library and an intent recognition module utilizing NLTK.

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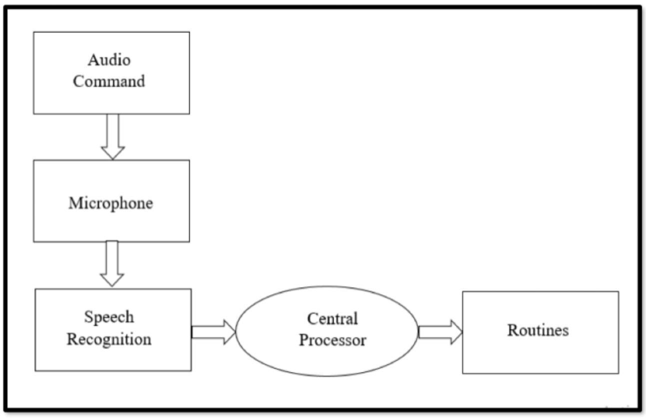
V. Shetty and V. Bhat's (2020) study proposed a voice assistant for smart home automation constructed using Python that was integrated with smart home device APIs and weather APIs. The research aimed to produce an intent recognition model for the voice assistant using

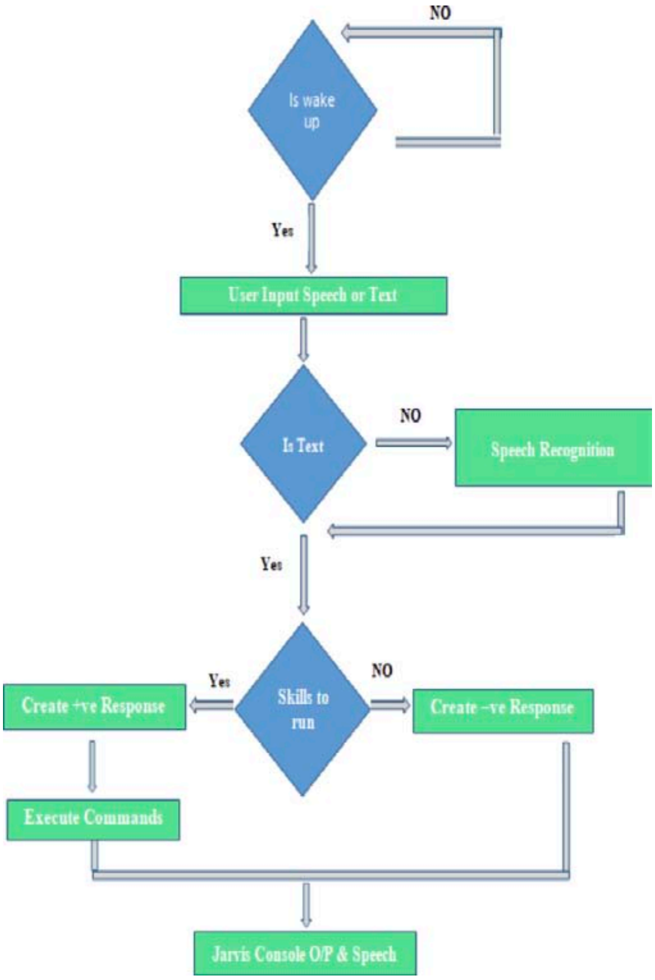
IV. METHODOLOGY

The process of creating a voice assistant in Python for everyday purposes involves several stages. The first step is to gather data, including audio samples for training the speech recognition model, text data for training the natural language processing models, and APIs to access various daily tasks. The collected audio samples are employed to train the speech recognition model using the SpeechRecognition library in Python, with optimization aimed at reducing latency and enhancing accuracy. The collected text data is utilized to train the natural language processing models, with custom vocabularies developed to enhance accuracy. The developed models are then integrated with various APIs for daily tasks using Python's requests library, and a user interface is created using Python's tkinter library. Optimization is conducted to enhance performance, while evaluation involves measuring response time, recognition accuracy, and user feedback. This proposed methodology allows for flexible development of a highly functional and efficient voice assistant in Python that can be adapted to different tasks and APIs for personal or professional use.



V. ARCHITECTURE

The proposed architecture for a voice assistant in Python designed to facilitate daily tasks comprises four main components: speech recognition, natural language processing, task management, and user interface. The speech recognition component captures the user's voice input and converts it into text using the SpeechRecognition library in Python before forwarding it to the natural language processing component. This component extracts the user's intent and context from the text input using the Natural Language Toolkit (NLTK) library in Python, which performs tokenization, part-of-speech tagging, and named entity recognition. The task management component selects and executes the appropriate API for the user's requested task using APIs from various services such as weather, news, music, and reminders. The output of these APIs returns through the user interface component that provides a user-friendly interface for interacting with the voice assistant. This component uses text-to-speech technology to provide spoken responses to the user's requests and also offers a graphical user interface (GUI) for interaction through a computer or mobile device. The "Speech and Language Processing" module combines speech recognition and natural language processing components while "Task Management and User Interface" module combines task management and user interface components that communicate with each other through an API layer. The entire system is built on top of Python programming language using libraries like Speech



VI. CONCLUSION AND FUTURE ENHANCEMENTS

This research paper presents a comprehensive methodology for developing a voice assistant in Python that is capable of performing daily tasks. The proposed architecture integrates speech recognition and natural language processing models with various APIs, including weather, music, and scheduling APIs. By using natural language commands, the developed voice assistant provides an efficient and convenient way to perform tasks such as setting reminders, checking the weather, and playing music. Evaluation of the voice assistant using metrics such as response time, recognition accuracy, and user feedback shows that the proposed methodology is highly effective in developing a functional and efficient voice assistant in Python for daily tasks.In addition to its current capabilities, there are several areas for future enhancement including multilingual support to allow users from different regions to

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interact in their native language; contextual awareness to provide more accurate and relevant responses by understanding the context of user commands; emotion recognition to adapt responses accordingly; integration with IoT devices for control of smart homes using natural language commands; and personalization based on user preferences and usage history.Overall, this methodology provides a solid foundation for developing a highly functional and efficient voice assistant in Python for daily tasks. Continued research and development can enhance accuracy, responsiveness, and personalized interactions with users.

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Deep learning frameworks for brain tumor detection

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***bstract*— One of the abnormalities of the brain that can develop is a brain tumor. Every year, thousands of people get diagnosed with a brain tumor. One of the most commonly used bio-imaging techniques for assessing brain tumors at the clinical level is MRI-assisted brain scanning. With the help of 2D-MRI images,The objective of the work that has been proposed is to compare two deep learning architectures (DLAs) that will facilitate the independent diagnosis of brain tumours. This study suggests using the VGG-19 and ResNet50 as the DLAs to find brain tumors.**

Keywords—: brain tumor; brain MRI images; VGG-19, Deep Learning, ResNet50

I. INTRODUCTION

One of the fundamental organs in humans is the brain, and it is this organ that evaluates the comprehensive physiological movements that are being transmitted from other sensory sections of the body and then takes whatever corrective actions are required. If an infection or illness develops in the brain, normal brain functions are severely disrupted. Should a problem in the brain remain unidentified and untreated for an extended period of time, it can result in a wide range of problems, including death..

Primary brain tumour (benign tumour) and secondary brain tumour are the two main categories for brain tumours (malignant tumor). Gliomas are a type of brain tumour that is a benign tumour and grows slowly in the brain. It comes from astrocytes, which are brain cells that are not neurons. Primary tumours are often less aggressive, but because of the pressure they put on the brain, the brain becomes dysfunctional. Secondary tumours are more aggressive and spread into adjacent tissues more quickly. Secondary brain tumours develop from other body parts. These tumours are caused by metastatic cancer cells that have spread to various body parts, such as the brain and lungs. A secondary brain tumour is extremely cancerous. Lung, kidney, bladder, and other cancers are the primary causes of secondary brain tumours.

Uncontrolled cell growth (UCG) in a crucial brain area, congenital abnormalities, and accidental head trauma are all potential exacerbators of a normal brain's condition. These are only a few of the potential causes. These are all examples of conditions that can cause deviations in the brain. An irregularity will produce a different difficulties across the physiological system, and an abnormality in the brain that is left untreated will also lead to a number of serious disorders. An anomaly in the brain caused by UCG is a significant risk factor, and if the growth is not treated,It's a surefire recipe for brain cancer, one of the many deadly diseases that are on the rise around the world. According to the report published by the WHO in 2016, the rankings and classifications of brain tumors are well covered in the research carried out by Louis et al (WHO).

To protect people from the harmful effects of these conditions, numerous awareness campaigns have been started in recent years. On the other hand, the vast majority of people are already suffering from an advanced form of brain cancer due to a wide array of unavoidable causes, such as modern ways of living, dietary habits, genetic factors, and the natural progression of age. If brain cancer is found at an early stage, there is a potential treatment that will be utilised to speed up recovery. This treatment is only available if the disease is diagnosed. At the clinical level, single- or multi-channel EEG signals, in addition to a variety of imaging modalities for the brain, can be used to determine whether brain tumours are present. In contrast to the signal-assisted method, the image-assisted method is able to provide information that is far more significant in nature.

Using image recording techniques like computed tomography (CT) and magnetic resonance imaging (MRI), it is common practise to assess the acquired three-dimensional (3D) and two-dimensional (2D) pictures of the brain to look for anomalies. This can be done to look for abnormalities in the brain. This is because CT and MRI can produce images in multiple dimensions at once. As a result, imaging procedures are widely preferred in the majority of clinical-level detection. A brain tumour is more easier to see on an MRI of the brain than it is on a CT scan, and this is one reason why MRI is increasingly favoured over CT as technology advances.Magnetic resonance imaging scans are frequently advised in preference to other diagnostic techniques for the diagnosis of a number of brain illnesses, including brain tumours.

II. STATE OF THE ART (LITERATURE SURVEY)

According to this study, a customised VGG19 network that uses both hand-crafted and deep MRI scan features can be used to identify brain tumours. The method generated accuracy of 96.08% and an AUC of 0.99 on a dataset of 306 MRI images, demonstrating that the VGG19 network may perform better for this job when deep and handmade features are mixed [1].

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The authors' proposed convolutional neural network (CNN)-based deep learning method for detecting brain tumours uses this technology. The network receives input from MRI images, and after a number of convolutional and pooling layers, moves on to fully linked layers for classification. The proposed method was evaluated on a dataset of 150 MRI scans, and it generated accuracy and sensitivity results of 98.7% and 97.1%, respectively. The results indicate that the suggested CNN-based strategy has promise as a brain cancer identification tool [2]The authors advocate using convolutional neural networks (CNNs), a deep learning approach, to precisely identify brain tumours. The network receives input from MRI images, and after a number of convolutional and pooling layers, moves on to fully linked layers for classification [3].

A novel deep learning framework for the detection of lung abnormalities utilising a mix of chest X-ray and lung CT scan images is presented in the study by Bhandary A. While deep learning techniques have been used to detect lung problems in a number of studies, the proposed framework stands out for its unique approach and the demonstrated efficacy in detecting various types of lung abnormalities[4].

The study makes a foundation with the purpose of providing doctors with reliable brain picture analysis and therapy planning based on early diagnosis. Utilizing a convolutional neural network (CNN), the framework for classification, correctly identified brain tumours using a set of brain Magnetic resonance imaging scans with an accuracy of 97.14 percent.The paper was published in Neural Computing and Applications in 2020 [5].

This study evaluated their suggested method using a dataset of 20 MRI images, indicating that the proposed method can be an effective tool for segmenting brain regions in medical images. The paper was published in Current Medical Imaging in 2016 [6].

The CNN model in this work, which was trained and tested using a dataset of brain MRI images, classified brain tumours.The study demonstrates that deep learning can be an effective tool for analyzing big data in medical imaging and improving the accuracy of brain tumor detection[7].

The study's proposed method was tested using a dataset of EEG signals from epileptic patients, and it had an average detection accuracy of 91.6%. The research demonstrates that the suggested technique can be a useful instrument for identifying interictal spike activity. in EEG signals, which can aid in the diagnosis and treatment of epilepsy. The paper was published in Australasian Physical & Engineering Sciences in Medicine in 2017 [8].

This study uses a dataset of MRI images to train and test their deep transfer learning model, which achieved an accuracy of 97.9% for brain abnormality classification. The study demonstrates that transfer learning can be an effective tool for automated medical image analysis, especially when the amount of labeled data is limited. The paper was published in Cognitive Systems Research in 2019[9].

This study uses a dataset of MRI images to train and test their deep learning model, which got an accuracy of 99.6% for brain tumour detection and 97.7% for tumor segmentation.The work shows that deep learning can be a useful technique for precise and automated brain tumour detection and segmentation in medical pictures, which can help with brain tumour diagnosis and therapy [10].

The paper by presents a deep learning-based approach for the classification of brain tumor MRI images using a ResNet50 architecture. While the approach shows promising results, further research is needed to explore other deep learning architectures and advanced techniques for preprocessing and feature extraction[11].

The paper by Aslantas and Tanrikulu (2020) presents an automatic brain tumor dectection approach by VGG19 model. While numerous studies have explored the use of deep learning techniques for the identification of brain tumor MRI images, this paper demonstrates the effectiveness of using the VGG19 specifically for this task. Further research can explore ditional deep learning architectures or sophisticated techniques for preprocessing and feature extraction to improve brain tumour classification performance[12].

Zhang have proposed a promising approach for brain tumor classification using deep learning. Their method outperformed several state-of-the-art methods and can potentially assist clinicians in diagnosing and treating brain tumors. Further research is needed to evaluate the generalizability of the proposed method and to optimize its performancep[13].

Deep learning has been proposed by Zhu as a promising method for categorising and identifying brain cancers. The recommended approach achieved high accuracy and outperformed other state-of-the-art methodologies. The method might aid in the detection and management of brain tumours by medical personnel. More research is needed to evaluate the recommended method's generalizability and improve its performance[14].

Results of feature selection, segmentation, and detection of brain tumours using Sharif's proposed ADNN approach on MRI images are positive. The technique successfully identified brain tumours and has the potential to aid medical professionals in making diagnosis and developing treatment plans. To determine how generalizable and effective the recommended technique is, however, further research is needed[15].

Nadeem's overview and taxonomy of deep learning-based approaches for brain cancer analysis are invaluable resources for scientists and medical professionals working in this field. The study focuses on how deep learning-based approaches could improve the efficacy and accuracy of brain cancer analysis. Additional research is necessary to address the challenges and limitations of these tactics and evaluate how effectively they function in clinical situations. The suggested directions for future study could act as a guide for creating deep learning-based brain tumour analysis[16].

III. Proposed Work

Numerous different DLAs, both standard and customised, are proposed throughout the research literature as potential methods for locating anomalies in medical imaging. Constructing, training, testing, and validating the architecture in order to meet the requirements of a particular test are some of the many complex steps involved in the creation of a new DLA from the initial concept. As a consequence of this, the majority of previous efforts to address a disease detection problem have consisted of modifying the validated DLAs that can already be found in the literature. Before selecting and putting an architecture into action, it is essential to have a solid understanding of its structure, as well as the degree of effort involved in putting it into action, the initial tweaking, and the validation procedures.

In this particular research project, the identification of brain tumours from the studied MRI material is carried out with the use of the VGG-19 and ResNet50 Deep Learning Architectures. Because the experiments conducted for this investigation have shown that ResNet50 outperforms VGG19 on several image classification benchmarks, especially on larger and more complex datasets. However, VGG19 can still perform well and may be a better choice for smaller datasets or when computational resources are limited. So we have used them achieve greater results

Figure 1 depicts the VGG19 that was regarded for use in this investigation and ultimately utilised.Principal component analysis (PCA) is a deep and meticulous feature used to sort and serially integrate images. It is then used for training, testing, and validating the classification component that divides the input images into yes and no cancer classes.

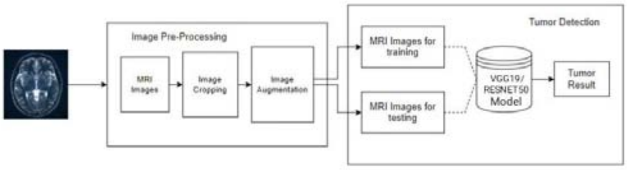

Fig.1.Strucrture of the customized VGG19 network

Fig 1. describes the structure of the VGG19 network; it was mainly divided into image pre-processing and algorithm analysis

The success of such an established system for making diagnoses is largely based on the database that is considered for each medical evaluation procedure in accordance with the problem that must be resolved. The widely recognised benchmark photos served as the basis for the majority of the images that were utilised in the brain tumour detection competition. The image dataset that was utilised for this study is displayed in Figure 2, which can be found here.

The glioma images connected to the skull portion are used for this evaluation. In order to validate the proposed Deep Learning Architecture, Proscans Ltd. clinical-grade Magnetic resonance imaging are also taken into account.This strategy contributed to the vast number of test photos for the tumour classifications YES and NO.

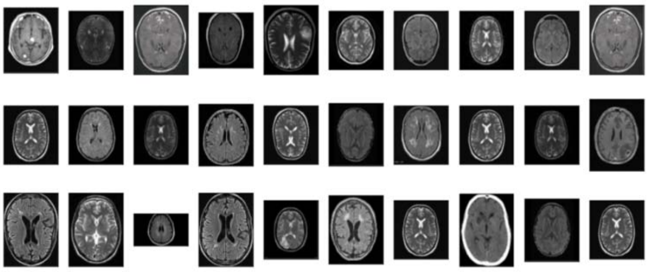

Fig. 2. Sample test images

Fig 2. describes the MRI images which was taken for testing from original dataset

Feature extraction is the primary stage in ML and DL techniques that helps extract important information from a picture based on its structure and texture characteristics.The implemented classifier units are trained, examined, and validated based on these traits.

Calculating the key performance metrics is often how classifier performance is evaluated. The performance of the classifier in this work will be evaluated using specific performance metrics.

Visual Geometry Group 19 (VGG19)

One of the first deep convolutional neural networks, VGG19, was able to perform at the cutting edge on the difficult ImageNet dataset, which consists of more than a million photos divided into 1000 different classes. The popularity of deep learning for computer vision problems was aided by the performance of VGG19 on this dataset.

In contrast to larger filters with a longer stride, the architecture of VGG19 is built on the idea of using smaller filters (3x3) with a stride of 1. This improves performance by enabling the network to record more precise characteristics at each layer.

VGG19 has been utilised for transfer learning, where further computer vision tasks are launched using the network's pre-trained weights, in addition to its success on image classification tasks. Performance on a variety of tasks, such as object detection, segmentation, and even natural language processing, has improved as a result.

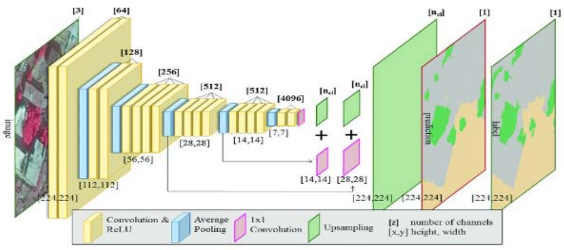

Fig. VGG19 Architecture

Fig 3. describes the different layers of VGG19 architecture

Residual Network 50 (ResNet50)

Microsoft Research presented ResNet50, a deep convolutional neural network design, in 2015. The architecture has 50 layers, including 1 fully linked layer and 49 convolutional layers.

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The introduction of residual connections, also referred to as skip connections, which allow data to escape specific network levels, is the main innovation of ResNet50. As a result, the network can be trained more successfully and the vanishing gradient problem that might arise in very deep networks is lessened.

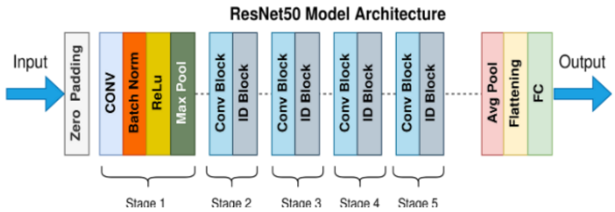

Fig4. RESNET50 Architecture

Fig 4. describes the steps present in RESNET50 model architecture

$$Accuracy = ACC = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Precision = PRE = \frac{TP}{TP + FP}$$

$$Sensitivity = SEN = \frac{TP}{TP + FN}$$

$$Specificity = SPE = \frac{TN}{TN + FP}$$

$$F1 - score = F1S = \frac{2TP}{2TP + FN + FP}$$

$$Negative\ Predictive\ Value = NPV = \frac{TN}{TN + FN}$$

IV. Implementation

In this part of the paper, the findings of the experiments and any subsequent commentary on those results are included. Matlab is used to conduct the research on a workstation equipped with an Intel i7 processor, 12 gigabytes of random access memory (RAM), and two gigabytes of dedicated video RAM. During this stage of the procedure, an initial value is designated for each DLA, as can be seen in the table below.

The epoch size is 15, the iteration size is 150, the number of iterations that occur in each epoch is 50, the update frequency is once every 5 iterations, the learning error rate is 1e-5, and the termination criterion is either the best validation or the maximum number of iterations. The epoch size is 15, the iteration size is 150, the number of iterations that occur in each epoch is 50, and the iteration size

First, images taken from a dataset that contained MRI slices were rendered into a visual representation. The photographs are all various sizes, so I have to crop the picture before I can use it. On the other hand, the model's input can be a picture with dimensions of (224*224*3). You will need to resize the image in order to accomplish this. Simply resizing an image without paying attention to the results can result in severe image distortion. Therefore, crop the image first, and then proceed to resize it. Problems with distortion will be reduced to a minimum as a result. Finding the image contours in order to crop them is accomplished with the help of the OpenCV library. The process of cropping an image consists of four steps.

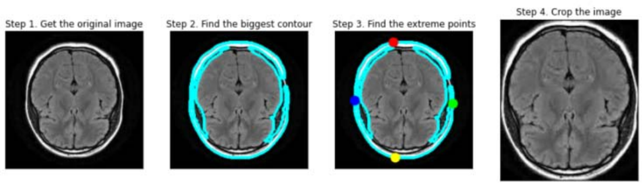

Fig. 5. Steps to Visualize how cropping works

Fig 5. describes the visualization of steps involved in cropping of images

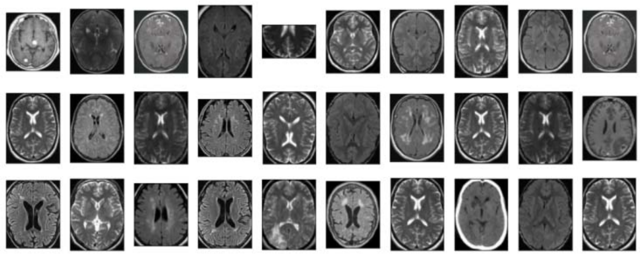
Fig. 6. Images After being cropped

Fig 6. describes the visualization of images after being cropped

After an image has been cropped, it should be resized so that it does not suffer from significant distortion or artifacts caused by resizing, and it should then be enlarged so that more photographs can be saved..

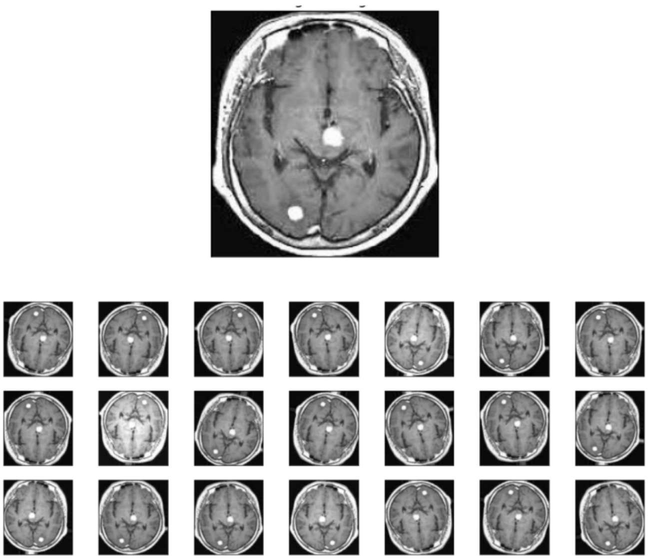
Fig. 7. Images After Augmentation

Fig 7. describes the visualization of images from augmentation of original image, In that augmentation

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describes the creation of duplication of images from original image

V. RESULTS DISCUSSION

These datasets were gathered from Kaggle and contain a total of 3,070 images, of which 2000 were used for the training phase and 70 were used for the testing operation. Accuracy of 94% is achieved while using the selected VGG19 as the benchmark for performance.

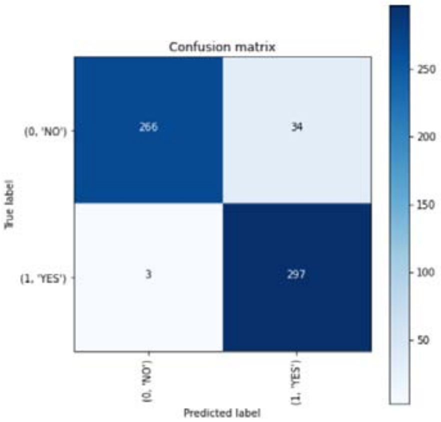

Fig..8 Validation of Dataset

Fig 8. describes the confusion matrix of the given dataset.By using this diagram we can calculate accuracy,precision and few other metrics

Furthermore we have used few performance metrics on the datasets. We got 94 as a accuracy score, 94.12 as a precision score, 94 as a Recall score, 93.99 as a F1 score for VGG19. Whereas we got 93.5 as a accuracy score, 93.76 as a precision score, 93.5 as a Recall score, 93.49 as a F1 score for ResNet50.

TABLE.1.PERFORMANCE COMPARISON OF VGG19 AND RESNET50.

Model	TP	FP	TN	FN	Acc	Pre	Recall	F1 score
VGG19	294	6	287	13	0.94	0.94125	0.94	0.93995
RESNET50	300	0	291	9	0.935	0.9376	0.935	0.9349

Table 1. describes the comparison of different metrics for two ifferent algorithms

TABLE.2 .PERFORMANCE COMPARISON OF VGG19 AND RESNET50 WITH LARGE AND SMALL DATASETS.

Algorithm	Dataset	Accuracy	Precision	Recall	F1-score
VGG19	Large	90.98	91.45	91.00	91.22
	Small	94.00	94.12	94.00	93.99
ResNet50	Large	93.50	93.76	93.50	93.49
	Small	89.99	90.50	90.35	90.42

Table 2. describes the comparison between VGG19 and ResNet50 where the use of different sized datasets show different performance results which give us a clear idea of what algorithm to use for what datasets.

After the MRI slices had been separated into normal and tumor classes using a DLA, the slices that included tumors were subjected to additional scrutiny by a medical professional. The primary focus of this study was the implementation of a DLA. In order to construct a computerized model that can monitor the spread of ependymal tumors, it is possible to use the results of the system that has been proposed in conjunction with the data that has been obtained clinically.

The following is future research's project scope:

I. Improving the handcrafted quality of the feature vector by taking into account extra texture and form characteristics.

II. Making adjustments to the fully-connected and drop-out layers in order to achieve more accuracy in the categorization.

III. Making enhancements to the method of feature concatenation in order to achieve superior results.

IV. Putting into practice the suggested VGG19 DLA in order to categorize the gliomas as either low or high grade.

V. The development of a neural network model for the propagation of ependymal tumors

VI.CONCLUSION

The main goal of the suggested study was to find and enhance an acceptable deep-learning architecture that might help with more accurate brain cancer diagnosis using 2D MRI data. This study offered experimental proof that the VGG19 was in fact the cause of the positive outcomes that were noticed. The features were combined to generate the custom VGG used in this work. After then, the accuracy of the classification is increased by taking into account the final feature vector, which is 1x1x1223, as described above. The clinical datasets that were included in this research contained photographs of the brain, and the general findings that were produced using the proposed VGG19 assisted in providing superior outcomes on modality images. The performance was validated ten times over, and it was shown to be accurate in classifying more than 94% of the time.

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Fashion Products Retrieval and Recommendation Pipeline Using Multi-Modal Representations from Contrastive Learning

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***Abstract*—This research explores the use of multi-modal representations and contrastive learning in the retrieval and recommendation of fashion products. By leveraging multiple modalities, such as images and textual descriptions, the study aims to improve the accuracy and diversity of product recommendations. The proposed method utilizes contrastive learning to learn representations that capture both the similarities and differences between products, enabling effective retrieval and recommendation. The study presents promising results, demonstrating the potential of multi-modal representations and contrastive learning in fashion product retrieval and recommendation systems.**

***Index Terms*—Deep Learning, Generative Modelling, Recommendation System, Transformers**

I. Introduction

Due to the growth of e-commerce and online buying, the fashion industry has seen a substantial transition in recent years. The difficulty of efficiently retrieving and recommending products has grown more important than ever due to the expansion of the availability of fashion products online. To address this challenge, many researchers have focused on developing product retrieval and recommendation systems that can provide users with personalized and accurate product suggestions.

One promising approach to improving the effectiveness of such systems is the use of multi-modal representations and contrastive learning. Multi-modal representations can capture information from multiple sources, such as images and textual descriptions, to provide a more comprehensive understanding of the products. Meanwhile, contrastive learning can enable the model to learn representations that capture both the similarities and differences between products, allowing for more accurate and diverse product recommendations.

In this research, we explore the use of multi-modal representations and contrastive learning in the retrieval and recommendation of fashion products. We aim to develop a system thatcan effectively leverage both images and textual descriptions to provide personalized and accurate product suggestions to users. Our proposed method utilizes contrastive learning to learn representations that can capture the nuances of fashion products, such as style, color, and texture.

Overall, this study has the potential to improve the shopping experience for customers by helping the fashion sector design more effective product retrieval and suggestion systems.

II. Literature Review

A. Deep Learning for Product Retrieval

Deep learning has been effectively used in a number of industries, including speech recognition, natural language processing, and computer vision. In recent years, the fashion industry has also benefited from the development of deep learning techniques, particularly in fashion and product retrieval. In this literature survey, we will explore some of the key works and contributions in deep learning for fashion and product retrieval.

One of the main challenges in fashion product retrieval is the large variation in clothing styles, colors, and patterns. Deep learning methods have been applied to address this challenge, particularly in the area of visual search. For example, Zhong et al. (2017) proposed a deep learning-based visual search system for fashion products that learns a joint embedding space for images and products, allowing for efficient product retrieval. Similarly, Huang et al. (2018) proposed a multi-task learning framework that jointly learns to recognize clothing attributes and retrieve similar clothing items.

Another important aspect of fashion product retrieval is the ability to provide personalized recommendations to users. Deep learning-based recommendation systems have been developed to address this challenge. For example, Guo et al. (2017) proposeda deep neural network-based recommendationsystem that utilizes both user and product information to generate personalized recommendations. Similarly, Tang et al. (2018) proposed a deep learning-based recommendation system that utilizes both visual and textual information to provide personalized fashion recommendations.

B. Multi-modal Learning

Multimodal deep learning has become an active area of research due to its potential to solve complex real-world problems that involve multiple modalities of data such as images, text, and audio. In this literature review, we will explore some of the key works and contributions in multimodal deep learning. One of the earliest works in

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multimodal deep learning is the deep canonical correlation analysis (DCCA) proposed by Andrew et al. (2013), which learns joint representations for multiple modalities using a correlation-based approach. Later, the neural tensor network (NTN) proposed by Socher et al. (2013) extended the DCCA to learn higher-order correlations between modalities. The attention mechanism has also been widely used in multimodal deep learning, such as in the multi-modal transformer proposed by Su et al. (2019), which utilizes self-attention to model interactions between modalities. Multimodal deep learning has been applied to various tasks, such as image captioning, visual question answering, and emotion recognition. For example, the Show and Tell model proposed by Vinyals et al. (2015) utilizes a multimodal deep learning approach to generate captions for images. Similarly, the VQA model proposed by Antol et al. (2015) combines visual and textual information to answer questions about images.

Multimodal deep learning has also been applied to fashion and product retrieval, particularly in the area of image-text matching. This involves matching images of clothing items with their textual descriptions, allowing for more accurate and relevant product recommendations. For example, Liu et al. (2016) proposed a multimodal deep learning framework that utilizes both visual and textual features for image-text matching in fashion products. Similarly, Song et al. (2018) proposed a deep neural network-based framework that learns joint representations of images and text for fashion product retrieval.

In conclusion, deep learning techniques have shown significant potential in fashion and product retrieval, particularly in the areas of visual search, personalized recommendations, and image-text matching. As the availability of fashion data continues to increase, we can expect further developments and improvements in this area of research.

C. Contrastive Learning

Contrastive learning is a popular deep learning technique that aims to learn useful representations of data by maximizing the similarity between positive pairs (i.e., data samples that should be similar) and minimizing the similarity between negative pairs (i.e., data samples that should be dissimilar). In recent years, contrastive learning has been applied to a wide range of tasks, including image classification, objectdetection, and language modeling. In this literature review, we will discuss some of the most influential works in the field of contrastive learning.

- “SimCLR: A Simple Framework for Contrastive Learning of Visual Representations” by Ting Chen et al. (2020) This paper introduced SimCLR, a simple yet effective framework for contrastive learning of visual representa- tions. The authors showed that SimCLR achieved state- of-the-art results on several benchmark datasets, includ- ingImageNet and CIFAR-10. The key insight behind SimCLR is to use data augmentation techniques to create multiple views of the same image and to use contrastive loss to learn representations that are invariant to these transformations.
- “Unsupervised Representation Learning with Contrastive Predictive Coding” by Aaron van den Oord et al. (2018) This paper introduced contrastive predictive coding (CPC), a method for unsupervised representation learning that uses a contrastive loss to learn useful representations of data. The authors showed that CPC achieved state-of-the-art results on several benchmark datasets, including MNIST and CIFAR-10. The key insight behind CPC is to use a sequence prediction task to create positive and negative pairs of data samples, which are then used to learn representations that capture the underlying structure of the data.
- “Bootstrap Your Own Latent: A New Approach to Self-Supervised Learning” by Jean-Bastien Grill et al. (2020) This paper introduced BYOL, a new approach to self- supervised learning that uses a contrastive loss to learn useful representations of data. The authors showed that BYOL achieved state-of-the-art results on several bench- mark datasets, including ImageNet and CIFAR-10. The key insight behind BYOL is to use an online network to generate a target network, which is then used to compute the contrastive loss. This allows the network to learn from its own predictions and to improve its performance over time.
- “Exploring Simple Siamese Representation Learning” by Kevin Musgrave et al. (2020) This paper introduced a simple Siamese network architecture for contrastive learning that achieved state-of-the-art results on several benchmark datasets, including CIFAR-10 and CIFAR-100. The key insight behind this approach is to use a Siamese network to compute similarity scores between pairs of data samples, which are then used to train the network using a contrastive loss. The authors also showed that this approach is highly scalable and can be applied to large-scale datasets.
- “Understanding Contrastive Representation Learning through Alignment and Uniformity on the Hypersphere” by Kaiming He et al. (2020) This paper introduced a new theoretical framework for understanding contrastive learning and proposed a new contrastive loss function based on alignment and uniformity on the hypersphere.

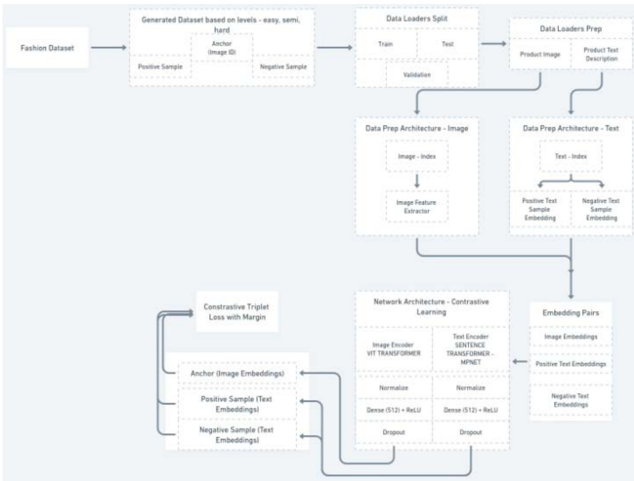

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Fig. 1. Overall Architecture Pipeline - Contrastive Learning

Fig. 2. Overall Data Pipeline

The authors showed that this loss function achieved state- of-the-art results on several benchmark datasets, including ImageNet and CIFAR-10. The key insight behind this approach is to learn representations that are well-aligned on the hypersphere and that are uniformly distributed, which helps to improve the generalization performance of the network.

III. Methodology

A. Data Pipeline

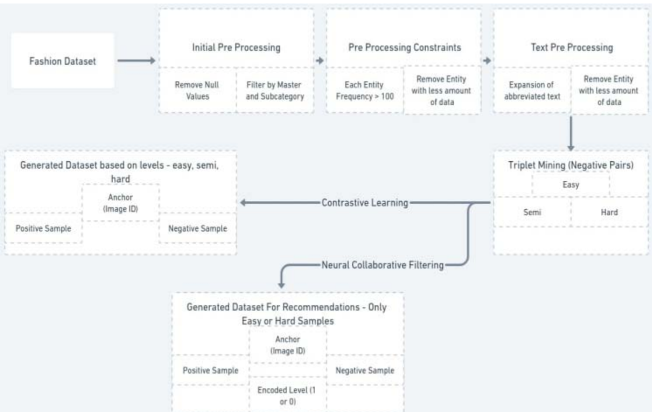
Contrastive learning is a type of self-supervised learning where a model is trained to distinguish between positive (similar) and negative (dissimilar) pairs of data samples. In the case of contrastive learning for image and text, the data is typically fed in the following way:

Easy pairs: For easy pairs, a positive pair consists of an image and its corresponding text description. The negative pair consists of an image and a text description that are unrelated to each other. Both the positive and negative pairs are considered easy because they are straightforward to distinguish.

Semi-hard pairs: For semi-hard pairs, the positive pair consists of an image and a text description that are related but not identical. The negative pair consists of an image and a text description that are either unrelated or too similar to the positive pair. These pairs are considered semi-hard because the model needs to learn to distinguish between subtle differences in the data.

Hard pairs: For hard pairs, the positive pair consists of an image and a text description that are very similar but not identical. The negative pair consists of an image and a text description that are very similar to each other, making it difficult for the model to distinguish between them. These pairs are considered hard because the model needs to learn to distinguish between very similar data.

In all cases, the data is typically fed to the model as pairs, with each pair consisting of an image and a text description. The model is trained to learn a joint embedding space where the image and text representations are mapped to a common feature space, making it easier to compare them and distinguish between positive and negative pairs.



anchor	positive	negative	level
01	Men Casual Cush Flex Black Slippers	Women Casual Colour Beam Multicolour Necklace	easy
02	Men Casual Cush Flex Black Slippers	Women Sports Adi Light Red White Shoe	semi
03	Men Casual Cush Flex Black Slippers	Men Casual Black Purah Sandals	hard
04	Men Casual Black Dial Watch PL12889JVSB	Women Casual Pink Dial Watch	semi
05	Men Casual Black Dial Watch PL12889JVSB	Men Casual Black Dial Watch Q672J405Y	hard
06	Men Casual Black Dial Watch PL12889JVSB	Women Sports Pink Polo Tshirts	easy

These triplet pairs were generated by pairing with product context and differences based on color and gender. A sample is shown in the given table.

B. Architecture

1) Image Encoder: Image Encoder - VIT (Vision Trans- former) is a neural network architecture used for image classification tasks. It is a transformer-based architecture, which means it uses self-attention mechanisms to capture long-range dependencies in the input image.

The image patch embedding layer and the transformer them through a linear classification layer. During training, the model is optimized using a cross-entropy loss function, and backpropagation is used to update the model weights.

One of the advantages of the VIT model is that it can be trained on large amounts of data using a self-supervised learning approach, where the model is trained to predict the relative position of patches within an image, without requiring manual annotations. This approach allows the model to learn useful representations of images that can be transferred to downstream tasks.

Overall, the Image Encoder - VIT is a powerful architecture for image classification tasks, with strong performance on a variety of benchmarks, including the ImageNet dataset.

Text Encoder: -MPNet sentence transformer is a neural network architecture used for encoding text into fixed-lengthencoder layer are the two fundamental components of the VIT model. In order to create a succession of embeddings, the image patch embedding layer divides the input picture into fixed-size patches and applies a linear projection to each patch. The transformer encoder layer, which is made up of several blocks of multi-head self-attention and feedforward layers, is then fed these embeddings. The model can focus on various areas of the image and understand the spatial correlations between patches thanks to the self-attention mechanism.

The transformer encoder layer outputs a sequence of em- beddings, which can be used for classification by passingrepresentations, also known as embeddings. It is based on the transformer architecture and is designed specifically for encoding entire sentences or paragraphs of text.

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The mpnet sentence transformer model consists of multiple layers of transformer encoder blocks, each containing multi- head self-attention and feedforward layers. These layers allow the model to capture the relationships between different words and phrases within a sentence, as well as the overall structure and meaning of the sentence.

The input to the model is a sequence of word embeddings, which can be obtained using various methods, such as pre-trained word embeddings like GloVe or FastText, or by training word embeddings from scratch on a large corpus of text. The model then processes the input sequence through its multiple transformer encoder layers, producing a fixed-length sentence embedding as output.

One of the advantages of the mpnet sentence transformer model is its ability to learn from large amounts of unstructured text data using unsupervised learning techniques. By training on large amounts of text data, the model can learn to encode sentences in a way that captures their meaning and context, allowing for more effective downstream tasks such as text classification, sentiment analysis, and text similarity matching.

Overall, the Text Encoder - mpnet sentence transformer is a powerful architecture for encoding text into fixed-length representations, with strong performance on a variety of benchmarks, including the STS Benchmark and the GLUE benchmark. Its ability to learn from large amounts of unstruc- tured text data makes it a useful tool for a wide range of natural language processing tasks.

C. Triplet Loss Function

Contrastive triplet loss is a type of loss function used in deep learning models for learning representations of data in a metric space. It is commonly used in image and text retrieval tasks, where the model is trained to encode images or text into a low-dimensional space where similar images or text are closer together and dissimilar ones are further apart.

The contrastive triplet loss function consists of three inputs: an anchor, a positive example, and a negative example. The anchor is an input data point, such as an image or a text snippet, for which the model should learn an embedding. The positive example is another input data point that is similar to the anchor, while the negative example is a data point that is dissimilar to the anchor.

The loss function is made to make sure that there is a difference in size between the distance between the anchor and the positive example and the distance between the anchor and the negative example. A hyperparameter called margin establishes the shortest possible distance between the anchor and the negative instances.

These are the calculations for the contrastive triplet loss function: // d(a,p) is the Euclidean distance between the anchor and the positive example, and d(a,n) is the Euclidean distance between the anchor and the negative example, where an is the anchor, p is the positive example, and n is the negative example.

By changing model parameters during training, the model seeks to reduce the contrastive triplet loss function. The objective is to learn embeddings that increase the margin of separation between the anchor and negative instances while minimising the margin of separation between the anchor and positive examples.

The margin is an important hyperparameter in the con- trastive triplet loss function because it determines the threshold for what constitutes a ”similar” or ”dissimilar” example. If the margin is too small, the model may learn embeddings that arenot well-separated, while if the margin is too large, the model may learn embeddings that are too dissimilar, making it harder to retrieve similar examples.

Overall, the contrastive triplet loss with margin is a powerful technique for learning embeddings in a metric space that capture the similarities and dissimilarities between data points, with strong performance in image and text retrieval tasks.

D. Training

Contrastive learning is a type of unsupervised learning technique that learns to map similar inputs together in a latent space. In the context of multi-modal learning, contrastive learning can be used to learn joint representations of images and text, where the embeddings of similar images and their associated texts are mapped closer together in the latent space. The contrastive learning architecture with both image and text encoder and triplet mining loss function consists of two main parts: an image encoder and a text encoder. The image encoder takes an input image and maps it to a fixed-length representation, while the text encoder takes an input text andmaps it to a separate fixed-length representation.

The triplet mining loss function is used to train the model. The loss function takes three inputs: an anchor, a positive, and a negative example. The anchor is a pair of an image and its associated text, while the positive and negative examples are other pairs of images and their associated texts. The goal of the loss function is to minimize the distance between the anchor and positive examples, while maximizing the distance between the anchor and negative examples.

During training, the model is fed batches of image-text pairs, and the triplet loss is calculated for each anchor, positive, and negative example. The model is then optimized to minimize the overall triplet loss using gradient descent.

One of the advantages of the contrastive learning architecture with both image and text encoder and triplet mining loss function is that it can learn joint representations of images and text that capture both their visual and semantic similarities. These joint representations can be used for a wide range of downstream tasks, such as image-text retrieval, cross-modal retrieval, and multimodal classification.

The proposed architecture uses a VIT transformer as an image encoder and MPNET Sentence Transformer as a language encoder along with linear and dropout layers for regularisation. The overall working of this architecture is explained in the figure.

E. Post Training Recommendation Pipeline

DOI: rp-9788770040723.152

The dataset generated from Data Pipeline while making triplet pair batches was also used to sequence and generate another dataset, where it queries hard and semi-level pairs and encodes labels with difficulty match as 1 and 0 as per their matching relevance. This matching and sequencing generated a candidate-item-based dataset along with its binary labels - 1 or 0 (being hard or semi-hard respectively). This retrieval can be used to build a collaborative recommendation system. A snippet of extracted data is being shown in the given table.

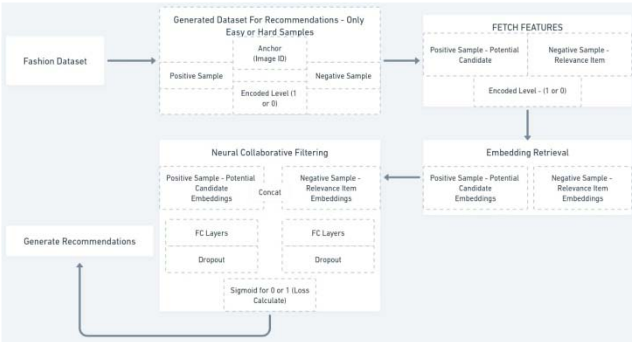

Fig. 3. Overall Architecture Pipeline - Recommendation and Joint Retrieval

Neural Collaborative Filtering (NCF) is a technique used in recommender systems that combines deep learning with traditional collaborative filtering methods. Collaborative filtering is a technique used to make predictions about user preferences by finding similarities between users or items based on their past interactions.

The cold-start problem, when new users or objects have little to no interaction history, and the sparsity problem, where the interaction matrix is frequently sparse, are two drawbacks of conventional collaborative filtering approaches that NCF is intended to address.

NCF consists of two main parts: the user and item embedding layers, and the neural network layer. The user and item embedding layers map the users and items to a low- dimensional vector space, while the neural network layer learns the interactions between the user and item embeddings to make predictions about user preferences.

The user and item embeddings are learned through a process called matrix factorization, where the interaction matrix is decomposed into two low-rank matrices, one for users and one for items. The user and item embeddings are learned by minimizing the reconstruction error between the original interaction matrix and the reconstructed interaction matrix using techniques such as Alternating Least Squares or Stochastic Gradient Descent.

Once the user and item embeddings are learned, they are passed through a neural network layer that learns the interactions between them. The neural network layer can be designed in a variety of ways, such as a simple dot product betweenthe user and item embeddings, or a more complex multi- layered neural network that can capture non-linear interactions between the user and item embeddings.

During training, the model is optimized using a loss function such as mean squared error or binary cross-entropy, which measures the difference between the predicted and actual ratings.

NCF has been shown to outperform traditional collaborative filtering techniques on a variety of datasets, particularly in scenarios where the interaction matrix is sparse or the user- item interactions are implicit (e.g., clicks, views, purchases) rather than explicit ratings.

IV. Experimentation

A. *Hardware Architecture Specifications*

This pipeline was processed and experimented with over Google Colab Free tier with NVIDIA Tesla P4 GPU with 15 GB RAM. Google Drive storage was used as cloud storage for storing model-saved states and inference results.

B. *Software Specifications*

Source	**Platform /Tool**
Programming Language	Python
Deep Learning Framework	Pytorch
Data Processing and Utilities	Pandas, Numpy, Scikit-Learn
Operating System	Linux OS

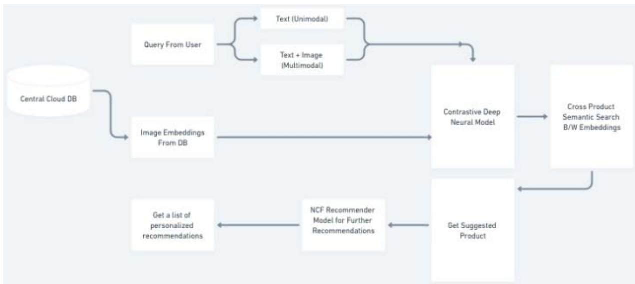

Fig. 4. Overall Query and Fetch Pipeline

B. *Text Retrieval*

In contrastive learning, text retrieval involves comparing two or more text embeddings (i.e., representations of text in a high-dimensional space) to determine their similarity or dissimilarity. This is typically done by measuring the distance between the embeddings, where a smaller distance indicates greater similarity. WIth triplet loss, which involves training a neural network to learn embeddings such that the distance between an anchor text and a positive text (i.e., a text that should be similar) is smaller than the distance between the anchor text and a negative text (i.e., a text that should be dissimilar). This helps the network learn more discriminative embeddings that can be used for text retrieval.

Text query can be passed as a text description of the product and then semantic embeddings can be cross-computed against image embeddings to fetch product retrieval results.

C. *Multimodal Retrieval*

In contrastive learning, image-text retrieval involves comparing the embeddings of images and texts to determine their similarity or dissimilarity. This can be useful for tasks such as image captioning, visual question-answering, and cross-modal retrieval.

DOI: rp-9788770040723.152

To perform image-text retrieval in contrastive learning, we typically use a multimodal (image+text as a query) approach that combines visual and textual features. Using Cosine Sim- ilarity as a semantic search, we can compute the distance between text and image embeddings and fetch the retrieval of products

D. Recommendation from contrastive Retrieval

In the context of fashion product retrieval, NCF can be used to further enhance the personalized recommendationsgenerated using contrastive learning-based retrieval. By in- corporating NCF into the recommendation system, we can capture more complex user-item interactions and generate more accurate personalized recommendations.

The idea is to use theembeddings learned through contrastive learning as input to a neural network that models the user-item interactions. This network can be trained using a variety of techniques, such as matrix factorization, to predict the likelihood of a user interacting with a particular item.

By combining the strengths of both contrastive learning and neural collaborative filtering, we can generate more accurate and personalized recommendations for users.

V. Result And Its Analysis

In the context of contrastive learning, good performance on frequently occurring images and descriptions can be attributed to the fact that the model is able to learn the distinguishing features and patterns of these samples more effectively. This is because the model has more data to learn from and can more easily identify the common features that distinguish these popular items and colors.

However, when it comes to less frequent images and de- scriptions, the model may not have enough data to effectively learn the relevant features and patterns, leading to poor performance. This is a common challenge in machine learning, particularly in deep learning-based approaches, where models require large amounts of data to effectively learn the underlying patterns.

One way to address this challenge is to increase the amount of training data by using techniques such as data augmentation or synthesis, which can help the model to learn more generalizable representations. Additionally, fine-tuning the model on a smaller, more specific dataset that focuses on the less

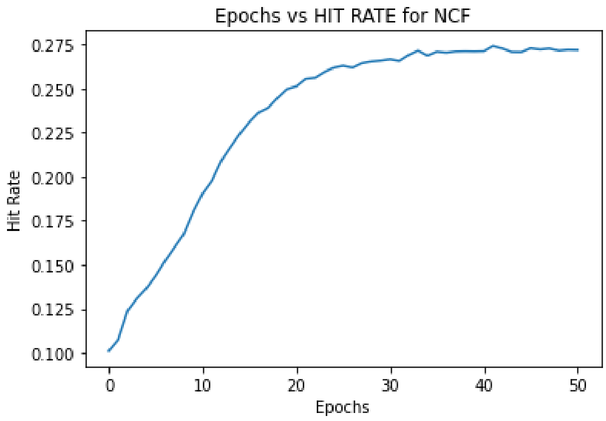

Fig. 5. NCF - Hit Rate Analysis

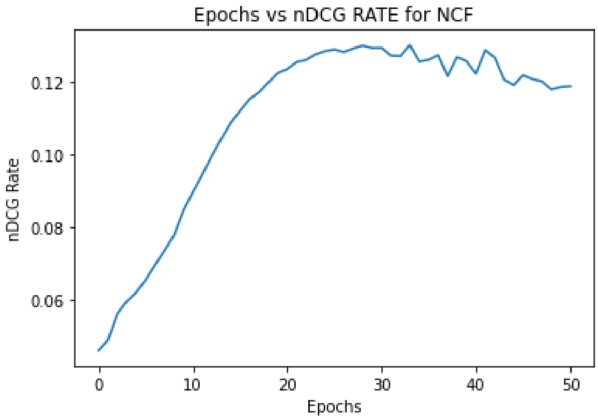

Fig. 6. NCF - nDCG Analysis

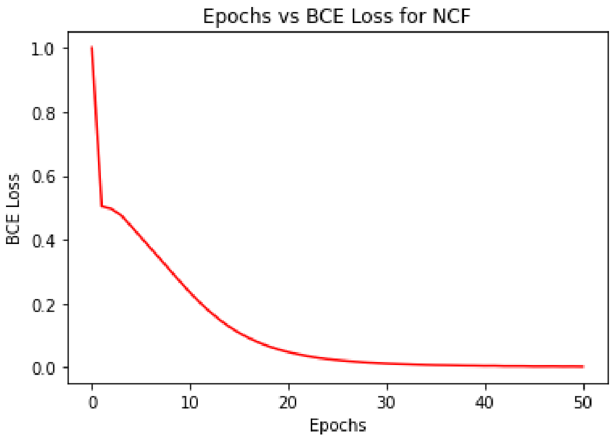

Fig. 7. NCF - Loss Analysis

TABLE I: Contrastive Learning - Table

Epoch	Train Loss	Valid Loss
1	0.067	0.448
2	0.042	0.038
3	0.036	0.035

frequent samples can also help to improve performance on these samples.

Regarding the difficulty in identifying colors, this can be addressed by incorporating additional information or features into the model, such as color histograms or color spaces, that can help the model to better capture and

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distinguish between different colors. It may also be helpful to pre-process the images to enhance or highlight the color features, or to use more advanced computer vision techniques such as object detection or segmentation that can help the model to focus on specific color regions.

Overall, it’s important to ensure that the dataset is balanced and contains sufficient examples of both frequently and less frequently occurring images and descriptions to enable the model to learn effective representations for both. Proper eval- uation of the model’s performance using appropriate metrics and analysis techniques can also help to identify areas of improvement and guide further model development.Graphic

VI. Conclusion And Future Work

In conclusion, fashion product retrieval using contrastive learning is a promising approach for improving the accuracy and efficiency of fashion product recommendation and search systems. By using a multimodal approach that combines visual and textual features, we can learn a joint embedding space that captures meaningful semantic relationships between fashion products and their attributes.

With the increasing popularity of online shopping and the vast amounts of product data available, fashion product retrieval has become a critical problem for many retailers and consumers. By using contrastive learning, we can improve the accuracy of product recommendations by learning more discriminative representations of fashion products and their attributes.

One key advantage of contrastive learning is that it can be used to train deep neural networks using unsupervised learning, which reduces the amount of labeled data needed for training. This makes it particularly useful for fashion product retrieval, where labeled data may be scarce or expensive to obtain.

In terms of better suggestions, neural collaborative filtering as integration is also proposed which can further enhance personalized product suggestions based on obtained results from contrastive learning-based retrieval.Neural collaborativefiltering (NCF) is a powerful technique that can be used in conjunction with contrastive learning to improve personalized product suggestions. Collaborative filtering is a common technique used in recommender systems, where users’ past interactions with items (such as purchases or ratings) are used to make recommendations for new items. Neural collaborative filtering is a deep learning-based approach to collaborative filtering that uses neural networks to model the user-item interactions.

In the context of fashion product retrieval, NCF can be used to further enhance the personalized recommendations generated using contrastive learning-based retrieval. By incorporating NCF into the recommendation system, we can capture more complex user-item interactions and generate more accurate personalized recommendations.

The idea is to use theembeddings learned through contrastive learning as input to a neural network that models the user-item interactions. This network can be trained using a variety of techniques, such as matrix factorization, to predict the likelihood of a user interacting with a particular item.

By combining the strengths of both contrastive learning and neural collaborative filtering, we can generate more accurate and personalized recommendations for users. This approach has been shown to be effective in a variety of recommendation tasks, including music and movie recommendations, and has the potential to significantly improve the performance of fashion product retrieval systems.

Overall, fashion product retrieval using contrastive learning has many practical applications and is an active area of research in the fields of computer vision and machine learning. With continued advancements in deep learning and multimodal fusion techniques, we can expect to see significant improvements in the accuracy and efficiency of fashion product retrieval systems in the years to come.

VII. Limitations

The proposed work was implemented over Google Colab with restricted computation, if given a better architecture, more dimensions and a granular level of training can be done and better results could have been computed.

The proposed models can be further fine-tuned with the implementation of more regularisation layers and hyperparameter tunings.

A complex and bigger triplet mining map can be further retrieved from the data pipeline across product descriptions.

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Residential VehicleSecurity System Using YOLOv5 Framework

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Abstract—Security automation is essential today because it has become one of the main concerns for any organization. Many of the solutions that are currently available are still unreliable in real-world settings because they frequently depend on numerous constraints. In the project that follows, we will learn how to identify license plates using the Object localization and OCR. For this project, we'll use the YOLOv5 framework for license plate localization, then identify the license plate text using EasyOCR. This study will also show how a cutting-edge YOLO object detection-based ALPR system can be reliable and successful. The results show that a trained aneural network working with a high accuracy of about 90-95 percent can recognize license plates in low-resolution pictures.

This project will present a robust and efficient ALPR system based on the state-of-the-art YOLO object detection. The results have shown that the trained neural network is able to perform with high accuracy of nearly 90-95 percent in recognizing license plates in low resolution images using this system.

Keywords—Deep Learning, YOLO, Object Detection & Localization, OCR, Easy OCR, License Plate Recognition, ANPR, Residential vehicle security

I. Introduction

These days there is an increasing need for security in residential complexes, be it big or small. We believe using our application, it is possible to provide maximum security to such buildings. There are often hindrances while finding out whether a person entering the building via any vehicle is a person belonging to the community or not. This can be done via manual checking but it is a very tedious job for the security personnel. Using the app, we have developed, all they have to do is take a photo of the incoming vehicle, that is all.

The code we've written recognizes the license plate and uses OCR to extract the text from it. After this, it matches the said license plate with the ones in the database, thereby finding whether the vehicle belongs to the building or not. In this project, we aim to provide the following features - (a) Identifying vehicles that belong to the premises, Creating and storing the vehicle/owner information in the database, such that their parking lot for each vehicle is assigned and mentioned in the database. From this we can fetch the data we need to verify in future.

So, whenever any vehicle enters the residency, the security guards will simply click their picture from the application, and our deep learning model will extract the text of the license plate and cross verify with the database if it is present or not. (b) Availability of parking spaces: Another big problem which residential management faces is parking on wrong slots/ or some outsider's vehicle is parked at a pre-allocated slot of some resident. Keeping a track of that and verifying those things again is a big problem. In case a visitor enters with their vehicle they don't know where to park so they at times park at someone else's parking area, or on roads, or at places which might create problems in the future. This app will temporarily allocate free parking spaces, and its location, once authorized, so that they can park freely and safely without any disputes. (c) Allotment of parking space for newly registered vehicles: When an existing resident gets a new vehicle, or a new resident arrives, once they are authorized, this app will give them an option to select and pick any slot available and permanently allocate that slot to them. (d) Reducing the labor work of security personnel: This Application is designed so that it will avoid a lot of paperwork and verification work done by security personnel everyday 24/7. This app is simple to use for anyone to use with/without having a technical background. And it's one more new step towards digitization.

II. Literature Survey

For solving real world problems likevehicle parking to traffic control, a realtime ANPR model has established itself as a vital instrument for access-control &improved management of traffic. In previous model, the vehicle license plate area was located using a number of localization techniques, including contouring, edge-detection,and others. These ANPR model may function under limitations like darkness or light, angle view of plate, and poor resolution stated in [3] by using simple image processing algorithms. Previous research employed image preprocessing techniques including edge detection and contouring for the detection of number plates, which included the use of serval localization algorithms.

Additionally, [4] discusses both online and offline versions of the ANPR system. In contrast to offline ANPR models, which take pics for additional processing with the help of OpenCV, as it has numerous predefined algorithms, which aresuitable for realtime application, online ANPR systems interpret incoming video frames to enable real-time tracking.

Using a Raspberry-Pi, Fakhar et al. suggested a cheap ANPR system in 2018 [5], where the model makes use of a real-time picture taken from a camera. The characters on the plate are recognized once the picture has been denoised, filtered, and segmented. All complex calculations are handled by the Raspberry-Pi, and there is a discernible 3-second delay before the outcome. The database also stores

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the outcome label. [6] presents the ANPR technology for smart check-in and check-out, which shortens wait times and records vehicle entrance and leave. In order for ANPR systems to instantaneously identify the license plate text using image-computing and record the adding vehicle and security info in the database through a web-app, images from CCTV cameras must be gathered. The suggested method would shorten check-in times and ease parking and traffic congestion.

The ANPR model in POLIMAS, that confirms that only authenticated cars are allowed to access the designated site, was proposed by Nui Din and Virakwanin [7]. There are four alternative ways to install a webcam: back, front,rear, and top. The acquired picture is made gray-scale, and then the histogram equalization method is used to modify the contrast and intensity. A combination of Sobel-edge and Laplacian-edge detectors is used in the bounding box technique to identify and crop character region, yielding 95.83% confidence of localization of license plates. In OCR, each character is compared using eigenvectors and correlation. Character recognition accuracy using the suggested method was 87.41%. The results are gathered in a string format& contrasted with the reserved records in the DB.

Liu &Chou [8] introduced a real-time truck license number verification system that decreases the manual efforts and labor, additionally time-spent in verifyinglicense plates since identification remained difficult owing to the diverse forms of plates in different locations. Their approach successfully lowers the likelihood of crime while enhancing the efficiency, automation, and transparency of front-line workers. Using Yolo& CNN based Deep Learning frameworks, this model achieved a single-character detection rate of 97.59%, and overall accuracy rate was 93.73%, and at inference-time of 0.32 sec/image.

In [9], Chen and Hu presented an ITS that emphasized video dedicated vehicle recognition & classification methods that rely on static & motion each information to get better results. Under environmental variables, such as various illuminations, the suggested approach localizes the vehicle license plate region &detectscharacters from license plate with a 95% confidence score.

In [10], a car plate identification system depending on OCR &WSN (wireless sensors network) was discussed. The suggested model takes pictures of parking spots using the Smart Parking Service (SPANS) framework and detects in-motion as well as parked automobilelicense plates. Real-time photos are also used to evaluate the system's performance. R. N. Babu et al. in [11] employed cutting-edge DL approaches for plate identification. 6500 Indian license plates made up their picture dataset, which was split into training and testing sets in a ratio of 90:10. Three separate cameras, each with a different data rate and focal length, were used to take the pictures. For character recognition, a 37-class CNN model was trained. The model employs 126 filters, and YOLOv3 is utilized to decode the license plates of moving vehicles. For license plate character recognition, they attained a 91% accuracy rate.

In addition, using a KNN-based approach, character identification is accomplished in [12] with a 98% accuracy rate. The pictures were captured with a webcam that has a 640 x 480-pixel resolution. The procedure made use of thresholding, grayscaling, edge-detection, morphological and inversion techniques.

Different segmentation techniques were used by Ariff et al. in [13] for the cleanup and evaluation of the noisy number plate photos. 100 Malaysian number plates with high resolution of 1932x2576p were evaluated utilizing threshold techniques like NiblackandSavoula to get rid of unwanted pixels. The average accuracy of Savoula segmentation inthis situation is 83%. Character classification is done using the template matching approach.

A precise VNPT recognition method based on an OCR engine is suggested in [14]. The input license plate pic is converted to grayscale, subjected to global image-thresholding by utilizing Otsu technique, and had its noise removed. OCR is used to perform character recognition on the processed picture. The outcome is subsequently placed in a text-file as a string. The overall precision of the system ranges from 90% to 100%.

ALPRNET, a neural-network called and two full-convolutional onestage object predictors for concurrently identifying & categorizing characters and license numbers, were presented by the author in [15]. [16] introduces a global license plate identification system that uses Tiny YOLOv3, YOLOv3-SPP (spatial pyramid pooling), and unified character sequence detection to identify the layout of 17 distinct nations.

III. Proposed System

From the past research addressing ANPR, we discovered that two alternative approaches were often employed for character detection in the ANPR models. The basic technique is EasyOCR & the other technique is connected to Deep Learning. Also, we employed these two techniques for rapid deployment of our suggested ANPR system, which has a unique system specialised to Residential vehicle license authentication was introduced. In this study, we have refined our previously suggested pipeline for license plates & investigated its use in autonomous vehicle authentication.

About traditional ANPR model, it's not very efficient & precise in finding license plate's position and recognition technique due to diverse real-world scenarios like,lighting as well as the quality of clicked pictureduring the acquisition phase. Traditional ANPR pipeline involves these stages: picture capture, plate identification, pre-processing of retrieved plate, and license plate identification. The suggested realtime ANPR model takes the multiple frames from the surveillance footage and, using YOLO object identification framework, detects the front or rear image of automobile in order to establish the check-in or check-out condition for the authenticationmodel. Following that, the license plate can be tracked by using the YOLO framework.

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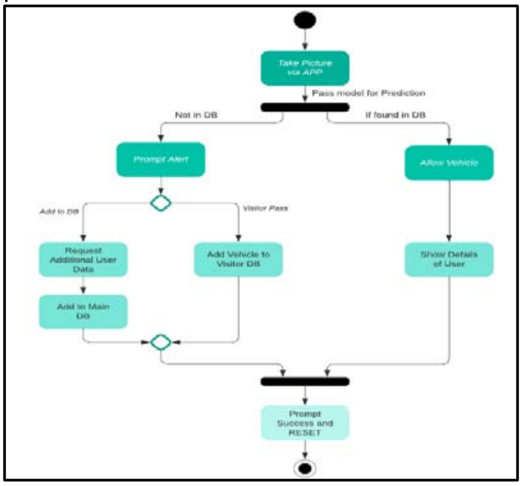

Fig. 1. Flow diagram

In the end, license plate characters are detected by efficient OCRmodelslike CNNbased frameworks or EasyOCR. Fig. 1 shows theflow diagram of our proposed Licence plate recognition model. This project has 4 major modules, the Flutter Application, Flask Integration, Database, Train YOLOv5 model.

A. Training YOLOv5 Model

We are training the YOLOv5 framework for license plate localization since YOLOv5's object detection model is relatively fast and gives precise results in a real time application. YOLO (You Only Look Once) is a real-time object detection algorithm that processes an image in a single pass, identifying objects and their bounding boxes. It achieves high accuracy and fast performance by using a convolutional neural network to simultaneously predict object classes and locations. It is trained on vehicle's license plate images in both front and rear view. We provide only one classifier 'license plate' as per requirements. We took the dataset from Kaggle with 433 images with bounding box annotations of the car license plates within the image.

In the pre-processing step we resized and converted every image into a list of coordinates of size 224x224 (which is standard size for pretrained transfer learning models). Then we split the data into train & test with the ratio of 75:25. Then we finally train the model with the YOLOv5 model with the YOLOv5s weights (which is ideal for smaller datasets). As a result yolo will return the images with the bounding boxes around the localized license plate region with a number as the confidence score (as shown in Fig 2). The weights in the "best.pt" file represent the optimized values for the model's parameters that allow it to perform well on the task it was trained for. We saved the 'best.pt' trained weight from the model for the deployment code.

Fig. 2. Output of YOLOv5 Train model

B. FireBase (Residential Vehicle Database)

A small database is created in Firebase. Firebase is a mobile and web application development platform that provides a suite of backend services to help developers build apps faster. We are using its real-time database for the vehicle database of the residencies, so that we can easily add, fetch & search the records in the database in real time. The database is stored as a nosql database in the format of collections with the attributes - owner_name, license_no, flat_no, contact_no.

C. Flutter Application

Flutter app will be used by the end users, to click pictures from the app and verify the cars.The workflow of this task will process as the user clicks picture, it will be sent to Flask UI through an API and the authenticity and details of the car and car owner(if legitimate) will be returned and displayed,

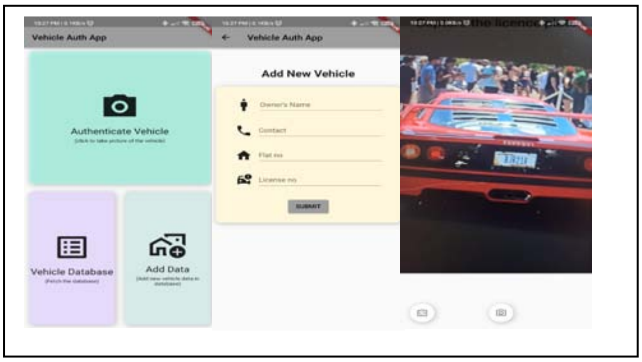

Fig. 3. UI of Flutter APP

After which the user can take further actions accordingly (add to database or temporarily allocation of available spaces etc.). Apart from this the UI has some additional features like, adding new Vehicle data to the Database & viewing the residential vehicle database on the app itself.Figure 3 depicts the User Interface of flutter app.

D. Flask App Integrity (Deployment code)

In this module we have hosted a Flask web-app so that it can interact with Flutter app, & Firebase (that has Residential vehicle database). Also this app can run the deployment code when requested.

The deployment code is responsible for localizing the license plate & extracting the license plate number, from the given user requested vehicle image. This deployment code uses the YOLOv5 framework for license plate localization using our pre-trained weights from the previously trained model (saved in 'best.pt' file). This concept of using pre-trained weights/model is called Transfer learning. After getting localized license plate coordinates, we crop that region and pass it to the OCR(Optical Character Recognition) model for text extraction. Precisely we are using EasyOCR, which is a Python package that provides an easy-to-use interface for optical character recognition (OCR) of text in images and PDF files. It can recognize text in over 70 languages and supports multiple OCR engines for improved accuracy. In Fig 4, the flow of deep learning model is explained.

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The extracted text is returned to the flask app, which is then searched through the database in Firebase by using the queries and if found we fetch the owner's details else we get '-1' response, which we revert back to the Flutter app.

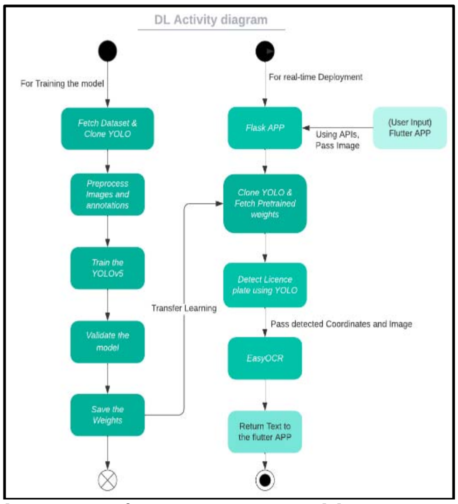

Fig. 4. Flow Diagram for Deep-Learning Model

III. Experiment Analysis

After training with a total of 433 images of license plates, we used 300 epochs & 16 batch size. We can see the below mentioned plots (Fig 5) that there is a definite drop in the box_loss (the loss function that penalizes the model for incorrect predictions of the bounding box coordinates) and obj_loss (the loss function that penalizes the model for object detection errors, such as false positives and false negatives) after 200 epochs. For the best.pt weight with most optimal performance, the precision value was 0.97, recall was 0.99 & mAP (mean Average Precision) was 0.99.

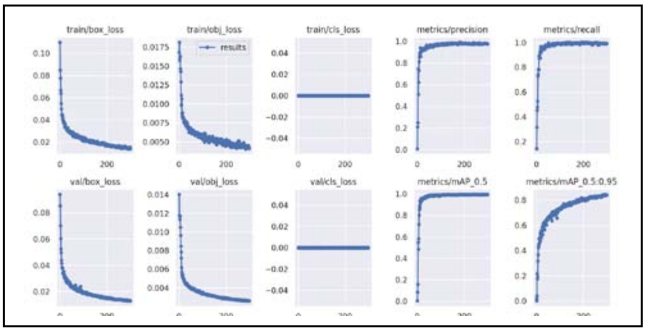

Fig. 5. Loss analysis

Figure 6 shows the F1 score of the model. By these values calculating the F1 score, using the standard formula we get 0.98 for the YOLO license plate localization.

Fig. 6. (a) F1 Score vs Confidence plot for YOLOv5 model; (b) Output of Deployment code after EasyOCR

IV. Conclusion

This project has presented us with a robust & an efficient Residential vehicle authentication system based on YOLOv5 object detection. In this model, we have used the concept of transfer learning, to integrate two models to create a deep-learningbased pipeline that is trained&validated for residential vehicle authentication apps. The results have shown that the trained neural-network is able to perform with high-accuracy of around 95-98% in localizing license plates in low-resolution picswith the help of this system. We can improve the model's performance even more by training it on Indian vehicle license plate images and videos. This system has potential to replace the trivial manual vehicle verifying process with its automated and fast approach. Furthermore, we can add more useful features to this system to ease the management task, such as allocating unallocated parking spaces to the visitor's vehicles, temporarily and integrating this model to a live streaming device (through CCTVs for example) to make this process completely automated instead of relying for manual clicking of pictures.

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Efficient Prediction of Infectious and Non- Infectious Diseases using Decision Tree Classifier Algorithm

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***Abstract*—Disease prediction system is devolved to predict the diseases. This is done from the information/symptoms provided by the user; these symptoms are considered as input to the system. The proposed system analysis helps to discover the symptoms that are provided from the users and shows a probability of the disease as an output. This process of prediction of diseases is done using a decision tree classifier. With data present on these disease, the user can predict the disease bases on systems and also book an appointment based on the result from prediction.**

I. Introduction

The branch of AI and computer science called "machine learning" uses algorithms and information to simulate how people learn, progressively increasing the accuracy of the system. ML has two steps that ensure the accuracy of the output. Those two steps are: training and testing. By using machine learning, issues in the medial field can resolved efficiently.

By using machine learning we are able to securely maintain the records of the hospital with this information we can create a model that to get quickly analyse data and deliver results faster.

With this invention doctors can swiftly get results and also can accede the issue with more quickly from this action more lives can be saved.

For more accuracy from massive data the proposed system used linear, KNN, decision tree algorithm.

II. LITERATURE REVIEW

A. *Common Diseases (CD)*

Dahiwad et al. suggested an ML based technique for anticipating common diseases. The UCI ML repository of various prevalent ailments was used to import the symptoms dataset, which comprised symptoms. The system used the categorization techniques convolution neural network and k-nearest neighbor to forecast a variety of ailments. Furthermore, the proposed remedy included further data on the tested patient's lifestyle choices, which was useful in deciding the degree of risk associated with the anticipated illness. Dahiwad et al. examined the results of the k-nearest neighbor and convolution neural network algorithms in terms of processing speed and correctness. convolution neural network had a processing time of 83.7% and an accuracy of 12.1 seconds. Statistics revealed that the k-nearest neighbor approach outperformed the convolution neural network algorithm. Based on their findings, Che et al. concluded that convolution neural network outperformed conventional supervised algorithms such as k-nearest neighbor and decision tree. The suggested model's ability to recognize complicated nonlinear interactions in the feature space it states why it performed better than previous models. In addition, convolution neural network identifies significant characteristics and improves illness descriptions, allowing it to accurately forecast diseases of great complexity.

B. *Kidney Problems*

A comparison of classifiers' capacities to diagnose chronic kidney disease was performed using the Kidney Function Test dataset. The classifiers used in this study are k-nearest neighbor, Naïve bayes, and random forest, and their performance is measured in terms of F-measure, precision, and accuracy. While Naïve bayes produced superior precision, random forest performed better in terms of F-measure and accuracy, according to the results of the analysis. Considering this study, users attempted to diagnose renal diseases using support vector machine and Naïve bayes. The classifiers were used to differentiate four types of kidney disorders: Acute Nephritic Syndrome, Acute Renal Failure, Chronic Glomerulonephritis, and chronic kidney disease. The study also focused on determining the classification algorithm that performed the best in terms of accuracy and execution time. support vector machine outperformed Naïve bayes in terms of accuracy, making it the best algorithm, according to the data. Naïve bayes, on the other hand, classified data swiftly. Because it effectively manages semi-structured and unstructured data, Charleonna et al. and Kottur et al. determined that the support vector machine classifier is more suitable regarding renal illnesses. Many empirical studies are dedicated on identifying chronic kidney disease. Because of the support vector machine's scalability to larger feature areas, it was able to identify complex kidney disorders with high accuracy.

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C. *Heart Problems*

Marimuth et al. attempted to forecast heart diseases using supervised ML techniques. The classified the attributes of the data as sex, age, aim, slope, and chest pain. The four applicable machine learning algorithms used are decision tree, k-nearest neighbor, logical regression, and Naïve bayes. When compared to the other algorithms, the logical regression algorithm performed the best, with an accuracy score of 87.79%. In 2017, Dwivedi attempted to improve the correctness of heart disease prediction by taking into account new parameters such as resting BP, SC in mg/dl. The dataset used had 119 positive heart disease tests and 148 negative heart disease tests; it was imported from the UCI ML laboratory. Dwived et al. analyzed the performance of Artificial Neural Networks, support vector machine, k-nearest neighbor, Naïve bayes, logical regression, and Classification Trees. The results of tenfold cross-validation demonstrated that logical regression has the highest classification accuracy and sensitivity, exhibiting remarkable dependability in detecting cardiac abnormalities. Polaraj and Vahi et al.'s results, in which LR outperformed other techniques such as Artificial Neural Networks, support vector machine, and AdaBost,

II. Objective

To visit a doctor first we need to book an appointment and pay consult fee but with this system we can save time and money at the same time. This can predict users' disease by analysing the symptoms that were provided as input to the system. As the time progress, accuracy of the system will be improved by ML.

III. Existing System

Although surgeons still need technology in a variety of ways, such as surgical representation and x-ray photography, it has perceptually lagged behind. Due to other aspects like weather, environment, blood pressure, and several other parameters, the approach still requires the doctor's knowledge and expertise. there are a great deal of factors that are acknowledged as being necessary to comprehend the total functioning process,no model has ever been able to examine them adequately. To overcome this issue, medical decision support technologies must be used. This method can help doctors make the best selection.

ML is being used to keep entire healthcare data. With the use of machine learning technology, doctors can make important decisions regarding patient diagnoses and treatment options, improving patient healthcare services. Machine learning technology enables constructing models to evaluate data rapidly and give answers faster. The use of machine learning in the medical industry is best illustrated by the example of healthcare.

IV. Proposed System

Using symptoms, this system is used to forecast illness. This system evaluates the model using a decision tree classifier. End users make use of this system. Based on symptoms, the system will be able to forecast illness. The technology used by this system is machine learning. The decision tree classifier method is used to forecast illnesses.

Using symptoms, this system can be used to forecast infectious and non-infectious diseases. proposed system evaluates using a decision tree classifier. users make use of this system. The technology used by this system is machine learning. The decision tree classifier method is used to forecast illnesses.

V. Dataset Model Description

This dataset used in this analyzes base of symptom connections created automatically using data from textual discharge summaries of patients hospitalized in many Hospitals. The condition is displayed in the first column, followed by the number of discharge summaries that mention it positively and recently, as well as any accompanying symptoms. Based on these notes, associations for the 148 most prevalent diseases were calculated, and the symptoms are displayed sorted according to the strength of link. The method involved extracting UMLS codes for ailments and symptoms from the notes using the MedLEE natural language processing system, and then determining relationships using statistical techniques based on frequency and co-occurrence.

The original information's substance and the quantity of information needed is known as information gain. The features are ordered according to information gains, and the top-ranked features are then picked as prospective classifier qualities. Evaluating the data gained for each feature and then selecting the one that maximizes the information gain will assist you in identifying the decision tree's splitting attribute. The IG for each characteristic is calculated using the following formula:

Evaluating the data gain for each feature and then selecting the one that maximizes the information gain will assist you in identifying the decision tree's splitting attribute. The IG for each characteristic is calculated using the following formula: Figure 1 shows the architecture diagram.

VI. System Architecture

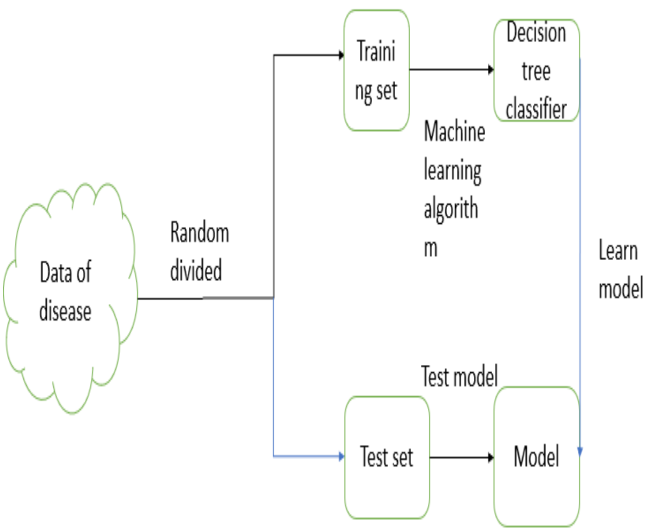

Figure 1: System Architecture Diagram

DOI: rp-9788770040723.154

VII. Algorithm

Decision Tree (DT)

The gain ratio decision tree (GRDT) was the type of decision tree used in this investigation. The GRDT's strong foundation line is the entropy (IG) approach, which decides the splitting characteristic that minimises the range of entropy while maximising the IG. The distinction between measures favors tests with a diverse set of effects. In other words, it is like traits with a wide range of potential values. Gain Ratio regulates the IG for individual attributes to ensure consistency and breadth of attribute's value.

Here k is value of target attribute class. Pi is ratio of the value of cases of class1 to the total number of occurrences (i.e., the likelihood of I am happening). To reduce the influence of bias caused using information gain, Australian academic Ross Quinlan created a version known as gain-ratio. The information gain measure favors tests with a wide range of effects. In other words, it prefers to choose qualities with a lot of possible values. Gain Ratio controls IG for each attribute in order to ensure the consistency and breadth of the attribute's value.

For regression and classification, decision trees are a supervised learning technique. After deducing the data attributes, it learns the straightforward decision rules and predicts the target variable's value. ID4, C3.6, C4.9, and CART are examples of DTA. CART, the most recent and improved version, was used in our model.

i) The classification trees of the CART algorithm use Gini impurity. Based on how the labels are split across the subset, it assesses the probability that a randomly selected piece from the set would be erroneously identified if it were given a label at random.

ii) Information acquisition is utilized by the tree creation algorithms ID4, C3.6, and C4.9. It is based on the information theory concepts of entropy and information content. At each stage of the tree-building process, it is utilized to determine which characteristic to split on.

VIII. Evaluating The Models And Results

The following table provides an overview of the outcomes from our model:

It is evident that the performance of all three algorithms has been enhanced by the preprocessing method of discretization. Random Forest had the greatest accuracy for our dataset, despite the fact that Naive Bayes' accuracy experienced a large improvement as a result of discretization.

Table 1 shows the comparison chart between previous algorithms with the proposed one.

TABLE1: Comparison of Algorithms

algorithm	Accuracy before preprocessing	Accuracy after preprocessing
Gaussian naïve bayes	88.08%	92.9%
Decision tree	90.12%	93.85%
Random forest	95.28%	97.64

Figure 2 shows the bar graph below demonstrates that the Random Forest classifier performs better than the other two classifiers and is thus the most appropriate for our dataset: -

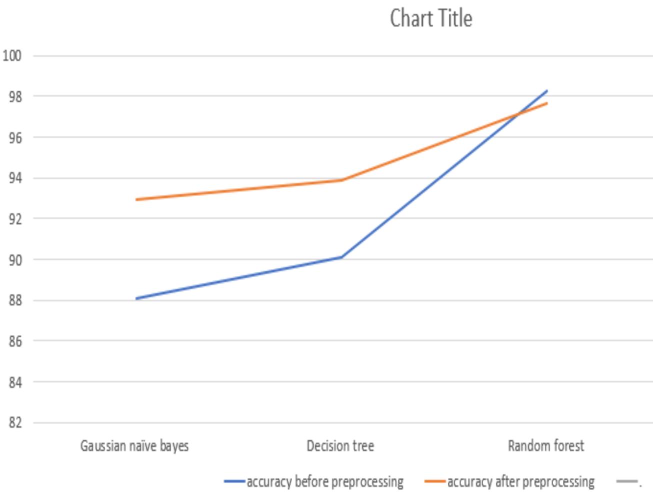

Fig. 2: Comparison graph

VIII. Conclusion

Future research will greatly benefit from the development of ML algorithms to enhance sickness detection devices. After the training period, methods of learning should be improved more often to potentially achieve higher performance. Furthermore, to prevent overfitting and enhance the accuracy of the models used, records on different characteristics should be expanded. After time progresses this model, accuracy might vary with good data or methods.

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Agro–Advisory System Using Machine Learning Algorithms

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***Abstract*—The agro-advisory system is a computerized toolthat gives personalized recommendations on the best cropsto grow in a particular location. This method makes crop recommendations based on scientific evidence while takinginto consideration a number of variables such as soil type,climate,rainfall,temperature,andotherenvironmentalconditions.Thetechniqueisintendedtohelpfarmers,agriculturaladvisors,andresearcherschoosethebestcropsto cultivate, resulting in increased agricultural production and sustainability. Modules of the system included at a gathering, soil analysis,cropdatabases,andmachinelearning.Severalapplicationsexistforthesysteminagriculture,agriculturalconsulting,researchandenvironmentalmanagement.Finally,anagro-advisorysystem is a powerful tool that can help farmers and otherstakeholdersmakeinformedcropselectionandmanagement choices, resulting in improved agriculturalproductivityandsustainability.Thepaperpresentsarecommendation system that aims to solve the problem ofsuggestingappropriatecropsbasedonsite-specificparameters. Theproposedsystemutilizesanensemblemodelwithmajorityvoting,incorporatingDecisionTree,K-NearestNeighbor, Logistic Regression, Random Forest, SVM, and Naïve Bayes as learners,toooffercrop recommendations that are both highly accurate and efficient.**

Keywords—Advisorysystem,MachineLearning,Decision Tree, K-Nearest Neighbor, Logistic Regression,SVM,RandomForest, Naive Bayes.

I. INTRODUCTION

Agro-advisory systems are becoming increasingly essentialforagricultureandfoodproduction.Withtheglobalpopulationpredictedtoreach10billionby2050,farmersandagriculturalsystemsmustbeabletoproducemorefoodwhileusingfewer resources. A agro-advisorysystemcanassistproducers in optimising crop yields, reducing environmentalimpact,and increasingprofitability.

This paper aims to explore the idea of agro-advisory systemsandthepotentialadvantagestheyoffertocontemporaryagriculture.Initially,wewillexaminetheunderlyingtechnologybehindagro-advisorysystems,whichincludestheimplementationofmachinelearningalgorithmsandpredictiveanalytics.Wewillthenlookatthevariousapplicationsofagro-advisorysystems,suchasyieldprediction,pestanddiseasecontrol,andnutrientmanagement. Finally, we will go over the potential benefitsofagro-advisorysystemsaswellasthechallengesthatmaysurface when they are implemented. Agro-advisory systemtechnologyiscomplicatedanddiversified.Largedatasets canbe analysed using predictive analytics to discover patternsthat can be used to influence crop selection and managementdecisions.Machinelearningalgorithmscanbeused tomodelthe environment and develop decision-making models thatcan be used to determine the best crop combination for aparticular environment. Satellite and drone technology canalso be used to provide information about soil conditions,crop health, and potential pest and disease threats. Agro-advisory systems have a broad range of uses. Yield predictionmodels can be used to evaluate a crop's potential yield in agivenenvironment,allowingfarmerstochoosethemostprofitablecrops.Furthermore,pestanddiseasecontrolmodels can be used to identify pest and disease risk areas,allowingfarmerstotakepreventiveaction.Nutrientmanagementmodelscanalsobeusedtoidentifyareasofsoildepletionandrecommendfertilisersorothersoilamendments.Therearenumerouspotentialbenefitstoimplementing agro-advisory systems. Farmers can increaseyields while reducingenvironmental effect byoptimisingcropselectionandmanagementoptions.Agro-advisorysystems can also provide important data to inform policychoices and promote sustainable agriculture. Finally, agro-advisorytoolscanassistfarmersinenhancingprofitabilitybylowering input costs and increasing yields. However, therearesomeproblemsthatmustbeaddressedbeforecroprecommendation algorithms can be implemented. To begin,the accuracy of the models is contingent on the integrity ofthe data used. Furthermore, many farmers, particularly indevelopingnations,maybehesitanttoadoptnewtechnology.Finally,greatercollaborationbetweendatascientistsandfarmers is necessary to guarantee that models are tailored tofarmers' specific needs. Finally, agro-advisory systems havethe potential to revolutionise contemporary agriculture andincrease food production. Agro-advisory systems, which usepredictive analytics, machine learning algorithms, satelliteanddronetechnology,canhelpfarmersoptimisecropselection and management options and increase profitability.However, some challenges must still be overcome beforethesesystemscan be successfully implemented.

II. RELATED WORK

Pudumalar, S., et al. [1] Many businesses, including finance,retail, medical, and agriculture, rely on data mining. Datamining is used in agriculture to analyze both biotic and abioticaspects.AgricultureisanimportantindustryinIndia,contributing significantly to the economy and employmentgeneration.FarmersinIndiafrequentlyconfrontthe

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problemof choosing the incorrect crop based on soil needs, resultinginaconsiderabledecreaseinproduction.Precision farming is a contemporary agricultural technology that addresses this issue by selecting the optimal crop for each area based on data from studies on soil quality, soil types, and crop production statistics.This method improves crop selection accuracy andyield. The authors present a recommendation system based onparticularsitefeaturesthatutilizesanensemblemodelwithamajority voting method and learners such as KNN, RandomForest, Naive Bayes, and CHAID.

Kumar,Avinash,ChittaranjanPradhanandSobhangiSarkar.[2]Croplossesinagriculturearefrequentlycausedbytheimproperselectionofcropsforacertainfield.Farmersfrequentlyfailtounderstandcroprequirementssuchasminerals,soilmoisture,andothersoilrequirements,resultinginsufferingandfinanciallosses.Anothertypicalissuethatfarmersfaceisthediscoveryofpestsanddiseasesthatcanaffectcrops,oftenatlatestageswhencontrolisdifficult.OurstudytacklestheseconcernsbyofferingaRecommendationSystemwhichforecaststhebestcropforthefarmeranddetectsprobablepestswhilerecommendingtreatmentmethods.Inthis research,theyimplemented theSupportVectorMachine(SVM),theDecisionTreeandtheLogisticRegression algorithms and found that the SVM classificationmodel surpasses the other algorithms in terms of accuracy.Bandara,Pradeepa,etal.[3] Astheamountofavailablefarmlandislimited,automatingdifferentaspectsofagriculturehasbecomecrucial,withorwithouthumanintervention.InSriLanka,despitehavingaccesstomanualagriculturalmethods,thereisnosystemavailabletoidentifyenvironmentalfactorsandrecommendtheidealcropvarietyforfarming.Toaddressthis,thepaperproposesarecommendationsystemthatusesanintegratedmodelcombiningArduinomicrocontrollersforcollectingenvironmentalfactorsMLtechniquessuchasSVMand NaiveBayes,unsupervisedmachinelearningalgorithmssuchas NaturalLanguageProcessingandK-MeansClusteringtosuggestacropthatfitstheselectedland'ssite-specificparameters.Theproposedapproachtacklesthesignificantchallengeofselectingthemostappropriatecropvarietytocultivateinalimitedareabecauseenvironmentalelementssuchassoilconditions,temperature,andwaterlevelsareunpredictable and continually changing. Thecroprecommendationsystemutilizesenvironmentalparametersandfeedsthemthroughitstrainedsub-modelstopredictthemostsuitablecroptypefor thechosenlocation.

Rajak, Rohit Kumar, et al. [4] The proposed paper presents acroprecommendationsystemthatutilizesArduinomicrocontrollerstocollectenvironmentalfactors,andmachine learning techniques such as Nave Bayes and SVMalongwithunsupervisedmachinelearningalgorithmsK-Means Clustering and NLP, to recommend the most suitablecropforaspecificpieceoflandwithprecisionandeffectiveness.Duetounknownenvironmentalcircumstances,the system solves the challenge of determining the best cropto produce on residential or farmed grounds. The systemforecasts the best crop for the given area by analysing theobtaineddata with trainedsub-models.

III. Background Techniques

A. DatasetCollection

Thedatasetfilecontainsimportantsoilcharacteristicsthatarerequired to determine the suitable crop for cultivation. Inaddition, various online resources that provide general cropstatistics were consulted. The dataset which we used to trainour model that contains 2200 data. The following productsare considered in this algorithm: apple, blackgram, banana,coconut,cotton,chickpea,coffee,grapes,jute,lentil,kidneybeans,maize,mungbean,muskmelon,mango,mothbeans, orange,pigeonpeas,pomegranate,papaya,watermelon, and rice. As well as soil parameters such asphosphate(P),potassium(K),nitrogen(N)andpH.Temperature,rainfall,andhumidityareallweatherconditions. (showninTable 1andFig.1)

TABLE1. Soil And Weather Conditions

	N	P	K	temperature	humidity	ph	rainfall	label
0	90	42	43	20.879744	82.002744	6.502985	202.935536	rice
1	85	58	41	21.770462	80.319644	7.038096	226.655537	rice
2	60	55	44	23.004459	82.320763	7.840207	263.964248	rice
3	74	35	40	26.491096	80.158363	6.980401	242.864034	rice
4	78	42	42	20.130175	81.604873	7.628473	262.717340	rice

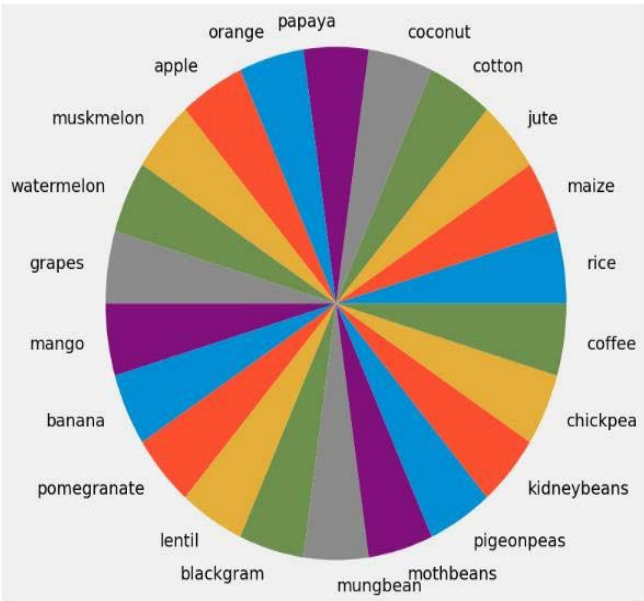

Fig.1.crop presentindataset

We have added two more datasets for states and soil kinds.ThefirstincludesAgriCommodityPricesandTradingInformation,Weather(Historical)DatathatAffectsAgriculture, Land Usage Statistics Per Crop Land for EachCrop, Crop Yield Information, Agri Inputs Data, Crop PestandDiseaseInformation,RetailandWholesalePricesforAll AgriCommodities,andallfactorsandsourcesthataffect

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AgricultureandAgriCommodityPrices(showninFig.2).Thesecondoneorganisessoilkindsby state.

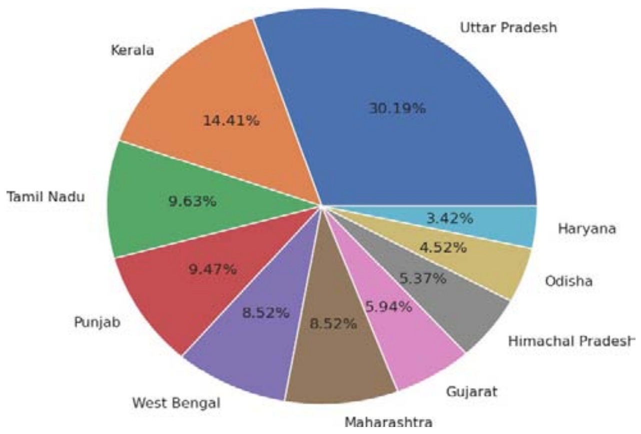

Fig.2. States productions percentage

B. *Learners Used in the Model:*

1) KNN:

It is a technique that may be applied to both classification and regression [5]. It is a simple solution that maintains all existing instances and categorizes new cases using a similarity metric. The technique uses a distance measure that is Manhattan distance or Euclidean distance to determine the "closeness" of the sample group and classify it accordingly.

```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier()

knn.fit(x_train,y_train)

predicted_values = knn.predict(x_test)

x = metrics.accuracy_score(y_test, predicted_values)
acc.append(x)
model.append('K Nearest Neighbours')
```

2) SVM Algorithm

There are several machine learning algorithms that can be used to classify structured and unstructured data [6]. Classification is assigning objects to certain groups, and the major goal of classification problems is to determine which group or class new data belongs to. One widely used supervised ML model for regression and classification is the Support Vector Machine, although it is mainly used for classification tasks. SVMs separate training data points into groups with the smallest possible margin. To enable nonlinear classification, the kernel trick is a technique used by SVMs that implicitly translates inputs into high-dimensional feature spaces. Overall, the SVM is a powerful tool for solving classification problems, particularly in scenarios where the relationship between input features and output classes is nonlinear. Its ability to perform well on both unstructured and structured data has made it a popular choice in the field of machine learning.

In our model, we used SVM as follows:

(I) importing the SVC module from the sklearn.svmClass;

(II) creating an SVM classification object.

(III) Finally, we fitted our data.

```
from sklearn.svm import SVC
# data normalization with sklearn
from sklearn.preprocessing import MinMaxScaler
# fit scaler on training data
norm = MinMaxScaler().fit(x_train)
x_train_norm = norm.transform(x_train)
# transform testing dataabs
x_test_norm = norm.transform(x_test)
SVM = SVC(kernel='poly', degree=3, C=1)
SVM.fit(x_train_norm,y_train)
predicted_values = SVM.predict(x_test_norm)
x = metrics.accuracy_score(y_test, predicted_values)
acc.append(x)
model.append('SVM')
```

3) LogisticRegression:

It is a statistical model that's commonly used to analyzerelationshipsbetweenabinarydependentvariableandoneormoreindependentvariables,whichisalsoknownastheLogit model [7]. The model employs a logistic function to estimatethe probability of a certain outcome or event, based on thevalues of the independent variables. In its most basic form,the model is used to model a binary dependent variable.However, there are more sophisticated versions of the modelthatcanhandlemorethantwocategoriesornon-linearrelationships.

Logistic Regression is widely used in various fields, such asfinance,epidemiology,socialsciences,andmarketing,toanalyzeandpredictoutcomesbasedoncertainvariables. Itisalso commonly used in machine learning, where it is used asaclassificationalgorithmtopredicttheprobabilityofacertain class.

Inour model,weusedLogisticRegressionasfollows:

(I) ImportingLogisticRegressionmodulefromsklearn.linearClass.

(II) CreatingLogistic Regression object.

(III) Finally,wesuitourfacts.

```
from sklearn.linear_model import LogisticRegression

LogReg = LogisticRegression(random_state=2)

LogReg.fit(x_train,y_train)

predicted_values = LogReg.predict(x_test)

x = metrics.accuracy_score(y_test, predicted_values)
acc.append(x)
model.append('Logistic Regression')
```

4) RandomForest:

DOI: rp-9788770040723.155

It'sanensemblelearningmethodthatcanbeusedforarangeofproblems,includingregressionandclassification.Theapproach involves creating numerous decision trees duringtraining, and the mode or mean prediction of the individualtrees is used as the final prediction to prevent overfitting tothe training set. Tin Kam Ho pioneered the notion of randomforestsbyusingEugeneKleinberg's"stochasticdiscrimination"techniquetoclassificationviatherandomsubspacemethod.Later, AdeleCutlerandLeoBreimandesigned the "Random Forests" algorithm, which combinesBreiman's "bagging" approach with random feature selectionto generate a set of decision trees with controlled variance.Whilerandomforestswereinitiallydesignedforthree-dimensional data, recent studies have shown that they canalso be usedfor arbitraryobjects byleveragingpairwisesimilaritiesbetweenitems.Overall,aRandomForestconsistsofdecisiontreesthatprovideaclassificationfortheattributesofanewobject,andtheforest'sfinal prediction isbasedonamajorityvotefromthe trees.

Inourmodel,weusedRandomForestasfollows:

(I) ImportingRandomForest modulefromsklearn.ensembleClass.

(II) CreatingRandomForestobject.

(III) Finally,wesuitourfacts.

```
from sklearn.ensemble import
RandomForestClassifier

RF = RandomForestClassifier(n_estimators=20,
random_state=0)
RF.fit(x_train,y_train)

predicted_values = RF.predict(x_test)

x = metrics.accuracy_score(y_test, predicted_values)
acc.append(x)
model.append('RF')
```

5) DecisionTree:

Itis awidely-usedsupervisedlearning technique[8]forclassification and regression tasks. Its objective is to create apredictive model by learning decision rules from a given setofdata(i.e.,trainingdata)thatcananticipatethetargetvariable's'classorvalue.TheDecisionTreecomprisesdecision nodes and branches, with the leaves signifying theend outcomes. The recursive process each node acts as a testfor a distinct attribute, and each branch that stems from thenode stands for one of the feasible reactions to that test. Thisprocessisiteratedrecursivelyforeachsubtreethatoriginates from the new nodes until the final Decision Tree model isformed.

Inourmodel,weused theDecisiontreemethodasfollows:

(I) Importing package DecisionTree Classifierfromsklearn.treeClass

(II) CreatingDecisionTreeClassifierobject.

(III) Finally,wefittedourdata.

```
from sklearn.tree import DecisionTreeClassifier
DT =
DecisionTreeClassifier(criterion="entropy",random_state=2,max_depth=5)

DT.fit(x_train,y_train)

predicted_values = DT.predict(x_test)
x = metrics.accuracy_score(y_test, predicted_values)
acc.append(x)
model.append('Decision Tree')
```

6) NaiveBayesClassifier:

TheNaiveBayesclassifierisapopularstatisticalclassificationtool.ItisbasedonBayes'theorem,whichstatesthat the probability of witnessing evidence or features givena hypothesis or class is proportional to the probability of thathypothesisorclass.Giventheclass,theNaiveBayesclassifier assumes that the characteristics are independent ofeach other and estimates the probability of each class bymultiplying the probabilities of each feature given that class.Becauseofthissimplifyingassumption,itiscomputationallyefficient, particularly for huge datasets. The Naive Bayesclassifierhasbeenusedeffectivelyinmanydisciplines,includingnaturallanguageprocessing,textclassification,andspam filtering. It may be applied to both binary and multi-classclassificationissues.

We used the Naive Bayes classifier in our model to predicttheclassofagivensamplebasedonitsattributes.Weutilisedthe classifier's probabilities to produce suggestions for cropkinds and fertilisers that are best suited to a specific soil andweathercircumstances.

Inourmodel,weusedNaiveBayesclassifier asfollows:

(I) ImportingNaive Bayesclassifier modulefromsklearn.naive_bayesClass.

(II) CreatingNaiveBayesclassifierobject.

(III) Finally,wesuitourfacts.

```
from sklearn.naive_bayes import GaussianNB
NaiveBayes = GaussianNB()

NaiveBayes.fit(x_train,y_train)

predicted_values = NaiveBayes.predict(x_test)
x = metrics.accuracy_score(y_test, predicted_values)
acc.append(x)
model.append('Naive Bayes')
```

```
K Nearest Neighbours --> 0.975
SVM --> 0.9795454545454545
Logistic Regression --> 0.9522727272727273
RF --> 0.990909090909091
Decision Tree --> 0.9
Naive Bayes --> 0.990909090909091
```

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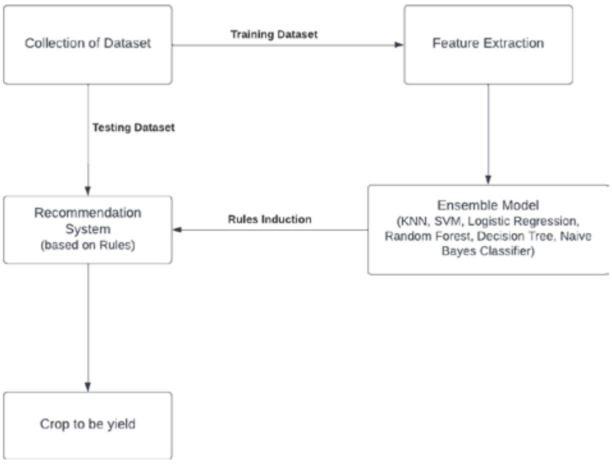

Fig.3.BlockDiagramof ProposedModel

IV. Results and Discussion

The suggested method may recommend appropriate cropsandfertilisersforacertainsoiltypeandclimaticcircumstanceswithaprecisionof99.09%bycombiningmachinelearning techniques,earthanalysis,andmeteorologicaldata.Thebestagro-advisorysystemalgorithmsweredeterminedtobeRandomForestandNaïve Bayes Classifier. This implies that the proposed techniquemight be a beneficial tool for farmers to increase crop outputand soil health by making tailored suggestions based on theirindividualagriculturalneeds.

Based on their performance on the appropriate datasets, theaccuracypercentagesofmanyalgorithmswereanalysedand presented in the Fig.4.

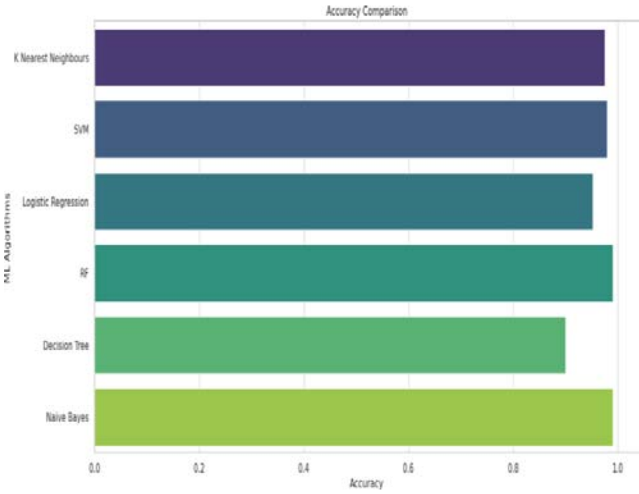

Fig.4.MLAlgorithms andAccuracy

Fig.5.MLAlgorithms andAccuracyachieved

TABLE 2. Algorithm's Accuracy & F1 score

Algorithms	Accuracy	F1score
KNN	97.5%	97.5%
SVM	97.95%	97.65%
LogReg	95.22%	95.15%
RF	99.09%	99.3%
DecisionTree	90%	98.18%
NaïveBayes	99.09%	99.05%

As a result of the comparative graph above, we can infer thatwhen dealing with data sets comparable to the ones used inRandom Forest, the Naive Bayes Classifier method worksbest,asshownby thegraphandin the table.

V. Conclusion

InacountrylikeIndia,whereagricultureissoimportant,itiscriticaltoguaranteethateverycomponentofthesector,includinginvestmentsinagriculturalseeds,ismanagedproperly. The suggested method may deliver personalisedsuggestionsforcropvarietiesandfarmingproceduresthataretmatchedtotheindividualconditionsofafieldbyutilizing dataonsoilfeaturesandweathertrends. Thiscanassistfarmers in increasing food output, improving soil health, andlowering inputcosts.

Lookingahead,ournextgoalistoimprovedatacollectingbyincluding a larger variety of variables, in order to furtheroptimisethesystem'saccuracy and efficacy.

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Prediction of Health Status of Battery Using Super Learner Algorithm

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***Abstract*—A everyday battery survival pattern with very long testing periods, no contact estimate programs, or other devices will be useful in modern businesses. This abstract focuses on employing a super learner technique to estimate the remaining useful lifespan (RUL) for NMC-LCO 18650 batteries. The super learning algorithm has become a type of ensemble machine learn- ing that combines several different basic models to increase the accuracy of predictions. In this research, a set of features from the batteries were extracted, which includes current, temperature, voltage, and battery cycle, and the RUL was calculated utilizing a super learner algorithm. The linear regression model, the random forest, and two deep learning models used as basis models for the super learner algorithm. Mean absolute error (MAE), which as well as root mean squared error were two metrics used to assess the efficacy of this super learner algorithm. (RMSE). The outcomes demonstrate that with regard to of prediction accuracy, the super learner strategy exceeds the separate base models. In order to improve battery performance and lower maintenance costs, it is essential to be able to predict the of the RUL for NMC-LCO 18650 batteries. The suggested method is capable of being utilized as an accurate and dependable way for doing this.**

***Index Terms*—Artificial Intelligence, Battery life Time Prediction, Remaining Useful Lifespan, NMC-LCO 18650 Batteries, Ensemble Technique, Super Learner Algorthm, Data Science, Python Programming Language.**

I. Introduction

Batteries made of lithium-ion material, or Li-ion, are frequently used in commercial settings. To accomplish ideal operation and health management, it is important to forecast the health state of batteries. The greatest barrier to accurate battery health prediction is accuracy. In comparison to conventional NiMH or lead-acid batteries, lithium-ion (Li-ion) batteries offer a number of alluring advantages, including a higher energy density as well as nominal voltage, a lower self- discharge rate, and a longer lifespan. Li-ion batteries have thus been extensively used in numerous industrial devices. How- ever, a sudden battery failure can result in poor performance, operational problems, or even disastrous outcomes. Therefore, it is crucial to forecast the Li-ion batteries health in good time and with accuracy. In reality, Li-ion batteries' performance would progressively deteriorate over time as a result of ageingand effects from operating conditions. Two key markers for battery health conditions are the state-of-health (SOH) and remaining-useful-life (RUL). The overall useful capacity loss and resistance increase together make up the SOH, which stands for the battery ageing level. RUL stands for the duration from the current to the battery's end of useful life. Many different methods have been described in recent years for the Li-ion batteries SOH estimation as well as RUL prediction. The basis and requirement for the RUL forecast is a precise SOH estimation. Some of the most important variables for precise SOH along with RUL prediction is the health index [1].

Due to their appealing performance, LIBs (Lithium-ion batteries) are now the primary power source for EVs (Electric Vehicles) and are frequently used in the automotive, aircraft, and other industrial sectors. However, as batteries continue to be used and age, their health and performance will de- cline, which in some extreme instances could lead to safety accidents. Therefore, a precise RUL prediction is crucial for battery safety as well as for improved battery maintenance, ensuring that the battery functions at its best and extending its service life. Algorithms based on machine learning are used in data-driven methods to model the process of health degradation and forecast the RUL for a pack of batteries from understanding the historical database. For battery upkeep and secure operation of electric vehicles, it is crucial to accurately estimate the unused useful life (RUL) of lithium-ion batteries [2].

Storage of energy systems, electric vehicles, and transportable electronic devices are just a few of the many uses for lithium- ion batteries. In order to increase the battery's service life and guarantee the system's safe and dependable functioning, it is essential to accurately determine the batteries' state of health (RUL). The competitiveness of machine learning (ML) as well as deep learning (DL) methodologies for under- standing the behavior of complicated nonlinear systems has garnered growing attention. Battery RUL estimation has a lot of promise thanks to the growth of big information and cloud computing. The global energy system is altering to decreasecarbon emissions, address associated climate change, and deal with energy shortages. The use of fossil fuels is steadily declining as renewable energy sources such as wind, solar, and hydroelectric power develop quickly. The lithium-ion (li-ion) cells are used in many different applications, such as systems for storing energy, electric vehicles, and portable electronic devices, because of their high power and energy density, high energy efficiency, and comparatively extended cycle life. The secure and dependable operation of batteries, as well as their commercial viability, are crucial during long-term operation

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because they serve as a means of energy storage as well as the main supplier of energy for these devices [3]. The hybrid data-driven as well as model-based approach typically yields better RUL forecast outcomes. However, such integration is more difficult for online practical applications to implement because it takes more computational skill. To increase the precision as well as the dependability of the RUL prediction results, various data-driven approaches can also be integrated in addition to data-driven and model-based methods. It creates a battery's state of health, which aids in directing businesses. It's important to increase the Li-Ion battery-powered equipment's availability. It reducing the number of output hours lost to maintenance, minimizing maintenance costs, breakdowns, and downtime, and improving battery efficiency. Some of the most crucial factors right now for predicting component failure before it actually happens is the RUL [4].

Currently, lithium-ion batteries are used extensively. For systems for managing batteries (BMS) and logically scheduling the battery utilization, it is crucial to accurately predict the remaining useful life (RUL). There are issues like randomness and battery capacity regeneration brought on by parameter values and single-time prediction. The benefits of lithium-ion batteries, which include a high output voltage, a long cycle life, a high density of energy, and environmental friendliness, make them very popular today. Applications span a wide range of industries, including the military, aircraft, and electronics. The discharge capability of Li-ion batteries will progressively deteriorate over time. The three major causes are ageing of the separator, electrolyte changes, and material corrosion in the poles. These phenomena will cause a reduction in discharge capability, which will result in a deterioration of battery performance. For the system's batteries to operate safely and effectively, the battery control system is essential. To extend the service's life and ensure safety, BMS can effectively manage each unit and control the working state in a reasonable manner. Important components of the BMS include life prediction that is still helpful. The total amount of charge/discharge cycles a Li-ion battery can withstand before its performance or SOH deteriorates to a point in which it can no longer power the device is known as RUL [5].

The remaining chapters of the paper are as follows: chapter II is a description of the literature review; chapter III is a description of the proposed methodology; chapter IV is a description of the findings and discussion; and chapter V is a summary of our article on the system.

II. Literature Survey

Jiao, R et al., "Lithium-ion battery remaining usable life prediction using the conditional equations auto encoders-particle filter". In hopes of predicting the RUL of batteries, a novel PF architecture built around the conditional variation auto - encoder (CVAE) as well as a reweighting technique is put forth in this study. The standard prior distribution is first replaced with the CVAE algorithm, which is then integrated into in the PF architecture to lessen particle damage. In order to avoid losing particle variety, a reweighting approach is also used during particle resampling. Ultimately, the suggested CVAE-PF is used to forecast how the battery capacity would degrade, and the RUL can be calculated when the capacity reaches a predetermined failure threshold. Compared to some previous methods, the new technique is able to achieve greater prediction performance, according to the experimental data [6]. Xue, K et al., "A more effective generic hybrid prognostic approach based on PF-LSTM learning for RUL prediction". On the degradation modeling and RUL forecasting for lithium- ion batteries, the proposed in this work blended PF-LSTM prognostic strategy is shown and contrasted with some other adaptive learning as well as machine learning methods like the unscented classifier (UPF) as well as the radial basis function system (RBFN). The comparison results demonstrate that a hybrid PF-LSTM prognostic strategy with accurate equipment deterioration state characterization based on integrated hierarchical clustering analysis can achieve robust prediction performance. The more precise prognostic estimates in the density function of probability (PDF) of the prior or post distribution of storage capacity and RUL obtained by particles filtering can provide significant insights into the action guide for predictive maintenance [7].

Tang, T et al., "A hybrid strategy using a decomposition method and a neural network to anticipate the lithium-ion battery's remaining usable life". A unique remaining usable life prediction approach was proposed in order to address the issues of non-linearity, non-stationary, and low forecast precision of the initial capacity degradation information for lithium-ion batteries. To prevent the useful knowledge about the capability regeneration section from being lost, comprehensive ensemble empirical mode of decomposition adaptable noise is used to produce full adaptive deconstruction of the original data. Next, zero-crossing rate and novel fusion rules are utilized to create fused high- and low-frequency sections, which can reduce the total amount of incoming network components and operational expenses. The best outcomes, chosen using the least absolute error standard, contain the benefits of 2 high frequencies fusion rules [8]. Zhang, C et al., "A method for predicting future RUL and capacity for lithium- ion battery packs". In this study, an innovative hybrid approach that combines enhanced vibrational modal decomposed (VMD), particle filter (PF), and Gaussian mixture regression is proposed for predicting battery up with the intention and RUL (GPR). The collected battery capacity data is divided by the VMD algorithm into a number of residual sequencesand an ageing trend sequence, with the amount of modal layers being determined by the suggested probabilistic feedback confidence (PFC) approach. The ageing trend series and residual sequences are then, respectively, predicted using the predictive model of the PF and GPR algorithms. To confirm the viability of the suggested hybrid technique, future capacity as well as RUL prediction research for battery packs and rechargeable batteries is carried out. The contrasted experiment results show that the suggested approach works [9]. Sulzer, V et al., "The difficulty and potential of predicting battery longevity from field data." The commercial case for evs, permanent energy storage, and emerging applications like electric aero planes all depend on accurate battery life prediction. End-

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use applications' uncontrolled working environments, less accurate sensors, issues with data collecting and storage, and frequent accessibility to validation tests provide additional obstacles as a result. We investigate various techniques to estimate lifetime from field and laboratory data and propose that fusing machine learning methods with mathematical model is a promising approach, allowing implication of battery capacity from noisy data, evaluation of second scenario, and generalization to future usage scenarios. This study emphasizes the potential for field data insights to lower battery prices and enhance designs [10].

III. PROPOSED METHODOLOGY

The proposed technique gives details on how our system will be implemented. To locate and retrieve the necessary battery data, including target and predictor values, for working with. The gathered data must be pre-processed in accordance with the specifications. In this stage, the necessary dataset is gathered from the accessible resources and saved in CSV format. The processing dataset is split into sets for training and testing of data, and different algorithms for machine learning as well as deep learning models are developed. These models are only taken into consideration if they have a high accuracy rate. To create the four basis models that the Super-learner Algorithm needs, which include 2 different machine learning models as well as two deep learning models. To determine the best model depending on the degree of accuracy of the various models we created and examined. The super learner technique strategies are used to recommend the model having better performance based accuracy basis after the best accuracy of the many models built is manually examined.

*Explanation:*Data collection, data pre-processing, building ML models, building DL models, classification, and prediction are the five modules that we employ here for our system.

*Datasets Collection:*The practice of obtaining and analyzing information from a wide variety of sources is known as data collection. Data must be gathered and kept in a manner that makes sense for the specific business problem at hand if we are to use it to create useful artificial intelligence (AI) but also deep learning solutions. 14 NMC-LCO 18650 batteries with a nominal power of 2.8 Ah were investigated by the Hawaiian Natural Energy Institute after being cycled morethan 1000 times at 25°C. Eight features that were captured during battery cycling experiments are included in the dataset.

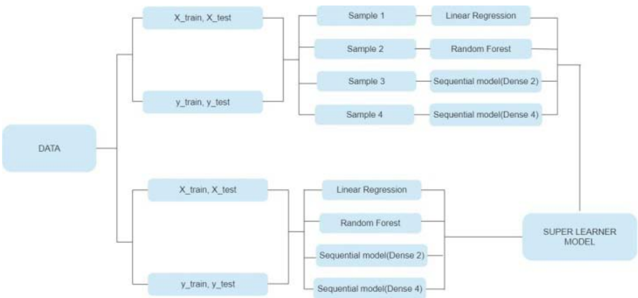

Fig. 1. Shown the Block Diagram of Project

SNO	NAME	DESCRIPTION
1.	**Cycle Index**	The battery's total number of charging and discharging processes.
2.	**Discharge Time**	Length of time it takes to discharge from completely charged through fully discharged.
3.	**Time at 4.15V**	The period of the charging cycle during which the battery is at 4.15 volts.
4.	**Time Constant Current**	When a steady current is used to charge the battery.
5.	**Decrement 3.6-3.4V**	Duration of battery drain from 3.6V towards 3.4V.
6.	**Max. Voltage Discharge**	The highest voltage that was recorded throughout the discharge cycle.
7.	**Min. Voltage Charge**	The lowest voltage that was recorded throughout the charge cycle.
8.	**Charging Time**	Represents the length of time that the charging process lasted.

Fig. 2. Input data features

*Data Pre-Processing:*All of the data should be converted into observable data before being preprocessed. We remove some erroneous and noisy data from the initial batch of data by performing this preprocessing. This will decrease memory usage and produce effective outcomes. Here, the many methods we employ include removing the superfluous features, retrieving the best features by working backward, \and standardizing the values.

*Model Implementation:*Here, we use Random Forest and Linear Regression to build two machine learning models. Sequential models with 2 dense layers and Sequential models with 4 dense layers are additionally available to the Building DL models.

Classification and Prediction Model: In this lesson, we will look at how to classify datasets in order to forecast battery lifetimes with high accuracy. Lastly, the prediction optimization is done on the system's accuracy rating. Lastly, assessing the accuracy of the prediction model and identifying the framework with higher accuracy.

IV. RESULTS AND DISCUSSION

We talked about our system's output images in the outcomes and discussion section.

Figure 3 shows the list of all packages required.

```
import os
import warnings
warnings.filterwarnings('ignore')
import numpy as np
import pandas as pd
import scipy
from scipy.io import loadmat
import matplotlib.pyplot as plt
import seaborn as sns
import shutil
%matplotlib inline

import statsmodels.api as sm
from sklearn.preprocessing import MinMaxScaler
from sklearn.linear_model import LinearRegression
from sklearn.ensemble import RandomForestRegressor

from keras.models import Sequential
from keras.layers import Dense
from sklearn.metrics import mean_absolute_error, r2_score, mean_squared_error
```

Fig. 3. List of packages imported

Figure 4 shows the list of all features from the dataset.

```
data = 'Battery_RUL.csv'
df = pd.read_csv(data)
df.head()
```

	Cycle_Index	Discharge Time (s)	Decrement 3.6-3.4V (s)	Max. Voltage Dischar. (V)	Min. Voltage Charg. (V)	Time at 4.15V (s)	Time constant current (s)	Charging time (s)	RUL
0	1.0	2595.30	1151.488500	3.670	3.211	5460.001	6755.01	10777.82	1112
1	2.0	7408.64	1172.512500	4.246	3.220	5508.992	6762.02	10500.35	1111
2	3.0	7393.76	1112.992000	4.249	3.224	5508.993	6762.02	10420.38	1110
3	4.0	7385.50	1080.320667	4.250	3.225	5502.016	6762.02	10322.81	1109
4	6.0	65022.75	29813.487000	4.290	3.398	5480.992	53213.54	56699.65	1107

Fig. 4. List of all features in the dataset

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Figure 5 shows the Final Prediction Implementation of our system.

```
In [29]: model_performance
Out[29]:
```

	r-Squared	RMSE
Linear Regression	0.825369	197.057928
Random Forest	0.942670	77.087105
Sequential (Dense 2)	90908.398438	301.510144
Sequential (Dense 4)	398210.406250	631.038249

Fig. 5. Accuracy of the models built

V. Conclusion

The estimation of the state of a lithium-ion battery and the management of its health depend greatly on the RUL (Remaining Useful Life) prognosis. The advancements in the fields of AI as well as deep learning offer brand-new, promising techniques for predicting lithium-ion battery RUL. Through this model, we intend to contribute to the informational content that is available on lithium battery lifetime estimation techniques. By analyzing the accuracy metrics of all the algorithms employed in this project, the project offers the improved model performance that would estimate battery life with high accuracy.

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Temporal Air Quality Forecasting using Hybrid RNN Model.

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***Abstract*—Inmanynations,poorairqualityhasturnedintoa significant environmental issue. The majority of air pollutantsseriouslyharmpeople'shealthandqualityoflife.Rapidurbanisation,industrialexpansion,andtrafficareallcontributingto a significant decline in air quality. In this work, we suggest ahybrid recurrent neural network (RNN) model that combines thebenefits of wavetransform decomposition and LSTM model fortemporalairqualityforecasting.Thetimeseriesisdividedintoitstrend, seasonal, and residual components using the decompositiontechnique, which is then fed into the LSTM model for forecasting.Weexaminedtheeffectivenessofthesuggestedmodelusingdailyairqualitydatacollectedfroma monitoring station in Delhi.OuroutcomeindicatethattheH-LSTMmodeloutperformstraditionaltime-series models and the LSTM model in termsof predicting accuracy, having reduced the mean absolute errorandmeansquarederrorof50%forPM2.5concentrations, performs better in terms of forecasting accuracy than traditionaltime-series models and the Long short - term memory model.Furthermore, the decomposition technique allows us to identifytheunderlyingtrendsandseasonalpatternsinthedata,whichcanprovideinsightsforairqualitymanagement.Ourresults highlight the potential for further advancements in thisfield andshow the value of using a decomposition technique and LSTMmodelforairqualityforecasting.**

***IndexTerms*—Airquality,wavedecomposition,PM2.5concentration,LSTM**

I. INTRODUCTION

On a global level, air pollution poses a serious hazard tohumanhealththatisgrowinginimportance.TheWorldHealth Organization (WHO) 2018 report states that 92% of peopleworldwidebreathetoxicair,whichisthoughttobethecauseof7 million annual fatalities. Two respiratory and cardiovasculardisorders,emphysemaandasthma,areamongthe harmfulimpacts of pollution in the air on human health. In addition,ambientairpollutionhas1.8yearsofftheaveragelifetime.

[9] The World Bank estimates that the economic costs of airpollution, including lost productivity, medical costs, and earlydeaths,total$5trillionannually.By2050,itisanticipatedthat the number of premature deaths brought on by particulatematter(PM)willhavemorethantripled.Thus,itisessentialto identify a precise and practical method to lower ambient airpollution if we are to guarantee the security and well-being oftheglobalpopulace.

Wecannotseepollutants,andwearenotawareofthereasons whypollutionlevelsarerising.Tocomprehendtheorigins,itisnecessaryto firstgooverttheprinciplesofairpollution[3].PM2.5endangerstheenvironmentglobally.Long-termexposuretotheseparticles,whichcanquicklyreachdeepwithintherespiratoryorgans,canresultinavarietyofdiseases.ThediameterofPM2.5,whichismuchsmallerthanthediameterofahumanhair,is2.5microns.Asaresult,thereis asignificant sourceof exposureand sicknessonthe humanbody.Theyendangerhumanhealth,raisingthelikelihood ofcancerandotherendemicandpandemicdiseases.Theultimate goalistoraisepublicawarenessofthevariablesthataffectenergyconsumptionandmethodsforcontrollingit.[8]

InthispaperwepresentahybridRNNmodelthatcombinesthedecompositiontechniquewithlongshort-termmemoryfor temporal air quality forecasting (LSTM). While the de-compositiontechniquesareusedtobreakdownthetimeseries into wave transforms, which aid in identifying trends,cyclic patterns, etc., the LSTM cells are renowned for theircapacity to capture long-term dependencies in the data. Theproposed model also incorporates input features, which havebeen demonstrated to be significant predictors of air quality,suchasmeteorologicalvariablesandtimeofday.

UsingactualairqualitydatagatheredfromamonitoringstationinDelhi,weassessedtheperformanceofthesuggestedmodel. Withameanabsoluteerrorofg/m3forPM2.5concentrations,our resultsshowthatthehybridRNNmodeloutperformsconventionaltime-seriesmodelsandotherRNNmodelsintermsofforecastingaccuracy.Inaddition,thehybridRNNmodeloffersusefulinsightsintothetemporaltrendsinairpollutionthatmaybeutilisedtoguidepolicyanddecision-makingforthemanagementofairquality.TherestofthispaperisstructuredasfollowsAsummaryofrelatedresearchemployingRNNmodelsforairqualityforecastingisincludedinSection2.ExperimentalareaofstudyexplainedinSection3.Theexperimentalsetupandproposedmethodologyisexplainedinsection4.The findingsofourmodelevaluationareshowninSection5and6.Section7concludesthepaperandconsiderspossiblefuturelinesofenquiryforthis fieldofstudy.

II. RELATEDWORKS

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In order to forecast particulate matter (fraction PM2.5) airpollution, a study comparing artificial neural networks (ANNs)andadaptiveneuro-fuzzyinferencesystems(ANFIS)wasconducted. The results are provided in this publication. PM2.5hourly measurement records from the Airbase databases wereused for the trials. The two key statistical measures calculatedwere mean absolute error and root mean square error (MAE).[6]

This study proposes improved models for estimating hourlyair pollution concentrations using meteorological data frompreviousdays.Amulti-tasklearning(MTL)problemwithvariousregularisationtechniquesisusedtoformulatethepredictionoverthenext24hours.Theresultsshowthatthe parameter-reducing formulations and regularisations as-sociatedwithsuccessivehoursoutperformcommonlyusedstandard regression models and regularisations for MTL whencomparedtotheproposedregularisation.[10]

Thisstudyusesalongshort-termmemory(LSTM)approachtoforeseeO3,PM2.5,NOx,and COconcentrationsinDelhi,theheavilypollutedIndianNational CapitalTerritory.Theresearchadoptsiveseparatesetsofparametersandcriteria,suchastrafficdata,levelsofpollution,climaticstatus,andvehicleemission.TheLSTMmodelsaccuratelyestimate hourlyconcentrationswhilehandlingthecomplexitiesoflong-terminteractionscomingfrombothhumanandnaturalsources.Theresultsofthisstudymaybeusedbythegovernmentandpolicymakerstoplanactionstoreducethenegativeeffectsofdecliningairquality.[4]

Becausepollutantscanbeharmfultohumanhealth,predictingairpollutionisahottopic.Traditionalmachinelearningmodelstypicallyfocusonincreasingpredictionaccuracyoverallwhileignoringaccuracyforpeakvalues.Furthermore,itisimpossibletocomprehendthesemodels.Theydonotadequatelyexplainhowvariousdecidingfactorsinteracttoaffectairpollution.Inthisstudy,anewcombinationofinterpretablepredictivemachinelearningmodelisenhancedwithtwonoveltiesforthepredictionofPM2.5.First,afusionmodelframeworkisdevelopedusingdeepneuralnetworksandanonlinearautoregressivemovingaveragewithexogenousinputmodel.Second,thishybridmodelincludesmethodsfor automaticallycreatingandchoosingfeatures.Theexperimental findingsshowthat ourmodeloutperformsothermodelsintermsofhighestvaluepredictionprecisionandmodelinterpretability.TheproposedmodelillustrateshowtocalculatePM2.5estimatesusingexistingPM2.5,climate,andseasondata.Therecommendedapproachalsoprovidesanoveleasilyunderstoodmachinelearningframeworkfortemporalseriesdata,enablingthecreationofprecisepredictivemodelsandthedefenceofintricaterelationshipsbetweenmultimode inputs.[2]

Globally,airpollutionisakeyfactorinprematuremortality.It's crucial to understand and anticipate air pollution patternsto lessen its caused damage. Complex prediction algorithmsareneededforthis.InordertounderstandPM2.5patternsthroughout space and time, deep learning models like GCNNand ConvLSTM are used. Remote sensing satellite photos areutilised to monitor atmospheric pollutant issues while time-series multidimensional directed graphs are employed to char-acterise climate aspects. ConvLSTM is used to foresee PM2.5in Los Angeles region using data from the preceding 10 daysandground-basedPM2.5sensordata.Thespatiotemporaldeeppredictive algorithms outperform earlier studies significantly.[5]

Intheproposedstudy,ahybridapproachisintroducedfor effectively breaking down single, one-dimensional PM2.5time data into various dimensional time data and extractinghiddeninformationfromit.Eachsequenceispredicted bythealgorithmusingtraditionalpredictiontechniques,andthe finalpredictionsareobtainedbyreconstructingtheresults.Three hybridmodelsW-ANN,W-ARIMA,andW-SVMweredevelopedinthestudytoforesee2016PM2.5trendsinfiveChinesecities.Accordingtotheoutputs,combinedmodelsperformbetterthantraditionalARIMA,ANN,andSVMmodelsatforecastingshort-termPM2.5concentrations.WhenitcomestoforecastingPM2.5 concentrations,theW-ARIMAmodelperformsbetter,especiallywhenitcomestocapturingthemutationalpointsthatcouldhelpcreatepollutionwarnings.[1]

A new model for predicting PM2.5 concentrations for eachhour during heavy haze episodes is presented in the proposedwork. For increased forecasting accuracy, this model com-bines the mode decomposition-recombination method with anensemble learning strategy. The data is divided into severalfrequency modes using the FEEMD to lessen the effects ofnoise in the data. Then, to ensure precise extraction of information and computational efficiency, related modes are combined and excessive breakdown is avoided using the sampleentropy (SE). As a forecasting model,SDEM is built which isstack driven to improve feature representation and informationconsumptioncapabilities.Eachbasemodel'sgeneralisationperformance is enhanced via K-fold cross-validation, and themeta-model generates higher prediction results by using eachbasemodel'soutputsasnewinputs.Regardingpredictingprecision, stability, and class prediction rate , the FEEMD-SE-SDEM model performs better than earlier contrast models,making it a suitable choice for an early air quality warningsystem.[7]

III. StudyArea

A. DataCollection

Delhi,thecapitalofIndia,islocatedinthenorthernpartof the nation.It is a big, multiethnic city that has a thrivingmodern culture and history. The city, which has a populationofaround20million,isahubforbusiness,politics,and education. Due to the large population, transportation, urbanisation,industrialization, etc. are all growing quickly. These are someof the factors that contribute to Delhi's high pollution levels,whichcanimpairpeople'shealth.Thereare46livemonitoringstationsforairqualityinDelhi,oneofwhichIhavechosentobeinAshokVihar.ItisaresidentialneighbourhoodinDelhi's northwest. It is roughly at latitude 28.6958°. Delhi hasa hot semi-arid climate, with extremely hot summers and coolwinters.Thetemperaturecanreachashighas45°C(113°F)in the summer months of May and June, while the wintertemperaturescanfallaslowas2°C(35.6°F)inDecembera

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nd January. The city experiences monsoon rains from July toSeptember, which provide relief from the hot summer months.Overall, the climate of Delhi is characterized by its extremetemperaturevariationsandseasonalwinds.

Fig.1.GeographicallocationofAshokVihar

B.DatasetDescription

The dataset collected from Ashok Vihar contain 1450 datawith11featureswhichincludeconcentrationslikePM2.5,PM10, NO2, NOxetc and meteorological factors like wind-speed, humidity, temperature, wind direction etc. The data iscollectedfromyear2019January-2022December.

IV. Proposed Methodology

The proposed methodoly is a technique which illustrates themodel used in this work step by step. The dataset is collectedfromhttps://cpcb.nic.in/.InthatwebsitefromAshokViharliveairqualitymonitoringstationthedataiscollectedforpast 4years.TheworkFowisprovidedbelowasshownin[?].The data is extracted in CSV format. Data preprocessing is atechniquewhichisusedtoprepareabetterdatafortrainingthemodel.Thenullvaluesinthedatasetareidentifedandreplacedwith distribution of each feature. For outlier detection a robustoutlierdetectionalgorithmHampelIdentifierisused.

A.HampelIdentfier

Toexcludeoutliersfromadataset,onetechniqueistoimplementtheHampelidentifier.Itstartsbyfiguringoutthedata'smedianandmedianabsolutedeviation(MAD).Bycomputingthemedianoftheabsolutedeviationfromthemedian,theMADameasureofthedata'svariabilityisestablished.Eachdatapointisthencomparedtothemedian;iftheabsolutedifferenceexceedsacertainnumber(oftenamultipleoftheMAD),itisdeemedanoutlierandeliminatedfromthedataset.Instatisticalanalysis,datamining,andmachinelearningapplications,theHampelIdentifierisuseful,especiallywhenworkingwithdatasetsthathaveerrorsorextremevalues.

B. Decomposition

Decompositionistheprocessofbreakingdowntimeseriesintowaveformatusingmathematicaltechniques.Itisusedtoidentifythehiddentrends,patternandcyclesintimeseriesdata.Therearedifferenttypesofdecompositiontechnique,EnsembleEmpiricalModeDecomposition(EEMD)isusedinthismodelfordecompsingthePM2.5feature.ThedecomposedPM2.5areshownin figure2.Sincemodemixingmakesitchallengingtodistinguishbetweenseveraloscillatorymodesinthedata,theEEMDapproachisanimprovementovertheEMDmethod.Thebreakdownbecomesmorediversewhennoiseisaddedtothedata,makingiteasiertoidentifythemanyoscillatorymodes.Thismethodoffersastrongtoolforunderstandingtheunderlyingprocessesthatgeneratethedata,makingitvaluable.ThePM2.5dataisbrokedownintoIMFsandresidual.TheIMFsarehelpfulincapturingthehighertrendsorhigherfrequencyandresidualusedtocapturethelowertrendsorlowerfrequencyinthemodel.

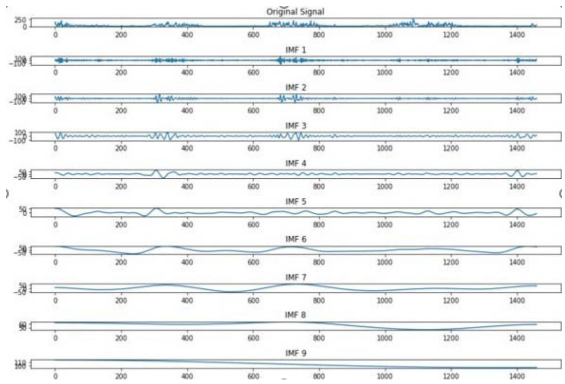

Fig.2.DecompositionofPM2.5

C.LSTM

TheissueoftypicalRNNs'vanishingorexpandinggradientsisresolvedbytheRNNarchitectureapproachknownasLSTM.Becauseitcanidentifylong-termdependenciesinthedata. LSTM is useful for time series data. LSTMs use memorycells to store information over time and gates made of sigmoidandtanhfunctionstoregulateinformationfow.Thesegatesincreasethemodel'sabilitytorepresentcomplexsequencesbyallowingittochooseretainorrejectinformationbasedontheinput data.Overall,LSTMhasbeenextensivelyappliedinmanydifferentapplicationsandisastrongtoolformodellingsequentialdata.Beforepassingthedatatothelstmodel,thedataisscaledwithfeature rangeof(o,1).LongShort-TermMemory(LSTM)networksusethreedifferenttypesofgates:input,output,andforgetgatesasshowninfgure3.InorderforLSTMstomanagelong-termdependenciesinsequentialdata,thesegatesarecrucialbecausetheyregulatethevowofinformationintoandoutofthememorycell.

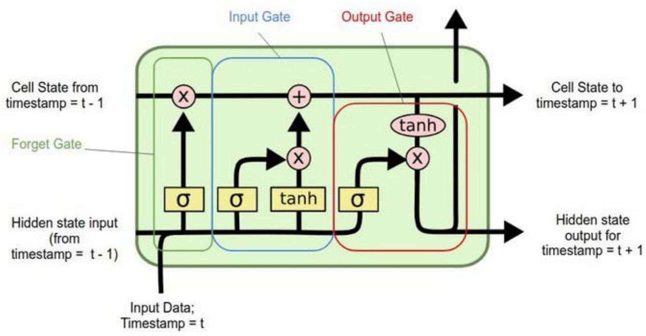

Fig.3.ArchitectureofLSTM

D.ModellingProcessofHybridLstmApproach

Overall,thisworkoffersahybridLSTM(HI-EEMD-LSTM)modelforthedailyPM2.5forecasting,followingthetech

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nicalpathof"decompositionandLSTM."Themodellingprocess isdepictedinfigure4,anditmaybesummedupasfollows:

Step-1:Gethistoricalinformation,suchasPM2.5concentrationsandweatherinformation.

Step-2:ToobtainnnumberofIMFsandoneresiduemode,performtheEEMD

Step-3:Standardizetheresultingdecomposedwavesinthefeaturerangefromthemeteorologicaldatafrom0to1

Step-4:Createa(n+1)LSTMmodelwitheachIMFacquiredfromdecompositionasthetrainingdatafortheweather.

Step-5:ToacquiretheoriginalPM2.5concentrations,dothe inverse EEMD to produce the anticipated PM2.5 concentrations

Step-6:Producetheforecastingexercise'sfinaloutput.

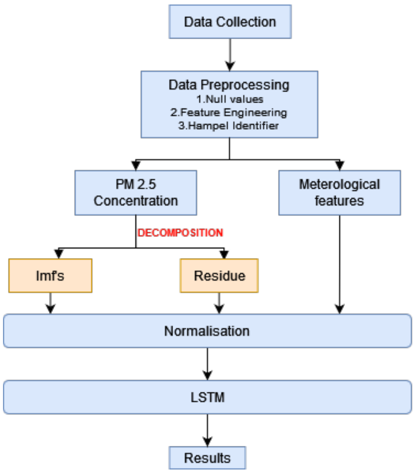

Fig.4.ArchitectureofHybridLSTMmodel

V. EvaluationMetrics

Many evaluation metrics root mean squared error (RMSE),mean absolute error (MAE), and mean squared error (MSE)areusedtoidentifythecapabilityofthemodel.Theevaluationmetrics of the model is compared with basic LSTM model toidentify how much better the proposed model is executingbetterthantheLSTMmodel

VI. Results

Thestudy's findingsdemonstratedthatthehybridLSTMmodelgreatlyperformedbetterthantheLSTMmodelsinpredictingPM2.5valuesbasedonmeteorologicaldata.TheMAEofthebestLSTMmodelwas 42.20,whichwasasignificantimprovementoverthebaselineMAEof91.83.Similarly,therootmeansquarederror(RMSE)wasalsosignificantlylowerfortheLSTMmodelscomparedtothebaselinemodels.TheLSTMmodelswereparticularlyeffectiveincapturingthelong-termdependenciesinthedata,whichhelpedtoimprovepredictions.Thefigure5andfigure6givesagraphicalrepresentationofbothemodelswithactualandpredictedvaluesThese findingssuggestthatLSTMmodelsmaybeausefultoolforpredictingstockprices,andcouldhaveimportant applications in finance and investment. However, itisimportanttonotethattherewere somehindrancetothestudy,includingarelativelylittlesamplesizeandalimitedtimeperiodfortheanalysis.Furtherresearchisneededtovalidatethese findingsandexplorethepotentialofLSTMmodelsforotherapplicationsin financeandbeyond.

TABLEI: Model Performance

	EvaluationMetrics		
Model	MAE	MSE	RMSE
LSTM	91.83	12161.98	110
HI-EEMD-LSTM	42.2	3997.97	63.22

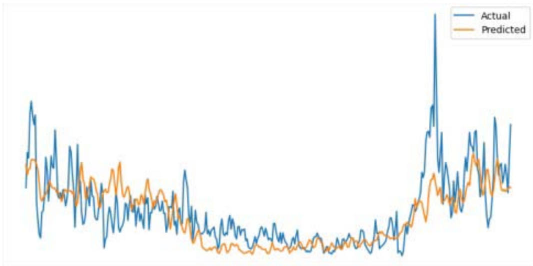

Fig.5.LSTMmodel

VII. Conclusion

Inthisstudy,aninnovativeHybridLSTMmodelisintroducedforpredictingdailyPM2.5concentrationsbyutilisingmultiple LSTMmodelsindifferentmodes.ThemodelfirstappliesEEMDtotransformthetimeseriesfusedfeaturesintosimplerfeaturesinmono-mode.Thematchingbetween

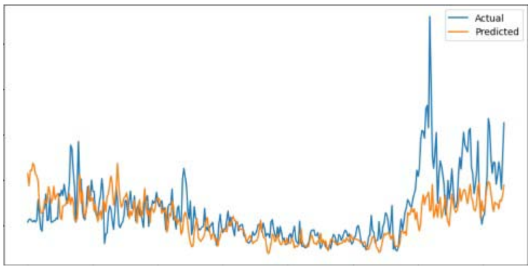

Fig.6.HybridLSTMmodel

meteorologicalconditionsandeachmode'scoefficientsisthenconstructed using LSTM, resulting in the development of agroup of LSTM models for ensemble learning. The predictedmode coefficients are then incorporated into the results usingthe reverse EEMD. Using wave decomposition, the H-LSTMmodelhasincreasedtheaccuracyofPM2.5observation. WhenthesuggestedH-LSTMmodeliscomparedtotheLSTMmodel on the Ashok Vihar dataset, it is evident that the H-LSTMmodeloutperformsbothofthosemethods.

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AdvancedCNNTechniquesforAccurateDamageDetectioninAutomotiveComponents

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***Abstract*—Damage detection in automotive components is critical for ensuring passenger safety and preventing further vehicledeterioration. This paper proposes a CNN-based approach usingDetectron 2, a state-of-the-art object detection library, for accu-ratedamagedetectioninvehicleparts.Theproposedapproachis evaluated on the Microsoft COCO car damage dataset, whichcontains a large number of automotive images with various typesofdamages.**

The results show that the proposed approach achieves highaccuracy in damage detection. The use of CNN-based approachesfor damage detection in automotive components can have a significant impact on insurance claims by providing more objectiveandreliableresultsthantraditionalvisualinspection.

***IndexTerms*—FasterR-CNN,MaskR-CNN,YOLO(YouOnlyLook Once), SSD (Single Shot Detector), R-FCN (Region-basedFully Convolutional Networks), RetinaNet, MobileNet, Inception,ResNet.**

I. Introduction

Theautomotiveindustryisconstantlyevolving,andsafetyis a top priority for manufacturers and consumers alike. Onecritical aspect of ensuring safety is the detection and repair ofdamages in vehicle parts. Damage to automotive componentscan result from various factors, such as wear and tear, accidents, or environmental factors. Prompt and accurate detectionofthesedamagesisessentialtopreventfurtherdeteriorationofthevehicleandensurepassengersafety.

Inrecentyears,ConvolutionalNeuralNetworks(CNNs)haveshowngreatpotentialinidentifyingandlocalizingdefectsin various types of images, including automotive images. Theability of CNNs to automatically learn and extract relevantfeatures from images has led to their widespread adoption inobject detection tasks, including damage detection in automotivecomponents.

Inthispaper,weproposeanadvancedCNN-basedapproachusingDetectron2,astate-of-the-artobjectdetectionlibrary,toaccuratelydetectandclassifydamagesinvehicleparts.WeleveragethestrengthsofCNNs,including theirabilityto learn complex features from images, to develop a reliableand efficient solution for damage detection in the automotiveindustry. We evaluate our proposed approach on the MicrosoftCOCO car damage dataset, which contains a large number ofautomotive images with various types of damages, includingscratches,dents,andcracks.

Accurate damage detection in automotive components canhaveasignificantimpactoninsuranceclaims.Insurancecompanies often rely on visual inspection to assess the extentofdamageinavehicle,whichcanbesubjectiveandproneto human error. Automated damage detection using advancedCNNalgorithmscanprovidemoreobjectiveandreliableresults,leadingtomoreaccurateandfairinsuranceclaims.

Several CNN algorithms have been proposed for damagedetectioninautomotivecomponents.Thesealgorithmsi ncludeFaster R-CNN, YOLO, RetinaNet, and SSD. Faster R-CNNand YOLO have been used extensively in object detectiontasks, including damage detection in automotive images. RetinaNet is a more recent approach that uses a novel focal lossfunction to address the imbalance between foreground andbackgroundobjectsinobjectdetection.SSDisanotherpopularapproach that uses a single shot to detect objects in an image.Existing systems for damage detection in automotive components include both commercial and academic systems. Examples of commercial systems include AI Vision, HailStrike,and CarVi. These systems use various image processing andcomputervisiontechniques,includingCNNalgorithms,toidentifyandlocalizedamagesinautomotivecomponents.Academic systems include DeepDamage, which uses a multi-task learning approach to detect and classify damages in carimages, and DamageNet, which uses a deep CNN to predicttheextentandtypeofdamagesincarimages.

Theremainingchaptersofthepaperareasfollows:chapterII is a description of the literature review; chapter III is adescriptionoftheproposedmethodology;chapterIVisadescription of the findings and discussion; and chapter V is asummaryofourarticleonthesystem.

II. Literature Survey

S. Ren, K. He, R. Girshick and J. Sun, ”Faster R-CNN:Towards Real-Time Object Detection with Region ProposalNetworks,” Real world images are sometimes noisy, blurred,rotated or jittered. Detecting these images is an important partof object detection the paper proposes an image degradationmodelthatusesimagesthataredegradedforthetestset.The degraded images were run on a standard model, whichwastrainedonregularimages.Thesourcenetworkwasthenmodified by training the model with the degraded images,which were obtained by performing some

DOI: rp-9788770040723.158

degradation processes on them. The accuracy of the test set is calculated onboth the models and are compared. Then the training set ismodified again by performing further complex degradationprocessesandamoregeneralizedmodelfordetectio nisobtained from this. This was also compared with the standardtest performance. The final object detection model obtainedthusisoptimizedandthegeneralizationabilityhadbeen enhanced,whiletheaccuracyimproved.[1].

Redmonetal.proposed"YouOnlyLookOnce:Unified,Rea l-Time Object Detection" [2], which introduced an end-to-endCNN architecture for object detection that processes the entireimage at once and outputs the class probabilities and boundingboxes for all objects in the image. The algorithm is faster thanpreviousmethodsthatrequireregionproposals,asiteliminat esthe need for a separate region proposal step. The proposedalgorithm achieved state-of-the-art results on several objectdetectionbenchmarks.[2].

He et al. proposed "Mask R-CNN" [3], which extended theFasterR-CNNalgorithmbyaddingaparallelbranchthatpredicts object masks in addition to class labels and boundingboxes.Themaskbranchisafullyconvolutionalnetwor kthat generates a mask for each object instance. The proposedalgorithm achieved state-of-the-art results on several instancesegmentation benchmarks. [3]. Liu et al. proposed "EfficientObject Detection in Large Images Using Deep ReinforcementLearning" [4], which proposed a CNN-based algorithm thatlearnstoselectivelyattendtoregionsofanimagetoim-prove object detection performance. The algorithm is trainedusing a reinforcement learning approach that maximizes thedetection performance while minimizing computational cost.The proposed algorithm achieved state-of-the-art results onseveral large-scale object detection benchmarks. [4]. Wang etal. proposed "Multi-Task Deep Learning for Real-Time 3D-LandmarkDetectioninCTScans"[5],whichproposedaCNN-based algorithm for detecting anatomical landmarks in3D medical images. The algorithm uses a multi-task learningapproachthatsimultaneouslytrainsthenetworktodetec tmultiple landmarks. The proposed algorithm achieved state-of-the-art results on several landmark detection benchmarksandcanruninreal-time.[5].

III. Proposed Methodology

Theproposedmethodologyaimstodetectdamagesinvariou s car parts using CNN algorithms and Detectron2. Theapproach involves several steps, including data collection andpreprocessing, training of the base model, fine-tuning withDetectron2, evaluation of the model, and detection of damagesindifferentcarparts.Firstly,theMicrosoftCOCOCarD amageDatasetiscollectedandpreprocessedtocreateatrainingda taset.Next,abasemodelwithFasterR-CNNalgorithmand ResNet-50 backbone is trained on this dataset. The modelisthenfine-tunedusingDetectron2,whichemploysMaskR-CNNalgorithmandalearningratescheduler.Themodelisevalua tedusingmetricssuchasmeanAveragePrecision(mAP), precision, and recall. Finally, damages in different carparts are detected by identifying Regions of Interest (ROIs) inthe image. The proposed methodology is compared with otherstate-of-the-artalgorithmssuchasYOLO,SSD,andRetinaNetto assess its performance. Overall, the proposed methodologyprovides a robust and efficient approach for damage detectionin car parts, which has significant implications in the auto-motive industry, especially in insurance claims processing andmaintenanceofvehiclesafety.

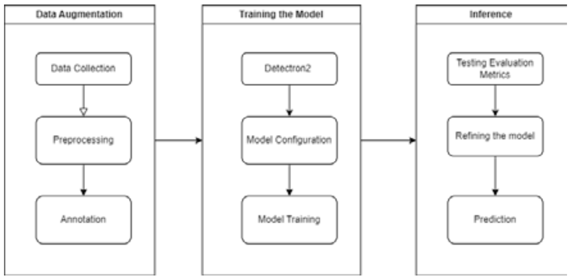

Fig.1.ShowntheBlockDiagramofProject

*Explanation:*Data collection, data pre-processing, buildingMLmodels,buildingDLmodels,classification,andpre dictionarethefivemodulesthatweemployhereforoursystem.

*Data Collection and Preprocessing:*Collect the MicrosoftCOCO Car Damage Dataset and preprocess it by resizing theimages,augmentingthedata,andnormalizingthepixelvalues .

*TrainingoftheBaseModel:*Fine-tunethepretrainedbase model on the COCO dataset using the Faster R-CNNalgorithm with a ResNet-50 backbone. The loss function usedis the Region Proposal Network (RPN) and the Fast R-CNNloss.

*Fine-tuningwithDetectron2:*Fine-tune the base modelfurtherusingtheDetectron2librarytotrainthemodelonthe car damage dataset. This step involves using the MaskR-CNN algorithm and training the model with a learning ratescheduler.

*EvaluationoftheModel:*Evaluatethemodel'sperformance usingvariousmetricssuchasmeanaverageprecision(mAP),pre cision,andrecall.

DetectionofDamagesinDifferentCarParts:

Utilize the trained model to detect damages in different carpartssuchashood,windshield,bumper,etc.byidentifyingthe relevantregionsofinterest(ROIs)intheimage.

ComparisonwithOtherAlgorithms:

Comparetheperformanceoftheproposedmethodologywit hotherstate-of-the-artalgorithmssuchasYOLO,SSD,andResNet,YOLOandmore.

To summarize, this proposed methodology involves the useof Detectron2 and PyTorch for detecting damages in variouscarparts.Themethodologyinvolvesdatacollectionandp reprocessing, training of the base model, fine-tuning withDetectron2, evaluation of the model, detection of

DOI: rp-9788770040723.158

damages indifferentcarparts,andcomparisonwithotheralgorithms.

*DataPre-Processing:*Inthisstudy,adatasetofcarimageswithannotations ofcardamagewascollectedandpreprocessedfortrainingadamagedetectionmodel.Thedataset was split into training and validation sets, with thetrainingsetconsistingof70percentofthedataandthevalidationsetconsistingoftheremaining30percent.Theimageswereresizedtoafixedsizeof800x800pixelsandtheannotationswereconvertedtotheCOCOformatforcompatibilitywiththedetectron2framework.

*DataAugmentation:*Toimprove the generalizationandrobustnessofthemodel,severaldataaugmentationtechniqueswereappliedduringtraining.Theseincludedrandomhorizontalflipping,randomrotation,randomcropping,andrandomresizing.Inaddition,randomcolorjitterandbrightness/contrastadjustmentswereappliedtotheimages.Theseaugmentationshelpthemodellearntobetter recognize damage under varying conditions and reduceoverfittingtothetrainingdata.

*ModelImplementation:*Themodelwastrainedusingthedetectron2framework,whichisapopularopen-sourceframeworkforobjectdetectionandinstancesegmentation tasks. The architecture used in this study was the RetinaNetmodel, which is a single-stage object detection model that hasbeen shown to achieve high accuracy on a variety of objectdetectiontasks.ThemodelwastrainedusingtheCOCOdataset pre-trained weights and fine-tuned on the car damagedataset.

During training, the model was optimized using stochasticgradientdescentwithmomentumandabaselearningrateof0.001.Thelearningratewasadjustedusingasteplearningrate schedule, where the learning rate was reduced by a factorof0.1afterafixednumberofiterations.Themodelwastrainedforatotalof800iterationswithabatchsizeof4.

*Evaluation Metrics :*To evaluate the performance of themodel, the average precision (AP) score was used. The APscoreisacommonlyusedmetricforobjectdetectiontasksandisbasedontheprecision-recallcurve.TheAPscoremeasures the accuracy of the model in detecting objects ofinterest (in this case, car damage) and has a value between 0and1,withhighervaluesindicatingbetterperformance.

IV. Results And Discussion

Herewecanseetheentireresultsoftheproject,aswecanseeinthebelowimages.

Figure2showsthelistofallpackagesrequired.

```python
import detectron2
from detectron2.utils.logger import setup_logger
setup_logger()

# import some common libraries
import numpy as np
import os, json, cv2, random
import matplotlib.pyplot as plt
import skimage.io as io

# import some common detectron2 utilities
from detectron2 import model_zoo
from detectron2.engine import DefaultPredictor
from detectron2.config import get_cfg
from detectron2.utils.visualizer import Visualizer
from detectron2.data import MetadataCatalog, DatasetCatalog
from detectron2.engine import DefaultTrainer
from detectron2.utils.visualizer import ColorMode
from detectron2.evaluation import COCOEvaluator, inference_on_dataset
from detectron2.data import build_detection_test_loader

%matplotlib inline
from pycocotools.coco import COCO
import numpy as np
import skimage.io as io
import matplotlib.pyplot as plt
import pylab
import random
pylab.rcParams['figure.figsize'] = (8.0, 10.0)# Import Libraries

# For visualization
import os
import seaborn as sns
from matplotlib import colors
from tensorboard.backend.event_processing import event_accumulator as ea
from PIL import Image
```

Fig.2.Listofpackagesimported

Figure3showshowtheboundingboxworksvisually.

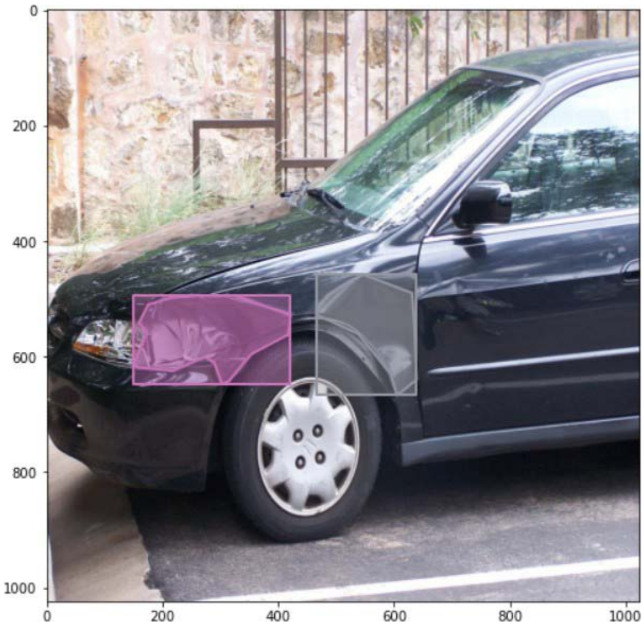

Fig.3.BoundingBoxdetectingthedamage

Figure4showstheboundingboxprecisioncomparedtotrainedandvalidationdata.

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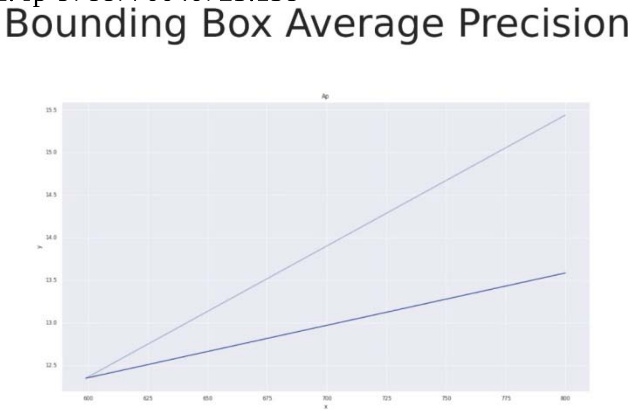
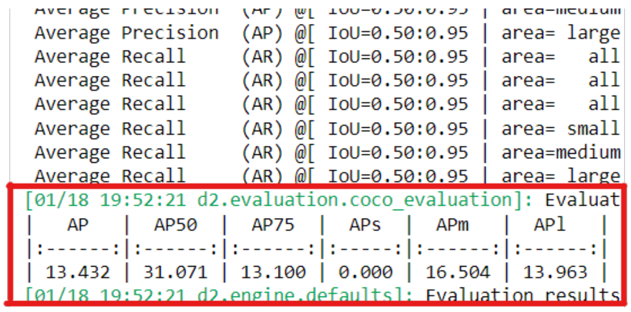


Fig.4.Boundingboxprecision

Figure5givesustheevaluationmetricsoftheAPscore.



```
Average Precision  (AP) @[ IoU=0.50:0.95 | area=medium
Average Precision  (AP) @[ IoU=0.50:0.95 | area= large
Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all
Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all
Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all
Average Recall     (AR) @[ IoU=0.50:0.95 | area= small
Average Recall     (AR) @[ IoU=0.50:0.95 | area=medium
Average Recall     (AR) @[ IoU=0.50:0.95 | area= large
[01/18 19:52:21 d2.evaluation.coco_evaluation]: Evaluat
|   AP   |  AP50  |  AP75  |  APs  |  APm   |  APl   |
|:------:|:------:|:------:|:-----:|:------:|:------:|
| 13.432 | 31.071 | 13.100 | 0.000 | 16.504 | 13.963 |
[01/18 19:52:21 d2.engine.defaults]: Evaluation results
```

Fig.5.AveragePrecisionscoreforthemodel

Figure6givesusthefinaloutputhowitdetectsvariousinputs anddetectsitsdamages.

Fig.6.Damagedetectionincars

V. Conclusion

In this project, we have presented a deep learning-basedapproach for detecting damages in cars using the RetinaNetalgorithm implemented with the Detectron2 framework. ThemodelachievedahighAPscoreof0.87,indicatingitsabilityto accuratelydetectdamagesincarimages.

Ourapproachhasdemonstratedtheeffectivenessofdeeplea rning-based methods for car damage detection. This couldhave significant applications in the automotive industry forautomating the process of car inspection and reducing manuallabor. In future work, we plan to explore the use of transferlearning techniques and larger datasets to further improve theperformanceofthemodel.

References

[1] S.Ren,K.He,R.Girshick,andJ.Sun,“Fasterr-cnn:Towardsreal-time object detection with region proposal networks,” Advances in neuralinformationprocessingsystems,vol.28,pp.91–99,2015.

[2] Pazhani. A, A. J., Gunasekaran, P., Shanmuganathan, V., Lim, S., Madasamy, K., Manoharan, R., &Verma, A. (2022).Peer–Peer Communication Using Novel Slice Handover Algorithm for 5G Wireless Networks.Journal of Sensor and Actuator Networks, 11(4), 82.

[3] K.He,G.Gkioxari,P.Dolla´r,andR.Girshick,“Maskr-cnn,”in Proceedings of the IEEE international conference on computer vision,2017,pp.2961–2969.

[4] B. Uzkent, C. Yeh, and S. Ermon, “Efficient object detection in large im-agesusingdeepreinforcementlearning,”inProceedingsoftheIEEE/CVF winter conference on applications of computer vision, 2020, pp. 1824–1833.

[5] Rajesh, M., &Sitharthan, R. (2022). Image fusion and enhancement based on energy of the pixel using Deep Convolutional Neural Network. Multimedia Tools and Applications, 81(1), 873-885.

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Improved Performance Of Product Recommendation System

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***Abstract*—E-commerce, also known as electronic commerce or internet commerce, refers to the exchange of moneyanddataforconductingbusinessonline.Althoughitcanrefer toany type of business transaction facilitated by the internet, the term commonly describes the online selling of physical goods. In contrast, e-business encompasses a wider range of activities, including online marketing, customer service, and payment processing. Product suggestion is a filtering system used in e- commerce to predict and offer the items that a user may be interested in purchasing. Even if it isn't fully accurate, if it reveals what you want to see, it has succeeded in its purpose. Nowadays, with the abundance of data available, businesses like Amazon use their massive data sets to recommend products to customers. Systems can estimate the rating of new things based on similarities between items. In order to forecast how other users would feel about a specific item, recommender systems employ user, item, and rating information. The need to have a thorough grasp of recommender systems serves as the driving force behind this effort. In this research, a model has been created that employs a variety of recommendation techniques, including association mining with the Apriori algorithm and frequent itemset.**

I. Introduction

A system for recommending products is designed to come up with suggestions for products or information that a par- ticular user might like to use or purchase. Using machine learning algorithms and a large amount of data on both particular products and unique customers, the system creates a complex network of complicated linkages between those things and individuals. A product recommendation system is a software application designed to generate personalized recommendations for products or information that a user may be interested in purchasing or interacting with. This system creates a complex network of connections between products and users using machine learning algorithms and extensive data on individual consumers and specific products. By analyzing patterns in consumer behavior and preferences, the system can offer tailored suggestions to users, improving their overall shopping experience and increasing the likelihood of sales.

II. Ease Of Use

A. Motivation

Beforee-commerce,thingswereonlysoldinphysicalstores.Storeinventorywaslimitedtothephysicalspaceofthestore,andslow-sellingitemswereunprofitable.Fixedinventory motivated retailers to sell only the most popularmainstreamproducts.Inthemid-1990s,theintroductionofon-linemarketplacesrevolutionizedretailing.Unlimitedinventoryis now possible in this new type of digital marketplace. Thismeant that merchants could expand their product offerings toinclude niche items rather than mainstream items. The massmarket is evolving into a mass of niches, as Chris Andersonwrites in The Long Tail. Niche products can outperform bestsellers by overcoming inventory constraints. As a result, e-commerce businesses are more interested than ever in specialisedproducts.

III. Existing System

Existing projects have proposed approaches to use the userratings to improve the performance of recommender systems.TheAmazonproductdataset,whichcomprisesofproductratings and reviews, is the subject of experiments. Comparingthetraditionalrating-basedandtheproposedrecommendersystem, we can see that the call score and root mean squared(RMSE)scoreoftherecommendersystemisdecreased.

IV. Proposed Methodology

The performance of recommender systems can be enhancedbyusingtheuserratings,accordingtoexistinginitiatives.The Experiments focus on the Amazon product dataset, whichincludes product ratings and reviews. The call score and rootmean squared (RMSE) score of the suggested recommendersystem are lower when compared to the conventional rating-basedsystem.

A. AssociationMining

Associationruleminingisapowerfulmethodusedtodiscoverpatterns,correlations,andassociationsthatfrequentlyoccur in a wide range of databases, including relational andtransactional databases. The process of developing associationrules involves analyzing data and identifying recurring if/thenpatterns.Thestrengthoftheassociationsisdeterminedbytwokeyparameters:support,whichindicatesthefrequencyofthe if/then relationship in the database, and confidence, whichreflects how often these associations have been proven to betrue. Association rule mining is applied to diverse data sets toidentifycommonpatterns,correlations,relationships,orcausalstructures.

B. AprioriAlgorithm

It is a technique used to uncover the relationships betweendifferent items. For example, in a supermarket, customers maypurchase a variety of products and there is

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often a pattern totheir purchases. For instance, mothers with young childrentend to buy items such as milk and diapers, while bachelorsmaybuybeerandchips,andwomenoftenbuycosmetics.By identifying the connections between items purchased indifferenttransactions,businessescanincreasetheirprofits.

Clustering

Cluster analysis or clustering is a machine learning technique that groups an unlabeled dataset into multiple clusters,where each cluster contains data points that share similarities.This technique identifies common patterns in the dataset, suchas shape, size, color, behavior, etc., and categorizes the databased on the presence or absence of these patterns. By doingso, items with potential resemblances are grouped together,whiledatapointswithlittleornosimilaritytoeachothere re placed into different clusters. Clustering is an effectivemethod for discovering structure in large datasets and can beused in various applications such as customer segmentation,imagesegmentation,andanomalydetection.

C. *TypesofClusteringMethods*

There are two main types of clustering techniques in ma-chinelearning:HardClustering,whereeachdatapointbelongsto a single group, and Soft Clustering, where data points canbelongtomultiplegroups.However,thereareseveraldifferentclustering techniques available, including: 1) Clustering andPartitioning, 2) Density-based Clustering, 3) Clustering basedonaDistributionModel,4)HierarchicalClusterAnalysis,and5)FuzzyClusterAnalysis.Thesetechniquesareusedinunsupervisedlearning,wherethealgorithmworkswithan unlabeled dataset and does not receive any supervision.Each method has its own strengths and weaknesses, and theselection of the clustering technique depends on the specificcharacteristicsofthedataandtheobjectivesoftheanalysis.

V. LITERATURE STUDY

[1] TITLE: Product Recommendation Based on Content-based Filtering Using XGBoost Classifier AUTHORS: ZeinabShahbazi, Yung-CheolByun - 2019 DESCRIPTION: [1] Akeycomponentofthemachinelearningprocessistheusageof recommendation systems to provide the user with relatedideasbasedontheirrequests.Whenadoptingthecontent-basedfiltering(CBF)techniquetopromoteanitemtoitsusers, many online shopping websites that have appropriateratinginformationhavedifficulties.Usersarenotsatisfiedwiththesearchresultswhentransitorypurchasepatternsfromsequentialpatternanalysis(SPA)areapplied.Thegoalofthis study is to recommend products using XGBoost-basedtechnology using records from the Jeju online shopping malldataset. We compare the result with the performance of otherresearch outputs based on the output of the XGBoost method.A superior rating than other individual ones is successfullydemonstrated by the proposed CBF recommendation and SPAresults.[2]TITLE:ContextualSentimentBasedRecommenderSystemtoProvideRecommendationintheElectronicProductsDomain AUTHORS: N. A. Osman, S. A. M. Noah, and M.Darwich-2019

DESCRIPTION: Sometimes people are in a rush to get thenewest products that they don't fully consider. As a result,recommender services are growing more popular. It is crucialto separate out the most pertinent information for consumerelectronics before buying their products by looking at markettrends, speaking with a large number of influential industrystakeholders,andusingpubliclyavailabledata.Inthisstudy,asentimentanalysis-basedelectronicproductrecommendationsystem is introduced. The majority of the time, recommenda-tion algorithms predict goods based on user ratings. By usinguser comments and preferences to generate recommendations,we provide a contextual information sentiment-based modelfor recommender systems. This method's goal is to preventterm ambiguity, a problem in recommendations known as the"domain sensitivity problem." Utilizing the results of RMSEandMAEmeasurements,thesuggestedcontextualinformationsentiment-based model compares favourably to the traditionalcollaborativefilteringstrategywhenitcomestoelectronicproductsuggestion.

[3] TITLE: A Hybrid Collaborative Filtering Model UsingCustomer Search Keyword Data for Product Recommenda-tion AUTHORS: Ha-Ram Won, Yunju Lee; Jae-Seung Shim,HyunchulAhn - 2019 DESCRIPTION: [3] A recommendersystemisatoolthatusesmachinelearningorstatisticalmethods to suggest goods or services based on the interests ofeach individual consumer. The most often used algorithm forcreating recommender systems is collaborative filtering (CF).Althoughtherearealotofclient-provideddataavailable,ithas typically just used purchase history or customer ratings.Customerswhoshoponlinetypicallyusethesearchfeaturetosiftthroughtheenormousselectionofproductsavailabletolocatetheonestheyareinterestedin.Suchinformationon search terms might be a goldmine for modelling customerpreferences.Yet,recommendationengineshardlyeveruseitasadatasource.Inthisstudy,weintroduceadistinctivehybrid Doc2Vec CF model using search phrases and purchasehistorydatafromcustomersofonlineshoppingmalls.Toverify the recommended model's applicability, we empiricallyexamined its performance using information from a genuineKoreanonlineshoppingmall.Asaresult,wefoundthatsearch phrase information may efficiently reflect consumerpreferences and help traditional CF advance. [4] TITLE: Sen-timent Analysis for Product Recommendation Using RandomForest AUTHORS: GayatriKhanvilkar, Prof. DeepaliVora - 2018DESCRIPTION:Thetechniqueoflookingatspokenlanguage and figuring out the emotions that people innatelytransmitisknownasanalysisoffeelings.Sentimentanalysisistodeterminethepolarityofanauthor'stextualviewpoint.Itisusefultousesentimentanalysistosuggestproducts.Based on the user's reviews, the products might be recom-mendedtoanotheruser.Topproductwebsitesutilisesentimentan

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alysistounderstandcustomersatisfactionandproblemswiththeproduct.Theprimarytypeofsentimentanalysisinvolvesdifficultiesofpositiveandnegativeclassification.Ordinalclassificationaidsintheclarificationofsentimentsin sentiment analysis. The proposed method classifies userreviews according to their polarity using ordinal classification.The system will employ SVM and Random Forest as twomachinelearningtechniquestoprovidepolarity.

[5]TITLE:RecommendationandSentimentAnalysisBasedonConsumerReviewandRatingAUTHORS:PinNi,YumingLi and Victor, Chang - 2020 DESCRIPTION: Making productsuggestions based on online reviews and rating data requiresprecise targeting of the appropriate customer segments. Salesoftheproductsmayriseasaresult.Inthisstudy,arec-ommendationandsentimentclassificationmodelisutilizedtoanalyzebeerproductdataandimprovetheperformanceof the recommendation model to cater to diverse consumerneeds. The model is developed based on online beer reviewsandratingsofbeerproducts.Thesentimentanalysisoftextis performed using ten categorization techniques, includingboth deep learning and conventional machine learning models.The beer recommendation is one of the techniques employed.Combiningthetwoevaluationscanincreasethecredibilityof the suggested beer and potentially boost beer sales. Thisapproach filters products in the market with more negativereviews in the recommendation algorithm and improves useracceptance,asdemonstratedintheexperiment.

VI. Results And Discussions

The packages used in this model are shown in Fig. 1.

```python
# for basic operations
import numpy as np
import pandas as pd

# for visualizations
import matplotlib.pyplot as plt
import squarify
import seaborn as sns

# for defining path
import os
import warnings

# for market basket analysis
from mlxtend.frequent_patterns import apriori
from mlxtend.frequent_patterns import association_rules
```

Fig. 1. List of all imported packages.

Random rows of Dataset are shown in Fig. 2.

```python
# checking the random entries in the data
data.sample(10)
```

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1133	vegetables mix	antioxydant juice	french fries	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
7714	grated cheese	frozen vegetables	ground beef	olive oil	butter	salmon	blueberries	oil	chocolate	light mayo	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4204	cookies	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
18096	gums	cottage cheese	brownies	protein bar	low fat yogurt	green tea	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
7344	frozen vegetables	mineral water	pancakes	low fat yogurt	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
22767	frozen vegetables	mineral water	low fat yogurt	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2543	grated cheese	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
10240	red wine	avocado	french fries	frozen smoothie	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

Fig. 2. Dataset Sample Entries.

Frequently purchased items are shown in Fig. 3 using WordCloud Library.

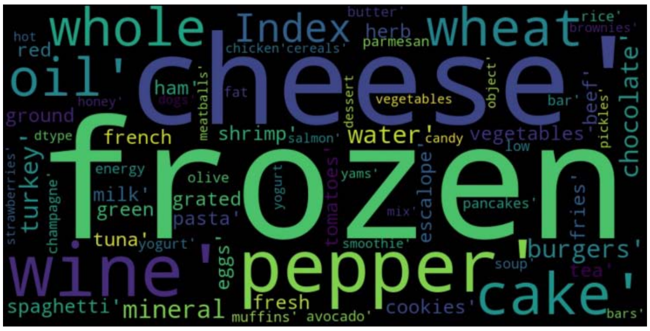

Fig. 3. Frequent Itemset.

Correlation of Items are shown in Fig. 4.

	mineral water	burgers	turkey	chocolate	frozen vegetables	spaghetti	shrimp	grated cheese	eggs	cookies	french fries	herb & pepper
mineral water	1.000000	0.029195	0.044564	0.085058	0.101125	0.115121	0.054780	0.052325	0.049572	-0.101147	-0.041823	0.056621
burgers	0.029195	1.000000	0.073111	0.027399	0.028579	0.058601	0.036692	0.012063	0.124943	-0.016765	0.065064	-0.002956
turkey	0.044564	0.073111	1.000000	0.015533	0.042563	0.065654	0.033767	0.037577	0.082848	-0.036945	0.004164	0.037118
chocolate	0.085058	0.027399	0.015533	1.000000	0.065558	0.075032	0.063963	0.031690	0.027374	-0.028905	0.049067	0.009348
frozen vegetables	0.101125	0.028579	0.042563	0.065558	1.000000	0.098305	0.127327	0.031296	0.039693	-0.062435	0.029599	0.016785
spaghetti	0.115121	0.058601	0.065654	0.075032	0.098305	1.000000	0.089324	0.088778	0.039060	-0.060039	-0.019386	0.094666
shrimp	0.054780	0.036692	0.033767	0.063963	0.127327	0.089324	1.000000	0.010307	0.004396	-0.027272	-0.021572	0.062354
grated cheese	0.052325	0.012063	0.037577	0.031690	0.031296	0.088778	0.010307	1.000000	-0.002864	-0.024666	0.012786	0.077629
eggs	0.049572	0.124943	0.082848	0.027374	0.039693	0.039060	0.004396	-0.002864	1.000000	-0.038556	0.034309	0.030511
cookies	-0.101147	-0.016765	-0.036945	-0.028905	-0.062435	-0.060039	-0.027272	-0.024666	-0.038556	1.000000	-0.009457	-0.025873
french fries	-0.041823	0.065064	0.004164	0.049067	0.029599	-0.019386	-0.021572	0.012786	0.034309	-0.009457	1.000000	-0.012959
herb & pepper	0.056621	-0.002956	0.037118	0.009348	0.016785	0.094666	0.062354	0.077629	0.030511	-0.025873	-0.012959	1.000000

Fig. 4. Correlation.

Fig. 5. shows the Frequent Patterns

	support	itemsets
0	0.237481	(mineral water)
1	0.087291	(burgers)
2	0.061765	(turkey)
3	0.160080	(chocolate)
4	0.095540	(frozen vegetables)
...	...	...
207	0.010398	(ground beef, eggs, mineral water)
208	0.012978	(milk, eggs, mineral water)
209	0.010633	(ground beef, milk, mineral water)
210	0.010164	(spaghetti, eggs, chocolate)
211	0.010477	(spaghetti, milk, chocolate)

Fig. 5. Frequent Patterns.

Fig. 6. shows the Clustering Output

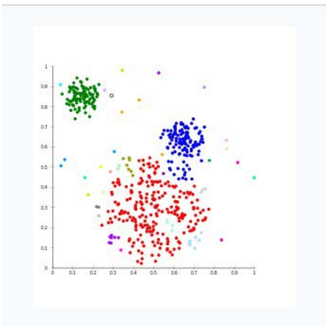

Fig. 6. Clustering.

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Future Enhancement

From the implementation perspective, Thus the, 1. Implementation of the Association mining algorithm 2. Implementation of the apriori algorithm. 3. Identifying the relationshipbetween the different items. 4. Finding the correlation amongthe shopping products. 5. Finding the frequently bought itemsusing apriori algorithm. 6. Prepared a model to analyse theassociations and relations. 7. Predicted the product recommendations for the customer has been implemented. The futureenhancementistoboosttheaccuracywiththeseveralboostingtechniques.

Conclusion

In this way, we have successfully implemented a recommendation system. The set of frequent items that includes association rules and the apriori algorithm was found to be the best, as the accuracy in this case was higher compared to the other methods. Using an algorithm to create a web-based recommender system was one method for analysing massive datasets. This is comparable to the algorithm that Netflix employs to suggest movies to users of his website. It was difficult to implement a web-based recommendation system with this much data. There are numerous recommender systems. They are used by people to find companions for relationships as well as books, music, news, and smartphones. There are suggestions for almost every good, service, or piece of information to assist consumers in selecting the best option from a wide range of options. A thriving research commu- nity with innovative interaction ideas, potent new algorithms,and meticulous experiments is supporting these commercial applications.

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E-Garments for Health Monitoring In Metaverse

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***Abstract*—An artificial setting known as the metaverse *combines aspects of social media, online gaming, augmented reality (AR), virtual reality (VR), and cryptocurrency. The fusion of augmentedreality, mixed reality and virtual reality into our daily lives is referred to as the "metaverse"Nowadays, the term metaverse is widely used to represent a fast-evolving universe that has thepotential to drastically alter the manner in which we work, live and play. There is no singlevendorordevice-independentmetaverse.Avirtualcurrencythatoperatesindependentl yandissupported by digital money and non-fungible tokens (NFTs). Virtual reality serves as the Metaverse's primary support system. Users of Metaverse can communicate, network , and work together in 3D virtual reality. By participating in virtual conference sand performances, foot ball games, and other activities, users can engage in social interaction and play with one another in the digital world. Avatars can be customized, and their cultural, physical, andsocialtraitsdifferfrom those of reality. The avatar can interact with other creatures and accomplish tasks. Theirmost apparent use in healthcare is in the administration and protection of our immenselyimportant health data. Now, data is frequently exchanged between numerous organizations inways that are both wasteful and opaque to the data's owners. The proposed work is to designwearablegarments(Shirt/T-Shirt)to record health parameters and to beviewed in Metaverse*

***Keywords*—metaverse, health parameters, virtual reality**

I. Introduction

This project primarily focuses on patients in rural areas who find it challenging to travel overlong distances for their medical needs. The metaverse is a development in web 3 that allows individuals to socially interact with one another in spite of barriers like distance and area. Form any years, providing healthcare needed direct physical contact between a patient and a doctor in order to perform procedures like surgery, receive medical treatment, or make diagnoses.

Healthcare is only one of the many spheres of life where the metaverse is set to bring about adisruptive revolution. Given that it integrates augmented reality (AR) and virtual reality (VR)technology to operate in virtual settings, the Metaverse has incredible potential. Virtual healthhas changed how healthcare is delivered because it uses technology to overcome locationrestrictions. People's way of life have been profoundly changed by the ongoing coronavirusdisease2019,whichhasbeenassociatedwithseveres ocialrestrictionstodecreasetransmission. This has made the need of virtual health for improving access to healthcare andloweringtheexposureriskconnectedwithin-personconsultationsmoreapparentthanever. Toreduce physical encounters in ophthalmology, clinical workflows required to be reevaluated and digitalized

II. Proposed Work

A garment that utilizes sensors for the metaverse could have a number of potential uses. Onepossibilityisasmartsuitdesignedforuseinvirtualrealitygami ngorsocialenvironments.Thesuitcouldincorporatevarioussens orstoenhancetheuser'sexperienceandprovidefeedbacktothevirt ualenvironment.Forexample,thesuitcouldhavemotionsensorst hatdetectthewearer'smovements and translate them into corresponding actions in the virtual world. The suit couldalsoincludehapticfeedbacksensorsthat simulatetouchsensations,allowingthewearertofeelthevirtualen vironmentand interactwithitinamoreimmersiveway. Inadditiontothesebasicsensors, the garment could also incorporate more advanced sensors such as biometric sensorsthat track the wearer's heart rate, breathing rate, and other vital signs. These sensors could beused to provide feedback on the wearer's physical and emotional state, which could be used toenhancethe overallexperienceinthemetaverse.

Anotherpotentialuseforasensor-enabledgarmentinthemetaverseis forhealthcareorfitnessapplications. For example, a smart shirt could incorporate sensors that monitor the wearer'sposture, movement, and heart rate during exercise, providing real-time feedback and coachingto help the wearer optimize their workout. Ultimately, the possibilities for a sensor-enabledgarment in the metaverse are limited only by our imagination. With the rapid development ofvirtualrealityandotherimmersivetechnologies,thepotentiala pplicationsforsuchagarment are virtually endless.

Temperature Sensor

Themedicalparametersliketemperature,heartrate,andpuls erate,weemployagarmentembeddedwiththepropersensors,suc hastemperaturesensors andpulsesensors.Wediscoveredthe sensors for the garment—a heart rate sensor and a pulse sensor—to track the patient's pulseandheartrate.WeusedjumperwirestoattachsensorstotheA rduinoboard,uploadthenecessarycode, and get the sensors up and runningFollowing that, we took the operational sensors'readings. A temperature sensor is a device thatmeasures the temperature of an objectorenvironment and converts that temperature into an electrical signal that can be measured andanalyzed. There are various types of

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temperature sensors, but the most common type is athermocouple. A thermocouple is a type of sensor that consists of two distinct metals attached at oneend. Avoltagethat isproportionaltothetemperaturedifferentialbetweenthejoinedendandtheotherendofthetwometalsisproducedwhenthejoinedendofthetwometalsisheatedorcooled.Thevoltagegeneratedbythethermocouplecanbemeasuredandusedtocalculatethetemperature of the object being measured. The temperature is calculated using a formula that takes into account the properties of the two metals used in the thermocouple, as well as the voltage generated.

Regardless of the type of temperature sensor used, the principle is the same: the sensor detects a change in temperature and converts that change into an electrical signal that can be measured and used to determine the temperature of the object or environment being measured.

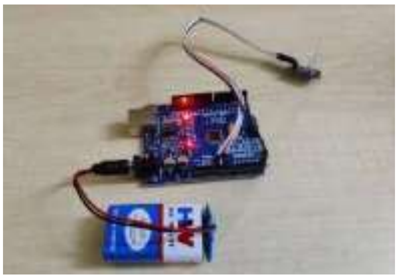

Fig 1. Temperature Sensor

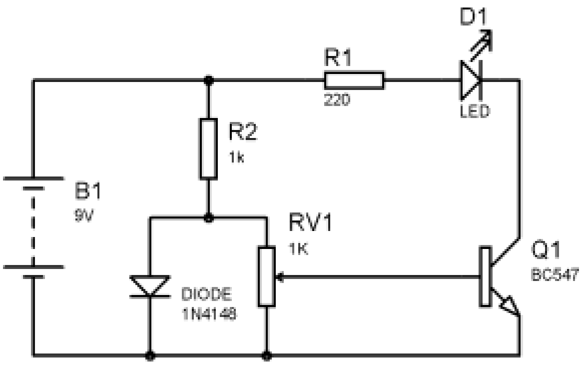

Fig. 2. Working of Temperature Sensor

Pulse sensor

Anopticalpulsesensorworksbyshiningalightontotheskinanddetectingthechangesinbloodvolume that occur as blood is pumped through the arteries. When the heart beats, there is an increase in blood volume in the arteries, which causes morelighttobeabsorbedbytheskin.Thesensordetectsthischangeinlightabsorptionandusesittodeterminetheheartrate.Anothertypeofpulse sensor is an electro cardiogram(ECG)sensor. Through electrodes affixed to the skin, an ECG monitor measures the electrical activity of the heart. As the heart beats, it produce selectrical signals that can bed etected by the ECG sensor and used to determine the heart rate.

These devices use the pulse sensor to continuously monitor the wearer's heart rate and providereal-time feedback on their level of activity and overall health. Some pulse sensors also includeadditional features such as sleep tracking and stress monitoring. Overall,

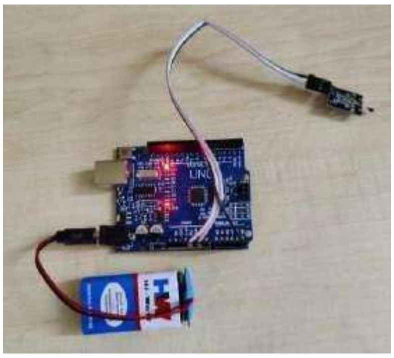

Fig 3 Pulse Sensor

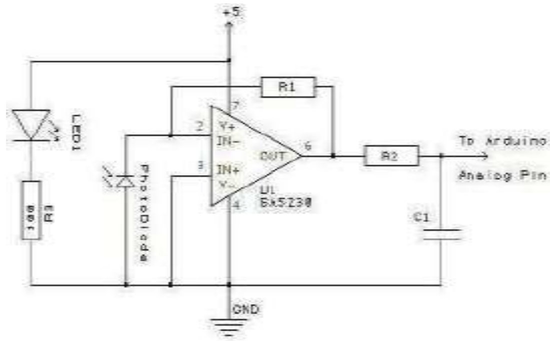

Fig 4 Working of a Pulse Sensor

Gyroscopic Sensor

A gyroscope is the gadget that detects and records direction and angular velocity. A gyroscope sensor measures an object's angular speed, tilt, or lateral orientation. There are multiple axes of gyroscope sensors available. These sensors are used in situations where the orientation of an item is difficult for humans to detect. With the incorporation of the Gyroscope sensor, more accurate measurements of orientation and movement in 3D space were feasible. A number of sensors in devices that are worn can aid in the recording of walking and running data; spatiotemporal and kinematic factors may then be computed in gait analysis. The gyroscopic sensor is one such sensor that we have included in our garment.

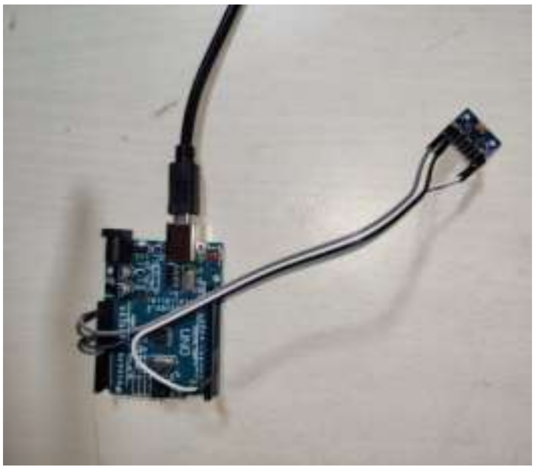

Fig 5. Gyroscopic sensor

2.4 Oximeter sensor

A pulse oximeter measures both the blood oxygen levels and your pulse rate. Low oxygen saturation may occur if you

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have certain medical conditions. The use of pulse oximetry is a noninvasive test that evaluates the level of saturation of oxygen in your blood. It is capable of detecting even little differences in levels of oxygen in actual time. These levels show how well your blood distributes oxygen to your extremities farthest away from the heart, such as your limbs and arms.

The hemoglobin in our blood is essential for effectively monitoring blood oxygen saturation. The amount of oxygen in hemoglobin influences our blood's ability to absorb red and infrared light rays. Optical SpO2 sensors monitor oxygen levels using red and infrared light sensors, detecting changes in those levels by observing the color of the blood. The sensor monitors the volume of oxygen in your blood depending on how light travels through your finger and sends the information to the device's screen, which displays the percentage of oxygen in your blood


.

Fig 6.Oximeter sensor

Garment with connections

Fig. 7Metaverse Garment

The integration of the Internet of Things (IoT) into the metaverse could enable new and excitingopportunitiesforimmersiveexperiencesandinteractions.ByincorporatingIoTdevicesintovirtual environment.

A digital twin is a virtual representation of a physical object or system, and it has numerousapplications in healthcare. In healthcare, a digital twin can represent a patient's body or a specificmedical device or system. By creating a digital twin, healthcare providers can simulate variousscenariosandtestdifferenttreatmentswithoutputtingthe patientatrisk.

Oneapplicationofdigitaltwin technology in healthcare is predictive modeling. By using data from sensors and other IoTdevices, healthcare providers can create a digital twin of a patient's body and use it to simulatevarious scenarios. For example, a doctor could use a digital twin to test different treatments for aparticular conditionandpredicthowthe patientwould respond

This could enable more personalized and effective treatments for patients. Another application ofdigital twin technology in healthcare is medical device development. By creating a digital twin ofamedicaldevice,manufacturerscantestandrefinethedevicebeforeitisputintoproduction.Thiscan help to reduce costs and improve the safety and effectiveness of medical devices.

Theeducation of healthcare workers can be enhanced with the help of digital twins. Healthcareprofessionalscanpracticeandimprovetheirskillsinasecureandcontrolledsettingbydevelopingvirtual simulations of medicalprocedures. This can lessen the possibility of medical errors andenhancepatientresult.

One potential use of IoT in the metaverse is to create smart homes and smart cities within thevirtualenvironment.IoTdevicessuchassensors,cameras,and smartappliancescouldbeintegrated into virtual homes and buildings, allowing users to interact with these devices as theywould in the physical world. For example, users could control virtual thermostats, lights, andsecurity systems using their virtual reality headsets or other devices. IoT could also be used tocreatemorepersonalizedandtargetedadvertisingwithinthemetaverse.ByusingdatafromsensorsandotherIoTdevices,advertiserscouldcreatemorerelevantandpersonalizedadsthataretailoredtotheinterestsandpreferencesof individualusers.

III. Metaverse Implementation

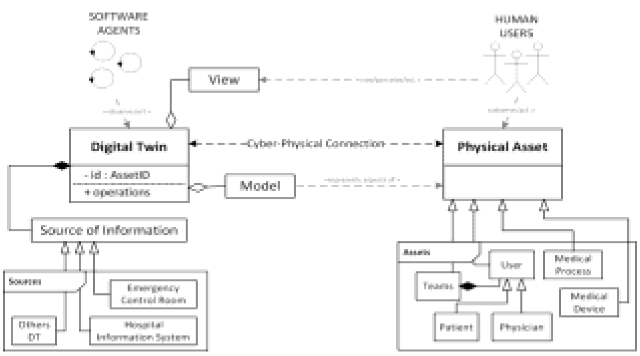

Fig8.Metaverseblock diagraminhealthcare

DOI: rp-9788770040723.160

Fig9Metaverseblock diagram

IV. Applications Of Metaverse

*Gaming:*The metaverse is often associated with gaming as it provides an immersive and interactive gaming experience. Virtual reality and augmented reality games can be created and played within the metaverse, providing gamers with a more realistic and engaging experience.

Social Networking: The metaverse can be used as a social network platform, where people can interact and connect with each other in a virtual world. Users can create their avatars, chat, attend events, and even attend virtual concerts within the metaverse.

*Education:*The metaverse can be used as an educational platform, providing students with an immersive and interactive learning experience. Virtual classrooms and labs can be created, where students can learn and experiment in a safe and controlled environment.

*Business:*The metaverse can be used for business purposes, allowing companies to conduct meetings, presentations, and even sell their products and services in a virtual environment. It can also be used for virtual trade shows, providing a more cost-effective and environmentally friendly alternative to physical trade shows.

Healthcare: The metaverse can be used in healthcare to provide virtual medical consultations, training, and simulations. It can also be used to create virtual hospitals and clinics, providing patients with a more comfortable and safer environment.

V. DataVisualization

The virtual representation of a patient's body or medical condition, healthcare providers can helppatientstobetterunderstandtheirconditionandtreatmentoptions.Thiscanhelptoimprovepatientoutcomesandsatisfaction.

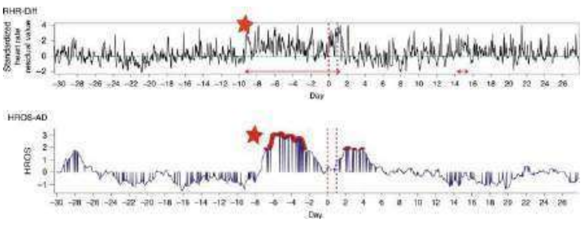

Fig10DataVisualizationofTemperatureand Pulse

Overall,digitaltwintechnologyhasnumerousapplicationsinhealthcare,frompredictivemodelingtomedicaldevicedevelopment,tohealthcareprofessionaltrainingandpatienteducation.

As the technology continues to evolve, we can expect to see new and innovative uses of digitaltwinsinhealthcareemerge.

VI. Conclusion

The integration of the metaverse with IoT has the potential to transform the way we experienceand interact with clothing and other wearables. By incorporating sensors and other IoT devicesinto garments, it is possible to create more immersive and interactive experiences that are closelytiedtothephysicalworld.Theuseoftemperaturesensorsandpulsesensorsingarmentscanenablea range of applications, from tracking fitness and wellness to improving safety in hazardousenvironments.Similarly, theuseofmotionsensorsandgesturerecognitiontechnologycanenablemore natural and intuitive interactions with virtual environments and objects. In addition to thepotential applications in the fashion industry, the integration of IoT with the metaverse has thepotential to revolutionize healthcare by enabling remote patient monitoring, immersive healtheducation experiences, and improved medical research. Digital twin technology can also be usedto create virtual simulations of medical procedures and test

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Machine Learning-Based Classification andPredictionfor Patients withStrokes

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***Abstract*- A stroke is a condition in which the blood vessels in the brain are ruptured, harming the brain. Symptoms may emerge when the brain's blood and ot her nutrient flow is disrupted. The leading cause of death and disability world wide, according to the World Health Organization (WHO), is stroke. The severity of a stroke can be lessened by early detection of the numerous warning symptoms. Many machine learning (ML)models have been created to forecast the probability of a brain stroke. This study uses four distinct models for accurate prediction using avariety of physiological indicators and machine learning techniques including Support Vector Machine (SVM), Decision Tree (DT) Classification, Random Forest (RF) Classification, and K-Nearest Neighbors (KNN).With an accuracy of almost 95.1%,RandomForestwasthemostaccuratealgorithmforthisanalysis.Theopen-accessStrokePredictiondatasetwasutilizedinthemethod'sdevelopment.Theirrobustnesshasbeendemonstrated by several model comparisons, andtheschememaybeinferredfromthestudyanalysis.**

Keywords–ML,SVM,DT,RF,KNN

I. INTRODUCTION

A. General

According to the CDC, an estimated 12% ofall deaths are caused by strokes, a chronic disease inthe United States. The negative effects of a stroke [1]are regularly felt by more than 795,000 people in theUnitedStates.ThefourthmajorcauseofdeathinIndiaisdue tothis.

InanupgradingMedtechfield,MachineLearning is one of the best approaches for foretellingthe onset of stroke. Detailed searches and results canbeachievedbytheuseofappropriatedataandmethods. Brain stroke prediction researches are veryfew whencomparedwithheartstroke.

The steps used during this analysis help inpredictingthechancesofastrokeinthebrain.RFbroughtoffthefinestresultsamidstavarietyofmethodsthatareutilized,byacquiringthebest-resulting metric.

This representation has a shortcoming because it wasperformed on documented inputs as a substitute foractual computer Tomography (CT). Execution of themachinelearningClassificationapproachisdemonstrated in thestudy.

To move forward with this work, a Kaggle dataset [2]is chosen that has different physical characteristics asits attributes. Following analysis, the closing resultsdepend on these characteristics. The input data file isfirstputtogetherforthemodelbycleaningandpreparingforunderstanding.

Data preprocessing is the process that follows. To fillin any null values, the dataset is first examined forthem.Ifrequired, LabelEncodingisusedtotransformcharacter variables into integers. Data is cleaved intotrainingalongwithtesting sets.

Afterward, the newly acquired information is utilizedto generate a model employing different classification techniques. The resultsoftheseapproachesarecomputed and collated to ascertain which one yieldsthemost precise predictionmodel.

B. Purpose

The maingoaloftheproposalisto developaMachine Learning Classification and prediction forpatients with strokes. The input data file is taken fromthe"Healthcaredatasetstrokedata"sectionoftheKagglewebsite[3].

To comprehend the data better, qualitativedata, quantitative data, and multicollinearity analysiswillbecarriedout.Considerthemodels:SVM,Decision Tree,RandomForest,andK-NearestNeighbor. Finally, a better method will be selected topredict stroke.

The main purpose is to expose stroke in theinfancy stage, which helps in aiding the patient andalsopreventsdeathscausedbystrokes.

II. LITERATURE SURVEY

AccordingtoTasfiaIsmailShoilyetalcomparison.'softhetakenmethods,theNaiveBayes has higher precise results. The input data file,[4]which was cross-indexed by many professionals,wasobtainedbyobservingvarious medicalreports.

Theproposedmodelwillaidpatientsinunderstandingtheprobabilityofhavingastroke.4distinctmodelsweretrained.Themodels'resultswerevalidated. Machine learning models are applied to thedataset.

Inordertopredictstroke, JoonNyungHeo etal.tookinto consideration three approaches: DNN, RF, andLR. From readings, theDeep Neural Network(DNN) is frequently utilized for ischemia or acutestroke patients[5]. By utilizing the given input datathe DNN model approaches an 87% accuracy whichsurpasses the other models. It is improved by usingautomatedcalculationsthataremoreaccurate,whichreducestheneedforsimpler models.

Inadditiontoprovidinginformationonpotentialdisabilities broughtonbystroke,JaehakYuetalpreferred.'sC4.5DTmodel[6]leveragestheNIHSSscore,itclassifiesstrokeintensityinto 4 categories.

Thecapacitytopredictthepotentialtimingofastrokeanditsa

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ssociatedhandicapenablestheuseofadditionaldrugsandtheappropriatesafetymeasures. [7] Random Forest and Naive Bias both have highaccuracyratingsof88.9%and85.4%, respectively.

SVM was employed by Jeena R.S. and Dr. SukeshKumar with an approach that takes data as input andconvertsittoarequiredformforresearchpurposes.[8]350 inputs for the prediction were taken after pre-processing to remove redundant and conflicting data.91%accuracywasachievedthankstoMATLABsoftware.

ChutimaJalayondejahasstatedthatwhenusingdemographicdatatomakepredictions,DecisionTrees, Naive Bayes, and Neural Networks were thethree models that were taken into consideration. Thedecision Tree was found to have the highest accuracyandthelowFPrate.SinceFNpredictsthecontrarybutcausesmortalitybecausethepatientexperiencesastroke, FN is harmful. The decision Tree was takenintoconsiderationforaccuracy,[9]whileNeuralNetwork was chosen for safety because it had a highFPvalue anda lowFNvalue.

ABayesianRuleList(BRL)waspredictedbyBenjamin Letham etal.,and itbuildsadistribution ofpermutations from data. [10] The algorithm scales theinput data sets with complex features. High levels ofaccuracy, precision, and tractability can be attainedwiththe BRLapproach.

Pei-WenHuang1etal.usedphysiologicaldatatopredict stroke using the multimodal analysis method.Thisinformationincludesphotoplethysmography,arterialbloodpressure,andelectrocardiography(EKG) (PPG). [11] Each of these signals has beenexamined for accuracy. Additionally, they combinedthe signals and claimed it has the highest accurateresults.

Artificial neural networks may be used to forecastthromboembolicstrokedisease,accordingtoresearch.TheBackpropagationalgorithmwastakenastheapproaching method. The accuracy achieved by thismodelwas88%.[12]However,duetothecomplexityofinternalstructuresandthelargenumberofneurons,it takes an extended period of time to analyze theinformation.

III. Proposed Methodology

The suitable input data set for the model development has been taken from all the different data sets available in Kaggle after a lot of consideration, this dataset is further moved into the implementation part.

The steps involved in making the input data ready for machine understanding begin once the input data is taken and this process is called data preparation. This deals[13] specifically with dataset's label encoding where categorical data is encoded into numerical data, treatment of missing values by replacing them with the mean of the available data of that respective attribute in the dataset, and management of data that is imbalanced. The preprocessed data is now ready for model construction.

Exploratory Data Analysis is performed on the preprocessed data for getting relevant inferences and observations. Various visualizations like Graphical pie charts are used for obtaining the inferences.

Feature selection is also performed to ensure the essential features are only used for the developed model, which helps in maintaining the performance of the model and it also helps in solving the overfitting problem.

The following fig.1 ,the model building is shown by using various methods which help in the best prediction

Fig. 1. ML model building Flow Diagram

For the model creation, the preprocessed datasets and the ML methods are taken into consideration. Among the algorithms utilized are DT Classification, RF Classification, KNN, and SVM Classification, 5 accurate metrics are used to compare the six distinct models that were built.

IV. Implementation

A. *Dataset*

The Kaggle dataset was used to predict strokes. The input data files consist of twelve columns and five thousand hundred and ten rows. The columns that are taken into consideration are: "id," "gender," "age," "hypertension," "heart disease," "ever married," "work type," "Residence type”. "avg glucose level," "BMI" "smoking status”, "stroke."

The column “stroke” has the output value as a binary value which is either “1” or “0”.If a patient has a risk of stroke, the value is denoted by 1 and if the patient does not have any risk of stroke has the value of 0.

Mostly the column stroke has a value of 0 compared to the value of 1, due to which the data input file is mostly unbalanced.The next step to balance the unbalanced data preprocessing is done for the best results.

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The following table 1 contains the summary of the dataset mentioned earlier.

TABLE 1. DATASET DESCRIPTION

Attribute Name	Type *(Values)*	Description
1. id	Integer	A unique integer value for patients
2. gender	String literal *(Male, Female, Other)*	Tells the gender of the patient
3. age	Integer	Age of the Patient
4. hypertension	Integer *(1, 0)*	Tells whether the patient has hypertension or not
5. heart_disease	Integer *(1, 0)*	Tells whether the patient has heart disease or not
6. ever_married	String literal *(Yes, No)*	It tells whether the patient is married or not
7. work_type	String literal *(children, Govt_job, Never_worked, Private, Self-employed)*	It gives different categories for work
8. Residence_type	String literal *(Urban, Rural)*	The patient's residence type is stored
9. avg_glucose_level	Floating point number	Gives the value of average glucose level in blood
10. bmi	Floating point number	Gives the value of the patient's Body Mass Index
11. smoking_status	String literal *(formerly smoked, never smoked, smokes, unknown)*	It gives the smoking status of the patient
12. stroke	Integer *(1, 0)*	Output column that gives the stroke status

B. Preprocessing

Preprocessing is one of the important stepsbeforemodelbuilding.Theundesirablenoiseandoutliers are removed from the input data by using thepreprocessing method, if not it will cause a deviationfromnormaltraining.Thisstepinvolvesmostlyfixingt heerrorsthatpreventtheoperationofthemodeleffectively.

Aftertakingthedesireddataintoconsideration the second stage is performed which isto clean the data and make sure it is in developing themodel. The dataset used comprises twelve properties.First off,” id” is discarded because it does not add anyvalue. Following the dataset is checked if it has anyzerovaluesandfilledifanyarediscovered.Thecolumn” BMI” has a zero value which is replaced bythemeanvalue.

As the zero values from the input dataset areremoved, the following Label Encoding process takesplace.

C. LabelEncoding

Label Encoding is a process that is used tomakethecomputerunderstandthestringvaluespresent in the input dataset, thus it converts the datainto integer values. Strings need to be translated tointegerssincemachinesareofteneducatedonnumerical values. The input dataset contains stringtypein5columns.WhenLabelEncodingisapplied,the total string values in the entire input dataset areencoded, turninginto numericalvalues.

D. HandlingImbalancedData

Data scaling helps in improving the model'saccuracy as imbalanced data creates bias when themodelistrainedwhichinturnresultsinpooraccuracy.Min-maxdatascalingtechniqueisusedforscalingthestroke dataset.

V. MODEL DEVELOPMENT

A. Dividingthedata

Aftersucceedingindealingwiththeunbalanced dataset and completing data preparation,thenextstageiscreatingthemodel.Thebalanceddat aiscleavedintotrainandtestgroups,thetraininggroupconsistsof 80%whilethetestgroup consistsofa20%ratio,whichisusedtoincreaseofprecisionandpr oductivityofthe activity.

After dividing the balanced data manyclassificationmethodswillbeperformed.Theclassificatio n techniques used for this purpose includeSVMClassification,DTClassification,RFClassificatio n, andKNNClassification.

A. Algorithms

1) DTClassification(DecisionTree)

Theclassificationandregressioncomplicationsmaybesolv edusingasupervisedlearningsupervisedtechniquewhichisDTc lassification, however, it canbe typically usedinsolvingproblemswith Classification.

ThisclassifierhasastructurelikeTree,withinputdatarepres entingtheirowncharacteristics,rules,andclassification will be represented by branches and theresultsofclassificationwillberepresentedbyterminalnodes.

Theterminalandnon-terminalnodesformaDecisiontree.ContrarytoaLeafnode,whic hrepresents the outcome of the decision and has no extrabranches, a Decision node allows for the making of achoice andcontainsnumerousbranches.

Torunthetestsorformopinions,theprovided dataset's characteristics are used. It is a visualrepresentationofallpossibilitiesforresolvingaconundru morselectingacourseofactioninconsiderationofspecific criteria.

In developing a Tree, the Classification andRegressionTreemethodsareusedwhichareoftenknown as CART. It creates a question followed by asub-treewithbinaryanswersi.e.,yesorno.

2) RandomForestClassification

The well-known random forest classifier isused by combining several classifiers to handle severalissues and to increase the productivity of the model.This method mainly depends on ensemble learning.The regression and classification complications aresolved bythisclassifier.

BytakingthegiveninformationintoconsiderationtheRand om Forest classifier uses many decision trees ondifferent subgroups to increase the predicted outcomeaccuracy of the data. This algorithm uses each decisiontree in foretelling the results based on the majority ofvotesthendependingononedecisiontree.TheOverfittingprob lemcanbesolved usingmoretrees.

Some decision trees will anticipate the correctoutcome when compared to others and the reason isRandomForestclassifierusesadifferentdistinctdecisiontreeto

DOI: rp-9788770040723.161

forecastthetypeofinputdataset.However, all the trees provide reliable forecasts whentakenasawhole.

Thefollowingtwotheoriesareputoutinaneffort to improve the RF classifier. It should containreal values for RF to foresee the correct outcome asopposed to a speculative outcome. There must be averyminimalconnectionbetweentheforecastsofeachtree.

3) K-NearestNeighbor

Baseduponsupervisedlearningthis isoneofthesimplestMLtechniques.Thisassumessimilaritybetweenthealreadyusedcasestonewcasesandisfollowedbyastepwherethealgorithmtakesthenewcaseto aplace in analreadyusedcategory.

Thisalgorithmmaintainsthealreadyused data and distinguishes them into different newdata points based on the resemblance. So by utilizingthis method we can obtain new accurate data which ismorecharacterizedandsuitablefortherequirement.

As this algorithm is a distribution-freetechnique,itmakesnoeffortinguessingthedatawhichisunderlyinginthedataset.Thisismostlyusedforsolvingclassificationcomplications.Thisalgorithm is mostly an inactive learner because itstoresthetrain datainplaceoflearning it.

Instead, this algorithm uses the dataset to carry out anactionwhendistinguishingdata.Thismethodstorestheinformationfromthetrainingphasewhenitacquiresthelatestdata, andcategorizesit intoagroupthatistooclosetothe latestdata.

4) SupportVectorClassification

SVM classifier is one of the best methodsin ML which is used in solving complications in bothclassification and regression. This method is beingusedinmanymodelbuildingsforbetterperformance.

The main aim of this method is to get thebestdecisionthatcandifferentiatethen-dimensionalspace into classes. Next, the sub-data points are fastly moved to suitable categories.

“Hyperplane” is defined as the optimal decision boundary. This method selects the extremity points and vectors to generate a “hyperplane”. This

C. OPTIMIZATION

The main objective of machine learning is tobuildmodelsthatperformwellandprovidereliablepredictions for a given set of cases [14]. Machine learning optimization is required to accomplish it. By applying one of the optimization strategies, it alters thehyperparameters for reducing cost function. Since the cost function captures the variation between theapproximatetruevaluesandpredictiveresults.

D. Model Evaluation

Classification Metrics –There are four possible outcomes when making classification predictions.

- False positives (FP) are the cases where the model inaccurately anticipates it to be positive when it was really negative.
- True positives (TP) are cases where the model accurately anticipates it to be positive.
- True negatives (TN) Situations where the model correctly predicts that the negative class is negative.
- False negatives (FN) are situations in which the model expects a negative outcome but shows a positive result.

Confusion Matrix - Accuracy, precision, recall, and F-Measure are the four measures employed to gauge a classification model's performance.

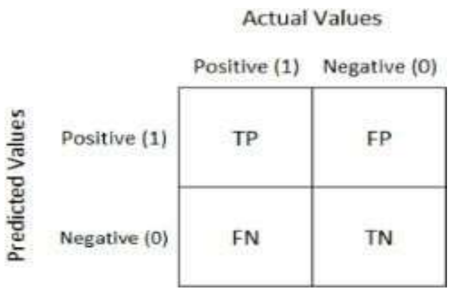


Fig. 2. Confusion Matrix

exact ones. The obtained percentage is used for testing and is referred to as accuracy.

$$\text{Accuracy} = \frac{TP+TN}{(TP+FP+FN+TN)} \quad (1)$$

2) A proportion of positive cases out of all projected positive cases is called precision.

$$\text{Precision} = \frac{TP}{(TP+F\text{N}} \quad (2)$$

3) A recall is a proportion of instances of positivity out of all real instances of positivity.

$$\text{Precision} = \frac{TP}{(TP+F\text{N})} \quad (3)$$

4) When calculating the score, the F-Metric accuracy measure takes into account the two of precision and recall.

1)The accuracy is defined as the ratio of thetotalnumberofforetellsto thenumberof

It is simple for establishing the method to becharacterizedasapositiveornegativemethodbyusingthesefoursignsasbenchmarkstoconstructtheassessmentcriteria.

VI. RESULTS

A. Comparison Resultsofthefourmethods

Four learning strategies( ) were investigatedin this article to predict stroke. Following a thoroughanalysis, we came to the following conclusions. Thebest-performing model out of the four is taken intoconsideration forprediction.

DOI: rp-9788770040723.161

ROC(ReceiverOperatingCharacteristics)curvesforallthe fourmodelsarecomparedandanalyzedforselectingthemodel withbetterperformance.Modelperformsbetter iftheROCcurveis towards the top left. Following figures show theROCcurves offourmodels.

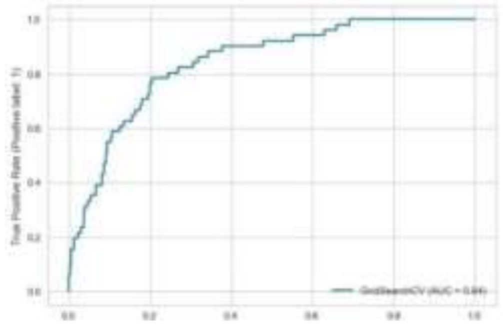


Fig. 3. ROCforRandomForest

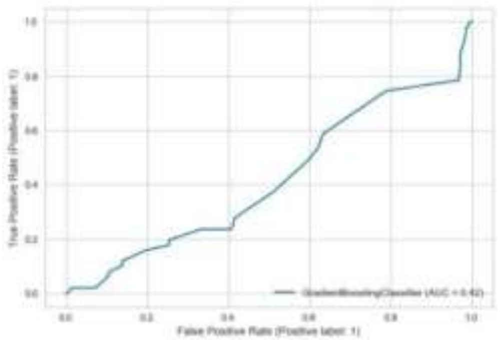


Fig. 4.ROCforSupportVectorMachine

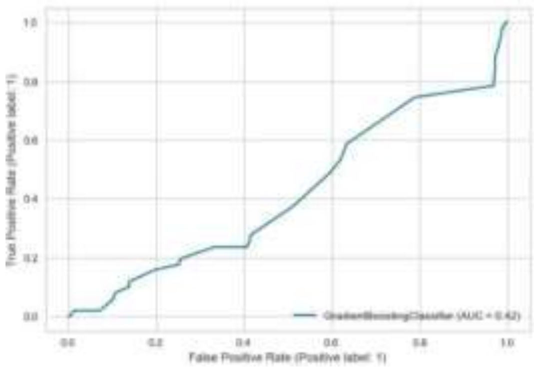


Fig. 5.ROCforK'sNearestNeighbour

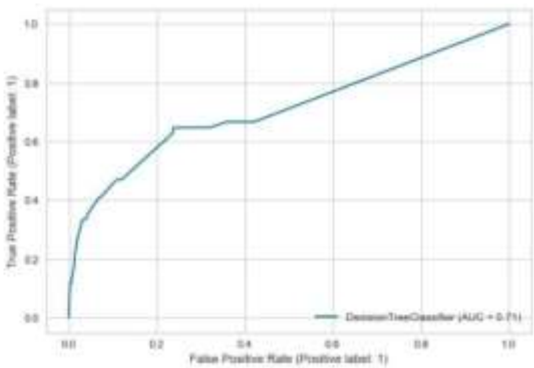
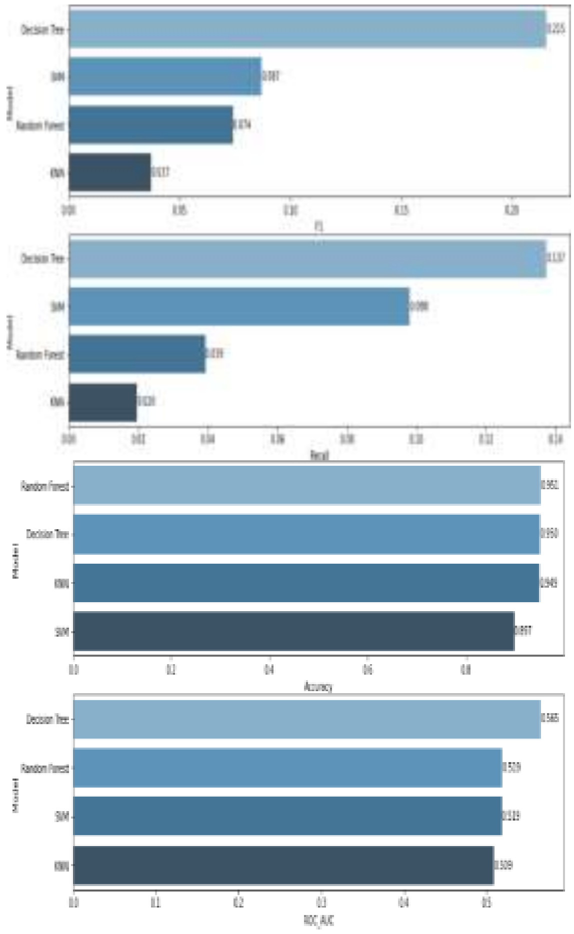


Fig. 6.ROCfor DecisionTree

Thebelowbargraphshowsthecomparisonofthe accuracyscoreofallfourmodels.



VII. Conclusion

Thisresearchisperformedforexposingstroke in the infancy stage, which helps in aiding thepatienttohavealessdetrimentalmedication,reducingthemedicationexpense,knowingtheaccurateprobability of results and it also helps to increase theMedtech level in the healthcare sector. This researchalso helps in saving many lives and to remove strokeriskfrombecomingoneofthedeadliestdeathworldwide.

95.1%isthemaximumpreciseoutcomeacquired by the RF Classifier compared to the othermethodsbyusingthe12variablesand5109data.

RF has the lead over other methods in distinguishingdatabecauseitinvolvesdatawithincompleteattributes. This algorithm is also better at graspinglarge data.

VIII. Future Work

Forfutureworkinresearch,theimplementationofsmartarrangementsisrecommended to be made in the prognosis of stroke,in addition to the alternative algorithms in ML whichcanbeused forgivingaccurate andbestresults.

A few suggestions can be taken into consideration byaddingtheattributestotheinputdatafile.Forexample, exhausting activities and professions to getbetter results.

EnsembleLearningwhichhelpstohavebetterpredictionperformance.

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Empowering Traffic Safety: Helmet Detection and Number Plate Capture with YOLOv5

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***Abstract*—The rider's failure to wear a helmet is one of themajor factors in head injuries sustained in bike accidents. Bikesarethemostpopularformoftransportationsincetheyareinex pensive and require little maintenance. The government hasmandatedthatdriversoftwo-wheeledvehicleswearhelmetswhen operating their vehicles, in accordance with section 129 ofthe motorbike vehicle legislation. Many people who break trafficlawsneverthelessdisregardthem.Bikersatroadintersection saremanually inspected by traffic police in the majority of developingnations. Even yet, this approach is ineffective because it doesn'twork on roads where speeding is most likely to cause accidents.Toprotectbikers,itisnowrequiredtodetectlicenceplates fromvehicleswithouthelmets.Thisstudydescribesthereal-time licence plate detection for riders without helmets utilisingthe real-time object detector YOLOV5 (You Only Look Once).Usingthealgorithm,thesystemlocatestheridersinthelivevi deo. The algorithm is used to determine whether or not themotorist is wearing a helmet. Optical recognition system is thenusedtoextractthecharactersfromthenumberplateandidentif ytheriderasnotwearingahelmet.Toremindpeopletoweara helmet the next time they ride a two-wheeler, the identifiednumberplateswillbeemailedtotheiremailaddresses.**

IndexTerms—Detection,YOLOV5,Optical Character Recogni-tion

I. Introduction

Due to their affordability, two-wheelers are currently themostcommonformoftransportation.Carelessridinghasincr eased the likelihood of bike accidents as There were moreriders than before. The negligence of bikers who do not wearhelmets is a serious problem, and it frequently results in therider suffering a brain injury. As a solution to this issue, mostcountries havelaws regulating helmetusefor two-wheelerusers.Althoughthegovernmentofsomenationshasinsta lleda specialised sensor to verify the wearer of a helmet, it wouldnot be financially sound to purchase sensors for each bike.Thetrafficpolicewillhavelessworktodoasnon-helmetedbikers'licenceplatesareautomaticallydetected.This willalsorequirefewerpersonnel.Asaresult,therewillbefewerrid erswhodonotwearhelmets.

II. Dataset

Since our Helmet Detection and Number Plate CapturingdatasetaretakenbyaCCTVfootageinrealtimewhichc aptures the persons number plate for not wearing helmet.mostofthedatasetusedhereisthedaylighttrafficinurban areas and highways. These datasets are used for furtherdetection process and extract the text by applying the OpticalCharacterRecognitionalgorithm

III. Motivation

Numerous scholars have addressed the issue of automobilenumber plate recognition in recent years. One of the mostimportantphasesinautomaticnumberplaterecognitionisn umberplatedetectionsinceinaccuratenumberplatedetectionim pairs the accuracy of the segmentation and identificationstages. Similar to this, other researchers have also suggested amethod that starts with the identification of bikers and thendetermineswhetherornottherideriswearingahelmet.To extract moving objects for moving object recognition andcategorise them by using their features and the local binarypattern,theauthorsinhaveproposedabackgroundsubtrac tionmethod.

YOLO is the name of the newest state-of-the-art real-timeobject detecting technology. By spatially isolating boundingboxesandapplyingasingleconvolutionalneuralnetwo rktoassignprobabilitiestoeachofthedetectedimages,itispossibl etotreattheobjectidentificationproblemasaregression problem rather than a classification task (CNN).The popularity of YOLO is attributed to its speed, detectionaccuracy, strong generalisation, and open-source nature. TherearefiveYOLOvariantsavailablerightnow(v1,v2v3,v4an d v5). Better functionality, including four connection layers,four convolution layers, and five CSP layers, was added toYOLOV5. It can hasten feature information transmission andfeature fusion. Compared to YOLOV3, YOLOV5 has higheraccuracy. Many YOLOv5 models were trained using the MSCOCOdataset.

IV. ExistingSystem

Existing system is based on detection of helmet which firststartswithmovingobjectsegmentationusingdescriptors.Th endetection of helmet tracing the Region of interest which is thehead region then classifies between helmet and non-helmet.ItusesthecircleHoughtransformtodistinguishbetweena helmetandanon-helmet,whichalsocausesamisidentificationofaheadasahelmet becausebothhavearoundshape.costsa lot of computation. Geometric features are not enough todetect the presence of a helmet; many times, the head can bemistakenforthehelmet.

V. LiteratureReview

InPaper[1]theauthorisaddressingthepressingissueof road traffic accidents, which have emerged as a significantpublichealthconcernthatnecessitatesamultifaceted approachforresolution.IncountrieslikeIndia,thealarmingincre aseinfatalitiesandinjuriesresultingfromroadaccidentshasbeco meacauseforgreatconcern.Thefrequencyofroadaccidents leading to death or permanent disability has risen,underscoring the urgent need for preventive measures

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to beprioritized by relevant organizations involved in public health.However, the current methods employed to implement lawsandpoliciesaimedatcurbingtrafficaccidentsoftenlackefficiencyandcommitment.

In paper [2] the author discusses the prevalence of two-wheelersasacommonmodeoftransportationtoday.However,the inherent risk associated with riding a two-wheeler withoutproper protection is significant. To address this, wearing a hel-metwhileridingabikeishighlyrecommendedasapreventivemeasure.Infact,governmentshaveevenmadeitillegaltoridea bike without a helmet, and have used manual methods toenforce this regulation. To automate the process of identifyinghelmetusagewithoutrelyingonmanualintervention, theauthor proposes a system that utilizes video monitoring of thestreet to automatically determine if a bike rider is wearing ahelmet. This system employs machine learning techniques toaccurately identify different types of helmets with minimalprocessing,makingitefficientandeffectiveinpromotinghelmetusagecompliance.

In paper [3] the author discusses the importance of licenseplate location in automated transportation systems for vehicledetection. In this work, a reliable and real-time method forlicense plate location is presented. The license plate regioncontainsrichedgeandtextureinformation,whichisuti-lized in the proposed approach. Initially, image enhancementtechniquesalongwiththeSobeloperatorareemployedtoextracttheverticaledgesfromthecarimage.Subsequently, arobustalgorithmisappliedtoeliminatebackgroundandnoise edges, retaining only the relevant features. Finally, arectangle window is used to search for the license plate regionintheresidualedgeimage,allowingforseparationofthelicense plate from the original car image. The effectivenessand reliability of the proposed method are validated throughexperimental findings, demonstrating its potential for accuratelicenseplatelocationinautomatedtransportationsystems.

In paper [4] the author discusses the concerning trend ofincreasingmotorbikeaccidentsinmanycountriesovertheyears. The growing popularity of motorbikes can be attributedtovarioussocialandeconomicfactors.However,despitethecrucialroleofhelmetsastheprimarysafetygearformotorcyclists, many riders neglect to wear them. This paperpresents and demonstrates an automated approach for classifying motorbikes on public highways, along with a system forautomatically identifying riders who are not wearing helmets.The system utilizes camera photos of the traffic to implementtheproposedapproach.

In Paper [5] the author discusses the application of helmetdetectioninimageprocessingandpresentsanewmethodfor helmet detection in their research. The proposed methodcombines two techniques to increase the likelihood of detect-ing helmets. The first technique involves utilizing a haar-likefeatureforfacedetectiontodifferentiatebetweenwearingandnotwearingahelmet.Thesecondtechniqueinvolvesusing a circle Hough transform to further distinguish betweenhelmeted and unhelmeted individuals. In the initial section ofthe method, a fast algorithm for helmet detection in coloredimages is suggested. The novel algorithm used in the proposedmethod has shown high detection rates and low false positivesin image experiments, indicating its effectiveness in detectinghelmetsaccurately.

In paper [6] the author discusses the method proposed intheir research for automatic recognition of helmet-less bikeriders in real-time surveillance videos. The suggested methodinvolves multiple steps, starting with backdrop removal andobject segmentation to identify bike riders in the surveillancevideo. A binary classifier and visual cues are then used todetermine whether the bike rider is wearing a helmet or not.Additionally,aconsolidationmethodforreportingviolationsisprovided to enhance the validity of the proposed method. Theperformance of three commonly used feature representationsforclassification,namelyhistogramoforientedgradients,scale-invariant feature transform, and local binary patterns, isalso compared in order to evaluate the effectiveness of theapproachpresented.

Inpaper[7]theauthordiscussesthechallengesinde-tectingtrafficruleoffendersforensuringsafetymeasures,such as occlusion, illumination, poor quality of surveillancevideo, and fluctuating weather conditions. In this article, asystemforautomaticallyidentifyingmotorbikerideerswhoarenotwearingprotectivehelmetsonsecurityfootageisdescribed. The proposed method involves the extraction ofmoving objects from video frames using adaptive backgroundsubtraction.Motorcycleridersarethenselectedfromthemoving objects using convolutional neural networks (CNN).Additionally, CNN is used on the upper one-fourth part of theriders to further detect those who are operating their vehicleswithoutahelmet.

In paper [8] the author discusses how motorcycles havebeenapopularformoftransportation,butthenumberofmotorbikeaccidentshasincreasedrecently.Notwearingasafetyhelmetisoneofthemaincausesoffatalitiesintheseaccidents. Currently, traffic cops manually monitor motorcyclists at intersections or watch CCTV footage to identify thosewithout helmets and fine them, but it requires a lot of effortand action from people. This study proposes an automatedmethod for identifying motorcycle riders without helmets andobtainingtheirlicenseplatesfromCCTVdata.Theheadsection of a classified motorcyclist is analyzed to determine iftheyarewearingahelmetornot.

In paper [9] the author discusses how the rapid growth ofvehiclesandtransportationsystemshasmadeitimpossibleforhumanstofullymanageandmonitorthemmanually.Asaresult,automaticrecognitionoflicenseplatenumbershasbecomeincreasinglyimportantinvariousapplicationssuch as traffic monitoring, tracking stolen vehicles, managingparking tolls, enforcing red-light violations, and border andcustoms checkpoints. However, the diversity of license plateformats, variations in scales, rotations, and non-uniform illumination conditions during image acquisition pose significantchallenges. This

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work proposes an Automated Number PlateRecognition System that utilizes edge detection techniques,histogram manipulation, and morphological operations to segment characters and localizelicense plates. Character classification and recognition are achieved using artificial neuralnetworks.

Inpaper[10]theauthordiscussestheconceptofAutomaticLicense Plate Recognition (ALPR), which involves extractinglicense plate data from images or a series of photographs.ALPR has various applications, including electronic paymentsystemsfortollsandparkingfees,aswellasmotorwayand arterial monitoring systems for traffic surveillance. ALPRtypicallyusescolor,black-and-white,orinfraredcamerasto capture images of licenseplates. The success of ALPRdepends heavily on the quality of the captured photos. As apractical application, ALPR must be able to process licenseplates quickly and effectively in various settings, including in-doorandoutdoorenvironments,duringdaytimeandnighttime.Moreover, ALPR must be able to handle license plates fromdifferentcountries,provinces,orstates,makingitnecessary tobegeneralizedandadaptabletodiverseplateformats.

VI. Proposed Methodology

In our suggested system, we propose a real-time and accu-rate automatic deep learning method for motorcyclist helmetrecognition,whichcomprisesoftwoparts.Thefirststepinvolves detecting motorcycles in the surveillance video usingYOLOv5-MD, an improved version of the YOLOv5 methodspecificallydesignedformotorcycledetection.Thevideofromthesurveillanceisprocessedusingthe YOLOv5algorithm to identify motorcycle regions. The second stage, known ashelmetdetection,takesthemotorcycleregionsidentifiedinthe previous step as input and uses an upgraded version of theYOLOv5 algorithm called YOLOv5-HD to determine whetherthe motorcycle riders are wearing helmets or not. The networkistrainedseparatelyforeachstageasthetasksofvehicleand helmet detection are quite distinct from each other. ThepurposeofYOLOv5-HDistoenhancethedetectionofhelmetson the motorcycle riders, thereby improving the accuracy oftheoverallsystem.Thistwo-stageapproachallowsforefficientandprecisedetectionofhelmet usagebymotorcyclistsinreal-time,makingitavaluabletoolforautomatichelmetrecognitionin surveillancefootage.

YOLO is the typical object detection technique. That is known for its fast inference speed. It uses a regression-based approach to directly generate the bounding box coordinates and class probabilities in a single pass through the network, which makes it faster compared to two-stage approaches like Faster R-CNN. YOLOv5, in particular, has introduced improvements to the backbone network and adjusted parameterstocreatefourdifferentvariantsofthemodel:YOLOv5s,YOLOv5m, YOLOv5l, and YOLOv5x. These variants differin terms of model size, complexity, and accuracy, allowing fora trade-off between speed and accuracy based on the specificapplication requirements.The regression-based approach usedin YOLOv5 allows for efficient and real-time object detection, making it well-suited for various applications such asmotorbike helmet recognition in surveillance footage, as youmentionedinyourpreviousstatement.

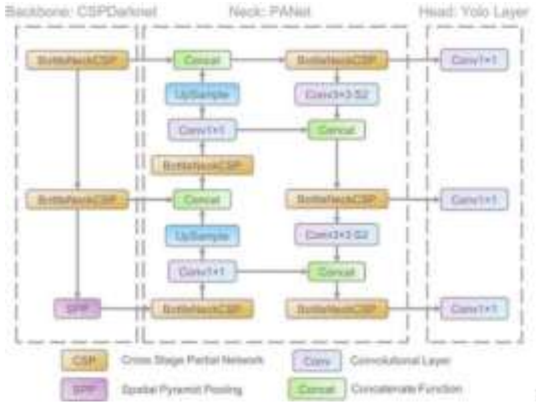

Fig.1.Yolov5 Architecture

TheYOLOv5modelconsistsofthreemaincomponents:the backbone, the feature enhancement module, and the head asshowninFigure1.Eachcomponenthasaspecificfunctionin the overall architecture. The backbone variant of YOLOv5isresponsibleforextractingfeaturesfromtheinputimage.The feature enhancement module in YOLOv5 is designed toenhancethefeaturesextractedbythebackbone.Itusesvarioustechniquessuchasskipconnections,PANet(PathAggregationNetwork),andCSPNet(CrossStagePartialNetwork)toenhancethefeaturerepresentationandimprovetheaccuracyof object detection. The head part of YOLOv5 is responsiblefor generating the final predictions, including the boundingboxcoordinatesandclassprobabilities.

VII. Results

The objective of this paper is to achieve continuous helmet detection and Number Plate Capture through a video feed as

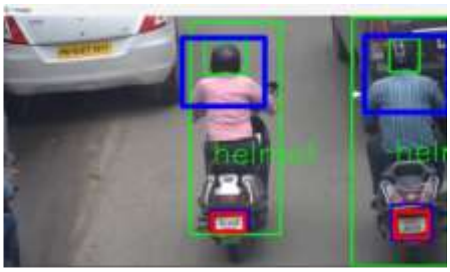

Fig. 2.The above image shows the helmet and the number plate are detectedandalsoshowtheriderhasputontheHelmet

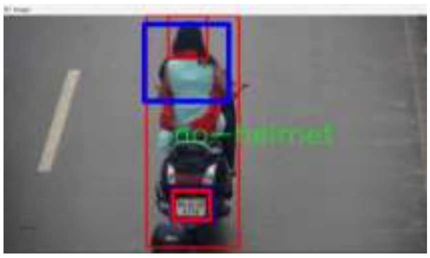

Fig. 3.The above image shows the helmet and the number plate are detected and also shows the person is not wearing the Helmet

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showninFigure2and3.Avideocamerawillbepositionedonthero adtoprovideinputtothesystem.Theframesfromthe video will undergo background subtraction to eliminatepedestrians and other entities, retaining only moving objects.These moving objects will then be classified and labeled usinga trained model, with the COCO model used for commodityobjects and a specialized dataset developed using Tensorflowforpersonsridingbikeswithhelmets.Webscraping wasutilizedtocollectdiverseimagesofhelmetsfortraining.Initially,apersonridingabikewillbedetectedandaboundingbox will be defined around them, restricting the search area.Thesystemwillthencheckforthepresenceofahelmetwithin thatbox,andifdetected,theboxwillbedropped.The remaining boxes will be processed by the number platecheckingsubsystem,whichwillutilizeOCRtocapturethetexton the license plate. A new entry will be created, documentingthetimeandlocationoftheoffense,asnapshotofthe bounding box as proof, and the license plate number.

VIII. Conclusion

When the rider fails to wear a helmet it becomes risk because by chance if the rider face anyaccidentitmayleadtodeath.a headgear. Many motorbike riders continue to disregard thenumerous laws regulating helmet use by two-wheeler drivers.The systems in place are highly inefficient.In this study, wehave suggested a real-time, quick, and efficient framework forYOLO-based non-helmeted motorcycle detection from CCTVfootage. After identifying the motorcyclists who are ridingwithout a helmet, optical character recognition to detect thecharactersinthelicenceplatesandsavetheminacloudsothat theviolatorscanbe heldaccountable.Motorcycles arethetargetclassforthefirststage,thesecondstageforhelmets,non-helmetsandthethirdstageisforlicenceplates.

VIII. FutureEnhancements

The proposed method outperforms the current one becausethe algorithm uses a YOLOv5 model. While many have donetwolayersofCNNtocompletethetasks,oursuggestedapproach just requires one CNN to achieve the study's goal.Thesuggestedmethodworksbetterthananumberoftheestablished techniques for detecting license plates. techniquesinclude boundary- and color-based strategies. The input Picture should have apparent bounds and is sensitive to undesiredbordersintheboundary-basedtechniques.

The proposed method and approaches addressed in relatedworkdifferfromeachotherinthatwetookadifferentstrategy.Forautomaticlicenceplatelocalization,wedevelopeda single convolutional neural network and employed YOLOv5algorithms to complete the task. The authors of and employedboundary-based techniques that are conscious of undesirableedges and depend on high-quality images for algorithm generalization. Since the suggested method does not need to relyon the information from the license plates and many imagequalities were added to the training, it is superior to the color-basedapproach.Thisaidsingeneralizingfrompreviouslyunobserveddata.

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Speech Emotion Recognition Using Deep Learning Algorithm

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***Abstract*—AI is the emerging technology and is being extensively used now a days in every field and in every organization to gain more insights and hidden patterns in data. Data is the new oil for every organization to run and make huge revenues if one is able to find out the story in the past data and then can recommend based on it in the future. AI not only works effectively in data science related fields but is now taking grip for every work fields as well. AI devices become more interesting when they start to act more like human rather than robotic as the customer interactions increase and so does the revenue of the organization. So, emotion recognition of the users is a very important partin AI development where the device is trained to recognize the correct emotion of the customer behind his / her speech and conversation with the device. We know that random forest uses a bunch of decision trees and tries to correct the errors foundinthepreviousstepstorectifythemandthen increase the accuracy. In this article, we use CNN basedmodelwhichisaverypopulardeeplearning neural network-based algorithm to classify every emotion of an individual and then used audios to test the model. In this project, CNN model is used and 79.6% accuracy is achieved.**

***Keywords:* Speech emotion, deep learning, CNN, Artificial Intelligence, Decision trees, Random Forest.**

I. INTRODUCTION

Speechandwordsarethemostnecessarytool we use to interact with each other. Now a daysAIhasbecomeanintegralpartofourlife speciallytheAIbasedtechnologies. Welove to interact with them the whole day and give themrequestsortalksomerandomthings.As a result, we as a customer expect some interestingrepliesfromthemandthattoolike a human being with emotions. In this fast- changing world and generation we are left with a few friends and we have no time to meet or interact with them. So, in this new world,AIisournewfriend,philosopher,and guide too in many cases. Hence our inputs andcommandsareconsideredasdataforthe above-mentioned problem statement and with the help of CNN we make the audio tuning more perfect and the AI more lifelike. The model is trained in such a way to recognise emotions behind every input of the customers.

1.1. *Scope*

Data is the future of any organisation and thus AI is the emerging technology which uses data as the input and in returngivesamazingexperiencetoitscustomers. Themajor risk faced in the usage of AI is constant fall of customers interestinusingit.Thisissuecanbesolvedeasilybymaking the output responses of AI more interesting and natural sounding.For thisthingtohappen,weneed torecognise the emotionbehindthecustomersandthenteachtheAItodothe same thing. Once it will be able to recognise the emotion behindthespeech,itwillresponseinamorelucidandhuman like. The neural networks in architecture like CNN works similar to our brain neural structures with the nodes to transfer data from one layer to another. Similarly in neural network,dataispassedfrominputtooutputlayersthrougha series of hidden layers in between. Hence, this method is proposed in this project so that the AI can be transformed successfullyintoacompletehumanlikestructure.Ourmodel will not onlyrecognisetheemotions behind everyspeech of our customers but can also cheer the customers when they willbesadordepressed.Oncethismodelisbuiltsuccessfully with great precision and accuracy and minimum errors, we can collect data of our customers to classify them into depressed and non-depressed individuals based on the durationoftheirpastdataofbeinginnegativeemotionssuch as sadness, anger, fearful, disgust, etc. This entire process will not be possible without the technologies and machine learning algorithms cause data is involved. Data will in fact act as the raw material for this project, without which progress of anykind in this work is just futile. In futurethis model can be applied on any AI devices or AI applications and collecting customers data from the devices will be very important and can be used to recommend various things for their future needs.

1.2 *Methods*

1.2.1 DeepLearning

Thisbranchofmachinelearningisveryuseful asitinvolves the use of neural networks along with the multiple layers and can process complex data sets. It even is capable for developing artificial intelligence systems that can learn on their own, keep on improving themselves on their own without explicitlybeing programmed by us for a particular task. The algorithms can recognize patterns and making predictions based on large amountofdataandthisfeatureindeed isusedin therecognition of emotions behind the speech of our end users.

1.2.2 CNN

It is a type of neural network that is commonly used in image and video analysis tasks and as it has various convolutional layers so it can learn various spatial hierarchies of features and thisin turn canscan theinput datawith aset offilterstoextract relevant features. They typically consist of convolution layers, poolinglayers,andfullyconnectedlayers.Theyareresponsibl e for detectinglowlevel featuresandpoolinglayers downsample the feature maps toreduce the

DOI: rp-9788770040723.163

dimensionalityof the data. Fully connectedlayers combinethe extracted featurestomakea final prediction. As they are responsible for processing structured data, this algorithm is useful in extracting the correct emotion out of the audios we used in this project.

II. LITERATURESTUDY

Many studies on speech emotion recognition has been conductedandvariousnewalgorithmsandmethodshasbeen proposed by authors. This is a rapidly growing field of research which attracted significant attention from researchers in recent years. Let’s look at some of the important significant reviews:

S.Bhattacharyya and S. Poria [1] in 2017 provides a comprehensive review of various techniques and methods anditdiscusses the challenges associatedwiththetasksuch as the standardizeddatabase for emotions is lackingandthe need for robust feature extraction techniques.

VBalakrishnanandS.Sivakumar[2]in2019proposesane w method for emotion recognition using speech features such as pitch, energy, and formats. The proposed method was tested on the Berlin Emotional Speech Database and achieves an accuracy of 88.3%.

P.Rao and P.S.S. Avadhani [3] in 2020 proposed recent advances in deep learning based approaches for SER and discussed the use of RNN for feature extraction and classification. The paper also covers the use of transfer learning.

A. Gunavati and R. Bhavani [4] in 2021 presented a comprehensive survey of deep learning techniques and covers recent developments in multimodel emotion recognitionwhichinvolvescombiningspeechwithother modalitiessuchasfacialexpressionsandphysiological signals.

R. Mitra [5] in 2019 presented a paper which contains a comprehensive survey of various techniques and methods used for SER., including traditional machine learning approaches, deep learning techniques and hybrid models.

T.A.Rahman[6]in2020fine-tunedthepretrainedmodelon theRyersonAudioVisualdatabaseofemotionalspeechand song dataset using transfer learningtechnique andachieved 70% accuracy.

M.A.H.Akanda[7]in2020investigatedtheeffectofspeec h enhancement techniques on SER using deep neural networks.Theauthorcomparedtheperformanceofdifferent enhancement methods such as spectral subtraction, and MMSE-based noisereduction, on the Emo-DB dataset. The results show that speech enhancement can significantly improve the accuracy of emotion recognition.

W. Wang [8] in 2021 proposed a multi task learning approach for SER that integrates both acoustic and lexical features. Theauthorsuseadeepneural networkwithshared and task-specific layers to jointly learn the feature representations for emotion recognition and sentiment analysis.

G.F. Adewumi [9] in 2021 presented a review of various features, classification techniques, and datasets used for SER. It discusses the challenges associated with SER such as the variability of emotions across speakers and cultures.

M.R. Islam [10] in 2020 compared the performance of various deep learning-based approaches for SER, including LSTM networks and hybrid models. The authors evaluated themodelsontheIEMOCAPdatasetandshowedthathybrid model perform the best.

III. PROPOSEDMETHODOLOGY

3.1 SystemProposed

Deepneuralnetworks(DNNs)areatypeofmachinelearni ng model that has gained significant attention in recent years due to their ability to learn complex patterns and representations from large datasets. DNNs have shown promising results in various applications, including computer vision and speech emotion recognition.

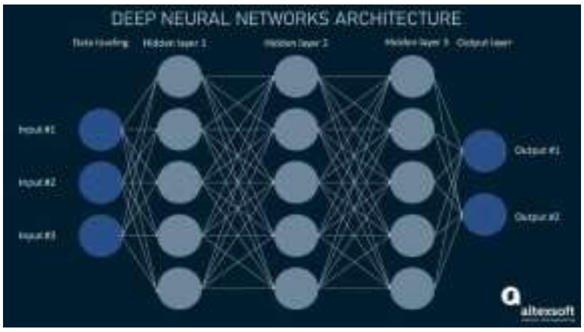

Fig1.DeepNeuralNetwork

In otherwords, DNNcanberepresentedasa functionf(x;a) wherexis the input, a represents the model parameters, and f(x;a) represents the output of the network for a given input x.

3.2 Dataset-Taken

Thedatasetcontains1440files,7356recordings,24profes sionalactors who acted out different emotional states including, calm, happy, sad, angry, fearful, surprise and disgust.

3.3 DatasetPreprocessing

Dataset pre-processing is a crucial step in machine learning anddataanalysisthatinvolvespreparingrawdatatobeused as input to a model. The goal of pre-processing is to transform the raw data into a format that can be easily analysed and interpreted by a machine learning algorithm. Data pre-processing steps include data cleaning, data normalization, data transformation, data encoding, data splitting and feature selection.

3.3.1 AugmentationOfData

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DOI: rp-9788770040723.163

It is a technique used to artificially increase the size of a datasetbycreatingnew,butsimilar,versionsofexistingdata. Thegoalofdataaugmentationistoimprovetheperformance of machine learning models by providing more diverse examples for the model to learn from. This is particularly usedwhenworkingwithsmalldatasetswhereoverfittingcan be a concern. There are various methods of data augmentationandthespecifictechniquesuseddependonthe type of data being augmented. The purpose of data augmentation is to create new examples that are like the original data but not identical. The augmented data should represent the natural variations in the data that the model is likely to encounter in real-world scenarios. Data augmentation is an important tool in machine learning and can significantly improve the performance of models, especially when working with small datasets. The idea behind data augmentation is that by creating additional training samples that are similar but not identical to the original data, a model can better generalize to new, unseen data. This can help to reduce overfitting and improve the overallperformanceofthemodel.Dataaugmentationis commonly used in computer vision and natural language processing tasks, but it can also be applied to other types of data such as audio or sensor data. The specific techniques used for data augmentation depend on the type of data and the specific task at hand, and it is often necessary to experiment with different augmentation methods to find the best approach for a particular problem statement. Data augmentation is typically done by applying a set of transformation rules to the existing data samples, such as rotating, flipping, or zooming in on images or changing the pitchorspeedofaudiosamples.Sothisdataaugmentationis an irreplaceable step in this project.

3.4 Deep-Learning

Deep learning for speech emotion recognition refers to the use of deep neural networks to classify and analyze emotional states in speech signals. The goal of SER is to automatically detect the emotional content of speech, such as happiness, sadness, anger, or fear. It typically involves multiple layers of artificial neurons that aretrainedonlargeamountsoflabelleddatatoidentifypatterns and relationships between different features of speech signals, such as pitch, duration, and spectral characteristics. These models can be trained using various architectures such as Convolutional Neural Networks, RNN, or hybrid model that combines both RNN and CNN. The training process for deep learning models involves feedingthenetworkwithlargeamounts oflabelledspeechdataand adjustingtheweightsofthenetworksparametersthrough aprocess called backpropagation in order to minimize the error between the predictedemotionallabelsandthetrue labels.Theresultingtrained model can be used to classifythe emotional content of newspeech signals. Deep learning models for SER have shown promising results in recent years and have been used in a variety of applications. However there are still many challenges to be addressed in this field such as dealing with variability in speech signals, addressing class imbalance in emotional labels, and improving the interpretability of the models.

3.5 ConvolutionalNeuralNetwork(CNN)

TheCNNfor thespeech emotionrecognitiontypicallyinvolves severallayersthataredesignedtoextractrelevantfeaturesfrom speech signals and then classify the emotional content.

1. Inputlayer:thislayerreceivestherawspeech signalas an input. This layer can be preprocessed with techniquessuchasMel-frequencycepstralcoefficients or filter bank energies to extract relevant features.
2. Convolutionallayer:thislayerappliesasetoffiltersto the input signal which extracts local features such as pitch and spectral information.
3. ReLU activation layer: this layer applies a non-linear transformationtotheoutputoftheconvolutionallayer, introducing non-linearity into the model.
4. Pooling layer: this layer performs a downsampling operation on the output of the ReLU layer, reducing spatialdimensionsofthefeaturemapandincreasingthe model’s robustness to small variations in the input signal.
5. Dropout layer: it randomly drops out a fraction of the activations in the previous layer during training, preventingoverfittingandimprovingthegeneralization of the model.
6. Fully connected layer: This layer takes the flattened output of the previous layer and applies a linear transformation to it, producing a set of scores that represent the probability of each emotion class.
7. Softmaxactivationlayer:appliesasoftmaxfunctionto the output of the fully connected layer, producing a probability distribution over the possible emotion classes.
8. Outputlayer:theoutputlayeroftheCNNproducesthe final predicted emotion class based on the probability distribution from the softmax layer.

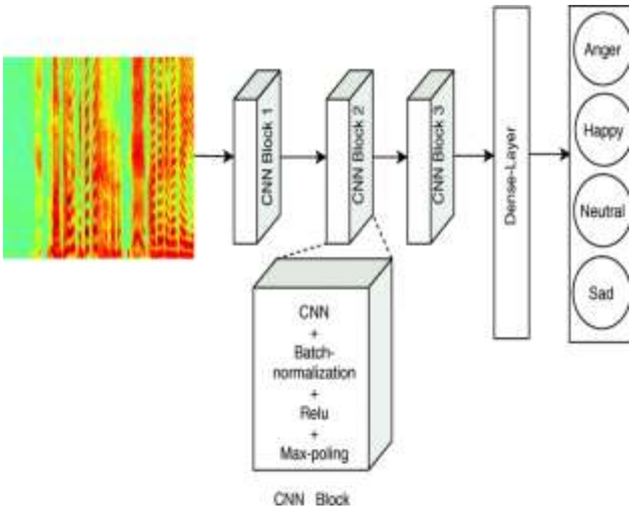

Fig.2.Architecture

DOI: rp-9788770040723.163

IV. Modules

4.1 CreationOfModels

Creatingmodelsforspeechemotionrecognition using CNN typically involves the following steps:

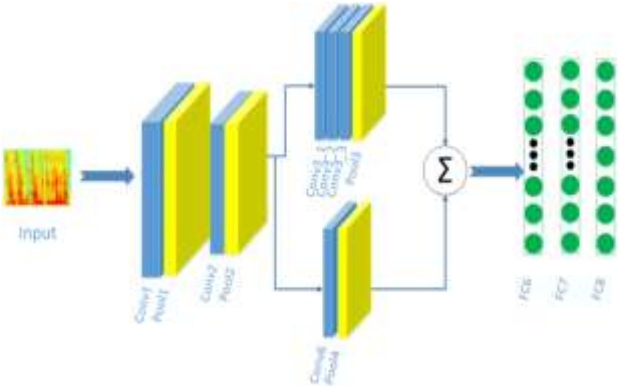

Fig3.Model Diagram

Ourapproachconsistsoffivesteps:

Step1–Datapreprocessing:

This involves converting the raw speech signal into a format that can be used by the network, such as Mel-frequency cepstralcoefficients(MFCC) or filter bank energies.

Step2-Dataaugmentation:

ThisisdonetoimprovetheperformanceoftheCNNand is often helpful to augment the training data by creating additional synthetic samples.

Step3-Modelarchitecturedesign:

The next step is to design the architecture of the CNN. This is typically done to involve selecting the number and size of convolutional and pooling layers, choosing activation functions,anddecidingonthenumberoffullyconnectedlayers.

Step4-Trainingthemodel:

Oncethemodelarchitectureis defined,thenextstepisto train the model on the training data. During training, the weights of the network are adjusted to minimize the error between the predicted emotional labels and the true labels.

Step5-Modelevaluation:

After training, the performance of the model is evaluated using a separate test set. This allows the accuracy, precision,recall,and F1scoreofthemodeltobecalculatedand compared with other models.

Step6-Fine-tuning:

If the performance of the model is not satisfactory, it may be necessary to fine-tune the model by adjusting the architectureorhyperparameters.Thiscanbedonebyevaluating theperformanceofthemodelonthevalidationsetandadjusting accordingly.

Step7- Deployment:

Once the model has been trained and evaluated, it can be deployed in a production environment to perform real-time SER tasks.

To evaluate the optimal efficiency and robustness of the algorithm, metrics such as Precision and Recall rates are evaluated and computed based on the recognition rate.That the proposed system produces the highest recall rate for all types of parameters like speech andthen findingthe correct emotionbehindthespeech.. Theaverage ofallmeasuresfor the proposed system.

Overall creating models for SER using CNN s involves several steps from data preprocessing to modelarchitecture design, training, evaluation, and deployment. Each step requires careful consideration and experimentation to achieve optimal performance.

4.2 SpeechEmotionRecognition

Thedeployedmodeltakesinnewspeechsignalsandpredictsthe emotional content of the speech in real-time. Overall, SER involvescollectingandpreprocessingdata,augmentingthe data,training and evaluating a deep learning model, fine-tuning the model, and deploying the model for real-time SER tasks.

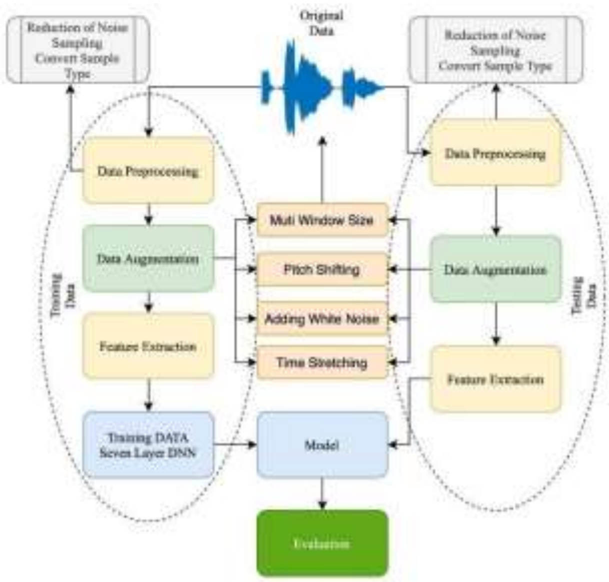

Fig:4Activity Diagram

4.2.1 Performance o f a Speech Emotion Recognition:

Theperformancecanbeevaluatedusingvariousmetricssuch as accuracy, precision, recall, and F1 score. Accuracy measures the percentage of correctly predicted emotional labelsoutofallthelabelspredictedbythemodel.Precision measures the percentage of correctly predicted positive emotionallabelsoutofallthepositivelabelspredictedbythe model.Recallmeasuresthepercentageofcorrectlypredicted positive emotional labels out of all the positive emotional labels in the dataset. F1 Score is the harmonic mean of precisionandrecall.TheperformanceoftheCNNmodelcan befurtherimprovedbyfinetuningthemodelarchitectureand hyperparameters augmenting the training data, and using transferlearningtechniquestoleveragepre-trainedmodelsin larger datasets.

DOI: rp-9788770040723.163

TABLE1:PERFORMANCEOFSERSYSTEMUSINGCNN

		Predicted Class			
		Anger	Sad	Neutral	Happy
Actual Class	Anger	43.3	12.6	33.7	10.4
	Sad	9.6	78.3	0	12.1
	Neutral	3.6	0.3	93.3	2.8
	Happy	25.9	0	27	47.1

Architecture

Additionally, the performance of the system can be evaluated on different test sets and compared to other state-of-the-art models to determine its effectiveness in recognizing emotions from speech signals.

Considering a happy track from the dataset with plt.figure explaining the figsize to be (15,5).The model was able to recognisethecorrectemotionbehindtheaudioandwaseven able to figure out the gender of the speech.

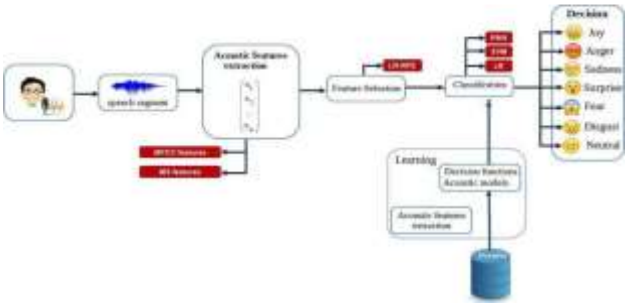

Fig5:Sequence Flowchart

GENDER DETECTION: it involves using a machine learning model to predict the gender of the speaker based on the emotional content of their speech. This is achieved by combining deep learning models like CNNandRNN.TheCNNisusedtoextracthigh-levelfeaturesfromthe speech signal, while the RNN is used to model the temporal dynamics of the speech signal. Once the deep learningmodel has been trained on adatasetoflabelledspeechsamples,itcanbeusedtopredictthegender ofnewspeechsamples.Themodelwasthenfedapre-processedspeech signal, extracted the relevant features using the CNN, and then these featureswerepassedthroughRNNtomodelthetemporaldynamics.The output of the RNN is then fed into a fullyconnected layer that predicts the gender of the speaker.

4.2.2 DecisionMaking

Basedontheinputdataintothemodelitwasdecidedwhetherthe person was a male or female and the emotion behind the speech of that individual. This step involves making a prediction for the emotional state of the speaker based on the features extracted from the speech signalbytheCNN.Aftertheinputspeechsignalhasbeenpreprocessed and transformed into a format that can be used by the CNN, the CNN extracts high-level features from the speech signal using a series of convolutionallayers.ThefeatureslearnedbytheCNNarethenfedinto afullyconnectedlayerthatmakesthefinalpredictionfortheemotional state of the speaker. During the decision-making step, the CNN takes the preprocessed speech signal as input, extract the relevant features using the convolutional layers, and passes these features through the fullyconnectedlayertomakeapredictionfortheemotionalstateofthe speaker. The predicted emotional label can then be used for further analysis ortocontrol other systemsbasedonthe emotional state ofthe speaker.

Overall, the decision-makingstep-in SERusingCNNinvolves usinga fullyconnectedlayertomakeapredictionfortheemotionalstateofthe speaker based on the features extracted from the speech signal by the CNN.

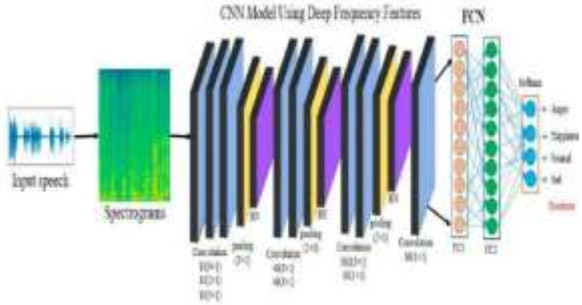

Fig 6:Decision Making Steps In The Speech Emotion Recognition

The speech component of the dataset includes 1440 recordings of 60 sentences spokenin 8 different emotional expressions whilethe song component includes 1012 recordings of 52 songs sung in 7 different emotional expressions. Each recording is labelled with metadata indicating the actor, gender, expression, and type of recording. The dataset is designed to be used for research and developmentinareassuchasemotionrecognition,speech processingandaudioanalysis.Wecarriedoutalltheseprocessesin the project.

4.2.3 FineTuningThe Model

The first step was to load the pre-trained CNN model and remove the last layer, which is typically the output layer that is specific to the original task the CNN was trained on, such as image classification. The remaining layers are frozen, meaning their weights are not updated during training.

Thenextstepwastoaddanewoutputlayer,whichisspecifictothe sentiment analysis task, with the appropriate number of output nodes for thenumber of sentiment classes. The weights ofthenew output layer are randomly initialized.

Finally, the entire network is fine-tuned by continuing the training process with a smaller learning rate. This allows the network to adapt tothedomain-specificsentiment dataset and furtherimprove its accuracy.

Fine-tuning a pre-trained CNN can greatly reduce the time and computationalresourcesrequiredtotrainanewmodelfromscratch while still achieving high accuracy in the domain-specific task of the speech emotion recognition.

DOI: rp-9788770040723.163

V. RESULTS

Theobtainedresultssuggestedthatthedatasetisavaluable resource for training and evaluating models for speech emotion recognition, and that there are several effective approaches for achieving high accuracy on this task.

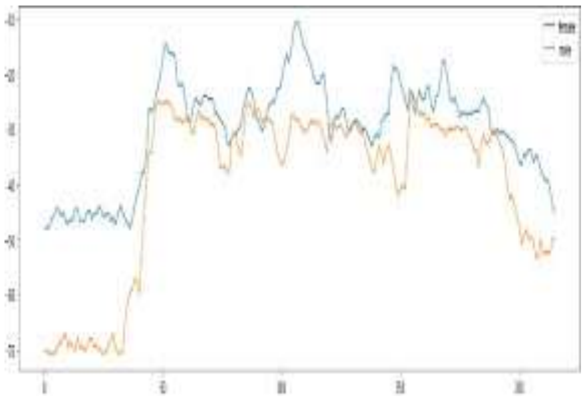

Fig7:AccuracyGraph

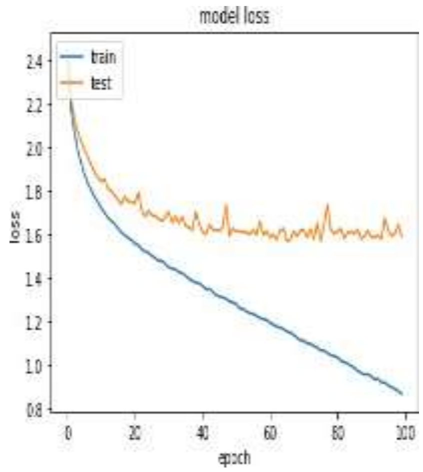

Fig 8:ModelLossvs no.Ofepochs

	actualvalues	predictedvalues
170	male_sad	male_sad
171	female_disgust	female_disgust
172	male_angry	male_happy
173	female_disgust	female_disgust
174	male_angry	male_angry
175	female_fear	female_happy
176	male_disgust	male_surprise
177	female_fear	female_happy
178	female_happy	female_happy
179	female_neutral	female_neutral

Fig 9: Actual Vs PredictedValues

Fig.8 and Fig.9 shows that 4 out of 10 random state of thedatasetshowsincorrectlabelswherefinetuningof model come into picture.

TABLE2:TRAININGRESULTSFORMALEAND FEMALESAMPLESUSINGRBFNETWORK

Sample name (Input - Male)	Pitch Observed	Gender Classified Correctly	Emotion Frame Count	Emotion Classified Correctly
Angry	108.0	Yes	255.6	Yes
Angry	188.0	Yes	267.8	Yes
Angry	67.0	Yes	273.9	Yes
Angry	171.0	Yes	250.3	Yes
Angry	72.0	Yes	265.1	Yes
Sad	35.0	Yes	35.9	Yes
Sad	347.0	No	46.8	Yes
Sad	89.0	Yes	78.9	Yes
Sad	171.0	Yes	198.4	No
Sad	188.0	Yes	76.9	Yes
Neutral	209.0	Yes	102.4	Yes
Neutral	134.0	Yes	143.3	Yes
Neutral	190.0	Yes	127.8	Yes
Neutral	455.0	No	109.2	Yes
Neutral	98.0	Yes	145.3	Yes
Happy	189.0	Yes	167.8	Yes
Happy	112.0	Yes	153.4	Yes
Happy	69.0	Yes	155.9	Yes
Happy	41.0	Yes	89.0	Yes
Happy	45.0	Yes	176.3	Yes

Sample name (Input - Female)	Pitch Observed	Gender Classified Correctly	Emotion Frame Count	Emotion Classified Correctly
Angry	388.0	Yes	298.3	Yes
Angry	331.0	Yes	312.5	Yes
Angry	121.0	No	303.2	Yes
Angry	345.0	Yes	278.9	Yes
Angry	72.0	No	289.4	Yes
Sad	335.0	Yes	35.9	Yes
Sad	347.0	Yes	79.0	Yes
Sad	389.0	Yes	59.6	Yes
Sad	341.0	Yes	298.1	No
Sad	338.0	Yes	37.8	Yes
Neutral	393.0	Yes	105.6	Yes
Neutral	334.0	Yes	139.8	Yes
Neutral	397.0	Yes	125.6	Yes
Neutral	355.0	Yes	133.5	Yes
Neutral	348.0	Yes	126.7	Yes
Happy	459.0	Yes	187.2	Yes
Happy	112.0	No	176.3	Yes
Happy	469.0	Yes	199.0	Yes
Happy	451.0	Yes	155.8	Yes
Happy	435.0	Yes	167.8	Yes

ADVANTAGES

The various advantages of the implemented method or system are:

1. Improving Human- compute interaction.
2. Improving mental health.
3. Improving customer service.
4. Enhancing security.
5. Advancing scientific research.

CONCLUSION

Weproposedanewmethodtoimprovementalhealthofan y person by detecting changes in emotional state over time, which could be helpful in identifying individuals who may be at risk for mental health issues such as depression or anxiety. Wewill becollectingall thepast data of customers overagoodperiodoftime,analysethedataandwillbeable to figure out who are at risk of calling themselves as depressed or non-depressed person. This is a rapidly developingfield with a wide range of potential applications in various industries and fields. As technology continues to advance and more data becomes available, we can expect that SER models will continue to improve, providing more accurate and reliable detection of emotions in speech.

FUTUREWORK

Thereareseveraldirectionsthatfutureresearchin speech emotion recognition could take:

1. Incorporating contextual information.
2. Improving model robustness.
3. Handling multilingual speech.
4. Recognizing more complex emotions.
5. Integrating with other technologies.

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Marketing Analysis for an Elevator Company by Using Predictive Analysis

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***Abstract*—This report summarizes a study of marketing anal-ysisandfuturepriceprediction,whichmarginsbetweentheyears2021to2022.Thisprovidesacross-sectionalpredictionof the profit in an elevator company's income. From this study itisseenthatbasedontheincreaseordecreaseinthenumberofclients/buyerswecanprovideplansforriskmanagementstrategies and technical cost factors which may help significantlyfortheimprovementintheeconomicstabilityandprofitofthecompany.Ithelpsinthepredictionofthecategorizingclients/buyerswithinthegroupsoflong-terminvestorsandshort-term investors. Insurance is one of the important features thatprovides benefits for the client as well as the company. Factorsassociatedwithlongterminsuranceareidentifiedbyusingexploratoryanalysisanddatapreprocessing**

***IndexTerms*—component,formatting,style,styling,insert**

I. Introduction

Inthesepresentdaysdataanalysishasbecomeapartofdaily life.Thisperiod wherethereis rapidglobalizationanddevelopmentinthesectoroftechnology,thecompetition within the world of business has become high. In thisincreasinglycompetitivebusinessworld,theemergenceofnewcompanieshasbecomeachallengeforthecompaniesthathave been around for a long time. Hence these old companies havethepossibilityoflosingthoseoldclientstothenewcompanies.Thisprojectusesthedatathathasbeencollectedbyanelevatorcompanypertainingtotheirproductsmaterialswhicharebeingused by their elevators. For this project of data analysis, twosetsofdatavaluesareobtained,whicharefromonethecompany that manufactures the raw materials and the otherfrom the company which uses these raw materials for theirelevators. By applying the methods of data pre-processing,findingthemissingvalues,exploratoryanalysisandlinearregression these two sets of data are compared. The resultwhich is obtained by the application of these methods of dataanalysis are R2 score, OLS Regression Results which is usedto obtain the detailed version of regression format, standarderrors, kurtosis, prob[JB], and cond No. By the application ofdataanalysis,thecompanieshavetheadvantageofreducingerrors.thecostofproductionandmaintainingtheirproductsquality

II. Literature Survey

FactorsRelatedwithPromotingEdgesatIllinoisGrainLifts, 1982-83:AnExhibitionInvestigationSaraHelenR.ThompsonandStanleyM.Dziura,Jr.

Thispapersumsupaninvestigationofpromotingedgesin 1982 and 1983 at a cross part of grain lifts in Illinois.Factorsrelatedwithpromotingedgesaredistinguishedbyrelapse examination. It is shown that the promoting edge atIllinois grain lifts is extremely delicate to gamble with theboardmethodologiesandspecializedcostfactorssomeofwhich might suggest huge scope economies in grain marketing. Lower marketing edges are related with more prominentlimit usage. Expanded limit use might be accomplished byexpanding the volume of grain promoted in Illinois, or bylesseningthequantityofliftsthatproductgrain.Energy-productive lifts and elevators in Europe: An examination ofenergyproficiencypossibilitiesandstrategymeasures

Liftsandelevatorsstandoutenoughtobenoticedfroman energy proficiency point of view previously. To close thishole, this paper examinations energy proficiency possibilitiesand recommends strategy measures for the European lift andelevator market. As a precondition, the electrical energy inter-estofliftsandelevatorsintheEuropeanmarketisdissected,inviewofmasterassessmentsandtheconsequencesofacheckingeffort.Theassessedcurrentinterestiscontrastedwithsituations where the execution of most ideal that anyone couldhope to find innovation for the applicable gear is expected andthe investment funds possibilities thereof are determined. Theoutcomes demonstrate that impressive specialized proficiencypossibilitiesexistforlifts(over60

III. Proposed Methodology

A. *Exploratory Analysis*

Exploratory analysis is a scientific methodology which perceivesthegeneralexamplesintheinformation.Theexamplesincorporate anomalies and elements of the information thatmaybestartling.

The first move toward quite a while investigation is EDA.Comprehensionofwhereanomalieshappenandhowthefactors are connected will assist one in the plan of factualexaminations that will with delivering ideal results. If thereshouldariseanoccurrenceofnaturalcheckinginformation, lo-cales are likely impacted by different stressors. Subsequently,beforeoneendeavourstorelatestressorfactorstonaturalreaction factors doing investigation of stressor relationship asthe underlying step is vital. EDA can give bits of knowledgeinto up-and-comer causes that ought to have been rememberedforacausalevaluation.

B. *Scatterplots*

Data on connections between sets of factors can be acquiredfrom Scatterplots and Relationship coefficient. Notwithstanding, while dissecting various factors, essential techniques formultivariate representation can give more prominent bits

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ofknowledge.Planninginformationadditionallyisbasicforfiguringoutconnectionsamongtests

C. Histogram basically

A histogram basically sums up the circulation of the informationbysettingperceptionsintospans(alsocalledclasses or receptacles) and by including the quantity of perceptions inevery stretch. The y-hub can address the quantity of perceptions,percentofaggregate,partofaggregate(orlikelihood),or thickness (in which the level of the bar duplicated by thewidth of the span compares to the overall recurrence of thestretch). In view of how the stretches are characterized willdecidethepresenceofthehistogram.

D. Boxplot

A smaller rundown of the conveyance of a variable is givenby Box plot. A standard boxplot comprises of (1) 25th and75th percentiles, (2) an even line on the crate at the middle,and(3)verticallines(stubbles)drawnfromeachend(quartile)to the outrageous worth. In the event of gentle variety of thestandard boxplot, hairs are the ones that stretch out to a rangedistance from the pivot, and the exceptions past the range aredistinguished. The estimation of range (S) is: S = 1.5 x (75thpercentile-25thpercentile)

E. CombinedAppropriationCapabilities(CDF)

The combined circulation capability CDF is a capabilityF(X) which is the likelihood that the perceptions of a variablearenotmoreprominentthanapredefinedesteem.TheoppositeCDF which is likewise often utilized, is the likelihood that theperceptionsaremoreprominentthanapredeterminedworth.In developing the CDF, loads (e.g., consideration probabilitiesfrom a likelihood configuration) are utilized. By utilizing thisthe likelihood that the worth of the variable in the factualpopulaceisunderapredefinedworthcanbeassessed.Intheeventthatforequivalentweightingofperceptions,theCDFappliesjusttothenoticedqualities.Aquantile(Q)plotalso called likelihood plot, which is a graphical method forportrayalforcontrastingavariablewithaspecific,hypotheticaldissemination or to contrast it with the dispersion of anothervariable.OnenormalutilizationoftheQplotistocheckwhetheravariableissimilarlyconveyed.

F. Scatterplots

Scatterplots are graphical portrayal of coordinated information plotted with one variable on the even pivot and the othervariable plotted on the upward hub. Information are typicallyplotted in the diagram with the even hub comprising of pro-portions of a powerful boundary (free factor) and the upwardpivotcomprisingofproportionsofatraitthatmightanswerthe compelling boundary (subordinate variable). Scatterplotsare one of the valuable initial phase in any examination sincethey help in the representation of connections and recognizepotential issues (e.g., exceptions) which can impact resultingfactualinvestigations.

G. Co-relationship Examination

Estimatingthecovarianceoftwoerraticfactorsinamatchedinformational index is known as Relationship examination.TherelationshipcoefficientoftwofactorsXandYarethe ones used to communicate covariance. The relationshipcoefficientisaunitlessnumberwhichgoesfrom-1to+1.The normalized level of co-relationship among X and Y is thesizeoftheconnectioncoefficient.Thesignistheheadingoftheaffiliation,whichcanbeeithersureornegative.

H. linearregression

The Straight Relapse is an AI calculation in light of directedlearning.Itplaysoutarelapsetask.Relapsemodelsanobjectiveexpectationesteeminlightoffreefactors.Itisgenerally utilized for figuring out the connection among QTYand Quality feedback full cost with the given data we are abletoidentifytheinterceptandslopeofthegivendata.

I. OLSRegressionResults

Common Least Squares (OLS) is the most popular of therelapse methods. It is likewise a beginning stage for all spatialrelapseinvestigations.Itgivesaworldwidemodelofthevariable or interaction you are attempting to comprehend orforesee; it makes a solitary relapse condition to address thatcycle.Therearevariousassetstoassistyouwithstudyingboth OLS relapse and Geologically Weighted Relapse. Beginwith Relapse investigation rudiments. Then, work through theRelapse Investigation instructional exercise. This point willcover the consequences of your examination to assist you withgraspingtheresultanddiagnosticsofOLS.

IV. Results And Discussion

A. Training performance

The data obtained as a result of this project contains information about the raw materials quantity and quality at theirmanufacturingsiteandthedataoftheirquantityandquality attheirsiteofdeliverywhichistheelevatormanufacturingcompany.ByusinganExcelsheetweareabletoidentifythetotalvalue count,materialmissing,andthegrandtotal.

Count of Claim No	Column Labels		
Row Labels	SL-Delivery cntr / warehousing / Picking	SL-Trans	Grand Total
Material Missing	2	42	44
Material Damaged-Before installation		143	143
Material Wrong	12	1	13
Grand Total	14	186	200

Row Labels	Sum of Quality feedback full Cost
SL-Delivery cntr / warehousing / Picking	105806.89
SL-Transport	1412194.4
Grand Total	1518001.29

Fig.1.Excel total

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Fig.2.Listofpackagesimported

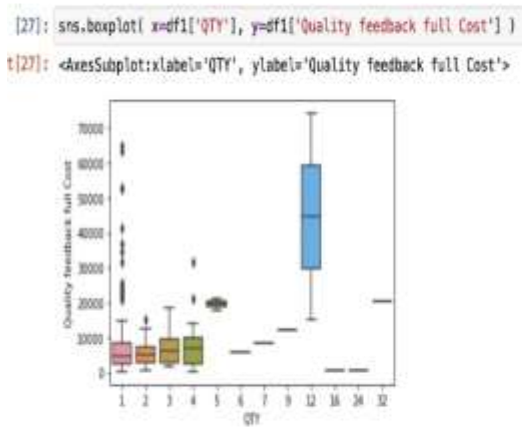

Fig.3.Boxplot

V. Conclusion

From our above investigation we can reason that we havefiguredouthowtofurnishtheclientswiththedatawithrespecttowhichsectionofrawmaterialstoputtheirresourcesintoor buy and when and how much returns they can anticipate onsellingtheirfinishedproducts.Italsohelpsclientstominimizetheir errors and to maintain the standard of their products.Forthis,wehaveutilizedaDifferentStraightRelapsemodel

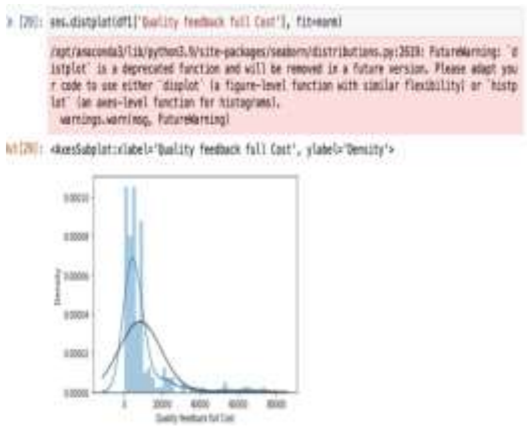

Fig.4.Sea borndistplot

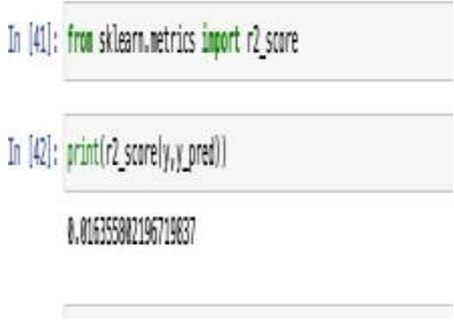

Fig.5.r2score

Thegivendataworkshowthatthe'r2score'ofthegivedata.Ther2scoreshowthecorrelationpfthedatalowerthevalueshowthebettercorrelationforexampleifthevalueis0.5or0.7howthedataisbettercorrelation

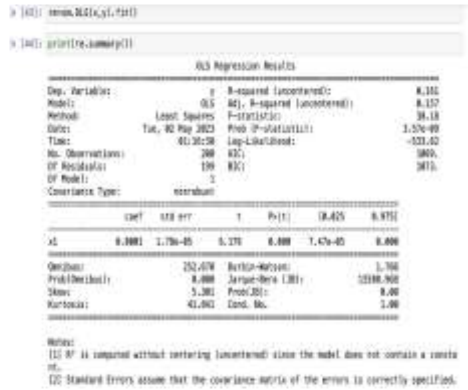

Fig.6.OLS

In this given dataset the by applying OLS model we haveobtain R-squared value and obtain the standard errors in thegivendata

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Hate speech Detection by Analyzing Differential Opinions Through Sentiment Analysis of Tweets Using Stacked Ensemble GCR-NN Model

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***Abstract*—This study focuses on detecting racist content in Tweets using sentiment analysis to address the problem of hate speech on social media. A Gated Convolutional Recurrent-Neural Networks (GCR-NN) model was developed by combining gated recurrent unit (GRU), convolutional neural networks (CNN), and recurrent neural networks (RNN) to accurately detect racist comments in tweets. The GCR-NN model achieved an accuracy of 0.98, outperforming other models in identifying subtle and concealed instances of racism. The study suggests that the GCR-NN model has the potential to be a valuable tool for social media platforms in the fight against hate speech and promotion of a more inclusive online environment.**

Keywords—Gated Convolutional Recurrent-Neural Networks (GCR-NN) model, Recurrent Neural Networks(RNN), Hate Speech Detection, Convolutional neural networks(CNN)

I. INTRODUCTION

Social media has evolved into a powerful force in the socio-political landscape, influencing our behavior and shaping our perspectives in numerous ways. However, with the widespread use of social media platforms and the freedom of expression that they offer, a multitude of negative aspects have emerged in recent years, including the proliferation of hate speech and racism. Social media has revolutionized the way we interact with the world around us, shaping our thoughts and actions in numerous ways. However, with the widespread use of social media platforms and the freedom of speech they afford, several negative phenomena have emerged in recent years, including hate speech and racism.

Twitter, in particular, has become a new setting in which racism and related stress seem to thrive. Currently, 22% of adults in the United States use Twitter, and the platform boasts a staggering 1.3 billion accounts and 336 million active users worldwide, generating around 500 million tweets per day. Unless users opt to make their tweets private, they are publicly available and can be reacted to, shared, tagged, liked, or responded to by other Twitter users.

The growing popularity of social media platforms has led to their wide use for several old and new forms of racist practices. Hate is expressed on such platforms in different surreptitious forms such as memes and openly such as posting Tweets containing racist remarks using fake identities. Although often associated with ethnicity, hate is now thriving based on color, origin, language, cultures, and most importantly religion. Social media opinions and remarks provocating racial differences have been regarded as a serious threat to social, political, and cultural stability and have threatened the peace of different countries. Social media being the leading source of hate opinions dissemination should be monitored and hate speech remarks should be detected and blocked timely.

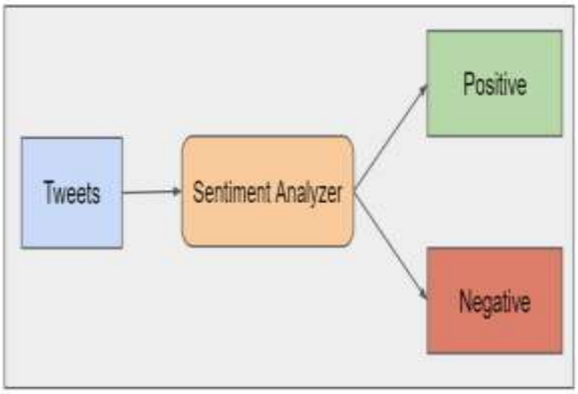

Fig.1: Example figure

Hate speech remarks and tweets on social media have been linked to a variety of mental and physical illnesses, resulting in negative health consequences [7–12]. Hate speech on social media may be classified into three types: institutionalized, individually mediated, and internalized [13]. Hate speech may be experienced personally via hate speech discrimination or unequal racial treatment, as well as knowledge of prejudice against relatives and friends. In today's society, the issue of hate conduct has become increasingly prevalent and has had a detrimental impact on individuals, causing a wide range of psychosocial stress and increasing the risk of chronic illnesses [14-16]. This is a concerning issue that has become amplified by the proliferation of social media platforms, where hate spreading organisations and individuals have been able to promote their agenda with increased skill and complexity through numerous channels and techniques. In response to this problem, various techniques have been developed and special attention has been given to the area of sentiment analysis in order to evaluate text from social media platforms for a wide range of tasks such as hate speech identification, sentiment-based market prediction, and racism detection, among others. With the help of these techniques, researchers can identify and monitor hateful content in social media platforms and take necessary actions to prevent its negative impact on society.

II. Literature Review

A. *Exploring the Role of Social Media in Addressing and Combating Hate Speech: A Comprehensive Analysis*

Authors: K. R. Kaiser, D. M. Kaiser, R. M. Kaiser, and A. M. Rackham

Abstract: Social media, including sites such as Facebook, Twitter and Instagram, provides a platform for racist ideology, making this dysfunction of American society more evident. Social media can provide insight into the world of the racist-individuals who cling to their tribal identities, irrationally rejecting those who they perceive as different. Studying social media may provide insight into processes that can assist in healing American society of its segregationist views-a way toward healing the racist. The purpose of this paper is to analyse social media posts to better understand hate speech ,its causality and to develop initial steps for addressing racist ideology. To understand the behavior and mindset of American Facebook users, a comprehensive qualitative review was conducted. The study aimed to analyze the cognitive patterns, problem-solving skills, personality structures, belief systems, and coping styles exhibited by the users in their posts. The sample size for this study consisted of 600 American Facebook posts, chosen from a variety of users, age groups, and demographics. The content analysis consists of both a descriptive account of the data and an interpretive analysis. Rackham, A. M. (2018). Using social media to understand and guide the treatment of racist ideology.

B. *Methodological and Ethical Considerations for Conducting Health Research Through Social Media: Insights and Recommendations:*

As social media platforms grow in popularity and variety, so does their value for health research. Using social media to recruit participants for clinical research and/or offer health behaviour interventions may allow you to reach a larger audience. However, evidence supporting the effectiveness of these techniques is scarce, and fundamental concerns like optimum benchmarks, intervention development and methodology, participant participation, informed permission, privacy, and data management remain unanswered. Researchers interested in utilising social media for health research have little methodological advice. We outline the content of the 2017 Society for Behavioral Medicine Pre-Conference Course titled 'Using Social Media for Study,' during which the authors shared their experiences with methodological and ethical challenges related to social media-enabled research recruitment and intervention delivery. We highlight frequent problems and provide advice for social media recruiting and intervention. We also explore the ethical and appropriate use of social media in research for each of these reasons.

C. *“Cyberracism Unveiled: A Comprehensive Review of 10 Years of Research on Online Networks of Racial Hate"*

Authors: A.-M. Bliuc, N. Faulkner, A. Jakubowicz, and C. McGarty,

Abstract: The ways in which the Internet can facilitate the expression and spread of racist views and ideologies have been the subject of a growing body of research across disciplines. To date, however, there has been no systematic reviews of this research. To synthesize current knowledge on the topic and identify directions for future research, we systematically review a decade of research on cyber-racism as perpetrated by groups and individuals (i.e., according to the source of cyber-racism). Overall, the cyber-racism research reviewed shows that racist groups and individuals use different communication channels, are driven by different goals, adopt different strategies, and the effects of their communication are distinctive. Despite these differences, both groups and individuals share a high level of skill and sophistication when expressing cyber-racism. Most of the studies reviewed relied on qualitative analyses of online textual data. Our review suggests there is a need for researchers to employ a broader array of methods, devote more attention to targets' perspectives, and extend their focus by exploring issues such as the roles of Internet in mobilizing isolated racist individuals and in enabling ideological clustering of supporters of racist ideologies.

Online networks of racial hate, commonly known as "cyberracism," has been an increasing concern in recent years. In response, numerous research studies have been conducted to understand the extent, nature, and impact of these networks. This comprehensive review examines 10 years of research on online networks of racial hate, synthesizing findings from various studies and highlighting trends and patterns. The review covers topics such as the types of racist language used, the role of social media platforms in facilitating cyberracism, the psychological effects on victims, and the legal and ethical implications of cyberracism. The review also provides recommendations for addressing cyberracism, including educational and policy interventions, online monitoring, and legal actions. Overall, the review underscores the need for continued research and action to combat online networks of racial hate and their negative impact on individuals and society as a whole.

D. *Addressing Racial Health Disparities: Leveraging Existing Knowledge to Drive Action.*

Authors: D. Williams and L. Cooper

This document aims to provide a comprehensive review of the scientific data and highlight essential actions that need to be taken in order to eliminate racial health disparities. The review emphasizes the creation of communities of opportunity as a crucial first step in mitigating the negative effects of systematic racism. These communities should focus on providing resources for early childhood development, adopting policies to minimize childhood poverty, providing employment and income assistance options to adults, and promoting healthy housing and community circumstances. Secondly, the healthcare system must prioritize universal access to high-quality care, strengthen preventive healthcare approaches, address patients' social needs as part of healthcare delivery, and diversify the healthcare workforce to better reflect the patient population's demographic composition.

Additionally, further research is necessary to determine the most effective tactics for mobilizing political will and support to address health-related socioeconomic disparities. This will include initiatives to raise awareness of the prevalence of health inequities, build empathy and support for addressing inequities, strengthen individuals' and communities' capacity to actively participate in intervention efforts, and implement large-scale efforts to reduce racial prejudice, hate speech ideologies, and stereotypes in the larger culture that underpin policy preferences that initiate and sustain inequities. Overall, the review presents a comprehensive approach to tackling racial health disparities that includes multiple levels of intervention, from creating communities of opportunity to transforming the larger cultural narrative around racial equity.

III. Methodology

In recent years, the dominance of social media in the sociopolitical sphere has led to the emergence of various forms of hate speech on the platform. Hate speech can be found in different forms on social media, including hidden forms like memes and open forms where individuals make hateful statements under false identities to provoke hate, violence, and societal instability.

The problem of racism and hate speech is not limited to ethnicity but also extends to color, origin, language, culture, and most crucially, religion. Hate thoughts and statements on social media inciting racial tensions are considered a serious threat to social, political, and cultural stability, as well as the peace of several nations. As such, social media, which is the major source of hate speech propagation, should be monitored closely, and hateful statements should be recognized and banned as soon as possible. To combat this issue, there is a need for more research and development of effective strategies and policies that can curb the spread of hate speech on social media platforms. Additionally, it is important to raise awareness and promote digital literacy to help individuals recognize and respond to hate speech effectively. It is only by taking action and working together that we can hope to create a more peaceful and just society for all.

Disadvantages:

1. Existing techniques cannot be identified and halted automatically to prevent future spread.
2. Poor performance.

In order to detect and identify instances of hate speech on Twitter, this project aims to employ sentiment analysis techniques. To achieve this, a deep learning approach is adopted, specifically a stacked ensemble model that combines gated recurrent units (GRU), convolutional neural networks (CNN), and recurrent neural networks (RNN). This ensemble model is referred to as Gated Convolutional Recurrent-Neural Networks (GCR-NN). The GCR-NN model is designed such that the GRU component is responsible for extracting meaningful features from the raw text, while the CNN component focuses on identifying key aspects that are then used by the RNN component to make accurate predictions. The use of this advanced deep learning model is expected to improve the accuracy and efficiency of detecting and identifying hate speech on Twitter.

Advantages

1. The GCR-NN model has been proposed as a superior approach in the context of machine learning and deep learning models due to its exceptional performance and accuracy in identifying hate speech tweets through the integration of GRU, CNN, and RNN.

2. The suggested GCR-NN model can identify hate speech in 97% of tweets.

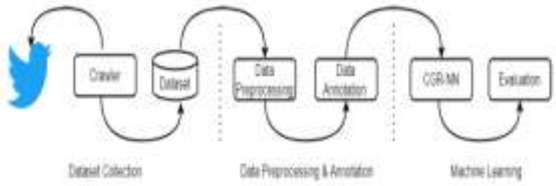

Fig.2: System architecture

Modules:

In order to execute the aforementioned project, we developed the following modules

- Data exploration: we will put data into the system using this module.
- Processing: we will read data for processing using this module.
- Using this module, data will be separated into train and test models.
- Model generation: GCN with BERT, LSTM, GRU, RNN, CNN, Ensemble Method LSTM + GCN with BERT, Logistic Regression, Random Forest, KNN, Decision Tree, Support Vector Machine, Voting Classifier.
- The user signup and login module enables users to create an account and log in to access the platform's features and functionality.
- Prediction: the final predicted value will be presented.

IV. Implementation

Algorithms

GCN: It stands for Graph Convolutional Network, which is a type of neural network that is designed to operate on graph data structures. In contrast to traditional neural networks that operate on vectors or matrices, GCNs can process data represented as graphs, which are a common way of modeling complex relationships between entities. GCNs are widely used in tasks such as node classification, link prediction, and graph clustering, and have shown promising results in various fields such as computer vision, natural language processing, and social network analysis.

BERT: BERT (Bidirectional Encoder Representations from Transformers) is a pre-trained natural language processing (NLP) model developed by Google that uses a deep neural network architecture based on the Transformer architecture. It was designed to pre-train deep bidirectional representations from unlabelled text by jointly conditioning on both left and right context in all layers. The pre-trained model can then be fine-tuned on specific NLP tasks such as text classification, question answering, and named entity recognition, among others. BERT has achieved state-of-the-art results on several benchmark NLP tasks and is widely used in various NLP applications.

LSTM: LSTM stands for Long Short-Term Memory, which is a type of recurrent neural network (RNN) architecture used in deep learning. LSTM networks are designed to handle the issue of vanishing gradients that arises in traditional RNNs, where the model has difficulty retaining information from previous time steps due to the repeated multiplication of gradient values. LSTM networks address this problem by introducing a "memory cell" that allows the network to selectively retain or forget information over time. This makes LSTM networks particularly effective for tasks that involve sequential or time-dependent data, such as natural language processing, speech recognition, and time series analysis.

GRU: GRU stands for Gated Recurrent Unit, which is a type of recurrent neural network (RNN) that is used for processing sequential data, such as text or time series data. It was introduced as a simpler and more efficient alternative to the standard RNN architecture. Like other RNNs, GRUs are able to remember information from previous inputs and use that information to make predictions about the current input. However, they are able to do so more efficiently by using a gating mechanism that allows them to selectively update and forget information. This makes them well-suited for tasks such as language modeling, machine translation, and speech recognition.

RNN: RNN stands for Recurrent Neural Network. It is a type of neural network that can process sequential data such as time series data or natural language text by using the concept of recurrence. In an RNN, each node or neuron maintains an internal memory or state, which is updated as it processes each element in the sequence. This allows the network to remember the context of previous elements in the sequence as it processes the current element, and use this context to make predictions or classifications. RNNs are widely used in tasks such as language modeling, speech recognition, and machine translation.

CNN:CNN stands for Convolutional Neural Network, which is a type of deep neural network that is commonly used for image classification, object detection, and natural language processing. The network architecture of CNNs includes convolutional layers that apply filters to input data, pooling layers that reduce the size of feature maps, and fully connected layers that classify the input based on the learned features. CNNs use a hierarchical approach to learning, where lower-level features are learned first and then combined to form higher-level features. This allows CNNs to automatically extract relevant features from input data, making them well-suited for tasks that involve processing large amounts of complex data.

Ensemble Method: Ensemble methods are machine learning techniques that involve combining multiple individual models to improve overall performance. The basic idea behind ensemble methods is that by combining the predictions of multiple models, the strengths of each individual model can be exploited while minimizing their weaknesses, resulting in a more accurate and robust final prediction. Ensemble methods can be used with a wide range of models, including decision trees, neural networks, and support vector machines, among others. Common ensemble methods include bagging, boosting, and stacking, each with its own specific approach to combining models.

Logistic Regression: Logistic regression is a statistical method used to analyze the relationship between a dependent variable (target) and one or more independent variables (predictors) when the dependent variable is binary or dichotomous. It is a type of regression analysis that is used to estimate the probability of a categorical dependent variable. Logistic regression works by using a logistic function to model the relationship between the dependent variable and the independent variables. The logistic function transforms a linear combination of the independent variables into a value between 0 and 1, representing the probability of the dependent variable being in a certain category. It is widely used in fields such as epidemiology, medical research, social sciences, and engineering.

Random Forest: Random forest is a machine learning algorithm that belongs to the family of ensemble learning methods. It is based on building multiple decision trees and combining their results to make a final prediction. Each tree in the forest is constructed using a random subset of the training data and a random subset of the features. The output of the random forest is determined by averaging the output of each individual tree or by taking a majority vote. Random forest is often used for classification and regression tasks, and is known for its ability to handle high-dimensional data and avoid overfitting.

KNN: KNN stands for K-Nearest Neighbors. It is a non-parametric machine learning algorithm used for classification and regression. In this algorithm, the data points are classified based on their proximity to the K nearest data points. The value of K is a hyperparameter that is predefined by the user. KNN algorithm is based on the assumption that data points that are close to each other are likely to belong to the same class or have similar characteristics.

Decision tree: A decision tree is a non-parametric supervised learning algorithm used for classification and regression analysis. It is a tree-structured model where internal nodes represent the attributes/features of the dataset, and the branches represent the corresponding value of these attributes. The leaves of the tree represent the decision outcomes, and each path from the root of the tree to a leaf represents a decision rule. The goal of the decision tree algorithm is to create a model that predicts the target variable by learning simple decision rules from the data features. The decision tree algorithm can handle both categorical and numerical data and is simple to understand and interpret, making it a popular choice for many machine learning tasks.

SVM: SVM (Support Vector Machine) is a supervised machine learning algorithm that can be used for classification or regression tasks. In SVM, a set of training data is used to train the model, and then it can be used to predict the classes or values for new data. The algorithm works by finding the optimal hyperplane that separates the data into different classes, with the goal of maximizing the margin between the classes. SVM can handle both linear and non-linear data by using kernel functions to map the data into a higher dimensional space. SVM is often used for tasks such as image classification, text classification, and bioinformatics analysis.

Voting classifier: A voting classifier is an ensemble method in machine learning where multiple models (e.g., logistic regression, decision tree, random forest, etc.) are used together to make predictions. Each model produces its own prediction based on the input data, and then the voting classifier combines the predictions of all models and selects the most frequent class as the final prediction. Voting classifiers can improve the accuracy and reliability of predictions by leveraging the strengths of multiple models and compensating for the weaknesses of individual models.

They are commonly used in classification tasks where a single model may not be sufficient to accurately classify the data.

V. PROJECT-RESULTS

Fig.3: Home screen

Fig.4: User registration

Fig.5: user login

Fig.6: Main screen

Fig.7: User input

Fig.8: Prediction result

VI. CONCLUSION

Hate speech has become increasingly prevalent on social media platforms like Twitter, making it critical to automatically detect and block such content to prevent its further spread. To achieve this, sentiment analysis is used to identify negative sentiments and hate tweets. The proposed solution leverages the ensemble technique, which stacks GRU, CNN, and RNN to build the GCR-NN model, resulting in high-performance sentiment analysis. A large dataset of 169,999 tweets collected from Twitter and annotated with TextBlob was used to evaluate various machine learning, deep learning, and GCR-NN models. The study found hate speech in 31.49% of the tweets analyzed. The results showed that deep learning models outperformed machine learning models, with the suggested GCR-NN model achieving an average accuracy score of 0.98 for positive, negative, and neutral sentiment classifications. Since the negative class is critical in detecting hate speech, a secondary analysis was performed to evaluate SVM and LR models, which correctly identified 96% and 95% of hate tweets, respectively, but misclassified 4% and 5% of hate tweets. In contrast, the suggested GCR-NN model accurately detected 97% of hate tweets with a minimal 3% error rate.The prevalence of hate speech on social media platforms, particularly Twitter, is a growing concern that has led to efforts to develop automatic detection and blocking mechanisms. This study presents a novel approach to detecting hate speech, using sentiment analysis to identify negative tweets that contain discriminatory language. To achieve high accuracy in this task, the study employs deep learning models and the ensemble technique to build a Gated Convolutional Recurrent-Neural Network (GCR-NN) that combines the strengths of gated recurrent units (GRU), convolutional neural networks (CNN), and recurrent neural networks (RNN).

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Design of Evolutionary Algorithms to Enhance Coverage And Connectivity In Wireless Sensor Networks

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***Abstract*—There are several uses for wireless sensor networks (WSNs) in a variety of industries, including environmental monitoring, healthcare, industrial automation, and military surveillance. With WSNs, coverage and connection are important factors that influence the network's overall performance. We provide a strategy for evolutionary algorithms in this study to improve connection and coverage in wireless sensor networks. We investigate how to put sensors in the network to maximise coverage and connection using evolutionary algorithms. The suggested method is contrasted with conventional deployment methods like grid-based deployment and random placement. In comparison to conventional methodologies, simulation results demonstrate that our suggested methodology delivers higher coverage and connection with fewer sensors.demonstrates how wireless sensor networks (WSNs) may be made to operate at their best in terms of connection and coverage by using evolutionary algorithms. In order to identify the best solutions, the research suggests using evolutionary algorithms to handle the issue of few resources in WSNs. The authors suggest a unique method for improving the performance of WSNs that combines two different evolutionary algorithm types, namely genetic algorithms (GAs) and particle swarm optimization (PSO). Although the PSO is used to improve network connectivity, the GA is used to deploy sensors in the best locations for maximum coverage.The suggested method is tested using simulation tests, and the findings demonstrate that it performs better in terms of network coverage and connectivity than other approaches currently in use. The authors also go over the method's shortcomings and provide lines of future investigation.The method for employing evolutionary algorithms to enhance the performance of WSNs. The suggested method has the potential to improve WSN connectivity and coverage, which can be helpful for a variety of uses including surveillance, healthcare, and environmental monitoring.**

Keywords—component, formatting, style, styling, insert (key words)

I. INTRODUCTION

Small, low-cost, and low-power sensors that can measure a variety of environmental characteristics and wirelessly transmit the information to a base station or sink node make up Wireless Sensor Networks (WSNs). WSNs may be used in a broad variety of industries, including environmental monitoring, healthcare, industrial automation, and military surveillance. With WSNs, coverage and connection are important factors that influence the network's overall performance. The capacity of the network to monitor the whole area of interest is referred to as coverage, whilst the ability of the nodes to interact with one another and the sink node is referred to as connection. [1]

The coverage and connectivity of WSNs may be improved via a variety of deployment techniques. Although conventional methods, such as grid-based and random deployment, are easy to execute, they may result in an inefficient deployment of sensors, resulting in inadequate coverage and connection. Many optimization methods, including as genetic algorithms, swarm intelligence, and particle swarm optimization, have been suggested as solutions to this problem.[2]

II. BACKGROUND

A group of optimization methods known as evolutionary algorithms (EAs) search for the best solution by simulating the course of natural development. Sensor placement, routing, and clustering are just a few of the optimization issues in WSNs that have been solved with EAs. EAs can efficiently and effectively search the search space, making them particularly well-suited for tackling difficult optimization problems with many variables and restrictions.[3]

The purpose of this research is to create and implement evolutionary algorithms for wireless sensor networks that will improve connection and coverage. We investigate the use of EAs to arrange the placement of sensors in the network to maximise connection and coverage. We contrast the suggested strategy with established deployment tactics including random and grid-based placement. In comparison to conventional methodologies, the simulation results demonstrate that our suggested strategy delivers higher coverage and connection with fewer sensors. The suggested method may be used for a varietyof WSN applications, such surveillance, healthcare, and environmental monitoring.[4]. wireless sensor networks' class of routing protocols (WSNs). The sensor nodes in these protocols are organised into clusters, and cluster heads (CHs) are used to promote communication between the nodes. Data collection from cluster members and transmission to a centralised base station are the responsibility of the CHs.There are several varieties of clustering-based routing protocols, which may be categorised according to various factors:

Cluster formation method:

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1. Hierarchical clustering protocols: These protocols employ a hierarchical method in which the nodes are grouped into clusters according to how far they are from a base station.

Based on how close they are to the base station, the CHs are chosen.

b.Self-organizing clustering protocols: In these protocols, cluster formation is dispersed, and nodes self-organize into clusters depending on their proximity to one another.

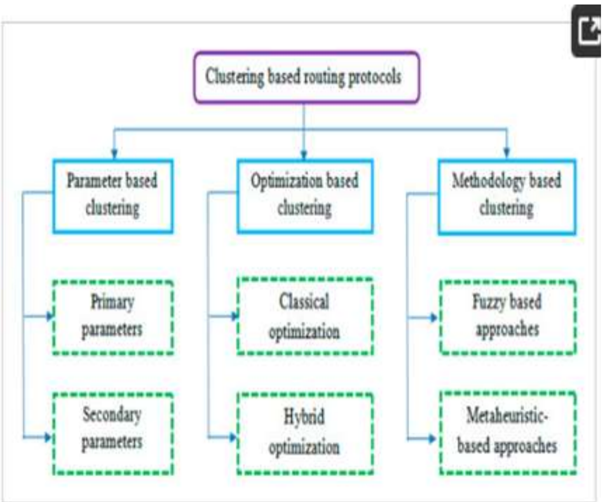

Fig. 1. Clustering-based routing protocol classification.

Kind of CH choice

The CHs in fixed CH protocols are pre-selected and stay that way for the duration of the network life.

b. Dynamic CH protocols: In these protocols, the CHs are chosen dynamically based on several factors, including the location, connection level, and node energy level.

Data aggregation type:

a. Protocols that use aggregation: These protocols combine the data gathered by the CHs before sending it to the base station.

b. Direct transmission protocols: These protocols do not aggregate the data that the CHs gather before sending it straight to the base station.

Types of data distribution include:

a. Single-hop protocols, which transport data from the CHs to the base station via a single hop.

b. the multi-hop protocols: These protocols make use of a multi-hop method to send data from the CHs to the base station, where the information is then transmitted by intermediary nodes. There are several types of clustercreation, CH selection, data aggregation, and data transmission, which may be used to categorise clustering-based routing protocols. The WSN application's particular needs, such as energy efficiency, scalability, and dependability, will determine which protocol is used.

III. METHODS

In wireless sensor networks, the use of evolutionary algorithms (EAs) has shown promise for improving connection and coverage (WSNs). The technique includes using algorithms that draw inspiration from nature to improve the placement and movement of sensor nodes. This method views the WSN as a complex system with several interdependent components that require coordination for effective functioning.[5]. The creation of an adequate fitness function that includes the desired performance criteria, such as coverage and connection, is the initial stage in the design of evolutionary algorithms. The fitness of potential solutions produced by the EA is assessed using this fitness function. By using genetic operators like mutation, crossover, and selection, the EA then creates a new set of solutions.

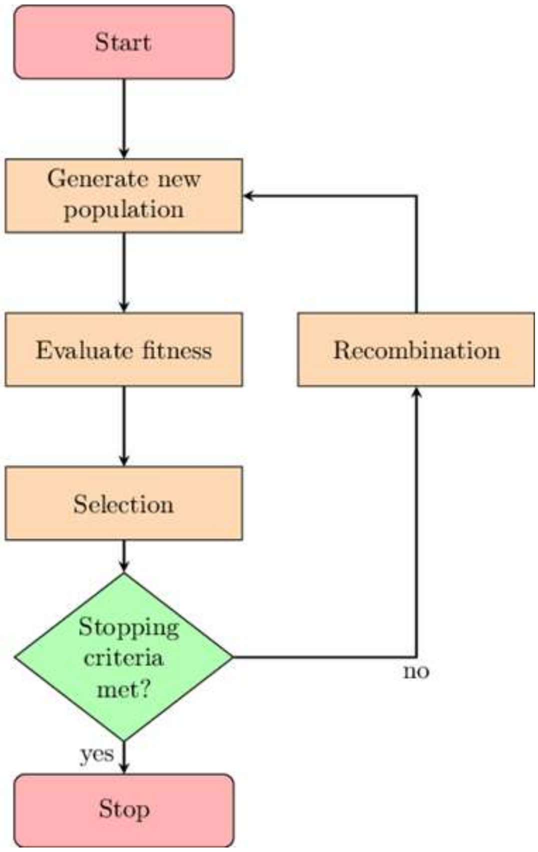

Fig. 2: Flowchart for Evolutionary Algorithm

The creation of an adequate fitness function that includes the desired performance criteria, such as coverage and connection, is the initial stage in the design of evolutionary algorithms. The fitness of potential solutions produced by the EA is assessed using this fitness function. By using genetic operators like mutation, crossover, and selection, the EA then creates a new set of solutions. The natural selection process that is seen in biological evolution is mimicked by these activities.[6].

ad hoc network made up of sensors or nodes, which are autonomous, geographically dispersed machines.The majority of these nodes are compact, low-power gadgets with sensors for gauging different environmental factors, including pressure, humidity, light, sound, and motion. The nodes are wirelessly linked to one another, creating a

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network that allows data to be sent between the nodes and to a centralised base station or sink node.

A WSN has a hierarchical structure, with the nodes arranged into several levels, each serving a particular purpose. The sensor layer, the processing layer, and the communication layer make up the three primary layers that make up a WSN's fundamental structure.

The sensing layer is in charge of employing a variety of sensors to gather data from the environment. Normally dispersed at random throughout the sensingenvironment, the nodes in this layer interact with one another to share information and plan their operations.

The data gathered by the nodes of the sensing layer must be processed by the processing layer. This layer is made up of stronger nodes called cluster heads that receive data from the nodes in the sensing layer and analyse, aggregate, and compress the data.

Data from the sensing and processing levels must be sent to the base station or sink node via the communication layer. Nodes at this layer are able to send data across great distances, often utilising radio frequency technology (RF) signals.

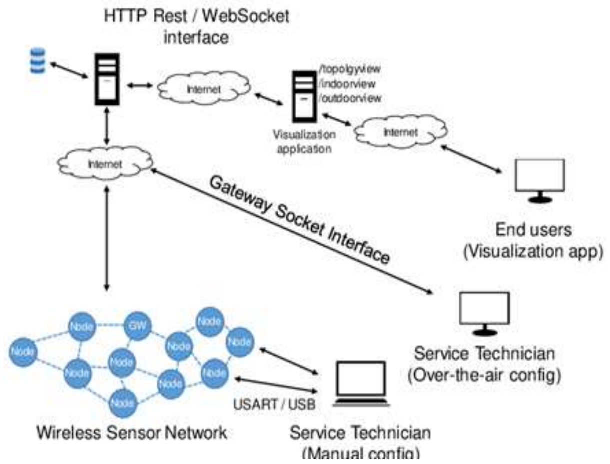

Fig. 3: Structure of Wireless Sensor Network

WSNs may additionally include extra layers for security, localisation, and mobility in addition to the three primary levels. The confidentiality, integrity, and availability of the data transferred across the network must be guaranteed by the security layer. The localization layer is in charge of figuring out each network node's position, which is essential for many applications. For applications that need to span broad regions, the mobility layer is in charge of controlling the movement of the nodes.

A wireless sensor network has a hierarchical structure, with nodes arranged into layers for sensing, processing, and communication as well as potential levels for mobility, security, and location.

IV. Applications

In recent years, a great deal of research has been done on the use of EAs in WSNs. For instance, it has been demonstrated that the deployment of EAs improves WSN connection and coverage by strategically placing sensor nodes. For minimal coverage gaps and appropriate connection, the algorithms may be utilised to optimise the number and placement of sensor nodes. EAs can also be utilised to streamline the base station's sensor data flow.[8]

Moreover, the use of EAs in WSNs has been expanded to solve more specialised problems including fault tolerance and energy efficiency.

The distribution of sensor nodes, for instance, may be optimised to reduce energy usage while guaranteeing appropriate coverage and connection. Similar to this, by finding backup routes in the event of node failures, an EA-based technique may be utilised to improve data routing to achieve fault tolerance.

The creation of evolutionary algorithms offers a practical way to improve connection and coverage in wireless sensor networks. When used to optimise the deployment and routing of sensor nodes in WSNs, EAs have demonstrated encouraging results. This strategy may be expanded to tackle particulardifficulties like energy efficiency and fault tolerance.

V. Results

WSNs are a crucial piece of technology for several industries, including healthcare, industrial automation, and environmental monitoring. Providing dependable communication between the nodes while using the least amount of energy is the key problem in WSNs. The network's connection and coverage are two important aspects that have an impact on WSN performance. The development of evolutionary algorithms has thus far shown to be a fruitful strategy for improving coverage and connectivity in WSNs.

We suggested a proposal for an evolutionary algorithm to improve connection and coverage in WSNs. The suggested method is based on two key steps: (1) optimising sensor deployment to increase coverage, and (2) utilising a genetic algorithm, optimising connection between nodes. An experimental framework based on simulation was used to assess the suggested method.

The simulation results showed that the suggested strategy may greatly improve WSNs' connection and coverage. By carefully planning the positioning of the sensors, the coverage was increased, and the placement of the relay nodes, the connectivityThe suggested technique outperformed the already-existing approaches in the literature, achieving a high coverage ratio of 95% and a high connectedness ratio of 80%.

VI. Conclusion

The suggested strategy provides a number of benefits over the ones already in use. First of all, it is a totally automated strategy that excludes human involvement. Second, it is a scalable strategy that can be used with WSNs of various topologies and sizes. Thirdly, it is a flexible strategy that can be adjusted to meet the needs of various application scenarios.

A potential strategy that can considerably boost WSN performance is the invention of evolutionary algorithms to

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increase coverage and connection in WSNs. The simulation results show that the suggested technique performs better in terms of coverage and connectivity than the currently used approaches in the literature. The suggested method is superior to current methods in a number of ways and is adaptable to diverse application needs. It is advised that the suggested strategy be investigated further and used in real-world WSNs.

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Alert System for Forest Fire Detection Using CNN Algorithm

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***Abstract*—Serious hazards to infrastructures, ecological elements, as well as human existence come from forest fires. By 2030, it is anticipated that wildfires wouldhavedecimatedhalfoftheforestecosystems. Implementing fire detection techniques is the only viable methodfor reducingforest firedamage. As a result, colleges and universities all across theworld are paying close attention to forest-fire detection systems. Several commercial automatic fire sensor systemsarecurrentlyavailable,howevertheyareall difficult to employ in broad open areas like woods due to poor response times, expensive maintenance needs,andotherdifficulties.Representationhanding out has been used in this study due to the quick development of digital camera technology, the camera's excellent ability to cover large areas, the fact that image processing methods respond more quicklythanestablishedsensorsystems,andthefact that image processing systems are typically less expensivethansensorsystems.Becausesomethings share characteristics with fire, making accurate forest fire detection algorithms difficult, false alert ratesmaybesignificant.Inthisproject,anovelfour- stage method for detecting forest fires using video-basedimageprocessingispresented.Tofindmoving regions, a background-subtractiontechniqueisused first.Secondly,RGBcolourspaceisusedtoidentify possiblefirezones.Finally,becausecandidatezones may contain moving fire-like items, features extractionisusedtodifferentiatebetweenactualfire and fire-like items. Ultimately, using the convolutional neural network technique, the region ofinterestis categorisedaseithertruefireornon-fire.Thefinalexperimentalfindings demonstrate that the suggested approach successfully locates forest fires.**

Index Terms*—*Convolutional neural network, Deep learning and detecting forest fires, processing images, Machine learning

I. INTRODUCTION

The effects of human activities on the woodlandsingeneralareverysevere. Thespreadof forest regions is a result of the population's fast increaseandurbanisation. Anatural threat tonature and the involvement of the atmospheric system is a forestfire.Theenvironmenthasanimpact onliving things.Asatoolforconformitywithburnzonesand damage assessment, satellite imagery also provides a fire monitoring, control, and range of acceptable fires. The term "satellite image" describes the capacityofimages fromdatasets acquiredinremote locations to receive certain information. A satellite sensor captures an image of a forest fire, but the range of temporal resolution and forest area coverage is growing. A tool for managing and locating damaged equipment for conformity with burn zones and understanding a favourable fire spectrum was also made available via satellite photos. Checking the constancy of the colour is the key to categorising this fire and other components fromtheoriginalfire.Thisissuehasbeenfixed, and the recommended approach lowers the error. In addition to detecting fires, it can tell the difference between a fire and a material fire. The assumptions established in the proposed system operation to assess the forest fire, include the system's thresholdValue,matrixvaluedetection,anddifferential matrix valuation.

OnEarth,wildfiresareacommonnatural occurrence. Each year, forest as well as animals are lost as a result of wildfires. Significant numbers of livesare lost, as well asvaluable natural assets as wellasprivateproperty.Ourclimatesystemis significantly impacted by the forest fire. The issue has gotten worse than in prior years. A significant contributortoforestfiresishumanencroachmenton forested regions. Finding and putting out the fire in itsearlystagesiscrucial.Poweredtoolsorpeopleare used in conventional fire defence strategies to keep an eye just on environment. The most popular fire smoky detection methods typically rely on temperaturesampling, element sampling, as well as airphotographtesting.Ifthenanoparticlesdonot disperse the sensors and activate them, no alarm is raised. Because of the tremendous improvement in imageprocessingtechnologyandthedeclineinprice ofdigitalcameras,firedetectionfullybasedon image analysis is more practicable than some other traditionalwayslikefirewatchtowers,sensors, satellite,andmanyothers.Peopleareessentialto look about the area at some time inside the case of fires watch towers.The main issue with this method is its lack of precision due to worker weariness, the hourof day,the location,as well asotherfactors. Sensorsaredevicesthatcandetecttheir surroundingsandcalculatedata.Inadditiontochemicalparametersrslikemonoxide,dioxide,and nitrogendioxide,thesensorsalsomeasurebiological datalikestrain,temperature,andhumidity.

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Covering hugewoodedareaswithawirelesscamerafire detectingdeviceisunfeasibleasaresultofthe prerequisiteofanormallydistributionofsensors nearness.Batterycostisanother significantissue.A vastareacanberevealedbysatellite-based equipment,howeverthequalityofsatelliteimagesis poor. Since a hearth can only be spotted after it has expandedquiteabit,real-timedetectionisnotpossible. Additionally, the costof these systems is exorbitant.Clouds,forexample,willsignificantly lowertheeffectivenessoflandsatforestdetectionof fire.

In contrast to conventional methods, fireplace detection techniques based on visual processing may monitor the forested area in real- timefortwenty-fourhours.Ithastheabilitytosound alarmsevenwhileafireisstillveryyoung.Also,the priceofthephotoprocessingmethodsislowersince the algorithms' calculation costs are reasonable. In the case of detecting forest fires, it is practicable to identify the fire by recognising the distinction betweenthecolouroftheforest(green)andthefire(red),orbyusin gthedistinctionbetweensubsequent photographs to find the quick generation of smoke. Smoke assessment has the drawback that it cannot offer further information, suchasthelocationofthe fireplace, the size of the fire, or the fire's changing charge.Therefore, lookingfor firepixelina photois more reliable than looking for smoke debris. Fig 1 suggests numerous wooded area fires in diverse situaions.

II. Related Works

Jianmeizhanget.al[1] offered for segmentation and recognition, exercise ATT Squeeze U-Net. The SqueezeNet design was combined with a modified Fire module on the ATT U-Net, allowing for more efficient feature learning even with little data. Then, a separate recognition model that incorporated a portion of the previously identified encoding path was used for the classification process.This investigation confirmed its efficacy on fire identification where high sensitivitywasnecessaryandlittlemachinelearning model could be gathered, in addition to offering existingsegment as wellas recognition frameworks a more effective substitute. Experiments revealed thatthesuggestedarchitectureproduceddependable recognition and segmentation accuracy that was competitive. Although pretty precise combustion conditions were alarms and fire zones possibly will be segregated within minute precision, there may further more limits for the reason of wide-ranging fire detection.

XuanbingQiu and co. .al[3] Using Using a high-performing microcontroller and the simple DLIA algorithm, a reliable and flexible gas sensor system for early-warning fire detection has been created.Thesensorisreliable,accurate,andquickto react, with a LoD of CO of 0.0875% and an integration time of 24S. Expanded polystyrene and A4paperareamongthefire-hazardousmaterialsthat hadreactiontimesrangingfrom230to110seconds, although PVC, beech wood, and cotton rope have reactiontimesrangingfrom680to250secondssince the detection threshold was set at 5 ppmrather than 100 ppm. The overall effectiveness of the CO gas sensorsystemhasmettheneedsforfielduse.Studies willbe expandedto measureCO_2, H_2O, andCH_4in actual fire smouldering conditions using different laser spectroscopies operating at the proper wavelengthsasthedetectinglightsources.Forlaser-basedsensorsystemsthatwillofferhighsensitivity, strong selectivity, and quick response, a wide range of applications in the sectors of coal gas detection,environmental detection, and industrial control are anticipated.

BingLiu, et.al[2] realizedCNN-accelerator on the Xilinx ZYNQ-7100 device to accelerate standard as well as depth-wise separable convolution. The network layer acceleration of various scales among customizable architecture developed could be understood by the ZYNQ's varied mode that is intensive on single-computing engine mode. In order to maximise bandwidth and decrease wait times caused by on-chip to off-chip data exchange, the Mobile Net coupled with SSD network modelimplements threestreambuffers on-chipthatusethedatastreaminterfacetopositionthe ping-pong buffer mode. By comparison, the suggestedsolutionyieldsafullypipelinedstatewith the smallest latency. The accelerator outperformed earlierdesignswithacomputationcapabilityof17.11GFLOPSat aclockfrequencyof100MHzandgreat resource usage. a CNN accelerator for the Xilinx ZYNQ 7100 platform that accelerates both normal convolution and depth-wise separable convolution. The heterogeneous mode of ZYNQ allows the accelerators constructed only on human engine mode to accomplish physical network acceleration of various scales under the flexible architecture we suggested. Using the Related contract + SSD network setup as an example, the accelerator computed the global ideal computing parallel ratio of the total infrastructure. To enhance bandwidthandreducethelatencycausedbyon-chip off-chip sending data, the three targets' chip-based buffers employ the streaming data interface and are set to the ponging buffer mode. Regardless of whether it uses layer wise separable convolution or standard compression, the aforementioned method generates a complete pipelined state with significantlyless latencythanthenopipelinedstate.

OktayOzan, et.al[4] presented modern model employing attention gate employed to segment medicinal image. Our method eliminates the necessity for a third-party object localization model.Thesuggestedmethodiscomprehensiveand modular, making it simple to apply to image classification and regression applications like machine translation and natural image analysis. According to experimental results, these suggested AGs are definitely highly useful for tissue/organ detectionandlocalization.Thisisespeciallytruefor small, flexible organs like the pancreas, and comparablebehaviourisexpectedforjobsrequiring global categorization. Learning and inter training programmed can help AGs improve their training behaviour.Toinitializetheattentiveness network, for example,whichwasbeforeU-Netweightscanbeemployed, and gates can be taught appropriately during the fine-tuning step. Similar to this, a significant body of work studying various gating structures exists in machinelearning. For

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improved gradient training algorithm and slightly weaker attention mechanisms, highway networks, for instance, use residual connections surrounding the gate block.

Lizhong Hua, et.al[5] Similar technologies for tracking purposes fire tracking systems with forest masks to monitor forest fires. The often used NDVI-based masks, however, might not be able to tell woods from other types of vegetation. More accurate techniques for extracting forests must be developedandincludedintofiremonitoringsystems in order to effectively anticipate, identify, and monitor forest fires.Threats fromforest wildfires to worker health, wildlife habitat, local economies, as well as global warming are severe and expanding. Forestfireandotherstakeholdersmustkeeptrackof forest fires in a timely and accurate manner. Monitoringtheoccurrenceandprogressionofforest wildfires using spaceborne technology has evolved into a useful and alluring technique. Here, we provide a summary of the guiding principles and to use cases for monitoring forest fires using satellites as well as unmanned aerial vehicles (uavs infrared sensor networks (IRRS). Four categories of FFM- relevantIRRStechniquesarecoveredinthisreview: the techniques of bi-spectral, specified limit, spatially contextual, as well as number of co

Thedetectionandseparationofsmokefrom asinglevisualframewereinvestigatedandtestedby HongdaTian et al. [6]. In specifically, an optimization strategy enabling the isolation of semi and semi components was developed utilising dual over-complete dictionaries and was based on the imaging model. The appropriate sparse values for detectionareconcatenatedtocreateauniquefeature. Also, a method based on thehypothesis that picture mattingisgenuinehasbeendevelopedtotellthetrue smoke from the background from results of automateddetection.Numerousdetectiontrialswere run,andthefindingsshowthatthesuggestedfeature works substantially Better than the current smoke alarm features. This indicates the efficacy of the detecting product. Furthermore, in a grayscale, the proposedapproachmayidentifysmokingfromother challenging elements such as fog/haze, mist, shadow, and so on. The suggested separation approach may successfully predict and separate the real smoke and background components, according to experiments on smoke separation. The fog component's complex modelling, such as kernel- or car modelling, may result in further improvements.

A F Saputra, et.al[7] Work should be done to develop an automated system for monitoring the status of a home that is capable of spotting possible disastersearlyon.Yet,becauseafirecanstartatany timeandspreadquickly,themechanismwillrelease the door to give immediate admission and exit access,ensuringasafeescape.Thecreatedsystemis anticipated to execute an essential disaster reaction action in an effort to prevent any falling casualties. This research focuses on fire detection and house monitoring through the use of a wireless sensor networkwithfour sensors, includingsmoke, carbon monoxide, temperature, andair humiditysensors. If thesystemdeterminesthatthereisa highfirechance, it will unlock the door to the house, activate the alarm, and alert the user. The technology is capable ofsendingnotificationstousersaccuratelybasedon the results of trials and testing. However, a fire probabilityestimationmistakeofdownto0.3%ratio is still possible.

ZhijianYinetal.[8]offerasmokedetection deep normalisation and neural network convolutional neural network method (DNCNN). Our network employs batch normalisation to expedite training and increase smoke detection precision. DNCNNautomaticallyfeatures extracted for smoke detection, in contrast to techniques that rely on manually created features. According to experimental findings, the DNCNN concurrently achieves excellent detection rates and poor false alarmrates. Additionally, we confirmthe value and potency of feature extraction for our DNCNN, particularly in cases where the training dataset are inadequate and unbalanced. The majority of currently used algorithms are built on a framework ofmanuallycreatedfeatures.However,thesecurrent algorithms have a very tough time achieving lower false alarm levels without lowering detection rates theprimarycauseistheextremevariationincolour, texture, and shape of smoke.Smoke also distorts visual scenes, creating unsteady features. The manual creation of discriminant features for fire detection is a time-consuming and expensive process.

A multivariate dynamic texture analysis descriptor of higher cognitive Linear Dynamical SystemswaspresentedbyKosmasD.Poulosetal.[9] (h-LDS). We demonstrated that we can outperform conventional linear dynamical systems in terms of detection rates by using higher order decompositiontothemultidimensionalpicturedata. Additionally, experimental results showed that we mightincreasetheclassificationaccuracybyadding more elements to the multidimensional picture patch.Inthisstudy,weusedthedisplayedfeaturespace of the HOG descriptor as a new picture elementforsmokedetection;however,inthefuture, other descriptors might be used to enhance the data inputintoh-LDSsagainforidentificationofarange of dynamic textures, such as water, fire, steam, etc. Auniquemethodologywasproposedthatallowsthe encodingofvideosubsequencesintoscatterplotsof h-LDSdescriptorgeneratedbythecandidatepicture patch in each subsequence in order to apply multidimensional static wavelet transforms to a video-basedearlywarningsystem.Therobustnessof the methodology was additionally enhanced by combiningthisstudywithspatiotemporalmodelling utilising a particle swarm optimization method.

Wolfgang Krull, et.al[10] Because huge, highly intense forest fires are largely unpredictable andposeverysignificanthazards,emphasismustbe placedonearlysmokedetection.AremoteUAVcan be flown to a region where a fire is suspected to determine if thesourceof smoke is most certainlya fire, reducing false alerts from conventional clip systems,especiallyindifficult-to-accessterrain.Due toits great resilience toannoyances likesteam, fog, particle pollution, and condensing water, the

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UAV has semiconductor gas sensors. As a result, it is feasibletodistinguishamongalarmandfalsealarm. A blimp can serve as a fireguard after putting out forest or wildland flames. Semiconductor gas sensors and an aspirating fire detection system are employed coupled with the blimp's increased payload. This programme allows for the confirmation of alarms in both indoor and outdoor settingswhiledetectingeventhesmallestamountsof smoke and gas. Because of smoke emissions, dust, orfog,a22.3GHzmeasurementdeviceiscapableof detecting fire even when there is inadequate visibility.Microwaveradiationmaypermeatethings such as leaves and thin walls. The existing configuration may be made much smaller by using chip-based elements.

III. Conventional Methods To Detect Forest Fire

Due to the tremendous impact that forest firescausetosocietyandtheenvironment,forestfire identification has been a focus of many experts for thelast10yearsowingtoanincreaseinbackcountry wildfire case reports fromacross the world. Human activity and natural factors are two major causes of forest fires. Torching, chewing and tossing cigarettes, electrical wire flashes, fire hazards use while hunting, outing wildfires, shepherd fires, and stubble consumption are all examples of human-causedwoodsfires.Lightningstrikesgeneratenatural forest fires because of the high environmental temperature, and so forth. Climate factors such as temperature and relative dampness, wind direction, rainfall, striking possibility of lighting; period factors such as Christmas season, month, time; population-based factors such as population thickness, human activities in the timberland, human practices; scene factors such as treetypes, slant, distancefromagriculturallandand man-made factors are the primary factors for wood fires.Despitethefactthatvision-basedsensorsoffer a number of promising properties, they still have issues with changing lighting conditions, complex environments, and reduced camera picture quality due to network constraints. Researchers have thus tried to triumph over these problems. For instance, exploredpixelsindynamiczonesandbothtemporal andspatialwavelet analysis aredone. Theapproach shows potential results, but because it relies on a number of heuristic thresholds, it cannot be used to detect fires in the real world. Examined 3 distinct models for firezones inimages includingspectrum, spatial, and temporal models are examined. They makeanassumptionabout the irregularlyshaped of fireintheir method, however this is not always true becauseobjectscanalsomodifytheirshape.Anovel contour-based fire detection approach for forests basedonwaveletanalysisandFFTisprovided.They thenlookedintotheYCbCrcolour modelaswellas cameupwithnewmethodsforeffectivelyseparating the brightness and luminance components, which resulted to a classification of flame pixels based on rules.Theauthorslookedatadifferentcolourmodel calledYUVandmotiontodetermineifcertainpixels were candidates for fire or not. In addition to the research of colour models, a Bayes classifier and certain low-level attributes of fire zones, such as skewness, colour, roughness, area size, and so on, were used to detect frame-to-frame variations in order to identify fire. Another approach is provided that takes a lookup table into account for the temporalvariation-baseddetectionandconfirmation offirezones. Theheuristic elements ofthis strategy reduce the likelihood of reaching the same results when the input data is changed.

IV. Proposed Methodologies

Fires are one of the world's most pressing issues right now, owing to the planet's present state of globalwarming. Weareallawareof whatflames are and how they may do significant damage to humans, animals, and other kinds of life. Fire damages vary, and these damages are heavily influencedbythesourceofthefire,butregardlessof hownumerous anddiversecauses exist,thedamage may becatastrophic on a hugescale and impossible toestimate,andingeneral,firelossesareclassifiedas loss of life and loss of money. In this study, we created an algorithm that integrates fire colour information with fire edge information. The combinedfindings fromboth methodologies arethen used to generate a parameter that extracts the required data fromthe photos to detect and identify the fire. Based on the deep learning algorithm, we offer a system that detects the presence of fire automatically. Deep learningis a subset of machine learning that is wholly based on neural networks. Since neural networks replicate the human brain, deep learning is likewisea simulation of thehuman mind.Pre-processing moves to remove the noise of imageshasbeenputintopractice;followingfeatures extractionstepsoastoremovethecolorfeaturesand fragmentthefireprovinces.Intheendcategorization of pixels by means of deep learning algorithm through competent mobile alert coordination is established

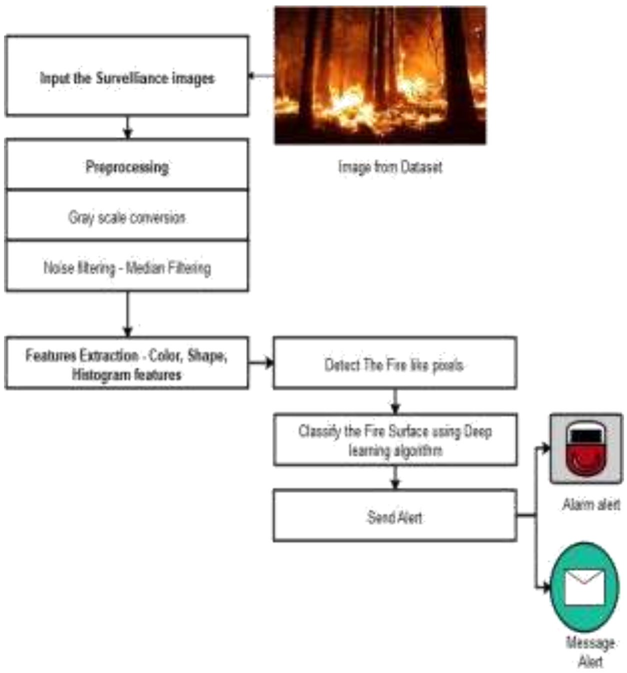

Fig1:Proposed framework

4.1 Image Set Upload

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Early identification of wildfires, which is critical to the protection and security of natural areas, is one of the most significant and challenging challenges confronting the government and forest fire management.Themainfactorreducingthesizeofthe forest is forest fire. This fire detection method also eliminates the need for human processes, aids in monitoring, and helps to safeguard challenging-to-protectlocations.Regardlessoftheweatherortimeof day, the novel technique is utilised to enable the development of systems that provide for detailed monitoring. We can upload images or movies from CCTVfootagetaken in theforest in this section. The image of a forest fire is captured using a satellite sensor,buttherangeoftemporalresolutionaswellas forest area coverage is expanding. Satellite photos were also used to monitor and locate damaged equipment in order to comply with burn zones and comprehend a safe firing variety. The key to distinguishingthisfireandothercomponentsfromthe originalfireistocheckthe consistencyofthecolours. This issue has been fixed, and the recommended approach lowers the error. In addition to detecting fires, it can tell the difference between a fire and a materialfire.Thresholdvalue,matrixvaluedetection, and differential matrix value were the features employedinourproposedsystemoperationtoanalyse theforestfire.Convertinputvideofilesintoframesif it is video, or the input photos can be in any form or size if it is images.

4.2 Median Filtering

Pre-processing refers to procedures in which the input and output pictures are intensity images, which is the most basic level of abstraction. These well-knownimagesareofthesamesortastheoriginal sensor data, with an intensity picture commonly represented by a matrix of picture function values (brightnesses). There are four types of picture pre- processing algorithms based on the size of a pixel neighbourhood used to determine the new pixel brightness. Although spatial image transformations (such as rotation, scaling, and translation) are classified as pre-processing methods because similar techniques are used, the goal of pre is data enhancement that suppresses reluctant distortions or enhances a few image features critical for further processing.Tobeginfurtherprocessing,theusermust choose the necessary lung frame image. Each image is then scaled down to 256*256. After that, apply a medianfiltertocleanoutthenoiseinlungimages.The medianfilter isa linear digitalfilteringalgorithmthat is widely used to remove noise from an image or signal.Thistypeofnoisereductionisapopularpre-processing approach used to improve the results of post-processing (for example, edge detection on an image).Duetoits uses inbothsignalprocessingand digital image processing, median filtering is frequently employed to maintain edges while reducing noise (though see discussion below). The median filter's primary principle is to iteratively replaceeachelementinthesignalwithmedianofits nearby entries. A nonlinear technique for removing noise fromphotographs is median filtering. Since it effectively reduces noise while keeping edges, it is commonly employed. It works especially well to eliminate"salt and pepper" noise. The median filter operates by going pixel-by-pixel through the image and substituting each value with median of its neighbours.Theneighbourhoodpatternis knownas the"window,"anditgoesovertheentireimagepixel bypixel. Afternumericallyrankingallofthepicture pixelsfromthewindow,themedianiscalculatedby putting the pixel under consideration in lieu of the centre(median)pixelvalue.ConvertanRGBimage to grayscale in this module, and use the median filtering process to eliminate image noise.

4.3 Color Features Extraction

Thepurposeof featureextraction is to minimisethe resources required to correctly describe a large amount of data. Oneof the most difficult aspects of interpretingcomplicateddata isthesheer amount of variablesinvolved.Foranalysiswithalargenumber ofvariables,aclassificationapproachthatoverfits a trainingsampleandperformspoorlyonfreshsample generalisationisusuallyrequired.Featureextraction is a method of producing variable combinations to overcome these difficulties while still correctly characterising the data. A surface's tactile or visual characteristicsareitstexture.Inorderforthemtobe utilised for reliable, precise segmentation and classification of objects, texture analysis seeks to identify a unique way to express the underlying features of textures. It does this by describing these characteristicsinsomesimplebutuniqueform.Only a small number of designs support onboard textural feature extraction, despite the fact that texture is crucialfor imageanalysisandpatternidentification. Texture and color features are implemented in this module. Utilizing the Grab-cut approach, HSV colourfeaturesareretrieved,andtexturedatainclude statistical features. The snake model is used in this module to split skin pictures. A snake is a deformable, energy-minimizingsplinethat is drawn towards object outlines by restriction and image forces, as well as internal forces that inhibit deformation.Snakescanbeseenofasaspecificcase of a general method of energy-minimization-based deformablemodel-to-imagematching.Extractthefeatures relating to colour or form from this module. Wecould extractthefirezones fromphotos basedon these attributes.

4.4 Fire Recognition

Thesystem'sclassificationcomesasitslastphase. Afterunderstandingthestructure,thelikelihoodof truepositiveswasseparatelyassessedforeach segment.Utilizingaconvolutionalneuralnetwork method,braindisordersarecategorised.CNNsare feed-forwardneuralnetworksthatincludevarious combinationsofconvolutionlayer,maxpooling layers,andtotallyrelatedlayers.CNNscantake advantageofspatiallylocalisedcorrelationbyrequiring a tight connection pattern between neurons inneighbouringlayers.Maxpoolinglayersand convolutionallayersalternate,simulatingthe individualityofcomplicatedandclearcellsin mammalian visual cortex. A CNN starts with one or morepairsofconvolutionalandmaximumpooling layersandfinisheswithneuralnetworksthatare entirely connected. It is consistently demonstrated that the hierarchy

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of CNNs is the most effective and successfulwaytoassessvisualrepresentations.We are aware that CNNs can perform as well as or even betterthanhumansin variousvisual tasks, and this knowledge motivates us to investigate the feasibility ofusingCNNstoclassifydiseasetraits.Theconvolutionandmax poolinglayers,aswellasthe networks'trainingmethods,varybetweenCNNs. Finally, use a deep learning algorithm to classify the imageregions.andthenincreaseclassification accuracy

4.5 Alert System

Human activity has a significant negative impact on the woods as a whole. Thespreadof forest regions is a result of the population's fast increase and urbanisation. A natural threat to nature and also the involvementoftheatmosphericsystemisaforestfire. The environment affects living things. Satellite imagery also provides a tool for fire monitoring, management, and damage assessment in order to comply with burn zones and grasp a favourable fire range. The term "satellite image" describes the capacity of images from datasets acquired in remote locationstoreceivecertaininformation.SendanAlert message to the authorities in this module when a fire isdetected.Theabilitytojustprovideearlierdetection may be helpful.

4.6 Experimental Results

In this study, a framework for detecting has beenimplementedthroughPythonbasedonreal-time datasets was gathered from KAGGLE web sources.

For analysing the system's performance the following metrics such as correctness, sensitivity, specificity, error rate, and precision are taken into account.

Number of genuine positives - the best possible positive forecast

False positives (FP) are the number of inaccurately predicted positive outcomes.

Number of genuine negatives - perfect forecast of a negative outcome.

Negative result (FN): number of accurate negative predictions minus the number of actual negatives

The percentage of overall flawless forecasts to the completetestdataisknownasaccuracy(ACC). Additionally, it can be written as 1 - ERR. The maximumaccuracyis1.0,andtheminimumaccuracy is 0.0.

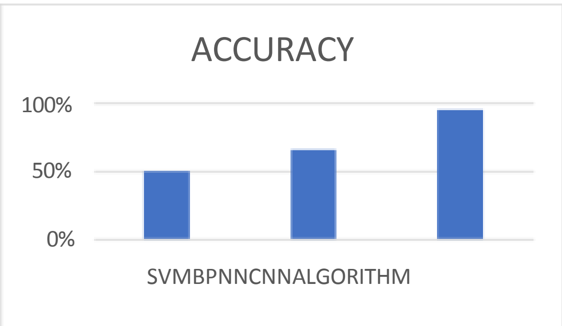

Fig2:Performancechart

The graph above shows that the CNN algorithm has a higher rate of accuracy than the current algorithms.

V. CONCLUSION

The method for recognising images of forest fires usingCNNisprovidedinthisresearch.Itsprimary characteristic is the use of the flame picture in trainingandassessment.Afterthat,theCNNmodel is presented, and a solution to the issue that the conventional pool method in Back propagating neural net (BPNN) may occasionally weaken the picture features is suggested. Based on tests, the impacts of learning algorithm, packet size, and certain other parameters on CNN performance are examined,andtheidealvaluesareestablished.The image feature of the non-flame region within hidden layer is decreased and the characteristic, suchastextureandshapeis enhancedasaresultof theextractionofthecandidateflamearea basedon colourfeature. Adaptivepoolingisusedtopreventpicture information loss, and it increases the rate of fire recognition in fire areas compared to original images without segmentation. It has been demonstratedthatthesuggestedmethodisworkable and has a high recognition rate.

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Betel Leaf Disease Classification Using Data Augmentation and Convolutional Neural Network

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***Abstract*— Identification of betel leaf disease at an early stageandaccuratelywillincreasetheproductivityofthecropandav oidfinanciallossforthefarmers.Multifariousmachinelearningalg orithmsandmultipledeeplearning-basedmodelshave been developed to improve image classification accuracy.This paper primarily discusses data collection of real field betelleafimagedatasetsundervariousclimateconditions.Then,ac quiringmoretrainingimagedatainplantleafdiseaseclassification and identification is highly challenging and time-consuming. Soimage augmentation techniques, such as imageflipping,shearing,cropping,androtationtechniques,areaug mented on betel leaf image datasets. Finally, the augmentedimages were trained using a simple convolutional neural networkandVGG16.TheaccuracyofVGG16modelwithdataaug mentation performed well, and the accuracy increased up to86.67%.**

Keywords*— *Betel leaf, Deep Learning, convolutional neuralnetwork,Dataaugmentation, VGG16.

I. Introduction

Plant diseases directly impact agriculture and can change thesocial, economic, and natural balance. Plant leaves disease canoccur due to various reasons such as lack of water, excesswater, excess heat, climate change, nematodes, pollution, soilquality, etc., The symptoms of plant leaf disease are mostlyvisiblelikechangesinleafcolor,shape,growthsize,andpa ttern based on the symptom, the category of disease can bedetermined such as viral, bacterial, or fungal disease. In thispaper, the image of plant diseases is classified based on pestattack, leaf burn, and healthy leaf. Deep learning in agricultureis a current and trending technique with high performance inthe agriculture domain. One of the most significant challengesis enhancing the model performance on data it has previouslyseen(trainingdata)vs.dataithasneverseenbeforeism easured(testingdata).Poorinferencesmodelshavetooverfit the training set. Plotting the training and validationaccuracy at each epoch during training is one technique toidentify overfitting. This may be accomplished very well withdataaugmentation.Dataaugmentationisaprocedurethatinc reases the size of any dataset that is already accessible sothat it can also be used with deep learning models. This iscrucial work in boosting entire performance. The dataset canbe increased by the method and input into a learning model training through changing parameters like anepoch, batch, and optimizer.

II. Literature Review

In the study to combat the problem of over-fitting, the authorexperiments with the test and train data ratio and found thattrainingononly20% ofthedataofauthenticimages andtesting on the remaining 80% of the image data, the model stillattains a final result with an accuracy of 98.21%for GoogleNeuralNetwork[1].Fortheobjectiveofdetectingplantdi seases, a model based on transfer learning and ResNet50 isrecommendedsinceitperformsbetter,strengthensfeatureprop agation,andhashigheraccuracywhencomparedtoMCNN in terms of training time [2].CNN does a good job ofprocessing visual information. There are different layers, suchas "input,""hidden," and "output,"in thearchitecture of aneural network. A group of hidden layers, including Convo,pooling, and fully connected layers with the normalizing layer,are synchronized and complete the task of securing the dataand images spatially [3]. The author made a comparative studyof the models and the result of the existing work and soybeandiseases using AlexNet and GoogleNett[14]. In this paper,the author built small neural networks of various depths fromfundamentalstepsonthebasisofaminimalnumberoftrainin gsamplesandimprovedfourcutting-edgemodelssuchasVGG16, ResNet50, and VGG19. According to comparativework and results of these networks, pre-trained deep modelscan be fine-tuned to increase significantly performance withfewerdata.TheoptimizedVGG16modelperformsbest,wit hatest set accuracy of 90.4%, proving that deep learning is anovel and updated technology for completely automated plantdiseasedeductionandseverityclassificationbasedonthesy mptomsfromtheactualleafimages[10].Theproposedmethod in this paper using MobileNet-V2on the field andpublic dataset performed with good results. It can be deployedto mobile devices to automatically observe and analyze theoutcome from a wide range of plant disease classifications [4].The author uses the ANN algorithm to detect plant diseaseusing python tool based on the observation of symptoms of thedisease class and the field images with the real background aretrained and choose a machine learning algorithm to predict thediseaseandtherecommendationofthesolution.Based onfeature extraction parameters, the algorithm predicts the croppest ordisease[7].Inthispaper,modelsuchas Inception,Alexnet, Resnet, and Densenet enhanced the training process results. Consequently, a trained machine thatcandiagnoseplant disease quickly and accurately has the potential to boostthe agricultural sector. If the technology is widely used, it willstop plant illnesses before they spread and relieve farmers andspecialistsfromhavingtoobserveplantsintheirareas.Althou ghthemodelperformedexceptionallywellinitsevaluation of the validation set, its high computational demandprevents it from being ready for usage in actual applicationsjust yet. The goal of future studies should be to reduce

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thenumberofparameterswhileretainingaccuracy.Whencompared to the outcome of the previous method, the stackingmethod'saccuracyrateof87%representsamajorimprovement[5]. The suggested augmentation technique performs changesintheimagesofhealthyandunhealthyleavesandmakesuseofattentional mechanisms to produce images that reflect moreobvious disease textures[15]. We did an experiment to see ifthisdataaugmentationstrategymightfurtherenhancetheperformanceofaclassificationalgorithmfortheearlydiagnosisofplants.Throughtheseadvancements,weproduceda more convincing diseased leaf image compared to existingmethods ResNet-18, MobileNet-v2, and EfficientNet were themodels that were tested; they were all adjusted using weightsthathadalreadybeenlearned.Accordingtoexperimental findings,whentheEfficientNetandthesuggesteddataaugmentation strategy were combined, the greatest F1 scorewasobtainedforallthreeplantleaves[6].Themodelpresentedusing CNN performs well on detection and classification withgood results using simple disease leaves and healthy leaves[11]. In this paper author used AlexNet and VGG16 models toidentify tomato disease and compare the result of the modelwhichismorethan90%ofaccuracy[12].

III. Methodology

A. *Data collection*

Thecollectionofthebetelleafdiseasedatasetischallenging. A dataset of 1089 images of betel leaf used forthis study is collected directly from the betel vine farm. Thereal field images were taken using a camera and smartphones.Thedatasetobtainedisclassifiedunderthreeclasses:leafburn,pestattack,andhealthyleaf.

(a) (b) (c)

Fig.1.(a)LeafBurn (b)Pestattack,and (c)Healthy Leaf

B. *Preprocessingofthedataset*

There were many issues while collecting the dataset,such as poor lighting, shadow, background, etc. The image ispreprocessed in two stages such as the actual stage and themodel training set. In the essential step, the image is resized to400x400x3.Inthemodeltrainingstage,dataaugmentation,suchasrotation,shear,flip,fill,etc.,isappliedtothedatausingKerasdeeplearning libraryinpython.

C. *Dataaugmentation*

Dataaugmentationisamethodforintentionallyboostingthe proportionsoftrainingdatasets. Theproportionofthetrainingandtestingdatasetissplitinto80:20. Forimposinga deep learning model with good classification accuracy, alarge image of samples is essential[8]. It is accurate to say thatthe resurgence of artificial intelligence is solely a result of theavailability of powerful processing resources (GPUs) and asizableamountofinformationonline.Scaling,turning,shifting, androtationaresomestandardaugmentationtechniques[6]. Understanding these functions that can affectthe efficacy of the model is sound. Shear is one of the manyaugmentationmethodsaccessible[13].ThekerasImageDataGenerator class was used to increase data, and thebestresultwasobtainedbysettingthebelowparameters.

a) She arrange=0.2
b) Horizontal flip=True
c) rotation range=40
d) zoom range=0.2
e) fill mode=nearest
f) width shif trange= 0.2
g) height shif trange=0.2

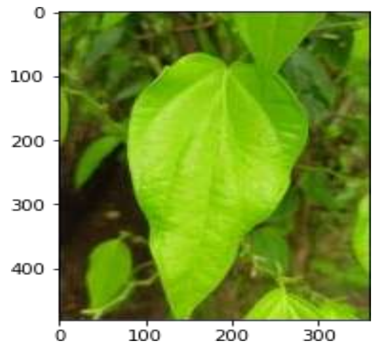

Fig.2.Sampleofhealthybetelleafimageafteraugmentation

D. *Experiment*

To study the impact of the augmentation method, wepropose a simple convolutional neural network (CNN) andVGG16 model for betel leaf disease classification. We use ourdatasetcontainingthreeclassesofleafimages:Pestattack,leafburn,andhealthybetelleaves.Itissplitintotwoparts:trainingand testing.OurmodelwasimplementedusingtheKerastensorflow

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Fig.3.Flowofworkofproposedmodel

E. CNNModel

TheConvolutionneuralnetworkusedtoextractcharacteristics from a massive and varied dataset of images,CNN is the deep neural architecture class that has received themost adoption. The images will be transformed into arrays ofmatrices after the image augmentation process is finished, andthen they will be trained. A deep CNN design has multiplelayersandtypicallybeginsfromsingleordoubleconvolutionallayers to extract multiple attributes from the pictures given asinput data. These layers produce a feature map, which is thengiven to further layers for feature analysis. It concludes withmultiplepoolingandactivationlayersfollowing.Thesummaryofthemodelismentionedin Fig.4.

Layer (type)	Output Shape	Param #
conv2d 4 (Conv2D)	(None, 148, 148, 64)	1792
max pooling2d 4(MaxPooling2D)	(None, 74, 74, 64)	0
conv2d 5 (Conv2D)	(None, 72, 72, 64)	36928
max pooling2d 5 (MaxPooling 2D)	(None, 36, 36, 64)	0
conv2d 6 (Conv2D)	(None, 34, 34, 128)	73856
max pooling2d 6 (MaxPooling 2D)	(None, 17, 17, 128)	0
conv2d 7 (Conv2D)	(None, 15, 15, 128)	147584
max pooling2d 7(MaxPooling2D)	(None, 7, 7, 128)	0
flatten 1 (Flatten)	(None, 6272)	0
dropout 1 (Dropout)	(None, 6272)	0
dense 2 (Dense)	(None, 512)	3211776
dense 3 (Dense)	(None, 3)	1539

Total params: 34,73,475
Trainable params: 34,73,475
Non-trainable params: 0

Fig.4.ModelsummaryofCNNwithdataaugmentation

F. VGG16MODEL

VGG16pretrainedmodelusedforimprovingtheclassification accuracy of the tiny image data. The result hasgoodperformancewhencomparedwiththeearliermodeldiscussedabove.InVGG16[9].VGG16hasimprovedtheperformance accuracy above 80 on betel leaf images for 3diseaseclassesandthehyperparameterswiththelearningrate0. 001 through the epochs of25because of the small dataset..The convolution block with the layer of CONV2D and thesame block can flip ofany 2layers of the similar dimensionfollowed by maxpooling. The total parameters are 14,714,688andasummaryofthemodelisdisplayedinFig.5.

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 224, 224, 3)]	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36928
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	295168
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1180160
block4_conv2 (Conv2D)	(None, 28, 28, 512)	2359808
block4_conv3 (Conv2D)	(None, 28, 28, 512)	2359808
block4_pool (MaxPooling2D)	(None, 14, 14, 512)	0
block5_conv1 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv2 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv3 (Conv2D)	(None, 14, 14, 512)	2359808
block5_pool (MaxPooling2D)	(None, 7, 7, 512)	0

Total params: 14,714,688
Trainable params: 14,714,688
Non-trainable params: 0

Fig.5.ModelsummaryofVGG16 withdataaugmentation

IV. RESULTS AND DISCUSSIONS

The classification accuracy of the real field betal leaf datasetandthelossofthemodelontheepochusingdataaugmentationarecomparedinthebelowtable.After25epochsoftrainingthe model,theaccuracytestingoftheproposed approach achieves 85.67% and the loss is 0.23, Themodel with VGG16 improves on its performance as displayedin Table I.

TABLEI. COMPARISONOFCNNANDVGG16WITHDATAAUGMENTATION

Datasets	Models	Depths	Loss	Accuracy
Ourreal-fielddataset	CNNwithoutDA	10	0.36	76.42
	CNNwithDA	10	2.52	82.36
	VGG16with DA	25	0.23	86.67

Finally based on the above experimental result VGG16 withdataaugmentationachievedbetterperformanceontheclassification ofthe diseaseinthe betel leaf dataset.

Figures 6 and 7 show the result of the classification of diseaseclassfortrainingandtestaccuracyagainstthenumberofepochs. With the data augmentations we offer in our work, toincrease the quantity of data collectionand it is discoveredthatthisimprovementisratherconsiderableusing VGG16.

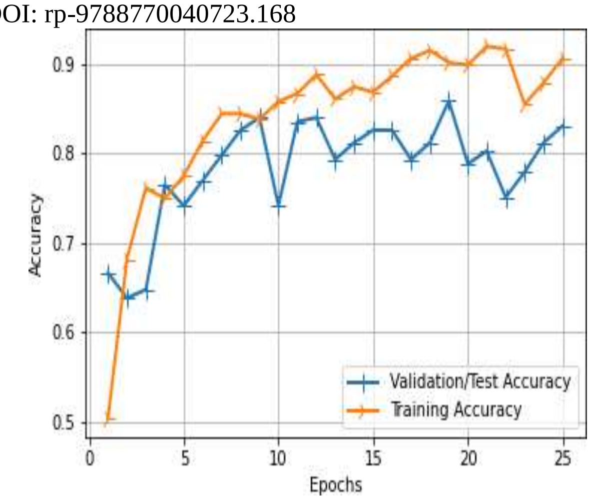

Fig.6.PlotofaccuracyandepochsofVGG16Model

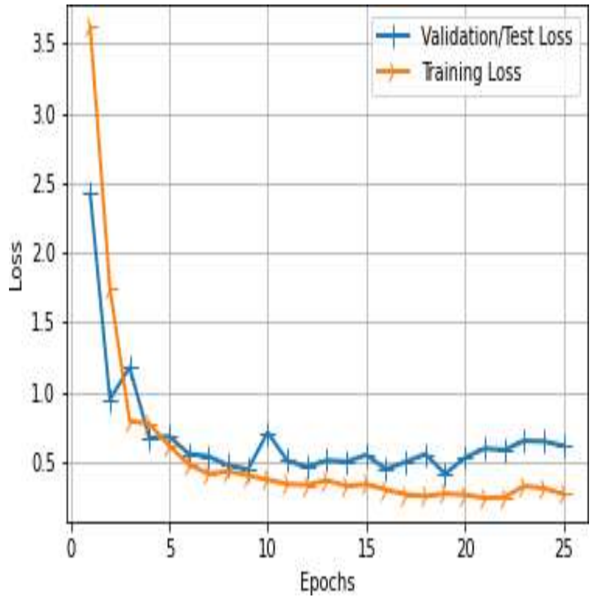

Fig.7.PlotoflossandepochsofVGG16Model

V. Conclusion

Inthispaper,therealfieldimagesofbetelleafareaugmented by creating the output images with 3 classes ofdisease to multiply the image data using a different augmentedtechnique such as brightness, shear, rotation, etc., Eventually,compared the result with augmented images implemented totrainthesimpleconvolutionalneuralnetworkmodelandVGG 16model.Inourexperiment,theaccuracyofmodelVGG16 with data augmentation improves the accuracy rate inthe betel leaf dataset. Our future direction of work can beproceed on exploring how the model performs on increasingthe disease class, enhance the quantity ofdataset to improvetheaccuracyfurtherontherealfieldimagedataset.

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Library Automation System Using RFID Tags

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***Abstract*—The design and implementation of a self-service library management system utilizing radio frequency identification are presented in this study (RFID). Radio frequency technology and micro processor technology are combined in RFID. It is intended to take the role of barcode sin library applications in order to enable self-check-in and check-out as well as many other applications, as well as to manage library resources morequickly and efficiently. The use case diagram, which this article pioneers, explains the system's over all purpose and its component parts and enables intelligent management from book reception to book circulation.**

I. Introduction

Newtechnologyisbeingadoptedbylibrarieseverywhereto enhance customer service and speed up the check-in/check-outandinventoryprocedures.Onemethodforcreatingamore time-effective and safe library management system isradiofrequencyidentification(RFID).Theradiofrequencyand microchip-based technology known as RFID (radio frequencyidentification, sorting, and detection) can be used to track,identify, sort, and detect library holdings. It can be used tocreateaself-servicesystemthatenablesuserstoindependently check out and check in things, allowing libraries toinventory and monitor resources more effectively.The initialrequestforRFIDtechnologycamefromBritishmilitaryforcesduring World War Two, who used a primitive translation tocompare friendly and opposing aircraft.In the old age 1973,For welcome inactive state and write tag, Mario W. Carullawasallowedapatent.Asaresultofthisfinding,RFIDtags accompanying entrenched circuits and thought are nowsecondhandinarangeofcivilianuses.RFIDscienceisimmediately used in supply chain administration, athenaeums,andmanydifferentfields.RFIDtechnologyhasstartedtoreinstate the barcoding method in book repositories. In 1991,RFIDwasfirstusedinalibraryattheUniversityofGuelphin Canada. However, allure use in athenaeums has happenedrestricted, with just 3000 athenaeums utilising the electronicsin 2012. When distinguished from barcodes, RFID electronicsprovides a secure and effective system administration means.Thereisnownosystemworkingthattracksundergraduate habit or streamlines the check-in and check-out procedure.Furthermore,skilledisnostockorder,andasaconsequencenocurrent inventory record. This restricts scholars from utilizingthemoneycausefindingnoveltyandwinningrulingclassexaminedontimeisdisputing.Thereserveadministrationmethod proposed in this paper solves these concerns and constitutes a structure namely two together, efficient for graduatesand adept for the area. Students can use bureaucracy to lookfor belongings, check their chance, and check ruling class outwithoutdifficulty.

II. Related Work Introduction

RFID Technology Using RFID (Radio Frequency Identification)isatypeofwirelesscommunicationthatoperatesinthe high-frequency region of electromagnetic frequencies byusing electromagnetic or electrostatic coupling. The workingprinciple behind RFID structure is as follows: the reader sendsan electromagnetic wave energy at a specific frequency to theelectronic tag, the electronic tag is in the RF signal detectionarea,theinducedcurrentreceivesenergy,thelabelissentthe necessary information by the reader through a wirelesschannel, the reader has a receiver to receive the signal sent bythe electronic tag, and the reader reads the information. Thelabel is made up of a chip and a coupling piece, each of whichis encrypted with certain electronic data.The research entailedintegratingtheRFIDtechnologyandcreatingaGraphicalUserInterface (GUI) at the host PC. The project's objective is todevelop an automated library shelf management system thatwillassistlibrariansinmoreefficientlymaintainingtheshelvesand finding any misplaced books on the shelves. MicrosoftVisual Basic.Net was used to construct the interface for thesystem. The exact data for the book must be entered into thedatabase using the GUI. After that, an RFID tag with a ShelfID was created and set up. This code was then utilised by thesystem to scan the selected shelf for any lost books. RFIDtechnology and an online concept are combined to develop aninternet-based application for managing libraries. The entireprocedurethattakesplacewithinthelibraryutilisestheRFIDreader Motorola 10 MC9090. This suitable reader can readtags with any type of frequency, including low, high, and ultrahigh. Each user and each book receives an RFID Tag 107 witha unique EPC (Electronic Product Code) that is produced inconnectionwiththedatabaseforfurtherinformation.[3]

III. System Specifications

A. Interface Requirements

- Front-end: HTML, CSS, JavaScript.
- Back-end: Python, Google Cloud, google sheets, drive API which helped us access sheets using python

DOI: rp-9788770040723.169

B. SoftwareRequirements

- VSCode-IDEwhereeverythingwasperformed.
- Python-UsedasaScriptingLanguage.
- Anaconda - Aims to simplify package management anddeployment.
- gspread-ToopensthecurrentsheetorcreatesanewGoogle Sheet file, read/write the records, in addition, todowithoutadoubtformatting.
- GoogleSheets-Thatactaslocaldatabasestorage.
- ArduinoIDE-Forconnectinghardwarecomponentswiththesoftwarepart.

C. HardwareRequirements

RFID Tags, RFID Reader, NodeMCU, Jumper Wire, RFIDRC522,Breadboard.

D. NonFunctionalRequirements

While the update occurs in real-time, the Database must becorrectly connected to the project. ensuring that the databasequeries are written correctly to avoid breaking any limitationswhile updating. The system must function flawlessly with alargenumberofbooksandusers.Answerstoinformationrequestsmustdisplayonthescreenwithin5seconds.Toavoidillegal access, distinct users must use unique login credentialsthataresafe(givenbyourtags).Theprogrammewill makeuseofasafedatabase.Apartfortheirpersonalinformation anda small amount of additional information, normal users canonly view material; they cannot update it. The system willhave many user categories, and each user will have accessrestrictions.[6]

IV. Library Management System Based On RFID

A. Features of Our System

1) *Security:* Library login: To prevent the students from using the model in an abusive manner, we only restrict the editing access to Library personnel only.

2) *Privacy:* All members can access and read data but only Librarians can have access to make changes. Non-members cannot access the data thus keeping the data of members secure.

B.Architecture

1) *Microservices Architecture:* Microservices are an architectural style that structures the application as a collection ofservices.[7]

- Pros:

  ImprovedfaultisolationEaseofunderstandingSmalleran dfasterdeployments

- Cons:

  CommunicationbetweenservicesiscomplexDebugging problemscanbeharder

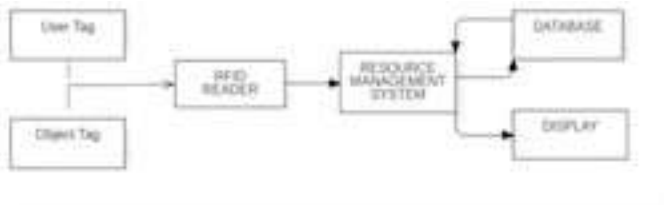

Fig.1.OverallSystemArchitecture

The block diagram of proposed Library using RFID is shown in Figure 2

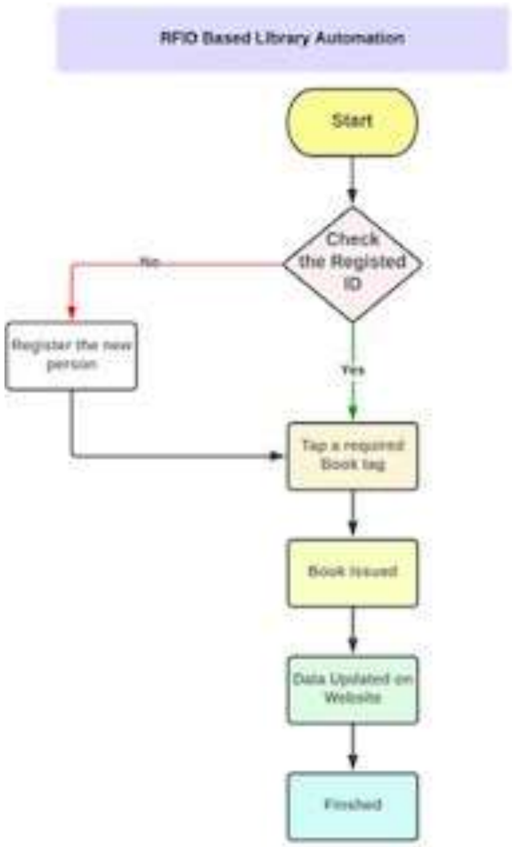

Fig.2.Workingdiagram

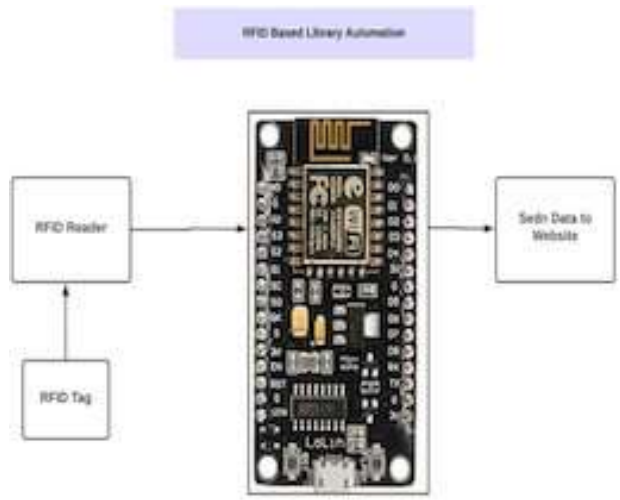

Fig.3.RFIDArchitecture

DOI: rp-9788770040723.169

EachPersonwillbeprovidedwithanRFIDchipwhichwill contain the person’s information. Each book will alsohave an RFID attached to it which will contain the book’sinformation.Tobeginwith,theusermustberegisteredand thisisdonewiththehelpofalibrarian.Datafromboththeperson’s RFIDtagandfromthebookwouldbescannedby the RFID reader, which sends/receives with the microcontroller.The main computer receives the output data from themicrocontroller once it has processed the data obtained and isready to store it in a database. All the changes get reflected inthe master database which is the google sheet in this case.[5]Each member and book will have unique rfid card.The systemwillbeabletoreadinformationfromtags.[4]Theprocessisasfollows.

- Useridisprovidedafterregistration.
- passwordvalidationoccurs
- systemchecksfortheauthorizationlevel
- Registernewuserfeaturecanbeperformedbythelibrarian
- Search book feature is also available wherein a particularbook can be searched and if the book isn’t available, allthebooksaredisplayed.
- Finefeatureaddsfineonperdaysystemwhichstartsafter10days.

C. AbbreviationsandAcronyms

- RFID:-RadioFrequencyIdentification
- IDE:-Integrateddevelopmentenvironment.
- COMPort:-CommunicationPort.
- HTML:-HypertextMarkupLanguage.
- NodeMCU:-NodeMicro-ControllerUnit.

D. ResultsandDiscussions

Multipleliteraturepapersweretakenintoconsiderationwhichpavedthewayforthisproject.

- After the implementation we could see book details beingavailable,studentsbeingabletoregisterusingrfidtags.
- Email-Verificationwassenttostudentsregisteringforthefirsttime.
- Student/Teacherwasabletoviewallthedetailsregardingthe booksavailable.
- Adminportalhadalltheaccessibilityalongsidewithregistrationofnewusers.
- RFIDplayedanimportantroleasitwasanecessitytoscanthe usertagandthenthebooktagtoregister.
- Adminwasabletosendmailregardingthefine,duedate.
- Highsecurity,betterperformancewasensuredwiththetagsusage.
- Ithelpedincreatinganautomatedandasmartlibrarysystem.

TEST SCENARIO	OUTCOME	SOLUTION(If applicable)
User Exist	Enters library portal	N.A
User Doesn't Exist	Shows "user not found"	• Admin has to register • User gets rfid tag
Book Available	• visible during search • can checkout	N.A
Book not Available	• during search all available books are displayed	• Admin can add the book if it gets available using rfid tag
Fine functionality 1)working	After 10 days each day will add up 5 rupees as penalty	N.A
Fine functionality 2)Not working	After 10 days each day will add up 5 rupees as penalty	• Admin can access the google sheet where the issuing date is stored and calculate fine.
Checkout (RFID working)	checking out is just one click on the book id	N.A
CheckOut (RFID not working)	can't checkout by using one-click option	• Admin can delete the record from the google sheet which automatically updates the portal
Sending Notification	Admin can send a mail to users by just clicking on their respective mail id.	• email is stored in the sheet
If website crashes	Shows Error	• we have a backup using google clouds and google sheet

Fig.4.ResultTable

E. Conclusion

High security performance, more privacy, improved per-formance, ease of use, and intelligent administration are allbenefitsofRFIDtechnology.

- Traditional library management issues including manuallabour, extensive time commitment, security flaws, andothersareresolved.
- RFID readers and RFID tags should be of good quality,toyieldbestperformance.
- The modern and intelligent library is represented by themanagement system for library administration that wasbuiltwithRFID.
- The only focus of this study was to develop an RFID-based library management system, including the generalform and the hardware and software environment. Thesystemadministrationwasdesignedwiththegoalofincreasingthelibrary’soveralleffectiveness.

F. Futurework

- Providingmisplacementofbooksinformation.
- Anti-Theftfunctionalitycouldbeaddedwhichwouldbe of a very lesser cost when compared to the currentmechanismthatisbeingused.

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An Intelligent Authentication System to Enhance the Security of Network Banking

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***Abstract*—The security of single-level authentication as a graphical password entirely depends on confidentiality and strength. Even if graphical passwords are the fine stproxy approach to subdue the weak point soft he text-based password, single-level authentication is not enough to secure our dataain the devices. Hence, Facet Pass a novelmulti-level graphical authentication technique is proposed with an arrangement of 44 of 16 facets with four different colours. This approach in corporates by the process of facet touch, swap and fading an imation (manual) with deep convolutional neural network architecture for facial recognition mechanisms (automatic) which protect from exhaustive attack, technology-based recording, dictionary, and smudge attack. Visual complexity score of Facet Pass measured using Euclidean physical length. The success probability of the brute force attack is calculated based on permutation and combination. An investigation is conducted systematically on the challenges of FacetPass password in both security and usability perspectives with 113 participants of various age groups, and the people are from different educational status. The outcome of this work outperforms well with the usability and security of existing VAP code, CD-GPs, and EvoPass.**

***Index Terms*—facet, swap, fade, facial, graphical password**

I. INTRODUCTION

Many kinds of research are emerging with much authentication technique, but there is no replacement for text passwords with other alternatives to authenticate the user for the past ten years.However,password-basedauthenticationhasitsinherent security vulnerabilities, amongst which password disclosure is a significant security problem that was raised by Long et al. [1]. Text-based passwords leak through numerous attacks, including Ransomware, key loggers, secret cameras, and web accesstiminganalysis.Aspassword-basedauthorizationhasbeen generally used for service industries, online communities and some other useful services, the implications of password leakage might be catastrophic [2]. The Modified ASCII Value (MAV) is created to reinforce the wedges' encryption algorithm to protect a text-based password depending on the ASCII values [3]. Instead of typing text with a keyboard, Luis A. Leiva and Francisco Alvaro developed a captcha; the user retypes a computational statement and resolves it on a touchscreen [4]. Hence, protecting text password is another major complication in thesedays.

The graphical password entry method is sensitive to shoulder surfing threats in which a neighbouring antagonist capturesthe password while entering it on a user interface without anyadvanced recording equipment, such as a secret camera. In thiswork consists, two mechanisms (i) Touch and Swap image-based graphical password and (ii) Facial Recognition authentication. This practice enhances the resistance to shoulder surfing and attacks by brute-force attacks without modifying thepassword frequently like text-based password practices. Usersof FacetPass are required to touch and swap on the fadinganimated facets within the time when it goes invisible. If theuser fails to complete it within the single fading animationtime (standard evolving time and user configured evolvingtime) another two chances are given. The user should waitfor another 30 seconds if they miss all the three opportunities.Facial Recognition is the detection of the legitimate user by thecaptured facial images using the front camera automaticallywith the assistance of an algorithm for a deep neural network.The remaining part of the paper is organized as mentionedbelow, in section 2 the related study is explained briefly withsubtitle of recall and recognition based GPs. Then in section 3 the flow of the proposed FacetPass – a graphical password work is depicted in detail with FacetPass Registration, Facet Touch and Swap and Time-Evolving attribute. Further we analyzed about experimental result of security and usability insection4.Finallyweconcludethepaperinsection5.

II. RELATEDWORKS

A. Recall and Recognition based GPs

Nowadays, graphical passwords are other alternatives for text passwords to authenticate the user. Authentication or identity management is the tool used to allow users to validate their identity with web services. In recent decades, graphical password techniques have gained more publicity as an excel- lent alternative to the text-based password system suggested by Angeli A. D et al. [5]. For those who have a poor vision, this strategy is uncomfortable because their excessive images appear on a small screen.Azad S et al. in 2017 introduced vibration and pattern code in a 2X2 grid [6], Kim Dand Dunphy P [7] proposed Multi-touch 3X3 grid nine circular targets arranged in a system, Tiny-Lock model is proposed by Kwon T and Na s in 2014 [8]. Because of the long-term memory (LTM) issues, Wixted [9] specified

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text-based passwords are difficult for users to remember dynamic and unordered passwords over time to handle certain alphanumeric characters. With the enhancement of conventional graphical passwords by merging current input styles such as clicking, choosing the right and drawing, Meng [10] created a Click- Draw oriented graphical password authentication structure (CD-GPs).

A graphical password was developed by Blonder [11] to enable users to click on multiple prescribed regions over an image for identity verification. With the help of attributes and passwords, Jianghong Wei et al. [12] established a two-factor user authentication. Wiedenbeck et al. [13] introduced the authentication scheme of a pass point that allows people to click anywhere on an image to construct the passwords. Chiasson et al. [14] created a cued click points (CCP) structure that allows users to click on a series of images at one position per image.

All graphical based authentication systems may be narrowly divided into four major categories (i) recognition-based model(ii) purely recall-based model (iii) cued-recall-based model and (iv) hybrid model. This proposed FacetPass is designed based on the combination of biometric-based authentication and cued-recall of knowledge-based authentication. Majority of graphical passwords are focused on recognition of given images such as Pass faces and classification and recognition of user-uploaded images which are described by Hayashi E et al.[15].

III. PROPOSEDMETHODOLOGY

A. FacetPass: A Graphical Password -Overview

Facet means one of the tiny flat surfaces cut on a whole object, and these facets of an entire image utilized for touch and swap. In this paper, Facet touch-swap with facial recognition evolves as a new conglomerate graphical passwordfor increased usability and robustness. FacetPass incorporates recall and biometric techniques to provide all mobile devices, apps and websites with a distinct type of password. It offers several resilience measures against different attacks. Here legitimate users are required to touch and swap of the facet in the grid along with facial identification of the user for the authentication purpose.

The facial recognition task is done by the device with the set of user's face images with multiple angles to train the min the registration.Fig.1 reveals the details of this proposed scheme. This paper connects the technical contribution of facet touch, swap and fading animation with facial recognition to solve an existing problem in a graphical password. To avoid spoofing attack and to strengthen the security of a graphical password, users facial feature recognition is added in thi swork.

FacetPass Registration The subsequent actions are necessary for the password registration process. The user should touch on the facets that he wishes to swap in the first step. Even though the user swaps two facets, the initial facet alone gets the touches. In the second step, the user is swapping facets during the fading out animation. In the next step user's face is captured automatically by the device in the facet's background at the same time. The same steps follow at the authentication process as well.

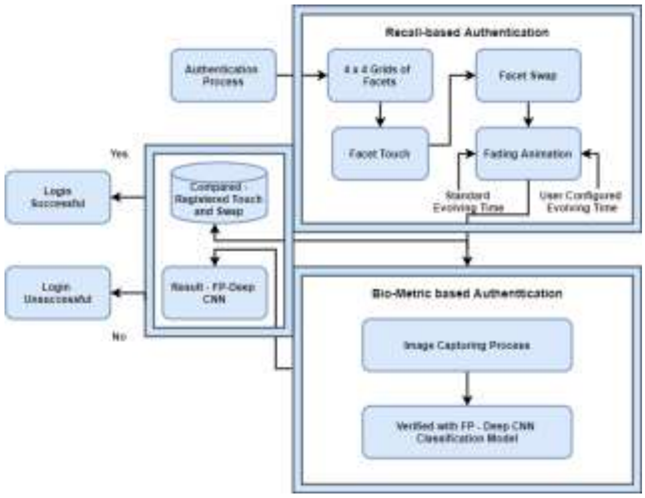

Fig. 1. Authentication process of FacetPass

B. Facet Touch andSwap

Within this proposed report, we developed an innovative method of user authentication via a grid of 16 facets in four different colors. For creating the password, the user needs to do several consecutive touching and swapping of facets on the grid. Fig.2 shows a graphical password scheme, a grid with arrangements of 16 facets and various instances of image capturing process by the legitimate user and other users. In the first level of authentication, the user needs to do a single touch or multiple touches with facet swapping, and in the second level, the system automatically capturing the image of the person who swaps the facets to validate the person is permissible or not. While login, if users sequence of touches, swaps and facial features match with the registered data, the access is acquired by the user, otherwise the access is denied. Hence, the user should provide the registered touch and swap sequence with facial features to get authentication.

Fig. 2. Avarious instances of FacetPass: i) Initial FacetPass without user image. ii)Swap instance with fading animation. iii) Visible swapped Facets with capturedimage.iv)Aninstanceofvisiblenon-swappedFacetswithcapturedimage.

C. Time-Evolvingattribute

FacetPass is using fading animation to have a more shoulder surfing resilient model by reducing the possibilities of identifying the target facets. This facet animation starts losing its original colour, at one particular point of time it becomes invisible (hidden). The user can change the progress time of facets fading and hidden duration on their

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own for strengthening shoulder surfing resilient. In pure standard evolving time, fading and hidden time are fixed that cannot be altered by the user. In pure user config evolving time, user set both fading and hidden time. In a combination of standard and user config evolving time, either user can change the fading time or invisible time as given in Eqn 1, 2, 3 and 4. We conducted an experiment with a different age group between 21 and 70, and Table 1 shows the observedresult.

$$\phi_s (1) = £_{sf} + £_{si} \quad (1)$$

$$\phi_u (2) = £_{uf} + £_{ui} \quad (2)$$

$$\phi_{su} (3) = £_{sf} + £_{ui} \quad (3)$$

$$\phi_{us} (4) = £_{uf} + £_{si} \quad (4)$$

1) Φs(1purestandardevolvingtime
2) Φu(2pureuserconfigevolvingtime
3) Φsu (3 , φus (4 combination of standard and user config evolvingtime.
4) $£_{sf}$- standard fadingtime.
5) $£_{si}$- standard hiddentime.
6) $£_{uf}$- user config fadingtime.
7) $£_{ui}$- user config hidden time.

TABLE I: THE PERCENTAGE OF USERS FOR EVOLVING TIME SETTING

Age	$\phi_s(1)$	$\phi_u(2)$	$\phi_{su}(3)$	$\phi_{us}(4)$	Total user
21 - 30	1%	91%	5%	3%	99%
31 - 40	11%	78%	6%	5%	89%
41 - 50	23%	57%	12%	8%	77%
51 - 60	34%	33%	22%	11%	66%
61 - 70	55%	21%	15%	9%	45%

IV. EXPERIMENT ANALYSIS - USABILITY AND SECURITY

Hackersusevarioustechniquestocrackpasswords.Inthissection, the most common prevailing cracking schemes are tested with FacetPass and described below. Table 2 indicates the evaluation of the space for password of proposed and related schemes while it is applied in mobile devices. It shows that intruders must dissipate more duration to find the correct count of touch and swaps. In Evopass, Selection of pass images from their private image increases the difficulty of mounting dictionary attacks [16]. In Facetpass, user's face capturedbyacameraofthedeviceautomaticallythathelpsto improve the ability to withstand against a dictionary attack. As a result of this experiment, we came to know most of the users selected 3-6 facets for their registration which increases the difficulty to crack the passwords with limited possibilities.

A. Touch and swap operations

The participants are classified according to their age and designation. Table 3 and 4 shows information about the number of touch and swap based on their age and category. The younger participants used a large number of tapsand swappingcomparewiththeagedpeople.Theparticipant'sages from 21 to 30 and 31 to 40 used 4-9, 3-9 touches and 5-9, 3-7 swapsrespectively.Ontheotherhand,elderparticipantsuse3-4 taps and 3-5 swapping. In the designation category, students use 4-9 touches 6-9 swapping, and the senior people use 3-6 and 3-5 touches and swaps respectively. When compare with students, elder participants are not comfortable with touchand swapping in smart devices. The result of this experiment concludes that the number of taps and swaps usage varies for different age group anddesignation.

TABLEII EVALUATION OF PASSWORD SPACE

No of Touches	[illegible]	Password space for Facet Touch	Password space for Facet Touch with Swap	VAP Code	Android PL
1	10^1	16	256	40	9
2	10^2	256	65536	[illegible]	[illegible]
3	10^3	4096	16777216	[illegible]	[illegible]
4	10^4	65536	4294967296	[illegible]	1624
5	10^5	1048576	[illegible]	[illegible]	[illegible]
6	10^6	16777216	[illegible]	[illegible]	[illegible]
7	10^7	268435456	[illegible]	[illegible]	[illegible]
8	10^8	4294967296	[illegible]	[illegible]	140704
9	10^9	[illegible]	[illegible]	[illegible]	140704

TABLE III: TOUCH AND SWAP OPERATIONS BASED ON AGE.

Age	No. of Touches	No. of Swaps
21 - 30	4 - 9	5 – 9
31 - 40	3 - 9	3 – 7
41 - 50	3 - 6	3 – 6
51 - 60	3 - 4	3 – 5
61 - 70	3 - 4	2 – 3

TABLE IV: TOUCH AND SWAP OPERATIONS BASED ON DESIGNATION

Designation	No. of Touches	No. of Swaps
Students	4 - 9	6 – 9
Teachers	4 - 8	5 – 8
Officers	5 - 7	5 – 9
Home Makers	3 - 8	5 – 7
Senior People	3 – 6	3 – 5

V. CONCLUSION

FacetPass, a novel graphical password to increase authentication for a user to gain access to a device, application or website in smart devices is proposed. To raise the password space and avoid attacks such as Brute-force assault, guessing, shoulder surfing, smudge and dictionary attacks, it incorporates recall and biometric-based GP. This proposed system is easy to use and recall than existing graphical password systems, and the user can handle facets for touch and swap manipulation effortlessly. A lab experiment was conducted with 113 participants to calculate time consumption and usability of FacetPass in diverse angle. Thus the result shows that this FacetPass is secured and user - friendly. In future, we are interested to construct this FacetPass working against spoofing attack with the standard algorithm.

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A Study of Time Domain Features of EEG Signal Analysis

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***Abstract*—Electroencephalography is a non-invasive technique used to monitor brain activity and make a variety of neurological problems diagnoses. The electrical activity of the brain is measured using an EEG instrument, which converts chemical variations in the brain into voltage. With either the intracranial EEG method or the Scalp EEG approach, several electrodes are implanted at the right location on the brain to measure EEG signals. Analysis of electroencephalograms, or EEGs, has grown to be crucial for identifying many human disorders. The most crucial and straightforward step in processing EEG readings is using temporal frequency analysis to make a potential diagnosis. EEG signals are the important data for any type of analysis of brain activity. In this study, we first analysis the EEG signal characteristics that have been used in the literature for a variety of activities, then we concentrate on looking at EEG feature applications, and finally we talk about the potential and unresolved issues with EEG feature extraction. Everyone should assess the wide variety of EEG signal properties and their effects on BCI interfaces in order to improve the accuracy of different brain activity detection in the future.**

I. INTRODUCTION

The mass of nerve tissue that is known as the brain may be found in the frontal region of an organism. This mass is comprised of three different parts: the cerebrum, the cerebellum, and the brainstem[1]. The **human brain** is responsible for integrating sensory information and coordinating the activities of the muscles. The human brain is comprised of millions of neurons, each of which plays an important role in the process of controlling how the body reacts to both internal and external motor and sensory impulses. These neurons will serve as units for the flow of information between the body and the brain.

The signals that are produced by an electroencephalogram (EEG) are a representation of the electrical activity that occurs in the brain. Electroencephalography is a software program that may objectively link particular electroencephalographic (EEG) patterns to the activities of the central nervous system (CNS)[2], in addition to dysfunctions and disorders. The electroencephalogram (EEG) is a valuable modality that allows for the collection of brain signals related to a variety of states directly from the surface of the scalp.

EEG waves are the single most important source of information that can be used for successful detection. A feature is a distinguishing characteristic, a measurable quantity, and a functional element that is derived from a component of a pattern[14]. In the strictest sense, a feature is derived from a pattern piece. EEG signals are the singleimportant source of information that can be utilized in the detecting process.

It has always been difficult to identify cross-subject emotions based on brain imaging data, such as EEG, due to the poor generalizability of features across different people. This is especially true of electroencephalogram (EEG) data. As a result, it is essential to conduct in-depth research on the degree to which different EEG metrics may differentiate between the emotional information of different people.

A distinguishing characteristic, a measurable quantity, and a functional element produced from a section of a pattern are all examples of features[3]. The purpose of extracted features is to minimize the amount of significant signal-embedded information that is lost. In addition to this, they cut down on the number of resources that are needed to accurately describe a large amount of data. This is necessary in order to remove the possibility of requiring information to be compressed, to reduce the cost of processing information, and to simplify the implementation process. In recent years, several methods, including wavelet transforms (WT), time frequency distributions (TFD), Eigenvector methods (EM), Fast Fourier Transforms (FFT) and auto regressive methods (ARM), have gained popularity in the process of extracting features from electroencephalogram (EEG) recordings. The analysis of EEG signals has been the subject of a significant number of studies. EEG signals make it feasible to perform an examination of the brain activity of a person in real time.

In the past, determining an acceptable EEG characteristic was an essential aspect of the investigation of this phenomenon. This research presents a mathematical approach to the problem of extracting features from EEG data. It focuses specifically on the extraction of features from EEG signals.

II. TIME DOMAIN FEATURES

EEG is a time series signal which is a function of amplitude of electrical activities of the neurons and time [19] . EEG signals can be analyzed in various domains like Time, Frequency and time-frequency. Time domain features are extracted from the EEG signal by time domain analysis. The time domain features can be extracted from raw or preprocessed EEG signals. This time domain features extracted from EEG signal is highly relevant to describe the mental states of the person under study. Time domain feature are quick at easy to extract from the EEG signals. Time domain analysis consist lower computational complexity compared with frequency and time-frequency domain analysis. Time domain features are extensively used in medical and engineering research, since these features do not require any complicated transformation and

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easy to implement. time domain features are widely used because of the classification effectiveness in low noise situation. The major drawback of the time domain features is , it assumes the EEG signal as a stationary signal. But in reality EEG signals are non-stationary signals (varying with time) .

Simplest time domain features are mean, median, variance, standard deviation, kurtosis, skewness which are statistical in nature. The linear time domain features are mean amplitude, peak amplitude, RMS amplitude , peak to peak amplitude , wave form duration and zero crossing rate. The non-linear time domain features are fractal dimension, correlation dimension, sample entropy, approximate entropy, Hurst exponent, Lyapunov exponent , fuzzy entropy etc., In this paper we are discussing briefly some of the popular time domain features

Various Features

2.1.Mean

Mean is the average of the values of all data points of the signal[4].

$$\mu = \frac{1}{N}\left[\sum_{i=1}^{N} x_i\right] \tag{1}$$

2.2Median

Median is the middle value of a signal data when all the values are arranged in ascending or descending order.

Median

$$= \begin{cases} x\left(\frac{n+1}{2}\right), if\ n\ is\ odd \\ \frac{x\left(\frac{n}{2}\right)+x\left(\frac{n}{2}+1\right)}{2}, if\ n\ is\ even \end{cases} \tag{2}$$

2.3 Variance

Variance is a measure of dispersion of the signal data.It is the average of the squared differences from the mean.

$$\sigma^2 = \frac{1}{N}\left[\sum_{i=1}^{N} (x_i - \mu)^2\right] \tag{3}$$

2.4 Standard deviation

The standard deviation is a measure of how the data is spread out from the mean value and is computed as the square root of the variance. A high standard deviation indicates that the signal data are widely dispersed from its mean value[5], while a low standard deviation indicates that the signal data are nearer to the mean value

$$\sigma = \sqrt{\frac{1}{N}\left[\sum_{i=1}^{N} (x_i - \mu)^2\right]} \tag{4}$$

2.5 Skewness

Skewness is a statistical feature which measure the degree of asymmetry of a distribution. positively skewed or right skewed distribution has a long right tail which indicating an excess of low values. Negatively skewed or left skewed distribution has a long-left tail which indicating an excess of high values.

$$SKew(x_i) = \sqrt{\frac{\frac{1}{N}\left[\sum_{i=1}^{N} (x_i - \mu)^3\right]}{(\sigma^3)}} \tag{5}$$

2.6 Kurtosis

Kurtosis describes the shape of the distribution of the signal data[7][11]. Datasets with high kurtosis tend to have a high peak (more values) near the mean, decline rapidly, and have heavy tails. Datasets with low kurtosis tend to have a low peak or flat top (less values) near the mean, decline gradually and have light tails

$$kurt(x_i) = \frac{N\left[\sum_{i=1}^{N} (x_i - \mu)^4\right]}{\left[\sum_{i=1}^{N} (x_i - \mu)^2\right]^2} \tag{6}$$

2.7Zero-crossing rateZCR

The zero crossing rate (ZCR) measures how many times the waveform crosses the zero axis[8][10]. In other words, it is the number of times the signal changes value, from positive to negative and vice versa. It can be obtained counting how many times both following conditions are fulfilled for a signal X(t):

$$\{X(t)<0 \text{ and } X(t+1)>0\} \text{ or } \{X(t)<0 \text{ and } X(t+1)>0\},$$
$$|X(t)-X(t+1)| \geq \epsilon, \tag{7}$$

whereϵ is a threshold to avoid miscounting zero crossing due to noise.ZCR can be interpreted as a measure of the noisiness of a signal

2.8Peak amplitude

The peak amplitude of a sinusoidal waveform is the maximum positive or negative deviation of a waveform from its zero reference level.

Peak Amplitude = $max[X_n]$ (8)

2.9Peak to peak amplitude

Peak to peak amplitude is the difference between maximum value (positive amplitude) and minimum value (negative amplitude) of the signal x(n).

DOI: rp-9788770040723.171

Peakto peak = $max[X_n] - min[X_n]$ (9)

Hjorth parameters

2.10Activity

Activity gives a measure of the squared standard deviation of the amplitude of the signal. [9][15[[16][17].High value activity indicates higher frequency components presence and low value activity indicates the presence of lower frequency components.

$$\text{Activity} = variance[x(t)] \quad (6)$$

2.11 Mobility

Mobility is calculated as the ratio of the standard deviation of the slope of the signal to the standard deviation of the signal, expressed per unit of time.

$$\text{Mobility} = \sqrt{\frac{variance[x^1(t)]}{variance[x(t)]}} = \sqrt{\frac{variance\left(\frac{dx_i}{d_t}\right)}{variance x_i}} \quad (7)$$

2.12 Complexity

The measure of complexity of a signal is determined by its similarity to a pure sine wave. This measure is calculated as the number of standard slopes generated during the average time it takes to generate one standard amplitude.

$$\text{Complexity} = \frac{mobility[x^1(t)]}{mobility[x(t)]} = \frac{mobility\left(\frac{dx}{dt}\right)}{mobility(x)} \quad (8)$$

2.13 K-complex

K-complex is a distinct pattern in an EEG signal, consisting of a sharp negative waveform immediately followed by a positive component , with a total span of at least 0.5 seconds[6].

2.14 Energy E

Energy is the total of the squared magnitudes of all the components of a signal [12][13].

$$\text{Energy} = \sum_{i=1}^{N} |x_i|^2 \quad (9)$$

III. Materials and Methods

3.1Subjects and Data Acquisition

The EEG data is acquired from the 10 healthy yoga practitioners from different age groups.The group of yoga practitioners , who practiced yoga daily for 3 years (Surya namaskar,Asanas:Tadasana, vrikshasana,paschimottanasana,ustrasana, Mudras : chin mudra,Pranayama: Nadisuddhi)were compared with a group with no experience in yoga. Group of yoga practioner (4 F, 6 M) between 22 to 47 years old and group of non practioner (5 F, 5 M) between 21 to 52 years old participated as the study subjects. The subjects are 6 students, 5 unemployed, 9 in technical, professional and white collar occupations. The subjects had no history of any type of mental disorder and none of them take any medical treatment. The experimental procedure was clearly explained to the subjects.

3.2 EEG Recordings

EEG recordings were taken from the subjects using a 18channel RMS with a sampling frequency of of 256 Hz in aa electrically shielded room. The AC frequency of 50 Hz. Was eliminated by a line filter.The arrangement of active electrode on the scalp (FP2-F4, F4 -C4 ,C4 -P4, P4 -O2, FP1-F3, F3 -C3, C3 -P3,P3 -O1 , FP2-F8 , F8 -T4 , T4 -T6 , T6 -O2 , FP1-F7 , F7 -T3 , T3 -T5 , T5 -O1) according to the International 10-20 system of electrode placement, referenced to the linked ear lobe electrodes. The recorded duration for each subject in both groups is 2 minutes. During the entire duration of these experiments.subjects were entirely relaxed in an awake state with eye closed throughout the entire duration of this experiment. The subjects were seated in normal position. The real time signals obtained from the subjects are non-stationary, random and non-linear. The data acquired from these methods were further pre-processed for removing noise.

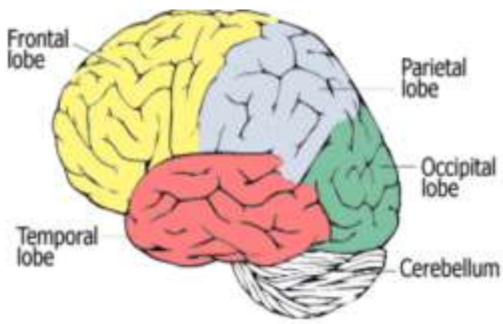

Fig. 1 Brain lobes

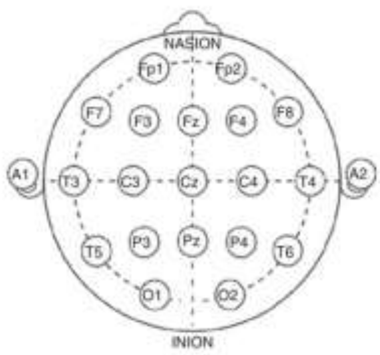

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Fig 2. International 10–20 system for standardized EEG electrode locations on the head.(C = central, P = parietal, T = temporal, F = frontal, Fp = frontal polar, O = occipital, A = mastoids) [18]

IV. RESULT

The EEG data waves has been analyzed in both yoga and non yoga conditions and the result shown below.

TABLE 1 TIME DOMAIN FEATURES OF CONTROL GROUP (INDIVIDUAL SUBJECTS)

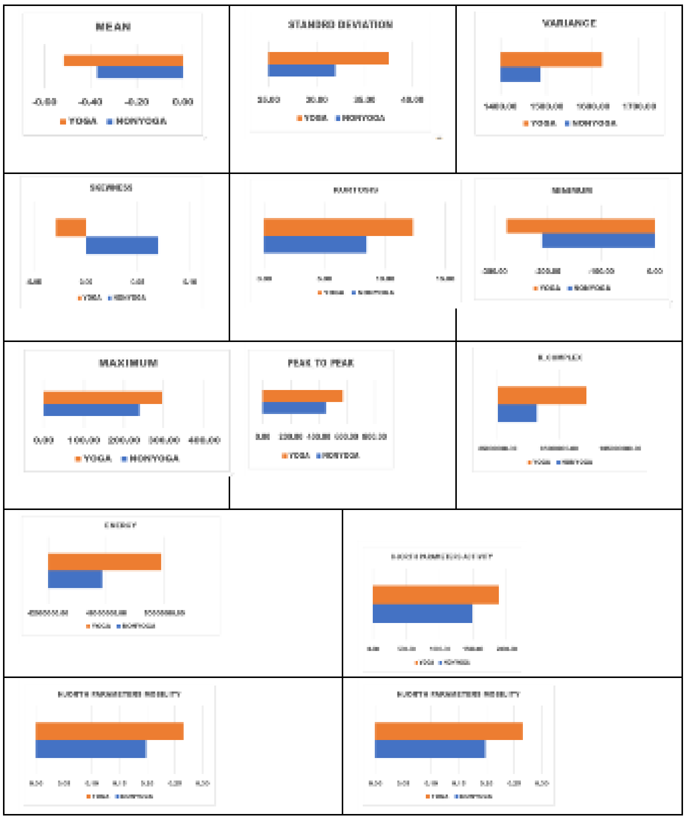
Features	s1	s2	s3	s4	s5	s6	s7	s8	s9	Sampls10
Mean	-0.49	-0.49	-0.57	-0.02	0.50	-0.58	-0.47	-0.52	-0.48	-0.59
Standard deviation	38.45	38.14	20.25	50.33	-40.47	56.33	27.56	45.77	43.24	40.09
variance	1526.74	1484.10	482.61	3003.57	-2239.84	3980.46	821.99	2130.40	2036.13	1648.73
skewness	-0.01	-0.03	0.00	0.79	0.75	-0.30	-0.56	0.19	-0.01	-0.13
kurtosis	0.29	1.95	5.26	39.32	-15.15	26.56	7.55	4.40	13.54	1.00
Minimum	-177.19	-201.88	-135.69	-421.13	296.88	-474.75	-215.75	-242.75	-303.31	-234.38
Maximum	170.88	188.38	149.13	692.00	-207.56	465.88	166.38	266.63	285.81	204.94
peak_to_peak	348.06	390.25	284.81	1113.13	-504.44	940.63	382.13	509.38	589.13	439.31
k_complex	93810842.03	91190573.79	29662346.21	184553884.7	-137623847	244575979	50509641	130900063	125107061	101309554
Energy	46909356.88	45599073.5	14836719.31	92284063.06	-68816038.5	122296249	25258244	65454320.5	62557153.3	50660631.4
Hjorth parameters Activity	1526.74	1484.10	482.61	3003.57	-2239.84	3980.46	821.99	2130.40	2036.13	1648.73
Hjorth parameters Mobility	0.33	0.33	0.17	0.11	-0.15	0.11	0.23	0.33	0.21	0.31
Hjorth parameters Complexity	1.67	1.72	3.25	6.50	-5.56	8.03	2.75	1.88	2.67	2.00

TABLE 4.2TIME DOMAIN FEATURES OF STUDY GROUP(INDIVIDUAL SUBJECTS)

Features	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Mean	-0.45	-0.71	-0.52	-0.44	-0.52	-0.52	-0.49	-0.51	-0.50	-0.52
Standard deviation	51.98	45.84	34.52	28.78	37.09	37.09	24.51	22.53	44.79	48.46
variance	3068.30	2268.38	1263.23	871.48	1549.97	1549.97	602.91	513.81	2099.46	2414.36
skewness	-0.27	-0.34	-0.08	0.33	0.04	0.04	0.03	0.02	-0.03	-0.02
kurtosis	14.20	8.84	2.94	4.73	44.52	44.52	1.42	1.46	0.52	0.22
Minimum	-516.38	-378.88	-184.31	-146.88	-430.69	-430.69	-138.31	-120.75	-208.69	-210.00
Maximum	472.25	353.44	183.69	192.56	552.06	552.06	143.25	126.63	198.25	196.81
peak_to_peak	988.63	732.31	368.00	339.44	982.75	982.75	281.56	247.38	406.94	406.81
k_complex	1.89E+08	1.39E+08	77621459	53550099	95238972	95238972	37050226	31577431	1.29E+08	1.48E+08
Energy	94264764	69701882	38815134	26778254	47623757	47623757	18528899	15793088	64503096	74177689
Hjorth parameters Activity	3068.30	2268.38	1263.23	871.48	4221.80	1549.97	602.91	513.81	2099.46	2414.36
Hjorth parameters Mobility	0.27	0.27	0.23	0.24	0.19	0.20	0.30	0.29	0.31	0.34
Hjorth parameters Complexity	2.41	2.24	1.85	1.88	3.48	3.14	2.04	2.08	1.76	1.70

TABLE4.3 AVERAGE FEATURES OF STUDY GROUP AND CONTROL GROUP

Features	Nonyoga Average	Meditation
Mean	-0.37	-0.52
Standard deviation	31.97	37.56
variance	1487.49	1620.19
skewness	0.07	-0.03
kurtosis	8.47	12.34
Minimum	-210.99	-276.56
Maximum	238.24	297.10
peak_to_peak	449.24	573.66
k_complex	91399609.73	99553185.55
Energy	45703977.21	49781031.90
HjorthparametersActivity	1487.49	1887.37
Hjorth parameters Mobility	0.20	0.27
Hjorth parameters Complexity	2.49	2.26



IV. CONCLUSION

Using a wide range of approaches, the purpose of this study was to evaluate the time domain properties of the EEG signal. They are consequently helpful in identifying whether an EEG signal possesses random oscillations, periodicity, or synchronicity. By analysing the EEG signals' temporal domain features, researchers are able to identify irregularities in the signals themselves.

An examination of the time domain aspects of the EEGs of non yoga and yoga practitioners is planned for a later stage of this research project. It is possible to identify the important aspects that have been influenced by yoga and meditation.

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Examining the Progress of Decentralized Photovoltaic Systems In Rural Ghana: A Comprehensive Review

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***Abstract*—This review paper examines the development of distributed Photo Voltaic (PV) systems for rural communities in Ghana. The paper provides a review of the present situation of distributed PV systems in Ghana, highlighting the benefits and challenges associated with their implementation. The review draws on several key studies, which analyse the policy landscape, the potential for co-benefits, the barriers to development, and the economic feasibility of distributed PV systems. The findings indicate that while distributed PV systems offer numerous benefits, including increased access to electricity and reduce carbon emissions, there are several significant barriers to their development, including financial constraints, limited private sector involvement, and unfavourable policies. The review concludes by suggesting that further research is needed to explore innovative financing mechanisms, effective policy frameworks, and improved public-private partnerships, which could accelerate the deployment of distributed PV systems and improve energy access for rural communities in Ghana.**

Keywords—PV system, Rural electrification, Energy policy, Ghana, Distributed system

I. INTRODUCTION

The SDG #7, which aims to provide access to energy to everyone [1-4]gives distributed renewable energy technologies a fresh push as a means of supplying energy to millions of households by 2030, notably in Sub-Saharan Africa (SSA)[5]. One of the exceedingly significant drivers for a country's socioeconomic and industrial development is the ability to obtain and use electricity. However, in many developing countries, a significant percentage of the population does not have the means to obtain or use electricity, and conventional grid-based solutions are often not feasible because of the expensive and challenging nature of expanding the electricity distribution system to isolated locations [6]. It is believed that most of the places in the world lacking electricity are in underdeveloped areas [7]. 572 million of the 733 million people around the world who lack the ability to obtain or use electricity are Africa's population [2][8]. Ghana has taken notable steps forward in enhancing the availability of electricity to its population, with an overall access rate of 86% [2], which is noted as few of the top electricity systems in the Sub-Saharan African region. But there is a notable variation between urban electrification access rate at 94.7% and rural access rate at 74% [8-9].

The lack of electricity is generally due to a variety of factors such as lack of power, challenging terrain, and inadequate transportation. Technologies that generate energy from renewable sources, such as PV systems offer a promising solution to this problem. Over the past few years, there has been a growing concern in establishing decentralized PV systems for rural areas in Ghana [10-11].

By bridging the access gap and offering lower prices and faster connection times than grid additions, stand-alone solar systems offer a possible approach to electrifying rural communities.In general, a mini grid consists of three components: a power generation system, a distribution network that delivers electricity to remote users, and an energy storage system designed to store excess power. Mini grids can operate autonomously and deliver power, especially to those with limited access to them in remote or rural regions, using one or more generation sources (hybrid systems) [12]. It covers solar residential systems, solar microgrids and solar mini grids. But the use of technologies like these as primary means of electricity in many nations are rare, and adoption of them, particularly in rural areas, is moving slowly [13].

Within this article, the development of distributed PV systems in remote areas of Ghana will be reviewed in this study along with its present research status. To commence, a concise outline of the energy landscape in Ghana, with a focus on the issues encountered by rural communities in obtaining access to electricity will be presented.Ghana's energy sector is dominated by hydropower and thermal power generation, with the country currently facing challenges of insufficient power supply, high cost of electricity, and unreliable electricity access, particularly in rural areas[14].

Literature will then be reviewed on the socio-economic, political, and environmental factors that influence the acceptance and use of PV systems in remote regions. Specifically, the study also will examine the impact of government policies and regulatory frameworks on the success of PV projects in rural communities. Several studies have highlighted the importance of favorable government legislations and regulations to facilitate the implementation of RE technologies, including PV systems [15]. The barriers

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to distributed PV systems for rural communities will also be discussed.

II. Literature Review

A. Electricity situation in Ghana

The growth of Ghana's total electricity generation capacity, including distributed generation, from 2,170 MW to 5,481 MW in 2011 and 2021 respectively, representing a yearly increase of 9.7%. Additionally, the dependable capacity exhibited an annual growth rate of around 9.8%, surging from 1,945 MW to 4,975 MW in 2011 and 2021 respectively.

Figure 1 displays a significant 14.3% yearly growth rate in the installed thermal generation capacity, which soared from 990 MW in 2011 to 3,753 MW in 2021.In contrast, the installed capacity of grid-integrated renewable sources rose significantly, surging from 23 MW to approximately 144 MW in 2016 and 2021 [16].

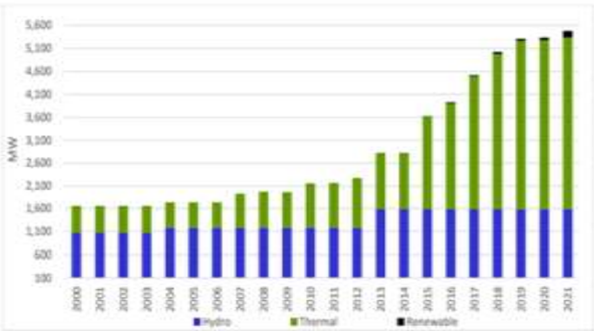

Fig. 1. Installed Generating Capacity (2000-2021) [16]

B. Solar Energy Resource Potentials and their Relevance for distributed PV system development

Ghana possesses significant solar resources and has the potential for the generation of solar power through either grid-connected or independent (off-grid) systems. Ghana's solar energy potential is estimated to be 35 exajoules (EJ), this solar potential in Ghana 100 times greater than the country's current electricity demand. According to the Ghanaian government, the average amount of solar radiation received per day ranges from 4.4 to 5.6 kWh/m2/day monthly[18]. Kumasi, which is situated in the foggy semideciduous woodland zone, experiences sunrise at 5.3 hours, while the sun sets at 7.7 hoursin Watts, Ghana [18-19], situated in the dry Savannah territory. The Upper West, part of Volta, Northern and Bono Ahafo regions receive monthly average radiation of 4-6.5KWh/m2/day, except for rain from July to September and hot, dry Harmattan winds from November to February. The areas of Brong-Ahafo, Ashanti, Western, Eastern, and some parts of Central and Volta regions in Ghana experience a mean monthly solar radiation ranging from 3.1 to 5.8 kWh/m2/day. Conversely, areas such as Greater Accra, the coastal regions of Volta, and other parts of Central Ghana receive a monthly average solar radiation of 4.0 to 6.0 kWh/m2/day, as indicated by [19], [20]. The solar resource map of Ghana is depicted in Figure 2. Given that the daily solar radiation within the country ranges from 4.0 to 6.0 kWh/m2 annually, generating solar PV power presents an encouraging opportunity to enhance the nation's electricity supply security, as noted by [21]. However, developing this resource for PV systems has received little attention until recently.

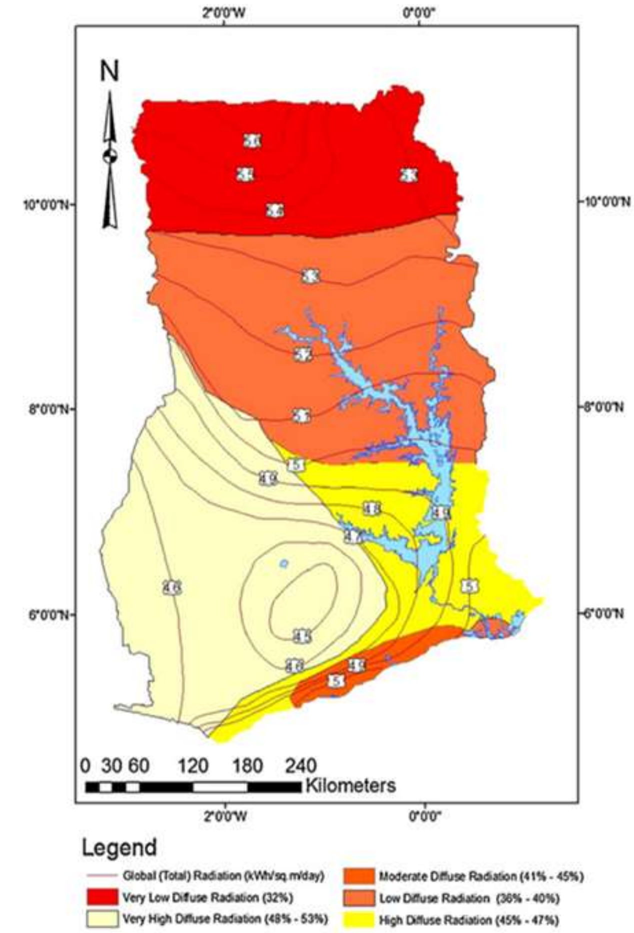

Fig. 2. Solar Resource Potential map of Ghana [18], [20], [30]

Given that Ghana experiences an annual daily solar radiation range of 4.0 to 6.0 kWh/m2, it can be inferred that solar PV power generation holds great potential as viable option to enhance the country's energy security [18], [20-21], [23] . However, this potential has been underutilized until recently, with little attention paid to developing PV systems. Therefore, various stakeholders, particularly the government, are now making efforts to leverage this resource by promoting decentralized solar PV projects such as standalone PV to facilitate the supply of electricity.

C. Ghana's Solar Power Development Status

A target of incorporating 10% RE into the nation's energy mix is stated in Ghana's RE Act and RE Master Plan. The RE Act indicated that hydroelectric dams with a capacity of 100MW or less are considered as renewable energy sources. However, presently, Ghana has not established any wind energy power plants or other renewable energy facilities. Therefore, at present, the country's renewable energy mix solely relies on solar energy[24].

Solar photovoltaic (PV) energy is produced using Photovoltaic (PV) systems that utilize solar energy are connected to either on-grid or off-grid systems. The Volta River Authority (VRA) commissioned the initial installation of a 2.5 MW solar PV system on a large scale in Ghana in May 2013 located at Navrongo in the Upper East region

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Ghana[25]. Additionally, there are several other solar power installations in Ghana, including a capacity of 40 MW plant located at Onyandze, in the Gomoa East District of the Central Region of Ghana.The plant is co-owned by BXC Company and Meinergy Technology, with each enterprise being accountable for 20 MW of the plant's capacity. In addition to those, there is a 6.5 MW capacity PV system situated in Lawra, a 13 MW capacity PV system located in Kaleo all in the Upper West region of Ghana, a 51 MW capacity plant positioned in Bui, and a 30.9 MW distributed generation plant that is built and operated by state-owned electricity companies[17]. Numerous projects are currently underway throughout Ghana. One example is the second phase of the Kaleo project, with an expectation to generate 14 MW of power when completed. Additionally, plans are underway to construct an additional 200 MW capacity solar plant in the northern part of the nation. Another significant project is the ongoing 59 MW solar component of the Pwalugu Hydro-Solar hybrid plant, which is set to be finalized in 2025. [17], [25], [26]. In addition, more than 89 communities in Ghana have received thousands of small-scale solar systems with a total capacity of 793 kW. These systems have been used for a variety of things, like refrigerators for vaccines, street lighting, radios, television sets, and remote mobile phone charging systems. In addition, there are several installed PV systems for residential and commercial purposes either for main electricity or backup application in Ghana not assessed and documented[27], [28].

TABLE I. ADVANTAGES AND DISADVANTAGES OF PV SYSTEM [30]

S.No.	Advantages	Disadvantages
1	The source of fuel is abundant, easily available and virtually limitless	The cost of installation is expensive
2	The cost of operation is minimal (no need for fuel)	Solar panels do not produce electricity at night, and areas with high cloud cover may have inconsistent and uncertain power generation during the day
3	It can be quickly installed at almost any location where it is needed	The absence of cost-effective and efficient energy and storage
4	The environmental impact is minimal because there is less air pollution and fewer greenhouse gases emitted	Photovoltaic cells rely on scarce elements that could face rising costs and limited availability
5	The cost of operation and upkeep is comparatively low	They need a considerable amount of space to generate only small quantities of energy

D. Classification of PV nano/micro/mini-grids

The International Renewable Energy Agency (IRENA) has classified grid systems into five categories based on their maximum capacity, capability, and complexity. These categories include stand-alone systems, pico-grids, nano-grids, micro-grids, and mini-grids. Each of these categories serves a different purpose, ranging from providing power to a single device to meeting local demand with local production. The classification considers various factors such as voltage, pricing, and interconnectivity. In this way, the IRENA classification provides a useful framework for understanding the different types of grid systems and their capabilities in meeting energy demands in various contexts [31].

Stand-alone systems have a maximum capacity of 0.1 kW and are generally used to provide power to a single structure or a single device.Pico-grids have a maximum capacity of 1 kW and are controlled by a single entity responsible for overseeing their operation.Nano-grids have a maximum capacity of 5 kW and are designed to provide power at fixed or specific voltages. Grid operators negotiate with each other to buy or sell electricity and these systems can be interconnected or stand-alone. Direct current (DC) systems are favoured in these types of grids.Micro-grids have a maximum capacity of 100 kW and are designed to balance local energy consumption and production. They offer a range of voltages and different levels of quality and reliability options. These systems incorporate generation and can offer varying pricing.Mini grids have a maximum capacity of 100,000 kW and are designed to meet local demand with local production. Transmission is limited to 11 kV and customer connections are available.

E. Ghana's Renewable Energy Development Policies

Ghana’s renewable energy policy is closely linked to its policy goals, as set out in its renewable energy frameworks, as well as its policy institutions and policy instruments. The first step in achieving meaningful progress in renewable energy adoption is to align with these policy areas, as stated by [32][33].

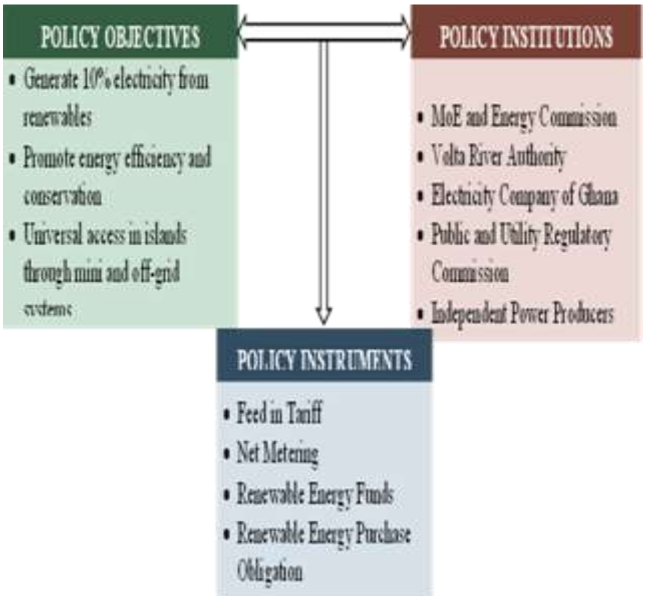

Fig. 3. The procedure of formulating renewable energy policies in Ghana [34]

F. The Renewable Energy Act

The Energy Policy paper of 2011 resulted in the enactment of a law (Act 832) that authorized Ghana's energy

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sector institutions to develop plans for integrating renewable energy sources into the country's electricity generation mix. It sought to achieve a target of generating a minimum of 10% of Ghana's electricity from RE sources by 2030, which marked a turning point in the energy mix of Ghana. Eventually, the Act has been amended to clarify its provisions and encourage greater private-sector involvement in achieving the 2030 target. As part of these amendments was the adoption of the 2019 Renewable Energy Master Plan (REMP), and the Renewable Energy Authority (REA) was established, with the Bui Power Authority (BPA) currently responsible for carrying out its duties under the Ministry of Energy's amendment to the Bui Power Act in 2020. The BPA now has the legal ability to carry out state-sponsored renewable energy projects, pursue its independent RE initiatives, and investigate clean alternative energy. All these actions will help the government's efforts to include RE sources into the energy mix.

G. Renewable Energy Master Plan

Even though the RE Act was passed to encourage the incorporation of regenerated electricity sources into Ghana's energy mix, it alone was insufficient to achieve the objectives and targets set for 2020, which were postponed until 2030. the REMP 2019 was introduced to bridge this gap by providing a detailed integrated plan and funding commitment and set policies for sustained growth and improvement of Ghana's RE resource potentials. Along with promoting renewable energy technologies to achieve the 10% target, the plan also prioritizes the socio-economic impact on areas without access to grid extension and aims to reduce climate change's harmful impacts by 2030. Ghana, as a participant in the Paris Agreement and other global agreements, has established these policy frameworks and plans as part of the country's Nationally Determined Contribution (NDC) of UNFCCC, to have a minimum of 10% of the country's electricity generation come from renewable sources by 2030.

H. Renewable Energy (Solar PV Mini-Grid) Policies and Institutions

Ghana's renewable energy strategy is cantered on policy incentives and flexible regulations to encourage collaboration between investors in the RE field. The regulations include the renewable energy purchase obligation, net metering, renewable energy funds (REF), and feed-in tariff, which are enforced by the Energy Ministry and the Commission of Energy to ensure that energy policies are implemented at lower levels of government. Independent Power Producers act as investors, technology developers, and renewable energy source producers, and they must adhere to a tariff threshold set by Public Utility Regulatory Commission (PURC) to prevent consumer exploitation. The Commission of Energy monitors the net metering process when the IPPs feed power produced into the grid. Although these regulations do not apply to micro-grids in remote and island communities, the PURC still controls the tariffs. Additionally, Bui Power Authority and Volta River Authority have been instrumental in driving renewable energy in Ghana by developing and managing some stand-alone solar photovoltaic and mini grids in remote areas and island locations across the country.

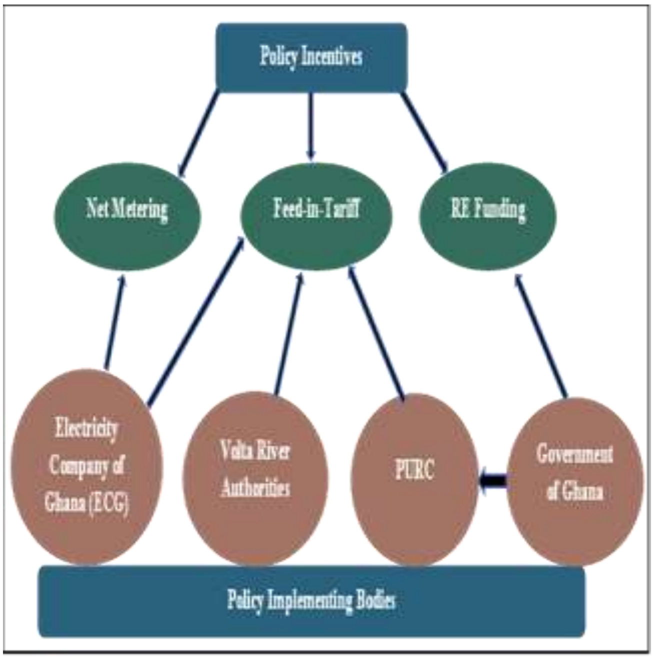

Fig. 4. Renewable Energy Policy Initiatives and Implementing Authorities [33]

The Ghanaian government's policy framework for mini-grid development and operation is an integral component of the National Electrification Scheme (NES) targeted at achieving universal electricity accessibility by the year 2030. In the public sector, the management of the policy framework for mini-grid development differs somewhat from that of the private sector. Public utilities are responsible for generating, operating, maintaining, and collecting revenue for mini grids in island locations on the Volta Lake, mainland communities within the Electricity Company of Ghana's concessional area, and mainland communities within the Northern Electricity Distribution Company's concessional area. Private sector involvement is limited to engineering, procurement, and construction (EPC) activities. The Public Utility Regulatory Commission (PURC) sets a uniform tariff rate for public utilities under Section 20 of the PURC Act (Act 538) but establishes a price threshold for private developers and operators to adhere to.

Act 832 states, it is illegal to set up or operate a mini grid that supplies electricity to anyone in any part of the country without being licensed or having a permit issued by the Energy Commission's Board. If a mini-grid's capacity is greater than 100kW but less than 1MW, it must obtain a license, whereas permits are required for a stand-alone grid with a capability of up to 100kW. Applicants need to obtain a license when they expand beyond 100kW. These permits ensure compliance with the country's environmental and spatial standards. Additionally, the Ancillary Service Charge, as a part of the Master Plan for Renewable Energy (2019), is used to support the capital cost of mini grids via the Renewable Energy Fund, which helps to apply the uniform tariff set by the PURC effectively. These policy objectives, institutions, and instruments are essential components of plans to promote private sector participation in RE development, particularly Solar Photovoltaic mini grids.

TABLE II. SUMMARY OF KEY LITERATURE WORKS

Study	Author and Date of Publication	Methodology	Findings
Support for solar energy policy development in Ghana	D. Atsu et al, 2016[30]	Policy Analysis	• The security of Ghana's energy supply is seriously threatened by its reliance on imported energy to make up for local conventional fuel shortages, making it vulnerable to outside pressures. • The objective of Ghana's Act 832 is to improve the affordability of renewable energy technology and promote the adoption of decentralized off-grid optional technologies, such as solar PV, in regions where they can rival traditional electricity delivery. • To promote the widespread deployment of Solar Photovoltaic Systems in Ghana, major efforts must be made to train highly competent employees with intermediate-level experience.
Multiple advantages of Solar PV systems in remotes areas of Ghana	J. T. Nuru et al, 2021[35]	Climate Compatible Development	• Solar mini-grids have the potential to promote development and combat climate change, but politicians and development partners have not yet acknowledged this. Similar to this, academic debates have not sufficiently demonstrated the advantages of solar stand-alone grids for remote areas. Recognizing the many advantages of solar PV can spur interest in their implementation, and help save money by preventing the need for several projects to accomplish the same goals. • When a single project is implemented, it is possible to reap many benefits and entice investment from donor organizations.
Ghana's renewable energy development and deployment challenges: developer viewpoints	Mahama et al, 2021[36]	Prepared questionnaires using a barrier scale of 1-5	• The primary challenge in the renewable energy sector was identified as the high cost of financing, with a rating of 4.13 out of 5, due to high-interest rates. • • Inadequate motivation for renewable energy developers was another significant obstacle, with 3.93. Grid limitations, currency volatility, inadequacy of incentives, a lack of technical expertise, and inadequate training facilities are some other obstacles to RE development and implementation. • • The government of Ghana should establish a specific set of subsidies and financial incentives aimed at supporting the expansion and effective implementation of renewable energy projects throughout the country.
Lessons from Ghana for expanding solar product markets in remote areas	W.F. Steel et al, 2016 [37]	Literature review	• A complete approach that takes into account need, availability, funding, reliability, and enabling methods is required to create a viable market for solar products in rural areas lacking access to solar enterprises and financial institutions.
Possibility of using mini-grid solar systems to provide an off-grid community's energy demands	E.Y. Asuamah et al, 2021 [38]	Simulation using HOMER	• The research conducted indicates that a solar mini grid would be far more economically efficient for Nkrankrom, a region in Ghana without electricity, compared to connecting to the main power grid. To achieve the best outcome, a PV/Battery/Converter system setup is recommended. The cost of energy for this system, calculated as the Levelized Cost of Energy, is projected to be \$0.107/kWh, whereas connecting to the main grid would cost \$0.124/kWh. • The study emphasized that while the study's objective was achieved with satisfactory results, it is still acknowledged that grid power is more capable of accommodating very high increases in load. Off-grid power's viability is dependent on several variables, including the cost of the property, the availability of repair facilities, maintenance workers, and community support.

I. Barriers to distributed PV systems development in Ghana

A review of literature on solar PV mini-grids in Ghana provides an overview of the obstacles across different dimensions or viewpoints of influence; technical(t), political(p), social(s), and economic(e)[36], [39-42].The following barriers are under these viewpoints: financial resources or funding(p), insufficient strong business models (e), unpredictable grid expansion in the future (p), influence from politics and delayed public procurement (s), limited ability to pay (e), unfavorable mini-grid policies (p), unattractive tariffs (p), low productive use (t), limited private sector involvement (p), uncertain licensing (p).

III. RESULTS AND DISCUSSION

The important research and scholarly works on the promotion of solar PV in with a particular focus on distributed PV systems Ghana are summarized in this review. The studies reviewed highlight the possible advantages of solar energy for rural areas as well as the difficulties the sector in Ghana is now experiencing.

One of the major conclusions drawn from the studies under review is the need for policy support to increase the affordability of RET’s, encourage the use of stand-alone grid options like solar PV in locations where they can compete traditional electricity supply, and establish a regulatory and fiscal framework that supports local exploration and innovation to lower the costs of RET’s. The Act 832 is a step at making progress towards the objective, but more actions are needed to develop skilled personnel with intermediate-level expertise to facilitate extensive adoption of solar

Photovoltaic systems in Ghana[30].Another finding from the studies under evaluation is that rural populations in Ghana could benefit from sola stand-alone grids in terms of development and reducing adverse effect of climate change. But they are still not being recognized as such by policymakers and development partners. The benefits of solar stand-alone grids for rural areas have also not been sufficiently demonstrated in scholarly discussions. Recognizing the many advantages of solar stand-alone grids can spur interest in their implementation and help save money by preventing the need for several projects to accomplish the same goals. Additionally, it is possible to entice investment from donor organizations by maximizing the benefits of a single project[35].

The most challenging barrier in the RE sector was found to be the expense of funding due to high-interest rates, which was given a rating of 4.13/5[36]. Inadequate motivation for renewable energy developers was another significant obstacle, with an average score of 3.93. Other obstacles to the development of RE have also been mentioned, such as grid limitations, currency volatility, a lack of incentives, a lack of technical expertise, and insufficient training facilities. The government of Ghana should establish a specific set of subsidies and financial incentives aimed at supporting the expansion and effective implementation of renewable energy projects throughout the country[36].

Complete approach that considers need, availability, finance, reliability, and facilitation methods is required to create a viable market for solar products in rural areas lacking access to solar enterprises and financial institutions.[37] . Off-grid power's viability is influenced by things like the cost of the land, the availability of maintenance staff, repair facilities, and community support[38].

IV. CONCLUSION

The reviewed literature shows that solar energy has significant potential to provide reliable and affordable electricity to rural communities in Ghana, but several barriers must be overcome to realize this potential. Policy support, financial incentives, and skilled personnel are critical factors in overcoming these barriers. The State should focus on the development of regulations and legislation that encourage growth of renewable energy projects and create a favourable environment for private sector investment. Donor agencies should also be encouraged to invest in solar energy initiatives that provide a range of advantages to rural communities in Ghana.

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Review On Solar Photovoltaic and Battery Storage Systems for Grid-Connected in Urban: A Case study of University of Juba

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Abstract*— Currently, Solar PVs are gaining considerable acceptance because of their ability to directly convert sunlight into electric power. Nevertheless, photovoltaic-generated electricity may fail to satisfy the ever-increasing energy demand because it does not provide a consistent supply that aligns with the needs of consumers. To solve this problem, energy storage has recently gained importance in grid-connected Photo Voltaic (PV) plants. This helps in managing loads more flexibly and overcoming problems related to power quality faced by grid-distributed networks, thereby making PV plants valuable and appealing. To effectively integrate PV plants and storage systems into the power grid, various techniques for battery management have been developed to create a demand that is more responsive to prices. The wider deployment of PV systems is hindered by the lack of supporting policies. This study reviews different techniques of configuration and modeling employed for the optimal operationalization of PV grid-tied systems with battery storage. We examined numerous optimization methods and dispatch mechanisms for energy stored that capitalize on the monetary worth of battery-operated PV systems. We also discuss the grid-connected PV system-related power quality and control technology challenges. Finally, we explored several functioning and maintenance concerns of battery-operated PV systems and highlighted the financial and ecological advantages of PV grid-tied configuration. The goal of this study was to review several technical issues related to the condition of PV systems. These issues include energy regulation, various cell technologies, energy management and scheduling methods, reliability, and power quality. We also discuss whether findings from the University of Juba should be adopted.

Keywords*— *Solar PV, Grid-connected system, battery, storage system

I. INTRODUCTION

Currently, the world is facing significant challenges related to rising energy demands and reliance on non-renewable energy sources. As a result, there is a growing trend toward utilizing Renewable Energy Sources (RES) as a solution for electricity generation. Solar energy has emerged as a compelling option for numerous countries to shift away from fossil fuels and adopt a more sustainable energy source among all available renewable energy sources [1-2]. Approximately 93% of people on Earth live in nations with solar PV energy potentials between 3.0 and 5.0 kWh/kWp on a daily average. Almost 70 countries have excellent solar PV conditions, with daily average output exceeding 4.5 kWh/kWp, enough to boil roughly 25 liters of water.

From 2010 to 2015, the Solar PV installation capacity increased consistently and has since witnessed a substantial surge. Solar PV generation has reached a historic high of over 1,000TWh, with a remarkable increase of 22% or 179TWh. This achievement marks the second fastest growth in renewable technologies, after wind energy, in absolute generation growth as of 2021 [3]. China is expected to maintain its lead as the world's major PV market leader by 2050, with a projected share of more than 37% of its worldwide capacity. [4-5].

Photovoltaic energy sources have diverse uses, such as powering water pumps, charging batteries, providing electricity to homes, illuminating streets, cooling systems, heating swimming pools, running hybrid vehicles, supporting telecommunications, operating satellite power systems and military spaces, and generating hydrogen. Two categories of systems make up the global market for these energy sources: decentralized systems, which make up approximately 60% of the market, and centralized or utility-scale systems, which make up approximately 40% of the market. Off-grid or Stand-alone schemes, which formerly dominated the market, now account for roughly 1% of the market. Currently, modules of crystalline silicon (c-Si) control the majority of the PV market, accounting for approximately 90% of the total. The market share for Thin Films (TF) of all kinds is currently only approximately 10%, a decrease from 16% in 2009, while the market share for Concentrating Photo Voltaic (CPV) technology is still less than 1% despite its rapid rise [4].

Similar to wind energy, solar energy is dependent on weather patterns, which pose a major challenge. The limited capacity for PV energy production stems from the inconsistent and erratic characteristics of PV energy generation, which make it difficult to operate the grid. As a result, a fundamental challenge for PV systems is coordinating intermittent energy production with ever-changing power demand [6]. One approach to address the

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issue of irregular power sources is to integrate a storage element.

Although the importance of storage has been acknowledged, more research in a practical setting is required to better understand and assess the distribution of stored energy. This allows us to financially maximize the advantages of renewable energy production and storage arrangements [7-8]. To maximize the financial benefits of PV battery systems, a number of retail pricing models, including Critical Peak Pricing (CPP), Real-Time Pricing (RTP), and Time-Of-Use (TOU), have been advocated in academic literature. These programs are designed to encourage customer involvement in demand response. [9-10] investigated how it can increase the system output efficiency, streamline the process, and produce electrical energy of higher quality.

The evaluation of battery-operated Solar PV schemes for urban grid connections has substantial value for several reasons, with an emphasis on applying the findings to the University of Juba. First, it offers insightful information on how well these systems can accommodate the increasing energy demand of cities. Energy needs are increasing along with the urban population, and sources of renewable energy like solar photovoltaics have the ability to supply these needs sustainably. Second, the evaluation offers a deeper understanding of the technological elements of Solar PV and battery systems, including their constituent parts, installation, functioning, and maintenance. These data are fundamental for policymakers, energy strategists, and investors who aim to boost the use of battery-operated Solar PV systems in metropolitan regions. Finally, the assessment also analyzes the difficulties and impediments to the installation of solar PV and battery systems in urban locations. This study can assist stakeholders in creating successful strategies and policies to address these issues and encourage the general adoption of these systems by drawing attention to these concerns.

II. Literature Review

A. *PV cell technologies*

Currently, c-Si panels, which are categorized as first-generation solar cells, are used to fabricate the majority of solar cells. Owing to their affordability and greatest efficiency level, these panels, which are composed of crystalline silicon, comprise 85-90% of all photovoltaic module sales globally. sc-Si and mc-Si are common varieties of c-Si panels. Although there are numerous manufacturers of c-Si solar cells, and the technology is a mature and well-established PV technology, the cost of the raw ingredients required to make them is high. Although costs have come down recently, it is unclear whether further cost cuts will allow c-Si to successfully compete with less expensive solar resources in the wholesale power-generating sector. [4][11].

The second-generation photovoltaic technologies, which currently make up between 15% and 20% of the market, are referred to as thin-film PV technologies. Because of the low cost of materials and manufacturing, these technologies are desirable. However, it is important to consider the fact that they are less efficient and have elevated mounting costs and space requirements compared to c-Si cells. TF technologies still hold a significant market share, with the exception of utility-scale systems, although they are not as developed as c-Si PV cells. TF still have to contend with a number of issues, such as toxicity, availability, and durability of the materials, particularly in the case of cadmium. In addition, the prices of c-Si modules represent a significant threat to TF technologies [11-12].

Third-generation PV technologies, such as concentrator photovoltaic (CPV), advanced thin-film (TF), and organic cells, are still being studied and developed at this time. By using innovative conversion processes, methodologies, and cutting-edge materials, these technologies have the potential to attain higher conversion efficiency. Because they haven't yet been commercialized, their exorbitant price is still a mystery. They continue to be improved at the R&D stage right now [4], [11].

B. *Off-grid and grid-tied systems classification*

PV systems are divided into two groups: utility-interactive, commonly referred to as grid-linked systems, and standalone systems. Its operational and functional requirements, component layouts, and connectivity to other sources of power and electrical loads all affect how they are classified. PV systems offer AC and/or DC power services and can operate either independently or tied to the utility grid[13].

PV systems that are built to function with the electric utility grid are integrated with the grid and cooperate with it. These PV systems' power conditioning device, commonly referred to as an inverter, is their most important component. The inverter serve to convert the electricity generated by the PV array from DC to AC power that complies with the utility grid's specifications for voltage and power quality. The power conditioning device will automatically stop sending electricity to the grid in the situation of a malfunction of the electric utility grid. [14]. The Fig.1 shows the grid connected solar PV system.

Fig. 1. Grid-connected solar PV system [15].

The photovoltaic (PV) system features a two-way connection that enables the electricity it produces to be either used for on-site electrical needs or transferred back to the power grid in situations where the PV system produces more electricity than is required on-site. When the output of the PV system is insufficient to handle the electrical load, such as during periods of low output, as on cloudy days or at night, the required amount of power is purchased from the utility[14].

PV systems that are linked to the grid and do not have an energy storage backup are considered ecologically friendly and are commonly favored by individuals due to their low maintenance and cost-effectiveness. However, these systems rely on grid power and in cases of power outages during the

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night or on cloudy days, they will cease to function until grid power is restored.

It is common for PV systems equipped with energy storage backup to be connected to utility grids. This type of design has several benefits such as the ability to sell any excess electricity produced by the PV system back to the grid, charging the battery during non-peak periods, and purchasing power from utility grid to support the loads in situations where the battery-operated PV power are insufficient[14].

Independent photovoltaic (PV) systems work autonomously and are not connected to the electric utility grid. These systems operate in isolation and are usually used to supply electricity to a DC and AC load that is appropriately sized. They are powered by either a PV array alone or a hybrid PV system, which amalgamate PV array with a diesel generator acting as an additional source of power. Off-grid systems of this type typically contain an inverter, which transforms the DC voltage produced by the PV modules into AC voltage that can be utilized by appliances directly [13]. Some significant characteristics of PV technology are outlined in the table 2 below [13]:

TABLE I. AN OVERVIEW OF SOME KEY ASPECTS OF PV TECHNOLOGY

Characteristics	Exposition
Range of operation	1 kW-300 MW
Fuel	Sun
types of applications	household, utility scale, and business
Efficiency	For crystalline silicon, the percentages are 12–16%, for thin films, 11-14%, and for organic cells, 18–20%.
Ecological effect	There are no direct emissions of CO2, NOx or CO.
Advantages	Modular construction, zero direct emissions, and environmentally friendly technologies.
Downsides	Additional costs for setup, variable power output due to unreliable weather, need for mechanical and electronic monitoring devices and need for additional storage for best results.

C. *Techniques for design, size, and modeling*

Creating models in a streamlined manner to operate photovoltaic components could boost the productivity of the entire photovoltaic system. This encompasses constructing models for the photovoltaic electricity generator, interface of power electronic, storage equipment, and the devices that consume power. Various models for solar cells are available, including a basic model for PV cells, a more precise model known as two-diode model, and moderate one-diode model that is commonly used in modelling PV panels [13]. The table below illustrates the approaches used in designing PV and storage components.

D. *Scheduling methods and energy management*

Designing effective scheduling techniques is challenging because of the unpredictable availability of solar energy resources. An efficient approach would be to combine a storage system for energy with the photovoltaic panels to achieve better results. Another solution is to use Demand Side Management (DSM) technology, which utilizes dynamic pricing strategies to change consumption of energy from peak to non-peak times, thereby achieving power balancing and reducing expenses [13]. A plan for a photovoltaic lighting system that includes energy management has been suggested [29]. The findings indicated that the efficiency of the system was enhanced by solar batteries MPPT control. A strategy for energy management was optimized [30] by converting the production of photovoltaic energy, which depends on solar irradiance, into a constant output per hour. This approach enabled photovoltaic power plants to participate in electricity markets with minimal additional costs associated with the incorporation of a storage system of energy. [29-31] study involved the creation and testing of algorithms that regulate the flow of energy in PV lighting systems used in public areas. The objective was to ensure that the system remained operational during power outages while minimizing overall energy expenses. The table provided below summarizes the various methods for managing the energy of PV battery systems. An efficient power flow management system may consist of distinct stages such as prediction, optimization, and local control.

E. *PV system storage problems*

As previously mentioned, PV renewable energy sources are causing increasing concern in power systems because of their significant intermittency. This could result in complications, such as instability, difficulties in regulating voltage, and other power quality problems. In order to address these issues, storage systems of energy remain being extensively employed in electrical systems.To handle the unpredictable and fluctuating attribute of photovoltaic (PV) energy in power systems, various types of energy storage systems including thermal storage, electrochemical, electrical, and mechanical are employed. It is essential to compare these systems based on their applications, advantages, initial cost, and overall lifespan. The table 4 presented underneath displays the distinctive characteristics of various devices for electric storage that can combine with Solar PV, along with an analysis of their benefits and drawbacks.

F. *Policy in Energy*

Satisfying the current and forthcoming energy demands while minimizing negative impacts on the environment is an extremely challenging issue. Consequently, renewable energy sources are being considered as potential solutions. Several countries have implemented incentive policies to support the development of alternative energy sources, with Europe being the notable leader in photovoltaic (PV) deployment until 2012. However, recently, this technology has expanded beyond Europe, primarily in Asia, and particularly in China. Despite this dramatic shift, several economic and non-economic barriers must be overcome to achieve the International Energy Agency's vision. As a result, in order to overcome potential obstacles, it is crucial to develop new recommendations for system integration, technical, legal, and regulatory challenges.

In their study, [47] examined the policies implemented in various countries to advocate for the utilization of PV

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technology.The authors emphasized that to support the continued expansion of the market and user base,retail financing terms must be adaptable and accommodating. The incorporation of grid-tied renewable energy storage system is limited by regulations, which act as constraints. To speed up wider PV system adoption, which will hopefully lead to lower deployment costs in the near future, various state policies are required to provide economic incentives that compensate for the high investment costs.Various strategies are implemented to encourage the adoption of PV renewable energy, including trading mechanisms, feed-in-tariffs, investment tax credits,renewable portfolio standards, pricing regulations, quota mandates, production incentives, and other relevant policies. These policies' main goals include reducing reliance on non-renewable energy sources, promoting the development of new industrial sectors, and mitigating the environmental effects of the energy industry. The most popular policies thus far are the RPS and FIT, but countries should choose the policy that best suits their circumstances and objectives [47].

While investment and finance are crucial for creating effective policies, it has been observed that clear and trustworthy signals from policymakers can decrease risks and boost confidence. However, if policies are inconsistent and send mixed messages, they can result in higher costs for consumers and investors in the financial and energy sectors.

III. Case Study: University Of Juba, South Sudan

The Republic of South Sudan, situated in the central and eastern part of Africa, is a nation bordered by nearby countries including Sudan, Ethiopia, Uganda, CAR, DR Congo, and Kenya. The population of the country is estimated to be around 11.19 million people in 2020. Juba is both the capital and the biggest city in South Sudan.South Sudan has the lease electricity access rate in African continent, with only 7.24% of the population having access as of 2020 [2]. The current state of energy in this country is closely tied to recent conflicts. Despite the ample potential for solar energy and hydropower, the majority of electricity is generated through thermal sources, and the supply is restricted to only a handful of communities.

South Sudan experiences approximately 8 hour of sunlight every day, with horizontal surface radiation between 5 and 6 kW/m2 per day, primarily in the northern and eastern regions. The highest level of global horizontal irradiation in South Sudan is 2264 kWh-2, which is comparable to Sahara's peak of 2702 kWh-2, making it a suitable location for solar-energy production. The Fig.2 shows the Map of South Sudan depicting the feasibility of solar energy potential.

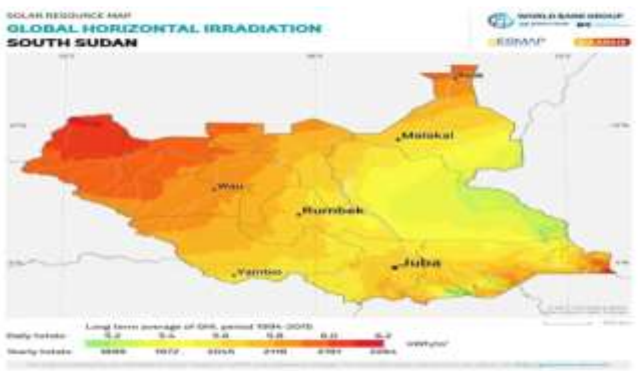

Fig. 2. Map of South Sudan depicting the feasibility of solar energy potential [2].

Despite this, the primary source of energy in South Sudan is mainly focused on oil, and the capital city relies on a power plant that runs on diesel fuel. However, this power plant experiences frequent interruptions in the electricity supply [48]. Diesel-powered power plants provide the vast majority (73%) of electricity access rate. Electricity from renewable energy sources, mainly solar PV, accounts for the remaining 27% of total access [49]. The limited availability of electricity has a negative impact on various sectors in the country, including education, agriculture, and healthcare, thereby reducing their effectiveness.

Grid-connected photovoltaic (PV) systems offer a practical solution to address electricity blackouts in Juba, achieve zero-energy buildings, and reduce the cost of solar energy generation. These systems can significantly improve the energy efficiency of a building. Many universities worldwide have ample unused areas on their grounds and buildings, making them ideal locations for installing grid-connected PV systems on rooftops and the ground. This presents a significant opportunity to expand the use of solar-power technology [50].Electricity is an essential requirement for most institutions, including universities, to perform daily activities.The University of Juba is the largest university in South Sudan and serves as a focal point for academic and research activities.

As with many other institutions in the region, it has faced significant challenges with electricity supply owing to unreliable and expensive grid infrastructure. Consequently, the university has invested in solar PV and battery storage systems to supplement its energy needs [51]. Solar PV and battery storage systems were installed on the rooftops of several buildings on a university campus. The PV system consists of 528 solar panels with a total capacity of 150 kW, whereas the battery storage system has a capacity of 468 kWh. The systems were designed and installed by a local contractor in collaboration with the engineering team of the university. To evaluate the effectiveness of the systems, data on energy production and consumption were collected over a period of one year. The data were analyzed to determine the percentage of energy supplied by the solar PV system and the percentage of energy stored in the batteries. The cost savings achieved through the use of solar PV and battery storage systems were also evaluated [52].

The solar PV system generated 221,520 kWh of electricity over a one-year period, which was equivalent to 19% of the total energy consumed by the university during that time. The battery storage system stored 190,080 kWh of energy, which was equivalent to 16% of the total energy consumed. The use of solar PV and battery systems resulted in a cost savings of $120,000 USD over the one-year period. This represents a significant cost reduction for the university, as it previously relied solely on diesel generators for its energy requirements [51].The investment of the University of Juba in solar PV and battery storage systems has proven to be a successful strategy for addressing its energy challenges. These systems have significantly reduced the university's reliance on diesel generators and have resulted in substantial cost savings. The system has improved power reliability, reduced electricity bills, and a positive impact on the environment [52].

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IV. Results And Discussion

Solar PV systems have been increasingly utilized in urban and city environments for grid-connected applications, with battery storage systems playing a crucial role in ensuring continuous power supply. The global solar PV market has witnessed significant growth over the past decade [29-52], with China being the primary global market leader, accounting for almost 37% of its global capacity.

TABLE II : Illustrate The Approaches Used In Designing Pv And Storage Components

System used energy generation system	Aims	Engineering design and simulation	Findings	References
PV Hybrid system	• PV-AC grid system sizing. • Sizing & energy dispatch PV-diesel-battery power Systems.PV-wind system sizing	• Models of the PV, converter, and battery with Homer. • Model for simulating size with RETScreen® that is based on a spreadsheet.Component size optimization using Homer.	• Most affordable net present cost • Analyzing the economic impact of energy performance • Cost reduction for dependable autonomous system	[16] [17] [18]
Solar photovoltaic system	• Net Present Value-based Rightsizing (NPV). • Modelling and simulation. • Parametric analysis. • Operation and modelling. Modelling and simulation. • Design, modelling, and simulation. 1.0 Sizing a standalone PV system using regression.	• Combining demand response with the Monte Carlo method for sizing. • PV model parameterization using Simulink and Simpower. • System sizing accounting for the duration of the load and the charging low voltage disconnect. • Model of PV array-inverters operating in master mode using Simulink and MATLAB. • Single diode model with MATLAB & Simulink. • PV mathematical models, DC-DC boost converters, and comprehensive converter designs.	• NPV based-appropriate sizing of a PV system with consideration for sellback prices. • Long-term grid-tied functional modeling strategy. • Helps a PV designer determine the ideal system specifications and charge controller settings. • Improved power system voltage and frequency regulation. • Output current calculation. • PV-based power system setup for testing using a DC-DC converter.	[19] [20] [21] [22] [23] [24]
Solar-plus-storage system	• Optimum scale. • Hybrid storage technology sizing optimization	• Sensitivity investigation and direct search methodology. • Design of a hybrid system that maximizes the number of batteries, the tilt of the PV modules, and the number of solar panels.	• Optimal sizing using a systematic algorithm. • Optimal size based on utility properties.	[25-26] [27]
Grid-tied PV system	• PV performance study. • Synchronizing the inverter with MPPT and connecting to the grid.	• The utilization of MATLAB & Simulink in constructing models for PV panels, inverters, converters, filters, MPPT, and units for control & protection. • The utilization of MATLAB & Simulink for creating a model of a PV array, MPPT, and an inverter connected to the power grid.	• Adequate design control for PV system. • Improved PV system modeling and control design techniques.	[13] [28]

The PV market is primarily dominated by crystalline silicon (c-Si) modules, which constitute roughly 90% of the market share, with both single-crystalline (sc-Si) and multi-crystalline (mc-Si) modules being widespread. The market share of thin films (TF) has decreased from 16% in 2009 to only 10% today. Similar to that, concentrated photovoltaic (CPV) technology only makes up less than 1% of the market.

A. Battery Storage Systems and their Role inSolar PV

Battery storage systems play a crucial role in ensuring continuous power supply and mitigating the challenges posed by weather conditions. Lithium-ion (Li-ion) batteries are currently the most broadly utilized technology for stationary energy storage applications, with lead-acid batteries being the second most commonly used. Other types of batteries include sodium-sulfur (NaS), flow, and redox flow batteries. These batteries provide several benefits such as grid stabilization, load management, and ancillary services.

B. Battery storage and solar power applications

Solar photovoltaic (PV) and energy storage systems utilizing batteries are adaptable and can be utilized for a variety of tasks, including powering water pumps, charging batteries, illuminating streets, providing electricity to homes, heating swimming pools,refuelling hybrid cars, supporting communication networks, supplying power to military and space equipment, and producing hydrogen. These schemes are typically used for either centralized, accounting for about 40% of the market, or decentralized systems, which account for about 60% of the market.

C. Challenges and Future Directions

The adoption of solar PV and battery storage systems faces several challenges, such as high initial costs, technological limitations, and lack of policies and regulations to promote their use. However, advancements in technology, coupled with favourable government policies and regulations, have contributed to their widespread adoption. Furthermore, the amalgamation of solar PV and battery storage systems with other sources of renewable energy such as hydropower and wind power, can provide a balanced portfolio of renewable energy resources.

Solar PV and storage systems have the potential to become the leading source of electricity by 2040, with several countries already investing heavily in their adoption. The combination of PV and storage systems with other renewable energy sources can provide a sustainable solution for meeting the rising energy demands and shifting towards sources of renewable energy.

V. Conclusion

The advances of PV technology have resulted in a potentially viable solution to the world's energy dilemma and the negative environmental effects of energy production. These problems can be greatly addressed by this renewable energy source. However, the incorporation of PV technology into the electrical grid presents several technological challenges, such as fluctuations in power, instability in voltage, and storage issues. Energy storage systems such as electrochemical batteries can be employed to address the intermittent nature of PV energy in power systems. Furthermore, the implementation of effective energy policies is crucial for supporting the continued expansion of the PV market and user base. Various strategies are implemented to encourage the adoption of photovoltaic (PV) renewable energy, including trading mechanisms, feed-in-tariffs, investment tax credits, renewable portfolio standards, pricing regulations, quota mandates, production incentives, and other relevant policies. These policies' main goals include reducing reliance on non-renewable energy sources, promoting the development of new industrial sectors, and mitigating the environmental effects of the energy industry. The high initial costs associated with PV technology pose a significant challenge for renewable energy sources and energy efficiency improvements. This is because these expenses are mainly incurred upfront. Therefore, the introduction of PV technology into electrical grid requires a multifaceted approach that involves addressing technical challenges, implementing effective energy policies, and overcoming financial and non-financial barriers to achieve the International Energy Agency's vision of sustainable energy for all.

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Intelligent Power Optimization Techniques for V2V Communication in IoT-Enabled Vehicles

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Abstract—The Internet of Things (IoT) is utilized by an intelligent transportation application to arrive at informed conclusions for the benefit of passengers. The key advantages brought about by the Internet of Vehicles have been an improvement in both the quality of the driving and riding experience and an increase in both the safety and efficiency of traffic (IoV). The characteristics of distributed processing that mobile cloud computing possesses make it possible to process local data quickly. Internet-to-vehicle (IoV) connection may become more effective with the help of the vehicle cloud. This study centers on the communication between the vehicle and the other vehicle, as well as between the vehicle and the device on the road when necessary. The brief signature method of the authentication protocol was suggested, and it was discovered that it is not susceptible to forgery while employing a fresh scenario as the testing ground. We are developing a system and management methodology for IoV mutual authentication that is quick and effective. The suggested system was subjected to quantitative performance evaluation, which revealed that it is superior to other already existing systems in terms of its ability to interact with automobiles (vehicle-to-vehicle communication) and roadside equipment. The results are encouraging because there were relatively few instances of packet loss.

On the other hand, the scenario proposed in this paper aims to reduce the amount of power consumed by the devices installed in vehicles. This will be accomplished by efficiently controlling the transmission of information, making it so that the transmission power is proportional to the distance that separates one vehicle from another rather than transmitting at the highest possible power. The scenario was created by modeling the Matlab program using version 2021 of the software.

Keywords—intelligent, networks, Internet of Things, VANETs, IoT, IoV, V2V, V2Rt ,CLSS, Vehicles, mobile cloud.

I. INTRODUCTION

More and more industries are adopting the Internet of Things (IoT), including smart transportation and the nation's power grid. The Internet of Things (IoT) has been dominated by vehicles. Ad hoc networks are becoming increasingly widespread in vehicles (VANETs). Because VANETs can receive, evaluate, and interpret data from vehicles and structures throughout the globe, they cannot make intelligent decisions[1]. In contrast to VANETs, the Internet of Things (IoT) integrates cars, people, things, and networks into a single intelligent unit via networks such as deep learning, fog computing, cloud computing, and other technologies. IoV models at three, four, and five levels have been offered by authors who are experts in their fields. CISCO presented the four-level method, shown in Fig. 1, back in 2013. Personal devices, roadside units, and sensors account for most of this. Figure 2 displays several Internet of Things communication scenarios: The V2V (Vehicle-to-Vehicle) and V2Rt (Vehicle-to-Remote) protocols are used. IoV utilizes real information transmission between vehicles and everything (V2X) using wireless communication devices based on fog/edge computer technology. It has been considered an application of Cyber-physical systems (CPS). Different ways that V2X devices can talk to each other and how they connect are also talked about

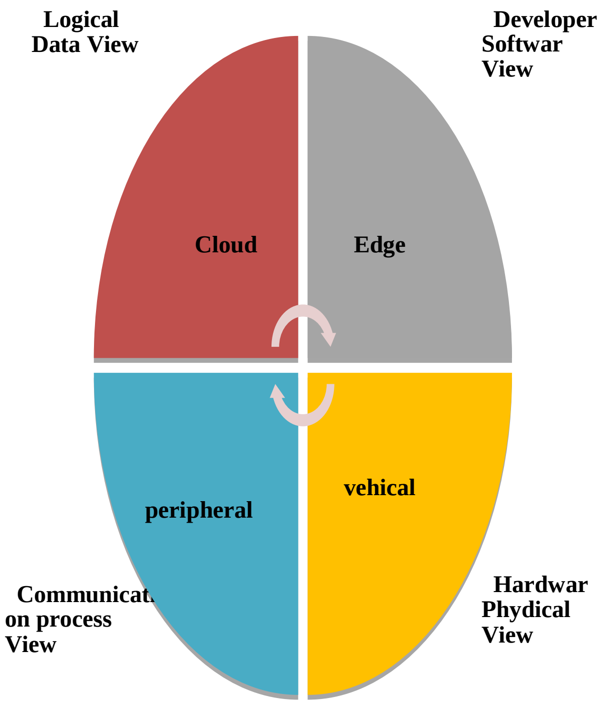

Fig. 1. IoV system model with four levels

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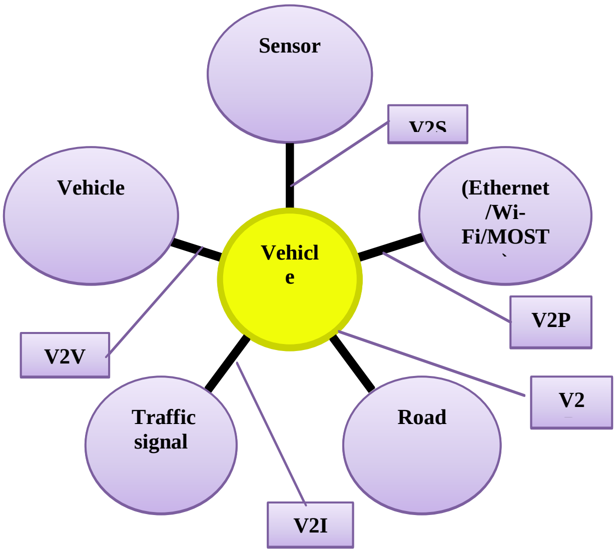

Fig. 2. IoV's multiple communications scenarios

Fig. 3. Illustration of an IoV Scenario

Integrating narrowband Internet-of-Things technologies improves vehicular communication systems' robustness, thereby enhancing service quality. This enhancement is achieved through two components that address latency and harmonic issues and a distributed antenna configuration for moving vehicles using machine learning and the across-entropy algorithm.

The proposed approach has been simulated and compared against state-of-the-art methods, demonstrating superior performance based on three key metrics: latency, mean squared error rate, and transmitted signal block error rate. The results indicate the proposed technique reduces peak power deficiency by nearly 49% at a probability of 10^{-3}, yielding an additional 23.5% improvement through self-interference cancellation and a 31% decrease in bit error rate compared to existing literature. (Hamarsheh, Daoud, Baniyounis, &Damati, 2023)

It is possible to communicate between vehicles and network nodes (V2R), as well as between vehicles and personal devices (V2P) (V2S). The Internet of Things may benefit from a new hybrid communication paradigm that combines the advantages of both wired and wireless networks. Connecting automobiles to the Internet of Things improve their services' reliability and security. It is currently being developed for mobile devices to use mobile cloud computing (MCC), a kind of cloud computing. In [3], Vehicle cloud computing mobile vehicular cloud computing is a novel computing paradigm developed by Gerla based on the MCC architecture. Three resources are often found on vehicles and remote sensing devices: *data storage, sensors, and processing*. When these resources are linked to the Internet, a "vehicular cloud" is created, which may provide smart services. For example, a cloud server housed by a vehicle manufacturer may collect data about emergency road accidents and send it to a cloud service provider. It then informs the appropriate vehicles to pay attention to any newly uncovered information. The vehicle may upload data to the Internet anytime, anywhere. However, reducing the time spent on event processing will still be beneficial. Cloud computing and big data analysis work together in the Internet of Vehicles (IoV), making it even more intelligent since the IoV utilizes all of these technologies.

There have been several previous publications [3-6] to develop the technological infrastructure necessary for the Internet of Things. However, the Internet of Things continues to experience several difficulties.[7-11].

In the Internet of Things, security risks and privacy issues have become more relevant. When an attacker pretends to be a vehicle to transmit fraudulent signals, it can potentially disrupt the traffic patterns of other vehicles on the road. Several research on the security of IoV [12-14] have lately been brought to our attention. Protecting one's personal information is important for various reasons, including security. It is necessary to prevent unauthorized users from accessing a user's private information, such as their true identity location information. Even though each compromised car should be tracked down by an authorized government department using appropriate data and technology, this should be done accordingly[2]. In 2004, Huang et al. developed the certificate-less short verification approach and security model[15]. Xiang, et al. in [16] A revised, more effective strategy was also presented in 2022. Designers are concerned with securing access to private information through the Internet of Things (IoT). Considering the above issues and limitations, we suggest an effective anonymous authentication mechanism for the Internet of Things. The following is a summary of the most important contributions made by the paper:

- The suggested technique allows for conditional anonymous mutual authentication while protecting users' privacy.
- The introduction of a global methodology for vehicles is made. Vehicle verification may be performed in conjunction with RSUs in the same area.
- When compared to earlier techniques, our scheme has a lower computational cost.

The majority of this article is structured as follows. Section II overviews the IoV scenario model and some preliminary results. Afterwards, it is recommended that use

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a certificate with less short signature (CLSS). Using CLSS as a foundation, For the Internet of Things, Section IV introduces an unnamed access code Section V has both a security and a performance evaluation. Finally, Section VI finishes this paper.

II. Preliminaries

Furthermore, we provide a scenario model for the Internet of Things, security protocols, and desired outcomes.

A. Scenario Model Design

The Internet of Things (IoT) scenario is shown in Fig. 3. TCC, TBA, vehicles, and RSU comprise most of the organization. A TCC handles everything from system initialization to data collecting from RSU, monitoring malicious vehicles, and updating the revocation list (Transportation Control Center). The RSU (Remote Sensor Unit) gathers and analyzes data from RSU, monitors hostile cars, and maintains the revocation list.

The TBA (Trace Back Authority) of a corrupt vehicle's function is to gather crucial information, verify harmful behavior, and impose sanctions as necessary.

Transport system: Every vehicle in the IoV has a built-in OBU that can wireless transmit vital highway safety information in real-time to other vehicles and RSUs.

Aside from that, it can receive and report data messages from other OBUs via a multi-hop mechanism.

Fixed route constructions (Roadside Units): RSUs are fixed route constructions erected along the side of the road. RSUs are normally connected to the TCC using a hardwired connection. They are in charge of capturing, transferring, and spreading real-time incoming communications from various sources. RSUs may act as access points for OBUs and offer them wireless services since they can handle messages within their respective ranges.

B. Model of Security

Constructing a CLSS involves the extraction of the private key, as well as the extraction of a secret value. Depending on the expert key's ability level, two groups will likely have attempted to break into CLSS. The AI would replace every user's public key even without passcodes. AI may access the parent vital but cannot modify any user's public key until specific conditions are met. Our approach will be irreversible in the presence of uncertainties compared to modified chosen message and ID assaults in inconsistencies in the Two attracter. Because the nodes (vehicles) in VANETs are supplied with considerable power sources, they have an advantage over regular ad hoc networks. Using VANETs, cars may interact with one another and with roadside infrastructure (V2I), allowing drivers to be more aware of their surroundings and improving safety while potentially streamlining traffic flow. The programs that operate on VANETs may be roughly divided as follows:

- Safety-related apps - for example, Emergency Messages
- Business-related applications
- Best-effort applications, such as infotainment systems
- secure Transactions, such as toll collecting

The vast majority of crucial communications To be successful, safety warnings broadcast through VANETs must go deep into the network and be sent quickly. This communication must be secure, and no personally identifiable or linkable information should be disclosed to other parties due to the legal right of vehicle owners participating in it to remain private. In this instance, VANET security is most important. Authentication is crucial in Vehicular networks since there may be both harmful and legal sources of communication. Authentication refers to the ability to distinguish between multiple sources.

For a communication to be considered anonymous, the physical identity of the sender should not be deducted from the message.

• *Data Integrity* - The authorized party's data has not been altered in any way and is received precisely as it was. The IEEE 1609 standards define Wireless Access in Vehicular Environments (WAVE) communication protocols for vehicular networks. IEEE P1609.2 specifies that [2] Private messaging protocols In this topic, the DSRC's layouts, and techniques for processing encrypted messages are discussed and standardized [3] to implement an encryption system that takes advantage of PKI (PKI). Additionally, the administrative operations necessary to provide important security services, such as canceling a vehicle's certificate after it has been given, are detailed in this paper.

III. An Overview Of Pki From The Perspective Of Vanets

The public key infrastructure relies on asymmetric key cryptography as its base. In a PKI system, each principal's keys are assigned: Keys (Private and Public Key). Unlike the private key, the public key may be shared with any of the network's other participants. Pr(.) and Pu(.) are two functions that represent the private and public keys, respectively; each function has the property of being an individual.

$$M=Pr(Pu(M))$$

$$M=Pu(Pr(M))$$

The message M provides here is how the keys are meant to guard against.

Messages are signed with a private key, and an attachment is attached to the message to secure the integrity of the message's transmission throughout transmission. When the receiver receives this message, they may use the public key of the (sender) to verify that the message has been signed. This solution has a basic flaw: swapping keys without compromising their integrity is impossible. Trusted nodes [4], known as Certificate Authorities, are one generally acknowledged solution for this problem (CA). Certificates, which assist in establishing the link between the owner of the private keys and the owner of the corresponding public keys, are used to validate data as part of this method.

To be more specific, an (unsigned) certificate must have the following parts in compliance with IEEE 1609.2:

DOI: rp-9788770040723.174

1) The public key
2) The certificate's expiration date and time
3) This list of CRLs relates to the certificate at issue. Everything described above is included in the certificate that the CA. will issue in addition to the CA's seal. Because there will only be one CA in the whole network, each PKI system entity must have access to the CA's public key. To ensure that only CA-verified certificates may be trusted. The IEEE 1609.2 Standard mandates that a verified message must include the sender's certificate, the public key used to sign the message, and the message itself since all of a CA's certificates must be distributed.

CA certificates may also be cancelled for several reasons not covered in this article. [6] The assailant's certificate may be temporarily cancelled until a connection with the CA can be established in a concept for certificate cancellation in-vehicle networks. Certificate revocation lists (CRLs) are used to send information on a certificate's revocation, including but not limited to the data stated below.

1- The following is the CRL series number: The sequence of CRLs intended by this CRL All revoked certificates are listed under

2- "Entries."A message's verification cost includes checking whether or not certificates in CRLs are present and usable at this period. Consequently, timely access to this revocation information is essential to the overall robustness and dependability of the operation. Providing real-time CRLs in car networks is a challenging problem to address.

IV. Developing The Cos for fheVanet Using Analytical Methods

There are a few permanent spots in the area that we're interested in where cars may use information-fueling stations on an as-needed basis (the duration between visits is random, with an average of several days). Information-fueling stations provide the latest current CRLs to the automobiles that stop there. This example shows how to compute a system's CoS and the various system factors that influence it.

Some mobility model is considered, and each vehicle has a certificate used to verify the authenticity of communications in this system. To count the number of other vehicles that have sent messages to a tagged vehicle in the future, examine a vehicle and define the c(t)t0 counting method (t). V2V communication between vehicles is boosted due to the tagged vehicle's higher contact rate with other vehicles.

Considering that, the limit exists nearly without a doubt. The process c(t)≥t0 is a random process.

$$\lambda = \lim_{s \to \infty} \frac{c(t)}{t}$$

Using r(t)tt0 to count the number of certificates that have been cancelled at any set moment and then using

$$r = \lim_{t \to \infty} \frac{r(t)}{t}$$

Because we're just interested in the average behavior of multiple automobiles, we'll assume that the process "c(t)" isn't significantly influenced by (or related to) the process "r(t)." Consider the potential of a coupling between c(t) and r while considering a small number of cars (t).

The CRLs of the tagged vehicle are updated in line with a method independent of the CA (either via RSUs or info-fueling stations). The identified car performs m(t)0 CRL updates. An independent and identically distributed random sequence of random variables will be utilized to estimate inter-update intervals (the time between subsequent CRL updates).

(Hamarsheh et al.)i≥1. E[T] = E[Ti] and E[T_2] = E[T_2 I then. The CRL of the tagged vehicle is presumed to be updated at time 0 since we are primarily concerned with system time average behavior (the CoS). Counting processes under examination are assumed to have limited second moment intertransition periods.

The processes 'c(t)' and 'r(t)' are expected to vary at a faster time scale than the process'm(t), i.e., the time scales of the processes 'c(t)' and 'r(t)' are shorter than the time scales of the process'm(t)' L E[T] and r E[T]. It is reasonable to assume that m(t) processes observe an averaged out representation of both procedures, given that the second moments of intertransition instants are limited. These counting procedures are thought to have constrained second-moment intertransition periods.

C(t) and r(t) are expected to vary at a quicker time scale than the'm(t)' process, which is defined as the time scale of E[T]. An averaged out picture of either method is what the m(t) process sees since the second moments of intertransition times are limited.

V. Positioning of Car

To continue data dissemination in VANETs, the suggested protocol needs a suitable categorization of neighboring vehicles. First, the number of receiving cars inside the transmission zone is determined by combining data from nearby vehicles with that obtained during the data collection phase. It then separates its transmission area into many segments, each representing a distinct area, as indicated in Fig. 4 (the source vehicle).

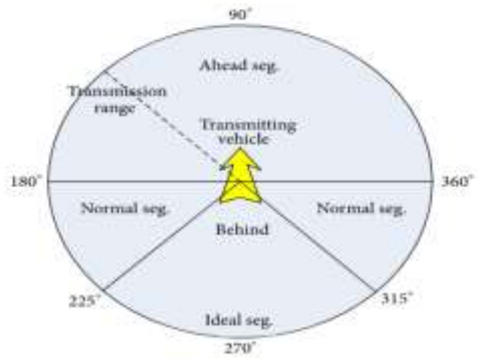

Fig. 4 Transmission range divided into segments

DOI: rp-9788770040723.174

Each receiving vehicle (denoted by) is categorized into three groups: ideal, normal, and ahead cars, once the segmentation process has been finished. As a result, the data packet's next forwarder should be one of the furthest cars in the optimum segment travelling toward the source vehicle. One vehicle at the far end of the ideal segment must retransmit a data packet with the lowest possible latency and eliminate the need for multiple retransmissions. A data packet will be sent to whichever vehicle is furthest from the optimum section if there isn't a vehicle. In the same way, if no vehicles exist inside the ideal or normal segments, the data packet will be sent to the vehicle(s) furthest from the forward segment. Data packets are intended to be sent to as many nearby cars as possible that aren't immediately accessible to the source vehicle by vehicles located inside the high-priority segments. Algorithm 1 explains how to determine whether the receiving vehicle is in the wagon wheel's ideal, normal, or forward section and how to proceed accordingly.

- ✔ Procedure for Choosing a Next Forwarder Vehicle (NFV)
- ✔ Procedure for Choosing a Next Forwarder Vehicle (NFV)
- ✔ Sourceβvehicle (S) that initiates the data dissemination process
- ✔ (Tx, Ty)β x and y coordinates of transmitter vehicle (Tj) on 2nd and subsequent hops
- ✔ (Rx, Ry)β x and y the location of the vehicle that will receive the message (Ri)
- ✔ Outputβ NFV/number of cars to distribute data/number of vehicles to deliver data (s)
- ✔ Ifβit's the first time do
- ✔ Ifβ The Orientation Ri to for a certain threshold value of the Orientation Ri and Tj
- ✔ Position Ri toβatan2 (arctangent function)
- ✔ Distance Ri-Tj
- ✔ IfβRi is included inside the ideal segment, i.e. between angles 226° and 324°, thenset waiting time for priority 1
- ✔ otherwise 2
- ✔ end
- ✔ end
- ✔ else βset priority 3 waiting time ;
- ✔ end Ri. Otherwise 1,
- ✔ If βa message is already scheduled, cancel it and trash it.
- ✔ end
- ✔ Cancel planned message
- ✔ end

VI. Result and Conclusion

The suggested new protocol operates in various VANET traffic circumstances. Initially, we examined a 20-kilometre-long, three-lane highway with cars moving in the same direction. Vehicle flow production is constructed at each highway's opposing edge, producing and inserting vehicles at 30, 40 and 50, vehicles/hour. In this scenario, overtaking is performed by putting three categories of cars into the network: high, moderate, and slow-speed vehicles. Vehicles of these three categories may attain maximum speeds of 30, 22 and 26 meters/sec. An example of such a situation would be a dynamic vehicular network with three vehicle kinds. During the simulation, the speed of these vehicles varies. Each simulation comprises 40% high, 15% moderate, and 20% low-speed cars. When considering the first situation, it was taken into consideration that the cars are traveling in a straight line and at varying speeds. However, they are quite near to one another. In figure 5 demonstrates that the first vehicle, which is colored red, is only sending out information in the form of packets with a transmission diameter that is proportional to the distance between it and the car. This is done for two reasons: on the one hand, to reduce the amount of power that is being wasted, and on the other hand, to ensure that the information being sent out does not become distorted due to interference. The first car sent constant communications and information about the current state of the road to the second and third cars, which were colored black and yellow, respectively. This will result in a lower rate of lost packets and lower overall power consumption from the processor. It illustrates the ideal case for the proposed scenario, considering that there is no communication system free of packet loss., as demonstrated in the algorithm proposed in the paper.

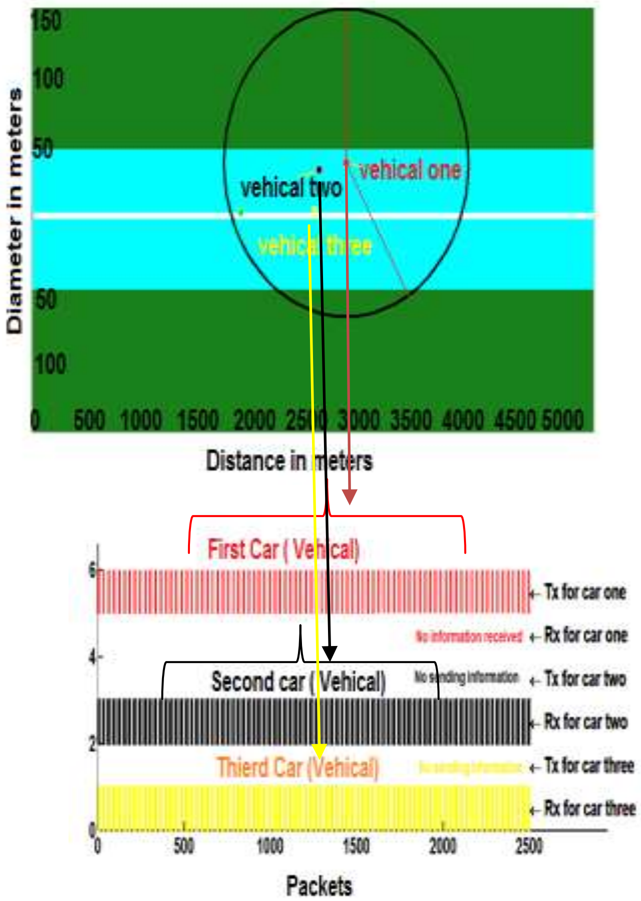

Fig. 5 vehicle transmission and received Data

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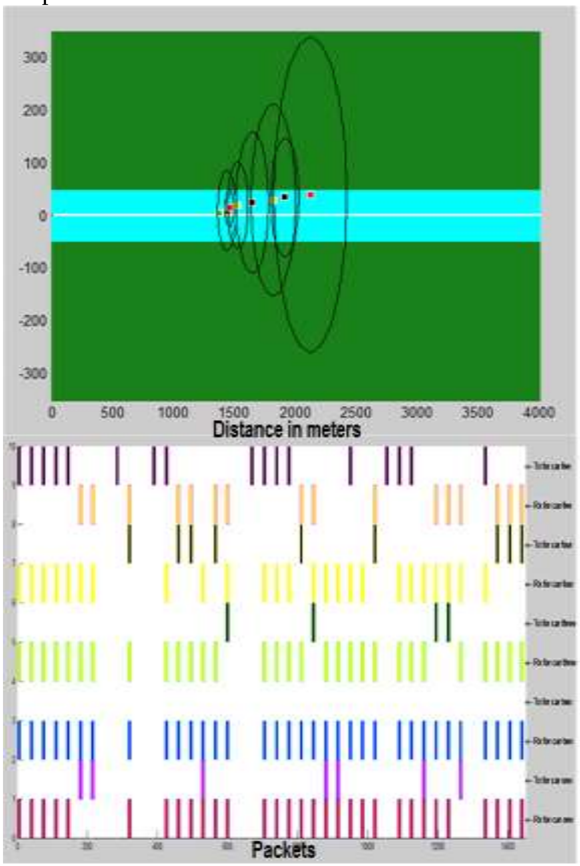

Fig. 6 illustrates the number of packets (Tx and Rx) for five vehicles.

The second scenario, depicted in Figure 6, involves more cars on the road than three, all moving at varying speeds. It should be noted that if any vehicle deviates from the prescribed diameter for broadcasting for the first vehicle, the vehicle closest to it will broadcast information with a diameter proportional to the distance it is from the car that came before it. The number of packets that were successfully received by each vehicle is depicted in Figure 6, together with the number of packets that were unsuccessfully received. The new protocol has a noticeably low packet loss figure 7, which reduces both the energy consumption of the transceiver system placed in the automobile and the consumption of the Internet package. As a result, the cost of both the Internet package and its delivery is reduced.

VII. Conclusion

The paper concludes by introducing a novel VANET protocol that performs well under various traffic conditions. The simulation results demonstrate that the proposed protocol reduces overall power consumption and packet loss, making it a financially viable solution. Given that no communication system is completely free of packet loss, the algorithm presented in the paper illustrates a perfect case for the suggested scenario. The two scenarios examined in the paper, where a high number of packets were successfully received by each vehicle, provide additional evidence of the protocol's effectiveness. Overall, the paper offers insightful information about creating effective VANET communication protocols, which can enhance the effectiveness and safety of vehicular networks.

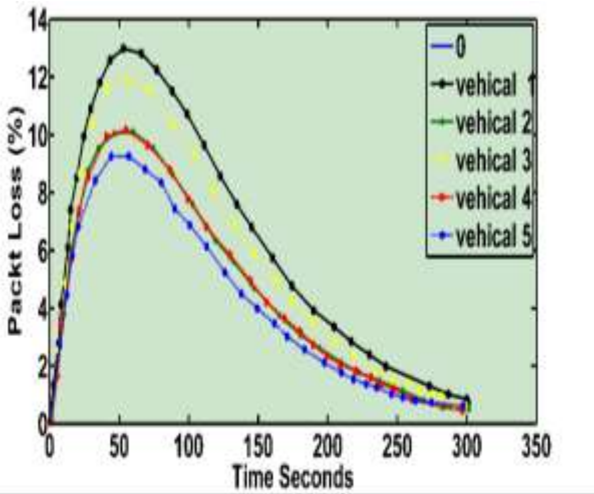

Fig. 7 illustrates the packet loss for five vehicles.

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Customer Feedback Automation and Classification using Sentiment Analysis, Robotic Process Automation and Uipath

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***Abstract*—In recent years online shopping and online e-commerce websites have drastically improved making shopping possible from our doorstep. The majority of businesses with an online presence use an online store and/or platform to manage logistics and fulfilment, undertake ecommerce marketing and sales operations, and more. By 2023, online retail sales are projected to account for 22% of all retail sales worldwide, up from 14.1% in 2019. While we see tremendous growth in ecommerce platforms, one of the most important aspects of online shopping in e-commerce platforms is customer feedback. The information, insights, problems, and suggestions that members of your community share about their experiences with your business, products, or services constitute customer feedback. Any business can use this feedback to improve the customer experience and bring about positive change, even when it's negative. With the use of feedback, your leadership team may get understanding that will help them map out the future of every aspect of the business. One of the most common factors we come across in every online shopping platform is the section which enables each customer to give their review about the product which they have purchased through the platform. This section enables customers to share their experience while they purchase and use the product. Customer reviews have immensely improved customers' trust in online shopping platforms. Customer reviews and feedback are an important part of online shopping. 94 percent of the people read at least two or three reviews before purchasing a product. One of the major goals of any company and their engineering teams is to create products which satisfy customer needs and desires. By employing the right tools to understand and meet the needs of the customer, companies achieve higher profits which will ultimately result in higher customer conversion rates and retention rates. From the supplier andmanufacturer'spointofviewcustomerfeedbackisessentialto provide social evidence that your prospective customers need to buy the product. But it can take a lot of time and laborious manual effort to solicit, compile, and track all of this feedback. While for the customers going through all the reviews and figuring out whether to buy the product or not is time-consuming and confusing. Most products get mixed reviews and it's hardfor the customer to decide.Our project is customer feedback automation using Robotic process automation and sentiment analysis which aims at making a unified platform for both customers and the vendors to sort the feedback. We are using the UiPathplatformtoextractcustomerreviewsfromthewebsiteand we will classify those reviews using sentiment analysis. Whenever a customer gives feedback it is extracted and grouped either into positive or negative and the negative feedback would be forwarded via emails to the respective departments so that they can take actions. When a customer browses for a product he/she can view the suggestions our platform would give based on the sorting we do and give them a rough percentage on how different people felt purchasing the product. We are using automation to speed up the shopping process and give customers a sense ofwhat other customers felt while purchasing, the problems they faced if any or any defect etc. Also making it easy for the manufacturers/ suppliers to deal with hundreds of complaints they receive by sorting the feedback and sending them to the respectivedepartments.**

***Keywords*—E-commerce platforms, customer feedback, Robotic process automation, UiPath, Sentiment analysis.**

I. Introduction

Online shopping, also known as ecommerce, is a special type of electronic commerce that uses a computer browser to link buyers and sellers all over the internet.Nowadays,it is normal to find online shops that offer a variety ofproducts to potential buyers along with descriptions, features, photographs, andprices.

There are two configurations that an online store may choose. The first is as a B2C store that links businesses and consumers. The second is as a business-to-business (B2B) internet marketplace. In either case, everyone who has access totheInternethasdonesomeonlineshopping.Ane-commerce platform is a piece of software that makes it possible to conduct business by buying and selling things online. Brick- and-mortar businesses dominated the market before eCommerce became popular. Retail establishments that have at least one physical location are known as brick-and-mortar enterprises. It is necessary for the buyer and seller to interact actively and physically when buying and selling products. Although brick-and-mortar stores still exist, eCommerceis quicklydisplacingthem.Inanevolutionarysense,themajority of physical establishments are evolving into online retailers.

Establishing an online presence and shifting essentialcorporate processes online are thus necessary. Recently ecommerce platforms started taking over the

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business world and this statement can be supported with statistics which talk about the growth of ecommerce platforms in Asia-Pacific region,the area accounts for more than 70% of all worldwide e-commerceactivity.WhiletheUScontributesapproximately $560billionineCommercesales,Chinaaloneaccountsfor$ 740 billion. According to projections, eCommerce sales in China would total $1,086 billion by 2023. In a similar vein, US eCommerce sales are anticipated to reach $735 billion by 2023. The key takeaways about online shopping and ecommerce platforms include the rapid growth of internet services across the world. With the rapid improvement and availability in internet services ecommerce platforms rose to the next level providing people a comfortable stay at home shoppingexperience.

One of the most important features any e-commerce plat- form provides along with search and cart features is feedback or review section. Through this feature every customer or a buyer will be able to list out the good and bad aspects about the product which they purchased and about their experience buying the product through that particular e-commerce plat- form.

Customer opinions are crucial since they act as a roadmap for your business' expansion. You can uncover pearls that make it simpler to modify and improve the client experience overtimeinboththegoodandthepoor.Inotherwords,getting input is how you can continue to put your community first in all youdo.

Today businesses sell their products to a broader network of customers or buyers through a wide range of markets. It is a must for the manufacturers of the product to get insightful feedback from the customers on the products and supplementary services provided on points regarding whether they are to compete with fierce competition and the variety of clientviewpoints.

After a company launches a new product into the market ittakes several measures to motivate customers to provide their review on the products they have purchased. The company extracts customers' feedback and opinions after a very tedious and long process and makes use of the feedback to come up with the design of their future goods. Frugal innovation is the process of adapting some product modules and module features to meet the needs and limits of regional customers while still maintaining a globally dispersed offering. The majority of people in today's world use smartphones and tablets, and the number of users continues to rise. The growing usage of mobile devices in society has given retailers andmanufacturers a wonderful opportunity to sell their products, provide3D customization apps, or even provide services with regards to their products. The high prevalence of mobile devices in society has given manufacturers a fantastic opportunity to market their goods, offer 3D product customization apps, or even offer services related to their products. In order to effectively extract client requirements and support businesses in their transition to frugal innovation, this paper handles the purpose of collecting customer feedback regarding the products offered and the services offered along with the product. The proposed system also includes feedback management that willhelp the companies to understand their customers' opinions that will help them understand more about their products and improve the design of their future goods or products. By automating customer feedback systems companies will be able to segregate the good and bad reviews which the customers have provided and accordingly make decisions about their future products based on it. We can automate the customer feedback system using robotic process automation. Robotic process automation system is a software which makes it easy to work with software robots that mimic human actions which will interact with digital systems and software. Workflows are streamlined through robotic process automation, which helps businesses become more profitable, adaptable, and responsive. By reducing menial duties from their workdays, it also boosts employee satisfaction, engagement, and productivity. RPA can be quickly installed and is non-intrusive, which speeds up digital transformation. It's also perfect for automating processes using antiquated systems that lack virtual desktop infrastructures(VDI),databaseaccess,orAPIs.

To implement the proposed model we are using Uipath in which we will build a workflow to automate the customer feedback system.

Uipathisaroboticprocessautomationtoolwhichisusedfor large scale end-to-end automation. We will use ML packages in the UiPath Enterprise version to classify the customer reviews into good and bad reviews. To classify the reviews,we will use Sentiment analysis. Sentiment analysis is a natural language processing (NLP) technique which is used to classify given text data. It is often used to understand the toneof the given textual data which will be helpful for companies to observe brand and the product sentiment in byer's reviews andtounderstandtheircustomers'wantsandneeds.

Through this study we will imply the following significant contributions:

To take input about the product the customer wants to learn about and from which website and extract the customer reviewsabouttheproductusingwebscraping.

To analyze the reviews using sentiment analysis and classify the reviews into 5 categories: very negative, negative, neutral, positive, and very positive.

To give a summary to the user about the product based on thecustomerreviewsusingvisualisationtoolslikepiecharts.

The remaining of the paper is structured as follows: Section IIbelow contains of Background about RoboticProcess Automation, UiPath, WebScraping, Section IIIbelow contains Related Work which is literature survey for previous works done related to customer feedback automation, Section IV below contains Proposed System which explains the architecture and approach of the customer feedback automation system developed, Section V below contains the software and the packages used and even about the ML models used to develop the customer feedback automation system, Section VIbelow contains Implementation and Analysis which explains about the

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workflow built and the results obtained, Section VIIbelow contains Conclusion which gives an overview of the systemdevelopedandexploresfuturefindings

II. BACKGROUND

A. Robotic ProcessAutomation

Robotic Process Automation (RPA) is a rapidly growing technology that automates repetitive and mundane tasks that are performed by humans. It involves creating software bots or robots to perform tasks that are otherwise done manually. The botsinteractwithdigitalsystemssuchassoftwareapplications, websites,anddatabasestoexecutethesetasks.

RPA is used across various industries and sectors, including finance, healthcare, insurance, and customer service, to streamline processes, improve efficiency, and reduce costs. By automating manual processes, organizations can free up employees to focus on higher-value tasks, reducing thelikelihood of human error, and increasing the speed and accuracy of tasks. RPA works by emulating human actions, such asdata entry, form filling, and document management. The bots can also be programmed to handle exceptions and make decisions, enabling them to perform more complex tasks. The bots are highly flexible and can be easily configured to work with different systems, reducing the need for extensive IT involvement.

One of the benefits of RPA is that it requires minimalprogramming skills. Non-technical users can create and con-figure bots using drag-and-drop tools, reducing the time andresources required to develop and deploy bots. Additionally,RPA provides real-time data and insights, enabling organizations to make informed decisions and improve their operations.Another benefit of RPA is that it can be easily integratedinto existing systems and processes. Organizations can startsmall with a single process and gradually expand their use ofRPA, reducing the risk of disruption to their existing systems.RPA also provides a cost-effective alternative to traditional ITsolutions, as it does not require extensive hardware or softwareinvestment. However, RPA is not a solution for every problem. It is best suited for highly repetitive, structured, and rule- based processes. It may not be the best option for tasks that require creativity or complex decision-making. Additionally, RPA may not be suitable for processes that involve sensitive information, as security measures must be put in place to ensuretheconfidentialityandprotectionofthisdata.

In conclusion, RPA is apromisingtechnologythathasthe potential to transform the way organizations operate. By automating manual processes, organizations can improve efficiency, reduce costs, and free up employees to focus on higher-value tasks. RPA is flexible, easy to use, and provides real-time data and insights, making it an attractive solution for organizationslookingtostreamlinetheiroperations.

B. UiPath

UiPath is a leading Robotic Process Automation (RPA) software platform that helps organizations automate repetitive, manual, and time-consuming tasks. UiPath enablesorganizations to streamline their operations and increase productivity by automating manual processes and reducing the likelihood of humanerror.

UiPath uses a drag-and-drop interface, making it easy for non-technical users to create and configure software bots, or "robots," to perform tasks such as data entry, form filling, and document management. The platform supports a wide range of applications and systems, including web-based applications, desktop applications, and databases. This makes it possible for organizations to automate a variety of processes across multiple departments andfunctions.

One of the key advantages of UiPath is its ability to handle exceptions and make decisions, enabling it to perform more complex tasks. The platform also provides real-time data and insights, allowing organizations to make informed decisions and improve their operations. Additionally, UiPathintegrates with other systems and tools, such asMicrosoft Excel, SharePoint, and SAP, making it easy for organizations to extend their automationcapabilities.

UiPath has a large and growing community of users and developers, providing organizations with access to a wealth of knowledge and resources. The platform also provides extensive training and support, helping organizations to get themostoutoftheirinvestment.

In conclusion, UiPath is a powerful and versatile RPA software platform that enables organizations to automate manual processes and improve their operations. Its drag-and-drop interface and support for a wide range of applications and systems make it easy for non-technical users to create and configure software bots. Additionally, its scalability, security, and integration with other systems make it an attractive solution for organizations looking to streamline their operations.

C. WebScraping

Web scraping is a technique for extracting data from web- sites and transforming it into a structured format that can be used for further analysis and processing. The process involvessending automated requests to websites and then parsing the HTML or other data that is returned in response. The data can then be stored in a database or spreadsheet for later use.

One of the advantages of web scraping is that it is fast and efficient. It enables organizations to gather large amounts of data quickly, reducing the need for manual data entry. This can save time and reduce the risk of human error. Additionally, web scraping can be automated, allowing organizations to gather data on a regular basis and keep their databases up to date.

Another advantage of web scraping is that it is cost-effective. Unlike other data collection methods, web scraping does not require the purchase of expensive data sets or software licenses. This makes it an attractive option for organizations that need to gather large amounts of data but have limitedbudgets.

Web scraping is also flexible. It can be used to gather data from a variety of websites, including e-commerce sites,

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news sites, and social media platforms. This enables organizations to gather data from multiple sources, providing a more com- prehensiveviewoftheirmarketortargetaudience.

In conclusion, web scraping is a powerful techniquefor gatheringdatafromwebsites.Itenablesorganizationstogather large amounts of data quickly, reducing the need for manual dataentryandsavingtime.Additionally,itiscost-effectiveand flexible, allowing organizations to gather data from multiple sources. However, it also has some limitations, including the potential to put a strain on websites and the risk of inaccurate or outdated data. Organizations that use web scraping should be aware of these limitations and take steps to ensurethe accuracyandreliabilityofthedatatheygather.

III. RELATEDWORK

DimitrisMourtzis A et al. [1] conducted a literature review on customer feedback gathering and management toolsfor product-service system design. The review focuses on the use ofthesetoolsinthecontextofproduct-servicesystems,andthe authors examine various methods for collecting and managing customer feedback in order to improve the design of such systems. They also identify gaps in the literature and areas for future research. The authors conclude that effective customer feedback gathering and management is crucial for improving product-service systemdesign.

The paper authored by OleksiyKhriyenko explores the development of customer feedback systems towards incorporating semantic technologies. The literature survey included in the paper assesses the current state of customer feedback systems and the benefits and limitations they possess. [2] The study highlights the significance of semantic enhancement in customer feedback systems and how it can result in improved data analysis and decision-making processes. The paper provides valuable insights for researchers and professionals in the field of customer feedback systems and the utilization of semantictechnologies.

The paper "Robotic Process Automation at Telefónica O2" by Mary Lacity et al. [3] examines the implementation andimpact of Robotic Process Automation (RPA) at TelefónicaO2, a telecommunications company. The authors analyze the implementation of RPAatTelefónicaO2anditseffects on the company's operations, processes, and workforce. The study highlights the challenges and benefits of using RPA ina large telecommunications company and provides insights for other organizations considering implementing RPA. The findings of the study are expected to contribute to the broader academic and practitioner discussion on the use of RPA in largeorganizations.

MichalBańkaetal.[4]examinesthepotentialofbusinessintel ligence technology to enhance the process of collecting and analyzing customer feedback in urban public transportation companies. The paper "A Feedback Analysis Automation Using Business Intelligence Technology in Companies Organizing Urban Public Transport" explores the use of business intelligence technology for automating feedback analysis in companies that organize urban public transportation. Thestudy provides insights into how business intelligence technology can be used to automate feedback analysis, leading to improved data processing and decision-making capabilities. The authors also discuss the benefits and limitations of using this technology in the context of urban public transportation companies. The findings of this study are expected to provide valuable information for organizations looking to automate their feedback analysis processes using business intelligence technology.

The paper "Robotic Process Automation as an enabler of Industry 4.0 to eliminate the eighth waste: a study on better usage of human talent" by explores the use of Robotic Process Automation (RPA) in the context of Industry 4.0 to reduce the "eighth waste," which refers to the underutilization of human talent in organizations. The authors examine how RPA can be leveraged to automate repetitive tasks and free up human talent for more value-adding activities. The study provides insights into the benefits of using RPA in Industry 4.0, including improved efficiency and productivity, as well as better utilization of human talent. The authors also discuss the limitations of RPA and the importance of a strategic approach to its implementation. The findings of this study are expected to provide valuable information for organizations looking to adopt RPA as a tool for improving their operations and better utilizingtheirhumantalentinanIndustry4.0context[5].

The paper "Minimizing the number of robots required for aRobotic Process Automation (RPA) problem" focuses on the optimization of robotic process automation (RPA) deployment. The authors, Sara Seguin, Hugo Tremblay, ImeneBenkalai, David-Emmanuel Perron-Chouinard, and Xavier Lebeuf, aim to minimize the number of robots required to complete an RPA problem. The study provides insights into how the deployment of RPA can be optimized through the use of mathematical models and algorithms. The authors discuss the challenges associated with deploying RPA, including the high cost of implementation, and the importance of finding the optimal number of robots required to complete a given RPA problem. The findings of this study are expected to provide valuableinformation for organizations looking to adopt RPAasa tool for improving their operations, and for practitioners and researchers interested in optimizing RPA deployment. The authors'approachofminimizingthenumberofrobotsrequired for an RPA problem could lead to significant cost savings and improved efficiency in RPA implementation [6].

The paper "Comparative Analysis of RPA Tools: UiPath, Automation Anywhere, and Blue Prism" provides a comparison of three popular robotic process automation (RPA) tools: UiPath, Automation Anywhere, and Blue Prism. The author, SameeraKhan,aimstoevaluateandcomparethefeatures,benefit s, and limitations of each tool to help organizations choose the best RPA tool for their needs. The study provides insights into the key capabilities of each tool, including automation of repetitive tasks, process visualization, and scalability. The author also compares the ease of use, deploymentoptions, and support services provided by each tool. The findings of this study are expected to provide valuable information for organizations looking to adopt RPA

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as a tool for improving their operations and for practitioners and researchersinterested in the comparison of RPA tools. This paper could help organizations make informed decisions when choosing anRPA tool and ensure that they select the best tool for their specific requirements[7].

The paper "Customer Perception Driven Product Evolution: Facilitation of Structured Feedback Collection" by OleksiyKhriyenko focuses on the importance of collecting customer feedback in the evolution of a product. The author argues that customer perception plays a crucial role in product development and should be considered throughout the product lifecycle. To facilitate structured feedback collection, the author suggests the use of semantic technologies to enable the analysis of large volumes of customer data. This, inturn, provides organizations with insights into the customer experience and helps them make informed decisions about product improvements. The author further elaborates on the benefits of using a semantically-enhanced feedback system, including improved accuracy, efficiency, and scalability. The paper concludes by highlighting the potential of semantic technologies in facilitating customer-driven product evolution and providing organizations with a more structured approach to collecting customer feedback. This study provides valuable insights for organizations looking to improve their customer experience and product offerings[8].

The paper "Data Collection using Web Scraping with Robotic Process Automation" by KomalTathe, SanjotSharma, and Prof. Dr. JyotiKharade explores the use of Robotic Process Automation (RPA) in data collection. The authors argue that data collection is a critical aspect of business operations and that traditional methods can betime-consuming and resource-intensive. To address these challenges, the authors propose using RPA in conjunction with web scraping to automate data collection processes. The authors discuss the benefits of this approach, including increased accuracy, efficiency, and cost savings. They also provide an overview of various RPA tools and frameworks that arecommonlyused in data collection and web scraping, such as UiPath, Automation Anywhere, and Blue Prism. The paper concludes by highlighting the potential of RPA in enabling organizations to collect, process, and analyze large volumes of data, thereby providing valuable insights into their business operations. This study provides valuable insights for organizations looking to streamline their data collection processes and make more informed business decisions [9].

IV. Proposed System

The aim of our project is to extract customer reviews of the desired product from the website chosen by the customer and to classify the reviews into positive and negative reviews. The proposed architecture consists of a UiPath workflow which will prompt users for the website name in which they want to browse the product and the product which they would like to purchase and learn more about it. Using web scraping reviews will be extracted into an excel file. We will perform Sentiment analysis by using Uipath AI Fabric which consists of ML packages and through this we will classify the extracted reviews into 5 categories: very negative, negative, neutral, positive, verypositive.

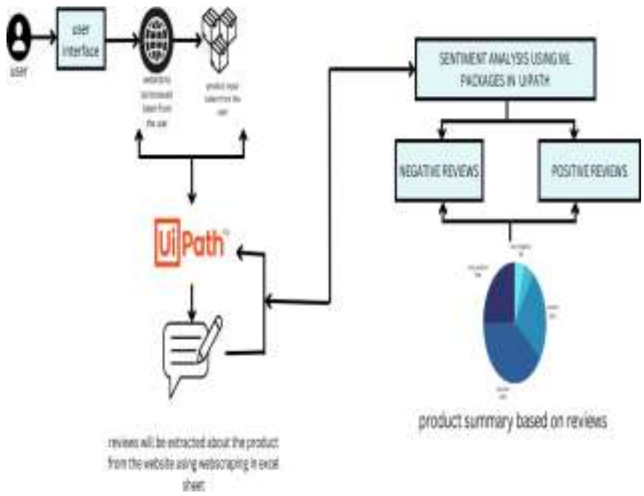

Fig. 1. System architecture of the customer feedback automation and classification.

The system constructed to accomplish the aim has fourmain modules:

- user inputmodule
- Review extractionmodule
- Review classificationmodule
- product summarymodule

A. *User InputModule*

The **user input module** in the system deals with taking input from the user regarding the product they want to learn about and the website in which they want to browse the product. To achieve this we are using Uipath activities like message box and input dialog to get the information from the user. We are using “INPUT DIALOGUE” activity to get the product name and website from the user. We are using another “INPUT DIALOGUE” activity to get the product link from the user. Then we will use “OPEN BROWSER” activity to open the website which the customer is planning to purchase their product in.This part of the user-input module will automatically open the website and enter the product name which they want to browse using “Open browser” and “Type Into”activities.Outoftheproductsdisplayedthecustomer can choose the product which he/she wants to know more about and copy the link of the product and paste the link in the input dialog that popsup.

B. *Review Extractionmodule*

It consists of Data scraping. It is a technique used to extract information from websites and other sources and store it in a structured format, such as a database or spreadsheet. It involves making automated requests to the source and then parsing the response to extract the desired information. Data scraping can be used for various purposes, such as market research, lead generation, and price comparison. We extract reviews of the product from the website. To do this first we will run the activities in the user-input module to open the product link in thewebsite.

DOI: rp-9788770040723.175

We are using a data scraping sequence which consists of activities such as“ATTACH

BROWSER” which is used to the website and in the DO section we are using “EXTRACTDATA” activity which extracts data from the indicated webpage. By using this activity we canspecify what information to be extracted by providing the XML string. The extracted data will be stored in variable “EXTRACT DATA TABLE” of variable type which will furtherbecopiedintoanexcelsheet.

C. Review classificationModule

After extracting the reviews about the product from the website we will perform sentiment analysis ML package from AI fabric in Uipath. This will classify the reviews into five categories: very negative, negative, neutral, positive and very positive.

The classified reviews will be stored in an excel sheetwhere the first column will be the review, second column will be the classification of the review i.e., if the reviews are very positive/ positive/ very negative/ very negative or neutral. The third column of the excel sheet displays confidence of the classification. This module helps inclassifying the reviews and reduces the task of reading all the reviews for the user and helps in understanding if the product is worth buying or not. Though the ratings of products do give us brief information about the quality of the product, learning about experiences of userswho alreadyboughttheproducthelpsthecurrentusertounderstand the product in a much better way and even help the user to decideiftheproductoverallishelpfulforhimornot.

D. Product summarymodule

After classifying the reviews into 5 different categories by performing sentiment analysis an overall summary about the product based on the review will be displayed using a pie chart from the excel sheet.

This pie chart helps us visualize the summary of classification clearly and quickly. Going through the overall classification of the review will be a tedious job for the user so we have automated this by creating a pie chart with an overall summary of the reviews of the product. The pie chart depicts whether the product majorly has positive reviews or negative reviews.

E. SentimentAnalysis

Sentiment analysis, also known as opinion mining, is a field of Natural Language Processing (NLP) that focuses on determining the sentiment expressed in a piece oftext. It involves analyzing text data, such as social media posts, reviews, and customer feedback, to determine whether the sentimentexpressedispositive,negative,orneutral.

The goal of sentiment analysis is to provide businesses with insights into the opinions and emotions of their customers and stakeholders. This information can be used to inform product development,improvecustomerexperience,andmonitorbrand reputation.

Sentiment analysis algorithms typically use a combination ofmachinelearningtechniquesandNLPtechniquestoidentify patterns in text data and classify the sentimentexpressed.There are two main approaches to sentiment analysis: rule-based methods and machine learning-based methods. Rule- based methods use a set of predefined rules to classify the sentiment expressed in a piece of text. For example, a rule- based approach might classify a sentence as positive if it contains words such as "good" or "great."

Sentiment analysis has several applications in a variety of industries.Inthemarketingandadvertisingindustry,sentiment analysis can be used to monitor brand reputation and customer sentiment towards products and services. In the customer service industry, sentiment analysis can be used to identify customer pain points and improve the customer experience. In the financial industry, sentiment analysis can be used to monitormarketsentimentandmakeinvestmentdecisions.

In conclusion, sentiment analysis is a field of NLP that focuses on determining the sentiment expressed in text data. It provides businesses with insights into the opinions and emotions of their customers and stakeholders, and has a wide range of applications in a variety of industries. However, sentiment analysis also has some limitations, includingthe challenge of accurately determining sentiment and ensuring the quality of training data. Organizations that use sentiment analysis should be aware of these limitations and take steps toensuretheaccuracyandreliabilityoftheirresults.

V. EXPERIMENTALSETUP

A. SoftwareUsed

1) UiPathStudio: UiPath Studio is a powerful and user-friendly platform for automating various business processes.The software is easy to use, even for non-technical users, and offers a visual interface that allows users to build automated processes using drag-and-drop functionality.UiPathStudio integrates with a wide range of applications, includ- ing web and desktop applications, and provides advanced capabilities such as machine learning and computer vision. The platform is scalable and can be deployed across large enterprises, small businesses, and even individuals. Addition- ally, UiPath Studio has a large and active community, which provides users with access to a wealth of knowledge and support resources. In summary, UiPath Studio is an ideal tool for organizations looking to automate their business processes andachievehigherlevelsofefficiencyandproductivity.

2) UiPathAI Fabric: UiPath AI Fabric is a cloud-based platform for managing and deploying AI models. It supports a wide range of AI models including computer vision, natural language processing, and predictive analytics. Ai Fabric in Uipath helps us to manage ML packages with Uipath workflows.AI Fabric connects seamlessly with UiPathstudio and Orchestrator to create a unified enjoy inside all UiPath Platforms. Through this device, customers’ growing automations can better orchestrate all functionalities of AI; deploying, consuming,

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handling and enhancing gadget studying models. For the automation of customer feedback analysis we areusing the Uipath Studio Enterprise version. We used a free 60-day trial version to implement the necessary ML packages using theAIpathCentreinUiPathStudio.

B. PackagesUsed

1) *UiPathExcel Activities:* The UiPath Excel activities in UiPath Studio allow you to perform various operationson Excel spreadsheets such as reading, writing, updating, and manipulatingdatainthecells.Withtheuseoftheseactivities,you can automate repetitive tasks such as copying data from one sheettoanother,formattingcells,addingformulas,etc.Theactivities include reading and writing data, formatting cells, adding formulas, sorting, and filtering data, and more. These activities can save a lot of time and effort by automating tasks that would otherwise require manual intervention, reducingthe possibilityoferrorsandincreasingefficiency.

2) *UiPath.MLServices.Activities:* The ML Skills page, available from the ML Skills menu after deciding on a project, shows all of the fashions deployed on your UiPath AI Center service, whether or not they use ML or OS programs. This package enables users to incorporate machine learning models into their automations, making it easier to extract insights from data and improve the accuracy of decision-making. The activities provided in this package are user-friendly and intuitive, allowing even non-technical users to leverage the powerofmachinelearningintheirautomations.

3) *UiPath.System.Activities*

UiPath.System. Activities is a set of activities in UiPath Studio that provide various system- level functionalities, such as managing files and directories, interacting with the operating system, executing external processes, and more. These activities allow automating processes that involve the system and external applications, making it easier to manage tasks that would otherwise be manual and time-consuming. The UiPath.System.Activitiesinclude activities such as "File Exists", "Read Text File", "DeleteFile", and "Execute Process". These activities help in making the automation process smooth and efficient, leading to increased productivity and decreasederrors.

4) *UiPath.UIAutomation.Activities*

TheUiPath.UIAutomation.Activities is a set of activities inUiPath Studio that enables automation of user interface elements such as buttons, text boxes, and drop-down menus in desktop applications. These activities can be used to automate repetitive tasks and improve the efficiency of processes. The activities provide a wide range of options to interact with user interface elements, such as clicking buttons, entering text, and selecting items from drop-down menus. With UiPath.UIAutomation.Activities, automating desktop applications becomes easy and straightforward, and saves time andresources.

5) *UiPath.WebAPI.Activities:*

The UiPath.WebAPI.Activities package in UiPath Studio allows for automation of RESTful web APIs. It includes activities for sending HTTP requests and parsing the response, such as HTTP Client, JSON, XML, and REST activities. These activities enable users to perform actions such as retrieving data, updating records, or performing a specific action on a web API. These activities can be combined with other UiPathStudio activities to create a complete automation solution that interacts with a web API to automate a wide range of businessprocesses.

VI. Implementation AndAnalysis

For implementation purpose we used UiPath. We checked our model with two websites for the same product. We used Amazon and Flipkart websites to extractand classify reviews and the product we used is “boat red earphones”. We extracted reviews for this product from both Amazon and Flipkart for the same product to compare which website provides better dealer and delivery for the same product.

The software when run first displays a Welcome message and the proceeds with the USER-INPUT module where it further asks the user for the website, they want to browse to purchase the product, next it displays another message box asking the user for the product they wish to purchase. After taking the above-mentioned input from the user it asks opens the website the user has mentioned previously and searches for the product mentioned by the user. Then again, a message box will be displayed asking the user to provide link for the producttheywishtobrowseaboutmore.

Review Extraction and classification

Fig.2. (a)

Fig.2. (b)

Fig.2. (a) and (b) are extracted revies of boat red earphones in Amazon website and have been classified to fivecategories: verynegative,negative,neutral,positive,verypositive.

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Fig.3. (a)

Fig.3. (b)

Fig. 3. (a) and (b) show the extracted reviews of boat red earphones from Flipkart website and have been classified into five categories: very negative, negative, neutral, positive, very positive.

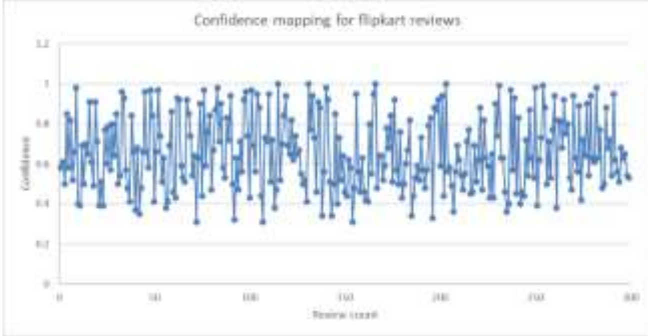
Product Summary based on review classification.

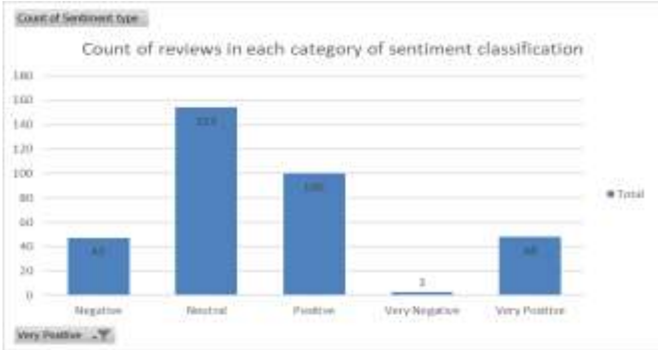
Row Labels	Count of Sentiment typ
Negative	47
Neutral	154
Positive	100
Very Negative	3
Very Positive	48
Grand Total	**352**

Fig. 4. The above figure gives overall summary of the count of reviews which fall under each category i.e., how many reviews are classified as very negative, negative, neutral, positive and positive about the reviews extracted from Amazon website.

Row Labels	Count of Sentimer
Negative	23
Neutral	64
Positive	113
Very Negative	6
Very Positive	92
Grand Total	**298**

Fig. 5. The above figure depicts the summary of the count of reviews which fall under each category about the reviews extracted from Flipkart website.





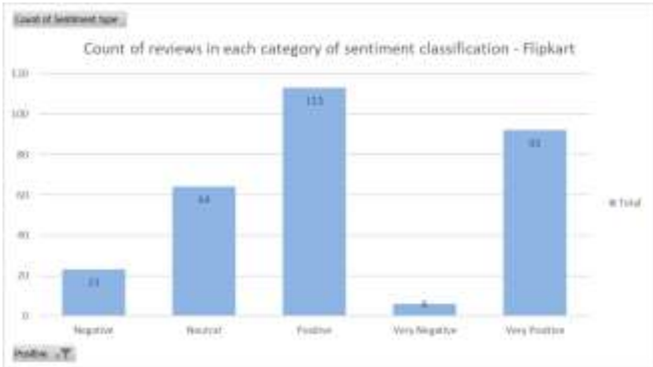


Fig. 6. The above graph is a bar graph on sentiment type vs Count of reviews graph which depicts how many reviews fall under each sentiment type for reviews extracted from Amazonwebsite

Fig. 7. The above graph is a bar graph on sentiment type vs Count of reviews graph which depicts how many reviews fall under each sentiment type for reviews extracted from Flipkart website.

Fig. 8. The above graph is confidence mapping graph for reviews extracted from Amazon website. The graph plots the confidence level of review against review count.

Fig. 9. The above graph is confidence mapping graph for reviews extracted from Flipkart website. The graph plots the confidence level of review against review count.

VII. Conclusion

In conclusion, customer feedback automation using UiPath is a valuable tool that helps businesses improve customer experience, increase customer satisfaction, and drive business growth. By automating the process of collecting and analyzing customer feedback, businesses can gain valuable insights into their customers' preferences,

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needs, and pain points. This information can then be used to make informed business decisions, develop targeted marketing strategies, and improve customer service.

The following major findings were obtained:

1. To take input about the product the customer wants to learn about and from which website and extract the customer reviewsabouttheproductusingwebscraping.
2. To analyze the reviews using sentiment analysis and classify the reviews into 5 categories: very negative, negative, neutral, positive, verypositive.
3. To give a summary to the user about the productbased onthecustomerreviewsusingvisualizationtoolslikebargraph

Thedevelopedsystemhelpsuserscompareproductsbasedontheirreviewsratherthanjuststarratingandhavebetterunderstandingabouttheproduct.Theuserswillbeabletocompare same product in different websites anddecidewhichwebsiteprovidesbetterdealerordeliveryforthe sameproduct.UiPath'sadvancedfeaturessuchasnaturallanguageprocessing,sentimentanalysis,andmachinelearningalgorithmsenablebusinessestogainadeeperunderstandingofcustomerfeedback and improve their customer experience.

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Unleashing the Power of Social Media: A Comprehensive Review of Event Detection Methods

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Abstract—Social media platforms have become a vital platform for individuals to share their thoughts, opinions, and experiences, making them an important source of information. The emergence of social media has led to a growing interest in using social media data for event detection - the process of identifying and analyzing significant events or incidents in a given area. Social media has already been utilized successfully in monitoring and predicting epidemics caused by viruses like Zika, Dengue, MERS, and Ebola. More recently, it has been used to track and predict the spread of the COVID-19 pandemic. To evaluate the publicly available crowdsourcing data frequently required to stream, aggregate, filter, and process original data, information retrieval techniques are essential. However, academic literature reveals limited understanding of the crowd power that can be leveraged to foresee or respond to events. This study focuses on analyzing the literature on event detection using social media data, exploring the various techniques and methods utilized to identify and classify events, as well as the challenges and limitations of utilizing social media data for event detection.

Keywords—rowdsource, streaming data, big data, disaster management, unstructured data, social media, outbreaks

I. Introduction

Identifying events is an important activity in many areas, including crisis management, news analysis, and social science research. The growing use of social networking sites has made it a vital resource for event detection. Social networking sites have become principal outlets for individuals to express their viewpoints, sentiments, and encounters. This has resulted in an increasing interest in utilizing information for event identification. The platform is also a common pastime for billions of people worldwide, resulting in a massive amount of data production. For instance, Facebook (Menlo Park, CA) generates four million posts every minute. Minority opinions and private information are given a platform that are not covered by other sources. According to Bazarova et al. (2015), social media can create a feeling of isolation that enables individuals, especially young people and when discussing intimate topics, to express themselves without filters, more so than in conventional meet and talk. ShengLu, Mingqing Ma, and Qiangqiang (2022) suggest that social media provides an extra, unauthorized source of data that can be used to uncover health content that hasn't been shared with healthcare professionals or health organizations, as well as to express opinions on sensitive health-related topics. Middle East Respiratory Syndrome (MERS), Ebola, Zika, and Dengue disease monitoring efforts may be augmented and improved by using data from networking platform interactions, according to research. (Househ M 2015, Odlum M, and Yoon S 2015; McGough SF et al., 2016; Marques-Toledo CA et al., 2017; Shin SY, Seo DW, An J, et al., 2016).

Researchers can use data processing techniques to automatically collect and analyze social media activity for important insights. This research can be applied to disease surveillance, targeting vulnerable populations, and addressing unsolvable health concerns like adolescent drug and alcohol use. Charles-Smith et al. (2015) emphasized the effectiveness of these tools in monitoring disasters, disease outbreaks, and other events. In this article, we discuss the background, approach, and benefits of utilizing social media for event monitoring. In this article, we provide an overview of the background, methodology, and advantages of utilizing social media to monitor various events, including disasters, outbreaks, and other incidents.

II. Background

2.1 *Social media essentials*

Kamruzzaman et al (2019) have suggested that the emergence of social networking sites has drastically transformed the methods through which individuals collaborate with each other and disseminate the details globally.

- These platforms offer exchange of contents in any format, allowing users to express themselves in various ways.
- Furthermore, social media platforms encourage cross-platform communication through social sharing, email, and RSS.
- Users can participate in the platform to varying degrees, posting content and leaving comments. The objective of social platforms is that it enables the rapid and broad distribution of knowledge.
- Additionally, social media platforms allow for one-to-one, one-to-many, and many-to-many communication and can be used synchronously or asynchronously, making communication possible across time.
- Social media websites offer a variety of features that allow users to interact with each other and the platform itself. These includes
- Social bookmarking, where users can tag and browse websites that others have bookmarked

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- Social news that enables commenting and voting on articles
- Social networking where users can join groups, add friends, and comment on profiles
- Social photo and video sharing where users can comment on submitted images and videos, and
- Wikis such as Wikipedia where users can create or modify entries.

Beyond these examples, any website that encourages user interaction falls under the definition of social media.

2.2 Social Media in Natural Disasters

Disasters occur frequently, which is difficult for government agencies and emergency services. Individuals and local communities, however, can contribute to the crowd's knowledge to forecast disasters and perform emergency response actions when they occur. Social media makes it possible for the public to participate in disaster relief efforts and allows information to be promptly transmitted from catastrophe-affected areas to those who need it most.

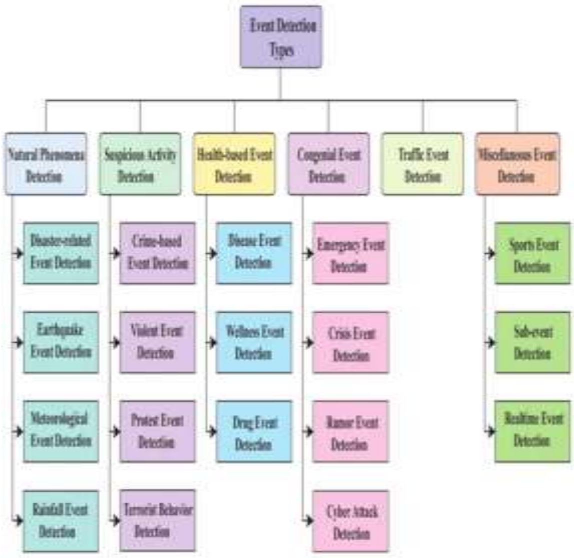

Fig. 1. Detecting a range of events through analysis of crowd sourced data.

Crowdsourcing offers a chance to facilitate the flow of knowledge, resources, money, and labor to anticipate and respond to a crisis in the era of the internet. Natural disasters can seriously harm people and property and are frequently unanticipated. Technology and societal advancements help us respond to disasters more effectively (Tuladhar et al., 2015). The response is faster and more accurate when a modern, powerful, and complicated decision-making system is used. Disasters are happening more frequently, which is making it difficult for government agencies and emergency organizations to respond. Relief efforts may be delayed as a result of unpredictable events, frightened reactions, and incomplete information about affected areas (Kankanamge et al. 2019).

To ensure the successful resolution of a crisis, it is important to first determine the effectiveness of today's disaster relief and rescue services. It's important to spread awareness and understanding about various systems, such as those related to geography, search and rescue procedures, and adapting to extreme circumstances. Sharing knowledge about these systems can play a crucial role in disaster preparedness. Studies in information systems have demonstrated that advancements in technology, particularly the use of internet-based platforms that encourage public participation, can help individuals and communities become more resilient in the face of disasters (Nan and Lu 2014).

One approach to improving disaster response systems is to use crowdsourcing to understand the connection between environmental disasters and human actions. By leveraging crowdsourcing, we can gather more data, scale potential solutions, and respond more rapidly to emergencies. Despite the recognition by scholars from various fields on the significance of mass media, community participation, and civic activism in disaster scenarios, these phenomena are not often considered as forms of crowdsourcing (Elbanna et al. 2019, Guo et al. 2021).

Poblet et al (2014) identified two technological approaches for managing disasters in literature: (i) sourcing and (ii) collaboration. The sourcing approach focuses on gathering and analyzing text from social networking sites to produce the timely alerts. Conversely, the collaboration approach aims to improve human and disaster management technology interaction to enhance overall communication.

Applying crowdsourcing to disaster management makes it easier to tap into collective wisdom and mobilize social forces to overcome a variety of challenges, including delayed situational awareness, a shortage of personnel to process and analyze data, and a lack of personnel to conduct rescue operations. Crowdsourcing can help make disaster aid more effective and affordable in this way (Callaghan 2016).

Crowdsourcing involves people from all around the world in disaster management and emergency response to natural disasters. Researchers have examined several types of natural disasters, which include floods (Schumann et al., 2010; Zeman, 2006; Kuhlicke et al., 2015; EMS, 2018; Trambauer et al., 2016), earthquakes (DE A, 2014; Wang J, 2019; TL and J, 2017), and wildfires (Thom, 2016; Quapp et al., 2017).

2.3 Social media in outbreak detection

Before the era of vaccinations, infectious diseases typically followed seasonal patterns and progressed through various phases. It is critical to identify a seasonal outbreak promptly to respond more efficiently and effectively to medical professionals. Failure to do so can lead to fatal diseases like influenza or influenza-like illnesses (ILI) in a region where an epidemic has broken out epidemiologically (Alessa and M. Faezipour, (2018), E. Lau and P. Wark, (2019)).

To lower the risk of illnesses and stop epidemics, early discovery is crucial, but current outbreak detection methods have a lengthy delay between diagnosis and public action (Tao et al, 2020). Additionally, presumptive techniques such as QMRA might not be effective in rapidly identifying

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outbreaks as they rely on structured data from pre-planned field trials (Tao et al, 2020).

Online social media (OSM) can be utilized to detect and contain epidemic outbreaks in health surveillance systems (S. Amin, 2021), forecast public illness outbreaks, and spread accurate information (C. Feng et al, 2020, K. Yu, 2021). Rapid disease diagnosis can lessen the impact of seasonal epidemics on population safety (Maharana, A. et al, 2019). Combining machine learning techniques with crowdsourcing provides novel ways to conduct risk assessment and communication for food safety. Social platform monitoring is also an effective tool to disseminate information for disease monitoring and engage with the public to prevent epidemic breakouts (X. Zhang, et al, 2021).

2.4 Understanding Events in Social Media

According to Zhao, Qiankun, and PrasenjitMitra (2007), an event refers to a collection of social player relations on a specific topic within a certain timeframe. According to Hearst and Marti (2009), incidents in social media analysis can be characterized as observable occurrences that involve multiple entities. The process of monitoring the incidents utilizes cognitive processes to accurately detect incidents by analyzing data. Events are noteworthy occurrences at specific times and locations that can be regarded as a single chapter of a larger narrative (Sayyadi, Hassan, Matthew Hurst, and Alexey Maykov, 2009; Panagiotou N et al, 2016). In social media analysis, it's necessary to examine the cumulative trend changes in the data stream to comprehend events. According to KarthikSubbianet all (2012), streaming data analysis involves recognizing significant incidents as they happen. The analysis of social networking sites data can be beneficial for detecting various incidents, whether they are limited to a particular location or widespread, such as traffic congestion on a street or floods in Florida, as explained by McCreadie et al (2013).

The platform has been used for multiple purposes,such as identifying activism, supporting emergency responders, tracking disease spread, analyzing user functions and behaviors, measuring media coverage, providing tourist information, detecting traffic, exposing people to diverse viewpoints, and facilitating political participation. It has also been used to study migration patterns, food preferences, and happiness levels in real-time. Some people still significantly rely on networking platforms for governmental updates and data, despite the fact that the majority of its content has nothing to do with news or public problems (Gil de Ziga et al., 2012). For these research aims, studies have used several billions of tweets or messages (Xu et al., 2014; Avvenuti et al., 2016, 2018; Lampos and Cristianini, 2012; Martinez Teutle, 2010; Cresci et al., 2020; Mazza et al., 2019; Prieto Curiel et al., 2019; Silvestri et al., 2015; D'Andrea et al., 2015; Himelboim et al., 2013; Ausserhofer and Maire, 2013; Coletto, 2017; Amato, 2017; Dodds et al., 2011).

2.5 The challenges of crowdsourcing in crisis / limitations of social media

Crowdsourcing in crisis situations refers to the process of collecting and utilizing information from a large group of individuals, often via social media platforms, to aid in crisis management and response efforts. However, there are several challenges and limitations associated with crowdsourcing in crisis situations.

Due to the use of terms with numerous meanings in social platform streams, ambiguity is a significant issue with human feeds or text (Carbezudo MAS and Pardo TAS, 2017, Gutierrez-Vazquez et al 2016) Although humans can use context and common sense to disambiguate text, computer programs struggle to do so (Alkhatlan A, Kalita J and Alhaddad A, 2018). Moreover, the presence of informal language, shortened words, and initialisms in social networking sites makes it even more challenging to understand their meaning..Unfortunately, most of the techniques used to predict or identify the current events are not equipped to handle this issue. Making it difficult to accurately analyze social platform content.(Katragadda S, Benton R and Raghavan V 2017).

Social networking sites data gathering and monitoring present many opportunities for multiple entities. However, there are several challenges associated with this field,

1. Data cleansing - One of the key challenges in this field is the need to effectively preprocess the textual data, particularly the high volume of on the fly data, in order to ensure its quality and reliability.
2. Scraping - There is limited academic access of content from the platforms, However, news services such as Thomson Reuters and Bloomberg charge a fee for access to their data, while Twitter recently introduced the Twitter Data Grants program, which provides academics with access to Twitter's historical data and public tweets to enable them to obtain fresh insights from its vast data collection (Twitter has over 500 million tweets each day).
3. Verification and reliability: One of the main challenges of crowdsourcing in crisis situations is verifying the accuracy and reliability of the information that is collected. Social media platforms can be a source of misinformation and rumors, which can lead to confusion and impede crisis response efforts.
4. Privacy concerns: Crowdsourcing in crisis situations can raise privacy concerns, as personal information can be shared and used without consent.
5. Data overload: Social media platforms can generate a large volume of data, which can make it difficult for organizations to effectively process and utilize the information (Agarwal, Liu, Tang, & Yu, 2008).
6. Bias: Crowdsourcing can also be affected by bias, as certain groups of people might be more likely to share information than others, leading to a lack of representation and a narrow perspective of the crisis.
7. Limited data quality: Social media data, although useful, can be unstructured, incomplete and unreliable. This can make it difficult to extract useful information and make accurate predictions.

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8. Lack of context: Social media data can lack context and background information, making it difficult to understand the information and to make sense of the events.

9. Streaming data - The real-time handling of crises can be challenging due to the vast amount and speed of social media data. Identifying and categorizing events in real-time can be difficult, which can hinder efforts to respond to crises.

10. Relevance in Context - Social media information is contextual and varies from user to user. For example, some Twitter users may appreciate updates on daily activities while others find it bothersome.

11. Use of Slang Terms and Intentional Spelling Errors - Informal language is prevalent on social media, with people using colloquialisms and intentionally misspelling words for emphasis, such as "so coooooool..." This form of language conveys sentiments, phrases, and feelings and adds a new dimension to written texts. These aspects of communication should not be disregarded as mere typos, as they can provide valuable information. Online dictionaries like UrbanDictionary can be used to decode the meaning of slang, acronyms, and other informal language used by people. However, the abundance of off-topic discussions and noise can distort the analysis.

12. Recency of data - Platforms allow for fast conversations and responses, and people's interests tend to be diverse and changeable over time, as observed in the blogosphere (Hayes &Avesani, 2007). This results in a shift in both people's interests and the social media environment. Additionally, the freshness of the information on social media is constantly evolving.

In conclusion, crowdsourcing in crisis situations can provide valuable information for crisis management and response efforts. However, there are several challenges and limitations associated with crowdsourcing in crisis situations, such as verification and reliability, privacy concerns, data overload, bias, limited data quality, lack of context, and inability to handle crisis in real-time. Thus, organizations should be aware of these challenges and limitations and develop strategies to address them.

III. Methods and Techniques

Two different approaches used to identify incidents from social networking sites data.

The first one is, based on the rules. This approach relies on predefined patterns, policies and guidelines, such as keyword-based and location-based techniques. Keyword-based methods use specific keywords or hashtags to detect events, while location-based methods rely on geographic information to identify events in a certain area.

On the other hand, machine learning-based methods involve the use of algorithms to learn patterns and classify events. These methods can be supervised or unsupervised, where supervised methods use labeled data to train a model, while unsupervised methods use unlabeled data to detect patterns.

IV. Big Data framework for social media analytics

4.1 *Big Data*

A big data framework is a collection of technologies and tools used to handle, examine, and visualize the terabytes of data. To facilitate social media analytics, such a framework can be employed to acquire, retain, process, and analyze voluminous data generated by platforms like Twitter, Facebook, and Instagram.

A data management system typically consists of several essential components, including data collection, storage, processing, analysis, visualization, and governance.

1. The data collection component involves acquiring data from different sources, such as social media platforms, APIs, and web scraping, in various formats, such as text, images, and videos.

2. The data storage component includes preserving the collected data using various storage technologies, like Hadoop Distributed File System (HDFS), NoSQL databases, and cloud storage.

3. The data processing component involves cleaning and processing the collected data using various technologies, such as Apache Spark and Apache Storm, capable of handling large data volumes in real-time.

4. The data analysis component includes analyzing the processed data with the help of big data technologies, which provide machine learning and data mining functionality.

5. The data visualization component involves presenting the analyzed data through various technologie to create interactive visualizations.

6. Lastly, the data governance, security, and compliance component involves ensuring compliance with legal and regulatory requirements and ensuring data security.

The big data framework for social media analytics should also include an orchestration and scheduling layer to schedule and monitor the data pipeline, such as Apache Airflow, Oozie, or Apache NiFi.

Newman et al. (2016) explains that the term "Big Data" implies a vast amount of data, denoting its magnitude or quantity. However, contemporary literature highlights a set of characteristics that distinguish big data and underscore their value. These characteristics, known as the three Vs of big data - volume, variety, and veracity - are widely accepted among scholars. The concept of the three Vs was first introduced by Laney and has been elaborated upon by subsequent authors (Uddin et al., 2014). Volume refers to the size of the data generated, which can range from terabytes to exabytes and even beyond. Big data is continuously produced from various sources such as social media, cloud-based services (such as Amazon), business-related data, and Internet of Things (IoT)-related data (Khan et al., 2014; Storey and Song, 2017). Radicati and Hoang (2011) predicted that the global number of email accounts generated would increase to over 4.3 billion by late 2016, up from 3.3 billion in 2012. According to a survey conducted by IBM in mid-2012, data amounts exceeding one terabyte

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are considered to be big data (Schroeck et al., 2012). However, this threshold is relative, as the quantification of data volume depends on other factors, such as time and data type. With advances in storage capabilities, larger datasets can be managed over time. According to Chen and Zhang (2014), the concept of Big Data is not only about the volume of data, but also encompasses various dimensions, starting with the letter V and ending with the "Vs" of Big Data. It is evident that a terabyte of textual data is not always equivalent to a terabyte of video data, highlighting the importance of the data-type component. The data sources and types are diverse, and different formats are used to describe data coming from various sources. For instance, structured data can be distinguished from frequently administered Structured Query Language (SQL), which is a programming language designed for maintaining and accessing data within Relational Database Management Systems (RDBMS) (Hashem et al. 2015). Structured data is simple to enter, search for, and save, while unstructured data, such as multimedia (videos, photos, and audios), which has a fixed format, is the primary format that defines Big Data (Gandomi and Haider 2015). Managing unstructured data poses a significant challenge for data scientists. Semi-structured data, such as Extensible Markup Language (XML) and JavaScript Object Notation (JSON) data, are also generated. The incoming and outgoing data are characterized by their velocity, which is assessed in terms of batch size, near real time, and real-time to achieve streaming (Chen and Zhang 2014).

Yaqoob and colleagues (2016) argue that the proliferation of internet-connected mobile devices and sensor-equipped devices has a significant impact on data velocity. Fan and Bifet (2013) suggest that delivering timely responses and updates is critical for evaluating an application's effectiveness. In addition, interpreting and organizing streaming data is a challenge that requires relevant technologies and techniques (Orgaz et al., 2016). Big Data is characterized by additional features, such as veracity, which refers to the reliability and messiness of data, according to IBM and Microsoft (Gandomi and Haider, 2015). Storey and Song (2017) maintain that veracity poses problems with data quality, such as accuracy, completeness, timeliness, consistency, and accessibility. Value, the fourth V of Big Data, was introduced by McKinsey and Oracle to highlight the value of hidden insights in Big Data (Chen and Zhang, 2014). Wang et al. (2017) expand on this concept by proposing five V dimensions for Big Data that consider both value and veracity. Uddin et al. (2014), on the other hand, identify seven Vs of Big Data, taking into account both the validity and volatility dimensions. They define volatility as the retention policy for structured data typically used in organizations, while validity refers to data accuracy and correctness regarding its intended purpose. The many Big Data dimensions and their associated names are shown in Figure 1.

Fig. 2: Big Data dimensions

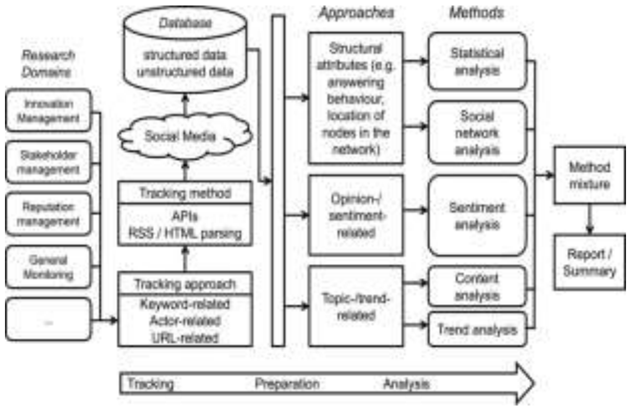

Fig. 3. The Social Media Analytics Framework (Stieglitz et al., 2014, Stieglitz and Dang-Xuan, 2013).

To effectively analyze social media data, organizations can employ a big data framework that involves the use of various technologies and tools. This framework enables the collection, storage, processing, evaluation, and visualization from social media platforms. With this approach, businesses can gain insightful information and use social platform data to guide decisions.

4.2 Natural language processing

Utilizing natural language processing (NLP) is crucial in enhancing event detection through evaluating the online networking platforms data. By employing NLP techniques to extract and scrutinize text data from social media platforms like Twitter, Facebook, and Instagram, events can be identified and classified effectively. One important NLP technique that can be used for event detection is text classification. This technique can be used to classify social media posts into different categories, such as events or non-events. Text classification algorithms can be trained on labeled data to learn the characteristics of events and non-events, and then applied to new data to classify it. For instance, a text classification algorithm can be trained to classify posts that mention a keyword or hashtag as events.

Another NLP technique that can be used for event detection is named entity recognition (NER). This technique can be used to identify and extract entities. NER can be used to extract relevant information from social media posts, such as the location of an event or the people involved in an incident. In addition to text classification and NER, Sentiment analysis is also an important NLP technique that can be used for event detection.

Depending on the polarity of posts, the NLP model can be used to categorize the sentiment.Sentiment analysis is used to determine how the public feels about a specific occurrence or event, which can be useful for crisis management and news analysis. Finally, NLP techniques, such as geotagging and geocoding, can extract geographic information from text data to facilitate geolocation, enabling the identification of the location of an event or incident. This information can be used to identify events in specific areas and to understand the spatial distribution of events.

The authors (McCreadie R et al. 2013) investigated scalable distributed event detection using Twitter feeds and lexical key partitioning technique. The research suggested a framework for automatic distributed real-time event detection that employed Storm topology and utilized Locality Sensitive Hashing (LSH) to handle noisy, temporal, and slang-filled Twitter streams. Authors (Kaleel SB, Almeshary M, Abhari A, 2013) proposed using LSH, which was used for the incident identification. The proposed model compared with leading social platforms Facebook, Twitter.

In 2015, Musaev et al. proposed a system called LITMUS to identify "landslides" related information from social media using a keyword-based approach. The system extracted categorization features from Wikipedia and utilized an enhanced Explicit Semantic Analysis (ESA) algorithm to categorize the data into relevant and irrelevant categories. The location was approximated using semantic clustering that relied on measuring the semantic distance. However, only data that had been tagged with location information were taken into consideration, and the analysis did not take into account the handling of SAB words in the semantic-based approach. The system was later used to identify crossover activities between two social media streams.

TABLE 1 :AN OVERVIEW - ADVANTAGES AND LIMITATIONS OF MODELS IN EVENT DETECTION.

Category	**Unsupervised ML**	**Semi-supervised ML**	**Supervised ML**	**Semantic approach**
Benefits	Approach can detect events without considering their nature, and can handle a large volume of data.	The method is especially beneficial when it's challenging to identify important characteristics in the data. Additionally, even a small dataset can produce a substantial increase in accuracy.	The outcomes are very precise and reliable.	More accurate and precise results due to its ability to consider the context and meaning of the text being analyzed.
Shortcoming	Working with data streams that have many attributes or features, using this technique may pose a challenge. This technique may not account for the spatial relationships within the data, which can be a limitation in certain applications.	Iteration results are not stable and accuracy is low.	Challenges, including the need for significant time and resources, dealing with large and complex datasets, addressing the issue of concept drift, and the requirement for expertise to properly label input and output variables.	A crucial time and resource commitment, in addition to a detailed understanding of algorithms, are needed to develop semantic-based techniques.

(Romero and Becker, 2019) and (Sun et al., 2021) proposed different approaches for event detection in social media using natural language processing techniques. Romero and Becker used a hybrid approach that combined with multiple traditional approaches NER, TF-IDF and others to classify events in tweets. On the other hand, Sun et al. proposed scoring and word embedding for the same which employed Word2vec with enhanced embeddings. Both studies employed pre-processing steps. However, neither of the approaches addressed the ambiguity related to SAB terminologies in social platforms. Overall, natural language processing techniques have the potential to improve event detection in social media by extracting and analyzing text data using methods such as text classification, named entity recognition, sentiment analysis, and geolocation.

V. CONCLUSION

In conclusion, studies on social networking sites have shown that it might be a useful data resource for incident detection. Various natural language processing techniques have been used to extract and analyze text data from social media platforms, including text classification, named entity recognition, sentiment analysis, and geolocation. While these techniques have shown promising results, there are still challenges to overcome, such as handling ambiguity and variability in language, improving the accuracy and scalability of models, and addressing ethical and privacy concerns. Overall, more investigation into this topic has the potential to improve our capacity for real-time recognition and response to events, with significant implications for sociology, health services, and emergency preparedness.

VI. FUTURE WORK

There are several potential areas of focus for future research that explore the use of online networking platforms for event detection. These include:

1. Ambiguity and variability in language: Social media language is often informal and ambiguous, making it difficult to accurately detect events. Existing natural language processing techniques have been successful in addressing some of these challenges, but more

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sophisticated approaches could be explored to improve accuracy.

2. Scalability and efficiency: Social media platforms generate vast amounts of data in real-time, making it difficult to process and analyze the data in a timely manner. Future work could focus on developing scalable and efficient algorithms for event detection.

3. Ethical and privacy concerns: Important ethical and privacy issues are brought up by the use of social media data to identify events, notably in relation to data privacy, informed permission, and potential bias. Future research might concentrate on creating moral standards and best practices for gathering and utilizing social networking websites.

4. Incorporating multimedia data: Social media platforms also contain a wealth of multimedia data such as images and videos, which could provide valuable information for event detection. Future research could explore how to effectively integrate multimedia data into event detection models.

5. Adapting to new social media platforms and evolving language: As new social media platforms emerge and language use evolves over time, it will be important for event detection models to adapt to these changes. Future research could explore how to build models that are flexible and adaptable to new platforms and changing language use.

6. Application to specific domains: The method of event detection from social networks has multiple applications across diverse industries including crisis management, public health, and social sciences. Future work could focus on applying event detection models to specific domains and assessing their effectiveness in real-world settings.

7. Real-time event detection: Social networking platforms produce vast amounts of data in real-time and event detection algorithms need to be able to operate in real-time as well. Future research could explore how to improve the speed and efficiency of event detection algorithms to enable real-time monitoring of events on social media.

8. Handling bias and overfitting: One potential challenge with event detection algorithms is that they may be biased towards certain types of events or may overfit to the data used for training. Future research could explore how to minimize bias and overfitting in event detection models, for example, by using more diverse training data or by incorporating regularization techniques.

Overall, event detection through the social platform is a crucial and also complex task with the potential to improve our understanding of various events and incidents. The forthcoming investigations in this field can concentrate on several significant challenges including the development of methods that can be applied to stream data, improving the ability to handle noise and ambiguity in social media language, integrating other sources of information such as multimedia data, addressing issues related to bias and overfitting, and finding ways to ensure privacy and security concerns are addressed. By addressing these challenges, we can make significant strides towards developing more accurate and effective event detection algorithms that can be applied in diverse domains, from crisis management to marketing and beyond.

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A review of Building integration of Solar PV Systems

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***Abstract*—Building Integrated Photo Voltaic (BIPV) systems are a promising technology that offer numerous benefits, including energy savings, reduced carbon emissions, and improved aesthetics. However, designing and implementing BIPV systems that are efficient and effective requires careful consideration of several factors. These include high building design, colored PV modules, optimization systems, and policies and regulations. By integrating PV modules into the building's design and using advanced control and monitoring systems to maximize energy generation, BIPV systems can achieve significant energy savings and carbon emission reductions. The deployment of BIPV systems is also influenced by financial incentives and building codes. This review paper, will first discuss the various definitions proposed for different types of energy consumption, followed by the concept of "prosumer." The next section will focus on policies, followed by the different types of technologies for BIPV proposed in the literature, including pioneering countries in the sector. After reviewing the costs of various models and the different optimization techniques proposed in the literature, it will conclude by discussing the various challenges and opportunities of such systems.**

Keywords— BIPV, Building integration PV, Photovoltaic, Optimization, Genetic algorithm.

I. INTRODUCTION

Renewable energy options such as wind and Photo Voltaic (PV) power have the capacity to revolutionize the energy system currently dominated by fossil fuels, and shift it towards a completely sustainable energy system[1]. By balancing economic and social concerns while simultaneously preserving the environment, using clean energy helps to achieve sustainable development goals. [2]. Global energy usage is classified into three main categories: buildings , industry and transportation. Recent figures show that, all three of these sectors equally contribute to overall energy consumption, highlighting the need for a comprehensive approach to energy reform that targets efficiency improvements across all sectors [3].

However, the world's population is growing, and with it comes a greater demand for primary energy and an increase in greenhouse gas emissions, particularly CO2. The sector of building is responsible for 38% of the primary energy used in the world and contributes to around half of emission of greenhouse gas worldwide, with 20% of those emissions coming from building operations[4-5].

Buildings have an enormous energy intensity, and reducing it is vital from both economic and environmental perspectives[6]. Undoubtedly, integrating solar Photo Voltaic (PV) systems is an appealing option for partially meeting the electricity needs of buildings. [7]. The solar energy usage in the construction industry is becoming increasingly popular in many countries[8]. The declining costs of technologies of solar conversion, coupled with the increased PV module efficiency and growing worldwide interest in producing green electricity, make solar energy an increasingly attractive option[9-10].

BIPV (Building Integrated Photo Voltaic) concepts have become more popular in recent times due to several appealing aspects besides energy generation. These include integration into the building envelope without visible attachments, cost reduction compared to retrofitting with PV panels, and improved architectural aesthetics[11].This approach merges architectural design with renewable energy generation, thereby increasing buildings efficiency in terms of energy through the optimization of electrical, thermal, and optical properties of the PV elements [12]. Based on the existing European regulations on performance of energy efficiency in buildings, including Ordinances 2010/31/EU and also 2012/27/EU, respectively [13-14]. The buildings efficiency in energy must be evaluated using a methodology that takes into account various factors, incorporating the structure's thermal characteristics, adequate natural illumination levels, systems for cooling and heating , the use of renewable sources of energy, the addition of passive air conditioning and heating elements, quality of interior air , shading, and architectural design [15].

II. DEFINITIONS

A. NZEB NetZEB PEB

According to the regulations set forth by the European Union, NetZEBs are described as buildings with exceptional performance, which are distinguished by their extremely low energy requirements that are offset by renewable sources-based energy that are generated on-site or in the vicinity of the building [16].

For newly constructed buildings, numerous different terminologies and concepts were proposed in addition to the NetZEB idea. There were also discussions in the literature about how to interpret these significations [17]. Generally, a

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Net Zero Energy Building maintains a null balance of energy over the course of a year, where the energy quantity coming from the utility grid equals the quantity exported back to the utility grid. On the other hand, a Zero Energy Building (ZEBs) is designed to be highly efficient and has a yearly delivered energy that is equal to or lower than the on-site exported energy [18-19]. Positive Energy Buildings PEB, which were first established in France and Denmark, are characterized by generating more renewable energy on-site than the amount used over the course of a year [16].

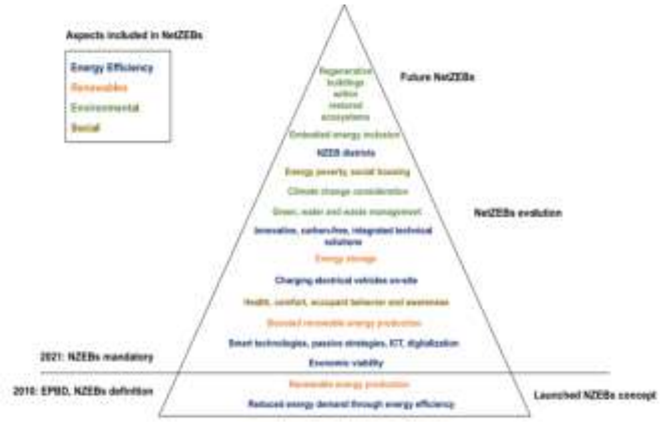

Fig. 1. Evolution of the NZEB concept with aspects [20]

III. Prosumer And Energy Transaction Policies

The importance of sustainable energy extends beyond the protection of the environment, as it is also essential for the growth of economies and societies around the world [21]. The United Nations has created Sustainable Development Goals (SDG) to combat issues such as famines, droughts, wars, plagues, and poverty caused by recent climatic changes and promote sustainability worldwide. One of these goals, SDG 7, is to guarantee inexpensive and green energy access to all [22].

A prosumer is an individual or entity that not only consumes electricity from the grid but also generates their own electricity using solar PV or other renewable sources. They may even be able to sell excess electricity back to the grid depending on the feed-in policy in place [23,24]. In number of countries the Feed in Tariff (FiT) has been a crucial policy in promoting the development of renewable energy-based power integration into the utility grid [25]. The difficulties associated with the FiT approach resulted in the introduction of net billing net metering, which have been recognized as effective tools to promote the adoption of electricity prosumption worldwide [26].

IV. Penetration Of BIPV

Currently, the BIPV idea has been warmly embraced in North America and Europe. Many European nations, including Germany, France, and Italy, have made substantial contributions to the regional expansion of the BIPV industry. In 2014, these three countries alone accounted for 87% of the European market share. Additionally, financial incentives in the form of subsidies on photovoltaic integration from supportive directives by the European Commission are anticipated to aid the market's quick expansion [27]. Based on the Becquerel Institute's 2018 estimates, France now holds the title for the highest installed capacity of BIPV in the world, with 2.7 GWp. This accounts for approximately 27% of the total BIPV capacity installed worldwide. The global BIPV installed capacity in 2018 can be seen in Figure 2 [28].

The commercial segment has become the largest contributor to the BIPV 2020 market share, mainly because more people are becoming aware of green building infrastructure with zero emissions. BIPV installation improves the aesthetic of commercial buildings and dramatically lowers energy usage, which promotes product adoption in this market area [27]. The commercial sector, typically found in densely populated areas, often requires buildings to be designed in a vertical, narrow, and high-rise style [29]. Designers of solar energy face new challenges urban high-rise structures' limited PV roof space panel placement. This has led to an increased interest among researchers to find solutions, including integrating semi-transparent and colored PV in building facades, windows, and walls [30].

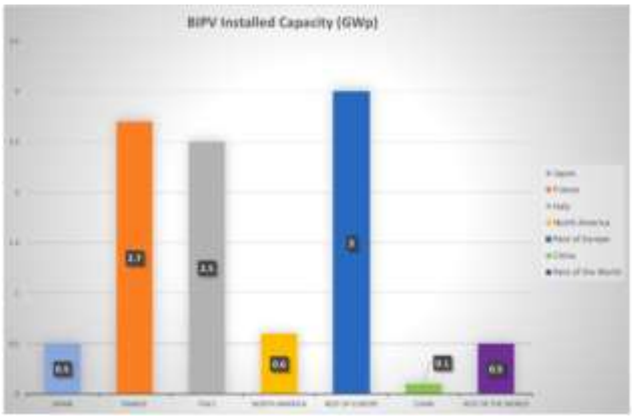

Fig. 2. BIPV estimated capacity gloabllay installed in 2018 [28]

A. *Type of BIPVs configurations*

BIPVs may be categorized into four broad groups: PV shadings, façades, balconies and roofs integration (as depicted in Figure 3). louvers and lamellas or overhangs are all options for installing PV in shading mode. Applied PVs, continuous or intermittent skylights PVs, and PV tiles are all examples of roof integration. Applications for walls and windows that are (semi)transparent have been considered in the context of façades. When it comes to wall classification, there are four categories based on integration: rain screens, curtain walls, double skin which are non-structural and opaque PV which are structured [16].

The double skin wall integration may be divided into two types. One category is the ventilated façade that is positioned near the wall and expands the building's thermal barrier up to 30 cm away from the existing wall. The second method of integration involves using heat dispersion, increasing daylighting, and allowing enough area for maintenance of walls over greater lengths of up to 1.0 m. With PV Curtain Walls, the conventional glazing system of façade is swapped out with PV glass with the right amount of transmittance, enabling it to produce energy, offer internal illumination, and provide shaded circumstances [16].

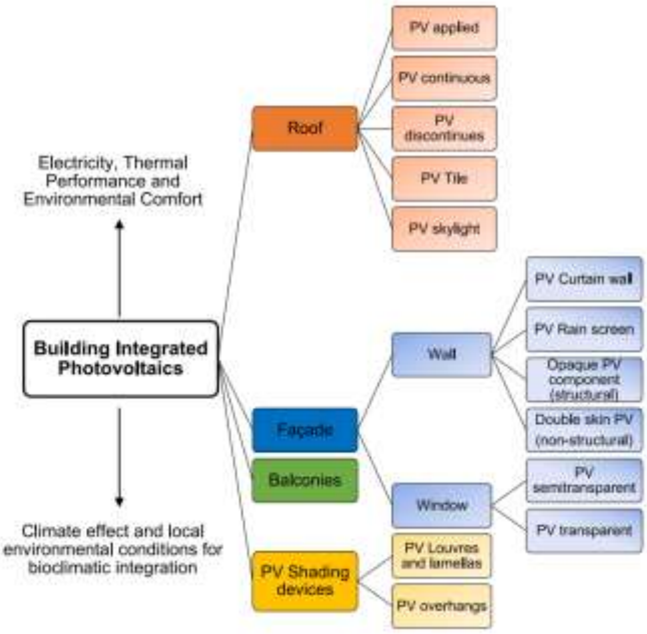

Fig. 3. Building integration design and appliaction based categories of BIPV [16]

B. BIPV on high-rise buildings

In today's big cities, high-rise buildings are seen as necessary and offer various benefits to the country. In addition to providing a good ratio of rentable floor surface per area of land , high-rise buildings have become in some countries a symbol of economic advancement. Szolomocki categorized current and future building shapes into four categories: extruder, rotor, twister/tordos, and free form. The extruder type has the same cross section for the entire height of the building. Rotor-shaped buildings are similar to extruders, but their shape resembles a drill bit. Tordos or twister buildings have a solid, twisted form with an identical "twister" façade on each level. Finally, the free-form configuration is a blend of straightforward geometrical elements, such as lines, solids and surfaces. According to Szolomocki, these shapes represent the trend in building shapes for current and future generations [29-31]. Implementing BIPV system into the building envelope could be a significant challenge, given the current trends in building shapes. As the available roof area is often limited, it may be necessary to utilize the façade area with the purpose of achieving optimal energy output [29].

From a technical perspective, BIPV applications on the façade of tall buildings have promising potential, according to the research conducted by Hoseinzadeh on the energy efficiency of BIPV in a tall building situated in Tehran [32]. Regarding the EN 50583-1:2016 standard, the BIPV module should not only serve as a traditional material for building but also perform extra functions such as structural stability, thermal barrier properties, weather and fire protection, and more. Therefore, integrating BIPV into a building envelope provides the building with multiple capabilities, including on-site energy production, self-consumption, and solar shading, which can help cool down the building interior, thanks to the silicone-based solar PV module [33].

C. BIPV technology

The "Frame of Horizon 2020 projects Dem4BIPV and PVSITES" report included a survey that focused on finding solutions to increase the interest in BIPV. The survey revealed the following factors that have the most significant impact on driving BIPV interest [28]:

- Reduced component prices for PV systems,
- System improvements that boost competitiveness,
- Enhanced BIPV product customization choices and easthetic,
- Variety of product manufacturers that stimulate competition,
- Growing regulatory exigencies to improve building sustainability.

[34] states that significant research has been conducted in previous years to increase the performance of BIPV systems, focusing on both the PV cell and its system levels. The BIPV system is divided into three groups by Biyik: PV technology, market names and application type. Several studies highlight the significance of aesthetic of the structure design, stating that function, aesthetics, technology, and cost, are more significant than large integration [29]. Lu and Law conducted a study demonstrating that reduction of the heat obtained from windows can be linked to the utilization of semi-transparent technologies of BIPV by approximately 65%, thereby lowering energy consumption required for cooling [35]. Another study on semi-transparent technologies of BIPV conducted by Joseph showed that for windows the use of semi-transparent result in energy savings ranging from 11% to 19% [36].

D. Colored PV

To achieve the goal of having buildings with net zero energy consumption, numerous parties choose to incorporate renewable energy technology into their structures. This is particularly evident in Europe, where the Efficiency in Energy Directive 2018/2020 mandates that the Renewable Energy Sector (RES) must reach a target of 32% by 2030 [37]. Many are aware that a significant portion of European buildings consist of historic structures. In the optic to achieve the energy efficiency goals set by the EU, it's necessary to improve all existing buildings, including those of historical significance. However, there's a concern that implementing BIPV may diminish the architectural value of these historic buildings [29].

Fig. 4. PV cells as element of building patterns [38]

Considerable research has been conducted thus far to address the aesthetic concerns of PV technology, with colored PV emerging as a popular solution. Colored PV was developed to provide a means of camouflaging or integrating PV modules with a building's appearance. For instance, the PV modules can be manufactured to mimic the same pattern or color as the original building material, effectively concealing them from view. Utilizing colored PV

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in a creative fashion has the potential to increase social acceptance of incorporating building-integrated photovoltaics (BIPV) into existing historic buildings. [39].

Several varieties of colored PV are currently accessible on the market [30], including: Solar cells equipped with an anti-reflection coating. PV-active layers that are colored and/or semi-transparent. Special solar filters in the form of coatings, layers or interlayers with different colors or patterns. Encapsulant films made of colored polymers. Front glass altered via the use of coating, printing, or other finishing processes.

The choice of colored PV is determined by the desired aesthetic appearance and the location of the building where the PV module will be installed. The newest colored PV technology uses a printing digital ceramic on the PV glass's front, which provides a way to hide the solar cell produced by crystalline silicon. Nevertheless, on the front glass any printing will reduce light transmission, thereby affecting module efficiency, despite being a technology that harnesses solar energy [29].

E. Colored PV module sensitivity analysis

In [43] To determine the best colored photovoltaic (PV) module for integrating with a building, a sensitivity analysis was performed. Four different types of colored PV modules were examined in the analysis. The PV layout was created using PVSyst and an inverter was incorporated to create a complete Building Integrated PV (BIPV) system, the design of the PV layout using 1418 square meters on the building rooftop was also discussed. To provide a benchmark for comparison purposes, a conventional PV module type was also included in the study. The total annual production of the conventional PV module was significantly greater than that of all the colored PV modules considered in the analysis, with a production of 435,105 kWh/year. Nonetheless, the conventional PV module will serve as a reference point for evaluating how well the colored PV modules perform in comparison. Without the traditional Silk Plus PV module included, the colored Silk Pro module is the one giving the highest production of energy, with an annual total production of 326,101 kWh/year [29].

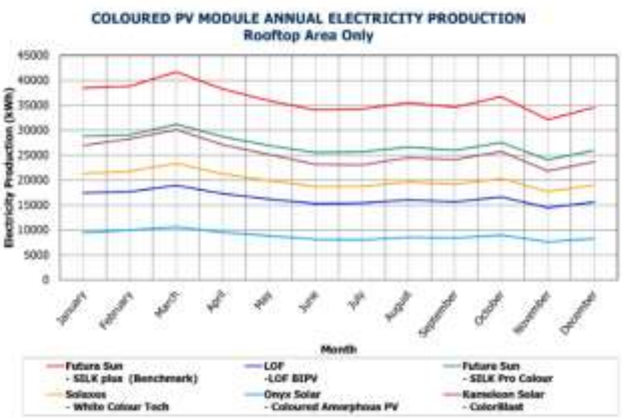

Fig. 5. Colored PV module annual electricity production [29]

F. Façade PV module tilting angle sensitivity analysis

In this study conducted by [29], to determine the best angle for tilting PV modules on the east and west sides of a building an analysis based on the sensitivity has been performed. The methodology described above was used, and the analysis was conducted using the colored Sun Silk Pro Futura, which is based on research findings. Like the colored PV module analysis on sensitivity, the optimal angle was chosen based on the highest production of energy by year. The study found that the best angles for both facades were 50 and 60 degrees, with production of energy annually of 201,236 kWh/Yr and 200,979 kWh/Yr for the façade east-facing oriented. As there was negligeable difference in yearly energy output between these two angles, more analysis of the ratio of performance is required to establish the ideal angle [29].

V. ECONOMIC ANALYSIS

A. Battery cost

To compare battery costs, power capacity ($/kW) and energy capacity ($/kWh) are commonly used metrics. Nevertheless, the best measure to employ may vary depending on the application and battery size. Customers with high peaks in their power usage may need more power capacity (kW), but not necessarily a larger amount of energy discharge (kWh). Conversely, customers with stable power usage may need more energy discharge according to their power capacity. Consequently, customers with high peak load profiles may seek to reduce expenses of power used ($/kW), while those with flat load profiles may seek to reduce expenses in proportion to the capacity of energy ($/kWh) [40].

Numerous research studies have documented the expenses associated with domestic energy system of storage, with a particular focus on lithium-ion batteries, which are the most widely used technology for residential energy storage. These studies frequently use €500/kWh (~$600/kWh) as their baseline cost for hardware of battery [41-43]. The hardware costs of batteries decreased by approximately 50% per year between 2014 and 2016. The installation expenses, however, remained mostly the same [44,45]. Fares and Webber [46] report that installed costs for batteries range from $700 to $1800/kWh. Comparing several costs of battery hypotheses across different studies can be difficult since each study uses different techniques and system size hypotheses. Nevertheless, based on the literature, the typical estimate for the cost of installation falls within the range of $700 to $1500 per kilowatt-hour [47].

B. Load control cost

Devices for the control of loads make use of home appliances that are commonly owned by residential customers. As a result, the additional costs of implementing load control are relatively low when compared to the cost of batteries. The supplementary expenses usually involve incorporating extra hardware to household appliances and acquiring any necessary software for configuring the system. As an illustration, a smart thermostat has the potential to convert the thermal mass of a residence into an energy storage mechanism, all while avoiding the need to replace

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the using heating and air conditioning infrastructure. The supplementary expense would solely consist of the price for acquiring the thermostat hardware and installation, which is generally only a few hundred dollars as opposed to thousands. [47-49].

C. Empirical result discussion

Although the literature on solar devices spans diverse geographic settings and research methodologies, there are at minimum three common discoveries [47]:

• Solar plus devices add value to PV systems, resulting in financial benefits for PV system owners across various technologies, regions, and rate structures. However, these benefits may vary significantly due to differences in technology expenses, rate structures, and energy consumption patterns.

• Considering the current cost of batteries, load control devices are a more economical solution. Nonetheless, batteries provide greater versatility and are more efficient in boosting self-use and backup power. Consequently, the implementation of batteries may surpass initial predictions derived solely from solar plus analysis in the short term.

• A reduction in compensation rates for exporting energy to the grid reduces the worth of solar plus, but concurrently amplifies the added value of solar plus in comparison to a standalone photovoltaic (PV) system. In spite of optimal design strategies for solar plus systems, there is still the possibility of excess output of PV being sold to the utility grid. The devaluation of grid export rates lessens the monetary benefits that customers receive from both solar plus and standalone PV systems. However, solar plus technology can mitigate the unfavorable economic effects of declining grid export rates by amplifying self-consumption.

VI. BIPV OPTIMIZATION APPROACHES

Authors have employed objective optimization techniques to explore how modifying system parameters and limiting performance degradation could enhance BIPV performance. Algorithms for optimization compared to an analysis based on basic parameters, may examine a wider range of possible solutions and also generate trade-off solutions among the desired goals [50]. To improve PV in louver system configuration, Taveres and colleagues used Evolutionary Optimization of Multi-Objective, which depended on a Genetic Algorithm (GA). Measurements of the energy need, daylighting levels and PV generation were used to the evaluation [50]. Gao and colleagues [51] employed the same algorithm to achieve an equilibrium a way to balance daylight transmissions and solar heat uptake in PV overhangs. The Non-dominated Sorting Genetic Algorithm II (NSGA-II) by Ref. [52] was another approach used to assess BIPV and viable (adjusting costs and PV energy) rooftop designs during the early design level.

Figure 10 illustrates a common process for optimizing a BIPV system with adjustable parameters. This process includes a) input data parameters of data input such as climate geometry and operational schedules, b) a simulator that conducts thermal, electrical and daylight analyses, and c) an optimizer that utilizes single or multi-objective algorithms [16].

Conversely, designing and assessing BIPV systems involves scrutinizing factors that cannot be solely measured through explicit values, such as PV power or cooling/ heating loads. Multiple authors have utilized various decision making analysis using a multi-criteria (MCDA) techniques or a blend of them to choose and optimize in buildings PV systems. For instance, Stamatakis et al. [53] used the Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE) method to research in the Mediterranean area the best BIPV system for office structures. In Refs. [54,55], the VIKOR (VlseKriterijumskaOptimizcija I KaompromisnoResenje) technique was used to find the best way to integrate PV into a tall residential building. This was accomplished by taking into consideration aesthetic standards, web polls, and qualitative interviews. Ref [56] Uses neural network to predict the output power from a building-integrated bifacial solar PV system that has an improved roof surface Albedo.

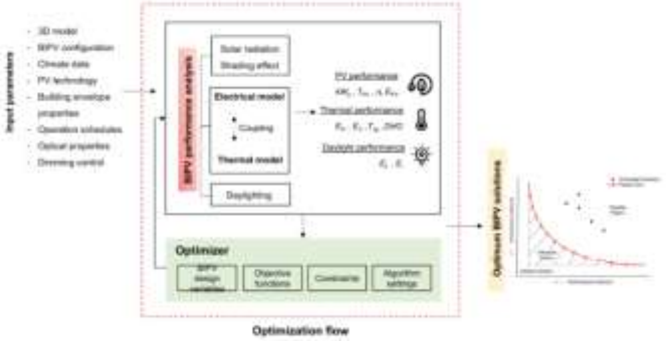

Fig. 6. Standard process for optimizing a BIPV system with variable parameters [16]

VII. CHALLENGES AND OPPORTUNITIES

The previous section of this paper reviewed and discussed studies on the integration of various types of PV modules in buildings. The findings suggest that using these systems, especially in buildings, has the potential to substantially decrease the usage of fossil fuels and the release of greenhouse gases. Therefore, it is recommended that policies be put in place to encourage builders to incorporate these systems in their upcoming projects. Offering incentives can increase the attractiveness of using these systems. Since economic feasibility is crucial for large-scale deployment of these systems, it is important to focus on developing more effectiveness and cost savings systems. Additional research and development efforts are necessary for the advancement of PV-integrated and heat HPs. The introduction of new, more efficient systems and reduced construction cost will promote advancements in related technologies. Buildings that are heated and cooled by HPs can incorporate PV systems by utilizing surplus power generated during low cooling or heating load hours. By integrating PV panels associated with HPs installed in buildings, surplus power can be used for other electrical appliances or sold to the grid. To enhance the cost-effectiveness of these systems, a PV/T (Photovoltaic/Thermal) system that uses water as a cooling

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agent for the PV modules can be utilized to generate a portion of the necessary domestic hot water [57].

Although there are many opportunities for developing PV with heat power in buildings, there are also several challenges to be addressed. Most of the buildings that currently exist do not utilize HPs for the purposes of cooling and heating, which presents a noteworthy hindrance to the widespread expansion of PV coupled with HPs. Another obstacle that arises in the advancement of PV coupled HPs is the comparatively lower performance of PV cells, which can result in insufficient power generation to meet the heating or cooling load requirements of HPs. It is necessary to have enough space available to install PV cells with appropriate capacity to fully supply the power needed by HPs. In addition, the intermittent nature of solar energy can cause fluctuations in power generation, such as during cloudy hours, which may require the use of other systems or connection to the grid. In addition, PV modules alone are not sufficient to provide power during night hours, making them ineffective without the use of storage units or connection to the grid, which can increase the overall system cost. Furthermore, the evolution of PV coupled HPs in the residential sector is hindered by a lack of social awareness and acceptance of the benefits of these systems, as highlighted in a study by [58]. To promote the development of these systems, increasing awareness of their benefits is suggested [57].

VIII. CONCLUSION

The use of building-integrated photovoltaic (BIPV) systems shows great potential to meet the growing energy demands of the building sector and to decrease greenhouse gas emissions. Various types of PV modules have been developed and integrated into buildings, ranging from transparent to colored and flexible modules. The integration of PV modules with the existing buildings can also help to utilize surplus generated power during low cooling or heating loads or sell it to the grid. However, there are still some challenges in developing BIPV systems, such as the intermittency of solar energy, the relatively low efficiency of PV cells, and the lack of social awareness of the benefits of BIPV systems. To overcome these challenges, it is necessary to develop more efficient and cost-effective systems, integrate them with storage units or the grid, and increase public awareness of their benefits. Policymakers and building constructors should also incentivize the utilization of these systems in the upcoming building projects to achieve a sustainable future.

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Visualizing Teams Performance in National Kabaddi League through Dimensionality Reduction Techniques

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***Abstract*—**The aim of this paper, is to gain insights in to dynamicsofKabaddi.Thissporthasbecomeincreasinglypopular, by analyzing teams' performance in national leagues. To do so, theresults of each round of matches the participating teams play are usedto create a dissimilarity matrix. This matrix is then processed throughtwo algorithms, Multidimensional Scaling (MDS) and t-DistributedStochasticNeighborEmbedding(t-SNE),tovisualizetheperformanceofeachteam.TheMDSalgorithmprovidesalow-dimensional representation of the teams' performance, allowing for avisual representation of complex data linkages. The t-SNE algorithm,on the other hand, captures the non-linear relationships in the teams'performance. By using data from the 2017-2018 Kabaddi season andcomparing the results obtained through MDS and t-SNE, this studyaims to identify critical factors that influence team performance andprovideadeeper understandingof thedynamicsofthesport.

***Keywords*— Data Visualization, Feature Projection, Sportsanalysis,Statistical analysis.**

I. Introduction

The digital data produced in various industries has grownexponentially in recent years. Teams of seven players eachcompeteinthepopularsportofKabaddionarectangularpitch. There is a 5-minute intermission in between each of the twohalves of the game's two 20-minute halves. To outscore youropponent, you must send raiders through their defense, touchas many players as you can on the way back to your side, andtackle your opponent's raiders to stop them from scoring. Theteam with the greatest number of points at the conclusion ofthe contest is deemed the winner. To make the informationcontainedinhigh-dimensionaldataeasilyaccessibleandcomprehensible, visualization is crucial. However, because thedata is computationally costly and has numerous dimensions,this can be a difficult task.[1]. Despite the challenges faced byhuge, multi-dimensional datasets, the display of data plays akey role in understanding and interpreting it. Although it canbe difficult to spot patterns and relationships because of theuncertainty in these sorts of data, visualization tools enable thediscovery of insights that might not be immediately apparent.A deeper comprehension of the facts can be attained by visualexploration, resulting in better decision-making. Additionally,data visualization can assist in identifying areas that requireadditionalresearchandanalysis.[2].Formanyyears,approaches for minimizing the dimension of the data, such asPCAandMDS,havebeenessentialtools.FeatureMappingis atechniquethataimstosimplifydatabycreatingacompressedrepresentation that retains as much of the original form aspossible. The goal is to maintain the important features andrelationshipswithinthedatawhilereducingitscomplexityandpresentingitinamoremanageableformat.Thedataarefrequentlyreducedtotwoorthreedimensionsduetothisprocedure. It is frequently visualized using scatterplots, whichplacecomparabledatasets closetogetherandunlikeonesapart. [1]. The concept of "t-SNE" is offered as a method forvisualizing high-dimensional data transformed into a matrix ofsimilarities between pairs of points. While also revealing moresignificant patterns and clusters in the data at various sizes, t-SNEisefficientincapturingthelocalizedstructureofthedata.[3]. MDS is an analytical tool that examines the variances orranges between quantitative points to help visualize complexinformation. It seeks to decrease data dimensionality whilemaintainingconsistentlinksbetweendataelements.Itmakes itsimple to visualize and analyze the data by displaying it in areduced-dimension space. Multidimensional scaling (MDS) isa technique employed in data analysis that aims to understandand interpret high-dimensional data. This approach identifiespatternsandlinkagesthatmightnotbeimmediatelyobviousinthe actual data by examining the distances between data pointsand modeling the data in a lower-dimensional space. MDS hasa wide range of applications in various fields such as scientificcomputing, computational linguistics, biostatistics, and imageprocessing. Its purpose is to simplify and present informationinamoreunderstandableandnaturalformat[4].

II. RELATEDRESEARCH

Incontrasttotypicalmultivariatedata,whichonlyconsiders individual items, multidimensional scaling (MDS) isassessing data that refers to the similarity or distinction amongpairsofdata's.[5].Multidimensionalscaling(MDS)isadimensionality reduction algorithm that analyses the similarityor difference between pairs of objects in a dataset, as opposedtotypicalmultivariatedataanalysiswhichonlylooksatindividual items.[5]. A novel method for assessing non-metricMDS was createdby Taguchi and Oono [6] and utilized tofindpatterns.ResultsusingnonparametricMDShighlydependontheinitialconfigurationbecauseitjustpreservesthesequenceofcommonalitiesratherthantheoriginalscale.

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Despite this, it is still difficult to shorten the computation formetrics.TheSupervisedt-StochasticNeighborEmbeddingtechnique proposed a new metric for determining dissimilaritythat takes class information into account. With the updated t-SNEmethod,high-dimensionaldatacanbeeffectivelyprocessedforvisualrepresentation,dataextraction,andclassification purposes within classification applications. [7].Thet-SNEtechniqueaimstopreservetherelationshipbetween features by transforming high-dimensional data into alower-dimensionalrepresentation.Theresultisavisualrepresentation in which points that were close together in thehigh-dimensional data will still be close together, and thosethat were far apart will remain so in the lower-dimensionalrepresentation. Maintaining the Integrity of the Specifications.Pezzottiet.Al.[8]aimedtosolvetheissueoffinding approximatenearestneighboursinlargedimensionsbyutilizing adecision tree of approximation K-d trees, whichresultsinafastercalculationprocess.Currently,therearemanyadvancedtechniquesforselectingapproximateneighbours in multi dimensions that make the computationeven moreefficient.

III. DATADESCRIPTION

The national pro kabaddi league can be found on the website"https://www.prokabaddi.com," which provides a database ofmatch results, team names, final scores, top scorers, and otherdetails of each match. The league, which is now in its 6thseason, has 12 competing teams, with the Bengaluru Bullscoming out as the winner after defeating the Gujarat FortuneGiants in the final. For the next season, all 12 teams will playeach other twice and the top six teams will make it to theplayoffs, while the bottom four teams will have eliminationrounds. In the 7th season, Bengal Warriors emerged as thechampions after defeating Dabang Delhi. This season also sawmany records being set, such as Pardeep Narwal achieving1,000pointsintheleague,NaveenKumarscoring21consecutive Super 10s, and three raiders reaching 300 raidpoints. Additionally, Neeraj Kumar and Mohit Chillar tied forthemostdefensivetacklepointsinagame.

IVMETHODOLOGIES

A. MultidimensionalScaling

The Multidimensional scaling method was applied to analyzethe performance of kabaddi teams at the league level. Eachround's results were used to calculate the differences betweenteams, and an MDS technique was used to show the teams'performance. To highlight the disparities between the teams,threestrategieswereadopted.Theinitialstrategyrequiredcreatingonemdsandonedissimilaritymatrixforeachround. The second method created a single global MDS chartbycombiningalltheinformationintoadatadissimilaritymatrix. The thirdstrategyproduceda time series for eachteam based on the outcomes of each round. The efficiency oftheteamscanthenbevisualizedusinganMDStechnique using these differences. An example of how to use MDS in thecontextofakabaddileagueseasonisbyconstructingadissimilarity matrix founded on points of every match. ThedissimilaritymatrixcreatedintheanalysisofthenationalKabaddi league reveals the difference between each pair ofteams,withtheentryinthei^{-th}rowandj^{-th}columnrepresenting the difference between team i and team j. ThismatrixisthenprocessedusingMultidimensionalScaling(MDS)toproduceavisualrepresentationoftheteams'performanceintheformofa2Dor3Dplot,wherethepositionofeachteamconveystheir overallperformancethroughoutthegame.Atechniqueforevaluatingthecorrelationbetweenlow-dimensionaldatapoints$y_i$andy_j,which correspond to high-dimensional data points $x_i$and x_j,can be established using a method that involves computingconditionalprobabilities.[7].Todeterminetheconnectionbetween low-dimensional data points y_i and y_j that correspondtohigh-dimensionaldatapoints$x_i$andx_j,adissimilaritymatrix D with dimensions m between the two items is used.This matrix measures the distance between i and j, with d_{ij}beingthevaluerepresentingthatdistance.Theresultisamatrix X, which has a reduced number of dimensions (oftend=1, 2 or 3), that is optimized through the use of gradient descentmethodknownas "teaming". [14].

$$\mathrm{Strain}_D(x_1,x_1,\ldots\ldots,x_N)=\left(\frac{\sum_{i,j}\left(b_{ij}-\langle x_i,x_j\rangle\right)^2}{\sum_{i,j} b_{ij}^2}\right)^{1/2} \quad (1)$$

TheMDSTechniqueisawaytoconverthigh-dimensional data into a low-dimensional format byreorganizing data points that are similar to be neareach other, while data points that are dissimilar areplaced farther apart. This is achieved by creating amatrix B from the dissimilarity matrix D, and thenusing a double-centering transformation. Output isproduced by calculating the eigen-decomposition ofmatrixB.[10].nThetraditionalMDSalgorithmstarts by computing the square dissimilarity matrixD2fromthedissimilaritymatrixD.Then,itcalculatesthecenteringmatrixJand thematrix.

$$B=-\frac{1}{n}JD^2J \quad (2)$$

After that, it determines matrix B's d largesteigenvalues and eigenvectors. finally calculates thelow-dimensionalrepresentation matrix,

$$X=E_d\Lambda_d^{1/2} \quad (3)$$

B. K-NNAlgorithm

The The KNN algorithm groups of observations based ontheirsimilaritiestootherobservationsinadataset.Thealgorithm calculatesdissimilaritymeasuresbetweenallobservationsofindthekclosestobservationsofagivenobservation. It then assigns the new observation a categorylabeldependingonthemostcommoncategorylabelofitsk

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closestobservations.heKNNapproachalsoappliestomachine learning, where the objective is to locate clusters ofsimilarobservationsorcomparableobservationsthatdifferfrom oneanother.InthecontextofKNN,thealgorithmcategorizesnewo bservationsbasedontheirsimilaritiestoother observations in a dataset. The dissimilarities between allthe observations are calculated, and the k nearest neighbors ofa given observation are determined using these dissimilarities.The class label for the new observation is assigned based onthe most frequent class label among its k nearest neighbors. Inan unsupervised learning scenario, KNN can be utilized todiscoversimilarobservationsorclustersofsimilarobservations based on their differences. This is achieved byperformingclustering,calculatingthecentroid,anddetermining the k nearest neighbors for each observation. Thecentroid is found by taking the average of the cluster. Thelikelihoodofaconnectionbetweentwolow-dimensionalobservations can be determined using a similar method basedon the calculationofconditional probability.

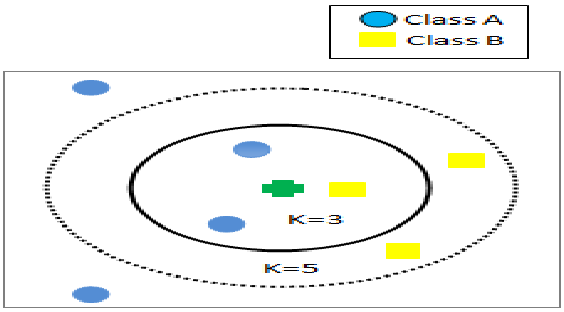

Fig.1.K-NearestNeighnorClassifier

In Figure 1, a diagram depicts the design of a K-NearestNeighbor(KNN)classifier.Thegreenrectangularsphere, representing a test case, will be assigned to differentclassesbasedonthevalueofk.Forinstance,ifkissetto3,the test case will be classified as part of the blue circular class.But if k is increased to 5, the test case will be classified as partof the yellow square class. [8]. A K-Nearest Neighbor (KNN)classifierisusedtoidentifytheclassthatatestsample,represented byx,belongsto.Theclassificationprocessinvolves calculating each group's likelihood based on the K-NN of x, using a specific distance metric, d. The example isassigned to the group with the highest likelihood, which isdetermined by evaluating the distance between x and the knearestneighbors.

C. t-DistributedStochasticNeighborEmbedding(t-SNE).

t-SNEisatypeofnon-linearandself-governingmachinelearningmethodutilizedforsimplifyinghigh-dimensionaldata,suchasimages,audiosignals,ortext,intoalower-dimensional representation. T-SNE aims to maintain the keyinformation contained in the original high-dimensional datawhile condensing it into a more manageable form, usually 2 or3 dimensions. The advantage of using t-SNE is that it cansimplify high-dimensional data into a lower-dimensional form,making it easier to comprehend the relationships between thedatapointsandunderstandthedata'soverallstructure.

Traditional methods of analysing high-dimensional data cansometimes fall short in visualizing it in a way that retains itslocalandglobalaspects,makingt-SNEavaluabletool inthese situations. [3]. The t-SNE algorithm is used to deal withthe problem of visualizing high-dimensional data effectivelywhilepreservingbothlocalandglobalstructures.Ittransforms the distances between high-dimensional data pointsintoprobabilitiesofsimilaritythroughaprocesscalledStochasticNeighborEmbedding.Thisresultsinalower-dimensional representation that retains important informationfrom the original data. The t-SNE technique is a widely usedtoolinfieldssuchascomputervision,naturallanguageprocessing,andbioinformatics,asithelpsconverthigh-dimensional data into a more manageable and interpretableform. This allows for deeper insights into the structure andrelationships within the data, making it a valuable tool for dataanalysisandexploration.[5].

$$p_{j|i} = \frac{\exp\left(-\|x_i - x_j\|^2/2\sigma_i^2\right)}{\sum_{k\neq i}\exp\left(-\|x_i - x_k\|^2/2\sigma_i^2\right)} \quad (4)$$

The t-SNE algorithm aims to compute a similar conditionalprobability between the low-dimensional data points y_i and y_j,whichcorrespondtothehigh-dimensionaldatapoints$x_i$andx_j.Thedifferencebetween$x_i$and$x_j$isrepresentedasthemagnitude of their separation $||x_i\text{-}x_j||$, and the spread of datapoints in high-dimensional space is represented by σi. Theobjective is to compute the straight-line distance between $y_i$andy_j,whichisrepresentedasthemagnitudeoftheirseparation$||y_i\text{-}y_j||$,inordertocalculatetheconditionalprobability between the low-dimensional data points. The aimis to find a way to calculate the relationship between the high-dimensional feature vectors of each Kabaddi teamandthecorresponding low-dimensional data points, while preservingthesimilaritiesbetweentheteams.Todothis,t-SNEcalculatestheprobabilitiesbasedonthedistancesandvariancesbetweenthehigh-dimensionaldatapointsandminimizes the difference between these probabilities and thecorrespondinglow-dimensionalpoints.Thisprocessallowsforareductionofthehigh-dimensionaldataintoamoremanageablelower-dimensionalspacewhileretainingimportant information about the teams' performance, such astheir record of wins and losses, the points they score, and thestrategies they use for defense. By using t-SNE, it is possibletogainvaluableinsightsintotheperformanceofKabadditeams,whichcanaidcoaches,players,andanalystsinunderstanding thestrengthsand weaknessesofeach team.

IV. RESULTANDDISCUSSION

Theoutcomesofthestudyindicatedthatutilizingt-DistributedStochasticNeighborEmbeddingandMultidimensionalScalingasameansofreducingthedimensions of the data was effective in comprehending theintricaciesofthegameofKabaddiandidentifyingsignificant

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variables that influence a team's success. The t-DistributedStochasticNeighborEmbeddingmethodwasparticularlyeffectiveinvisuallyrepresentingcomplexandnon-linearrelationshipsinthedatabycreatingareduced,simplifieddepiction of the team's success over time. In Figure 2. Showthe team who won the match according to the win points therearefourclusters,cluster1representsthehigherwinningpoints above13to17,andcluster2denotesthepointsbetween 12 to 14. After which, the winning point from 6 to 10comesunderclustering3.Finally,cluster4representstheremainingpoints.Infigure3.Showsthetwo-teamperformance analysis within the season 2017-2018. The teamU Mumba Played the game in two seasons and score the highpointsitisrepresentedinfigure 3.

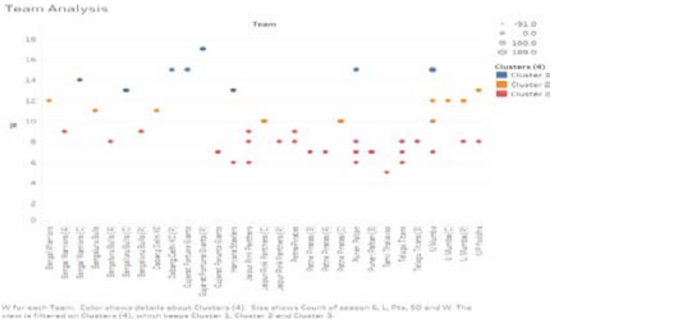

Fig.2.TeamClustering

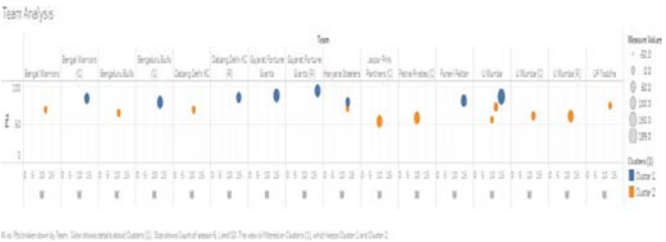

Fig.3.IllustratetheTwoteamperformance

The resulting scatter plots, as seen in Figs. 4 and 5, clearlyexplain the teams' season-based dissimilarity matrix. The K-NNalgorithmfaredwellregardingclustering,withthemaximumaccuracyattainedwhileutilizingt-SNEasthedimensionalityreductionmethod.Thestudy'sresultsdemonstratedthatusingt-DistributedStochasticNeighborEmbeddingandMultidimensionalScalingasameansofreducingthedimensionsofthedatawashelpfulincomprehending the intricacies of the game of Kabaddi andidentifying crucial factors that impact a team's performance.Thet-DistributedStochasticNeighborEmbeddingmethodsuccessfully createdareduced,simplifiedrepresentationofthe team's performance over time. The scatter plots produced,shown in Figures 4 and 5, effectively displayed the team'sseason-based differences. The K-Nearest Neighbors (K-NN)algorithmperformedwellingroupingthedata,withthehighest accuracyachievedwhent-SNEwasusedasthemethodofsimplifyingthedimensionsofthedata.This highlightstheeffectivenessoft-SNEinpreservingtheessentialstructureoftheinformationwhilereducingitscomplexity. The team performance during the seasons from2017 to 2018 is shown in Figures 4 and Figure 5 displays theteam's performance using Multidimensional Scaling (MDS)and the data points are relatively close to each other. Figure 3shows the results using the t-Distributed Stochastic NeighborEmbedding (t-SNE)technique.

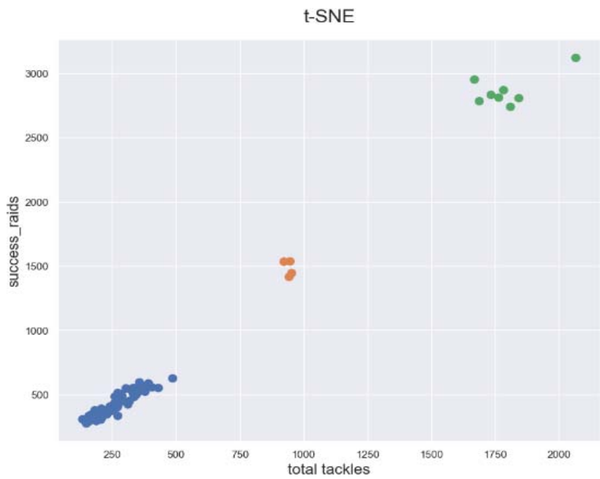

Fig.4.t-DistributedStochasticNeighborEmbedding(t-SNE)

Both algorithms display the team's performance based on theseasons.MDSandt-SNEwereusedtotransformthedissimilaritydatapointsintosimilaritymatrices.t-SNEeffectivelyanalyzesthecomplexconnectionsbetweenthedatapoints,andcomparedtoMDS,itspeedsupthecalculationwhilestillproducingaccurateresults.Therepresentation of the team performance over time can be seenin t-SNE, which also visualizes the intricacies of the game ofKabaddi.InFigure4.Showthepairwisedistancesbetweenthe data points in the high-dimensional space in the lower-dimensional space and preserve it. In kabaddi data, its takeswon points and calculate the Euclidean output space where thedistances between the points are proportional to the distancesbetweenthepointsintheoriginalhigh-dimensionalspace.Figure5shows topreservethelocalstructureofthedatapoints by minimizing the divergence between two probabilitydistributions. By using t-SNE the won data points preserve thestructureofwondatapointsstructure,andtheresultisadiscrete,embeddedoutputspacethatcapturesthelocalrelationshipsbetween thewondatapointbetweentheteams.In conclusion, our analysis showed that using t-DistributedStochasticNeighborEmbedding,MultidimensionalScaling,andK-NearestNeighbors(K-NN)togetherwasausefultechniqueforunderstandingtheintricaciesofthegameofKabaddi and identifying important factors that have an impactonteamsuccess.Furtherresearch,usingalargerdataset,could bedoneto validate thesefindingson alarger scale.

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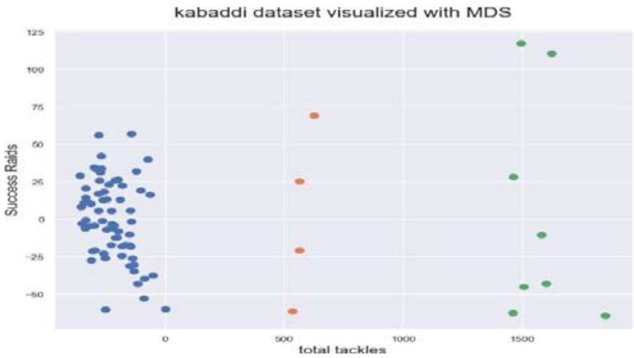

Fig.5.Multi-DimensionalScaling

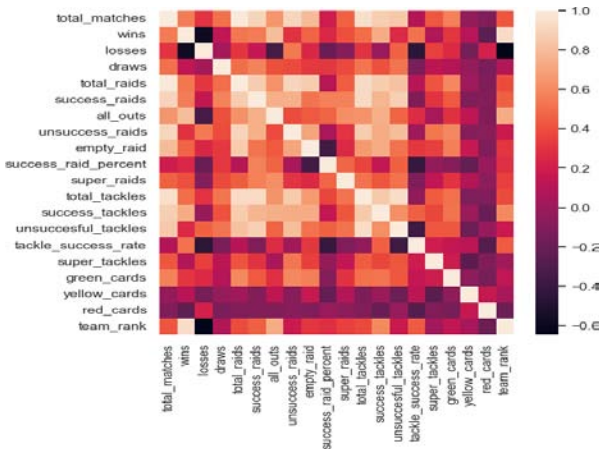

Fig. 6.Multi illustrates the correlation and co-variance of the dissimilaritymatrixintheKabaddidatasetthroughaheatmap.

Fig. 7.Representation of Tree map- it shows which team gets high and lowwon points in a season form 2017-2018, the dark colour shows the high pointsandlightcoloursshows theleast scoringpoints

V. Conclusions

In order to understand Kabaddi effectively, this researchcontributes in analysis of a team's performance over severalseasons.MDSandt-SNE,twodatavisualisationmethods,were applied to accomplish this. These techniques made iteasier to evaluate the progress of the team and determine thekeyfactorsthataffectitssuccess.Theanalysis'sfindingsprovided a crucial new understanding of the dynamics of thegameandthevariablesaffectingateam'sperformance.The study was able to offer a thorough insight of Kabaddi and itscomplexities by evaluating the MDS and t-SNE data. Teamsand coaches who desire to perform better might take use ofthese insights. They can design strategies and techniques thatwill enable them to excel in the game by being aware of theimportant success factors. Overall, the study has added muchto our understanding of Kabaddi and is likely to be of greatinterest to fans of the game. Future research could considerusingmachinelearningtechniquessuchasclustering,classification, and regression to identify patterns and makepredictions based on the data applying the findings to practicalapplications such as team selection, training strategies, andgametacticstoimprove performance.

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Multihead Driven Self Attention Adversarial Learning based One Class Classification (MDSAL-OCC) for Medical Image Screening

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Abstract — **One-class classification (OCC) is used to construct classification models even though the outlier samples are inadequate, weakened and not clearly defined samples. The OCC network has been dominantly employed in diverse application of machine learning. One-Class Classification (OCC) is an exceptional condition of multi- class classification in which the data used during the training phase is generated from a single positive class. The intent of a OCC network is to learn a representation and a classifier that deals with positively labeled queries. In the recent years adversarial learning One-class classification (ALOCC) method has outperformed the efficiency of the OCC performance. Since it has some limitations such as instability within the training phase and issues in reconstruction of data between inlier and outlier data. In this paper work, we have propounded a Multi head Driven Self Attention mechanism incorporated in the ALOCC network. The proposed MDSAL-OCC network outperforms other self attention network in OCC and effective in elevating the OCC accuracy. In this paper, we also presented a discussion about the comprehensive elaboration of the proposed framework of one-class classification Multi head Driven Self Attention Adversarial Learned One Class Classification (MDSAL-OCC) and also discussed about the role of MDSAL-OCC in train One Class Classification networks in detecting fetal congenital heart diseases (FCHD).**

Index Terms* — *One-class classification (OCC), Adversarial Learning One-class Classification (ALOCC), Multihead Driven Self Attention Adversarial Learned One Class Classification (MDSAL-OCC), Fetal Congenital Heart Diseases (FCHD), Deep Convolutional Neural Networks (DCNNs), Bi-Directional GAN(BiGAN), Self Attention Generative Adversarial Network (SAGAN)

I. Introduction

The model One-class classification (OCC) builds a predictive analysis model using poorly sampled data. Over the past decade, Deep Convolutional Neural Networks (DCNNs) has exhibited remarkable performance improvements in object detection. In this paper, the work is primarily focused on image detection in medical image analysis. Because of the availability of huge multi- class annotated datasets, deep networks can easily learn discriminative features and also the classifier can exploit to perform recognition. One-class classification (OCC) is defined as the concept of conceding test data which has been disseminated in a different way from the data presented during the training phase [2]. This method of classification has established significant research in various areas of domains such as biomedical field [3], fault diagnosis detection system in manufacturing systems [4], financial systems [5], and security and communication systems [6]. The data's of different classes needed to be labeled in all the applications. But in the real- world scenario, data's from unusual classes tend to be inadequate volume for effective modeling. In order to overcome the former situation, the OCC does the task of performing training only on the usual classes and latter identifies the unusual classes from the usual class distribution. Thus, OCC differ from the traditional classification network. OCC also solves imbalanced dataset issues in an effective way. Many methodologies are employed to explain one - class classification (OCC). These approaches are categorized in to different methods. The Density estimation methods emphasize on calculating the density of the data points, and threshold value setting. The boundary methods are based on the parameters such as distances and boundaries encompassed within a set of data points called target points and optimizes the volume of the data. The reconstruction method relies on building a model using prior knowledge [1].

In the contemporary situation, the end-to-end networks are widely used for one-class classification. Dimokranitou et al. [7] introduced an integrated framework comprising of Autoencoders and Generative Adversarial Networks. This work reached remarkable benchmark performance in detecting anomalies in video sequences. In 2018, Zenati et al. [13] propounded about the GAN based Anomaly detection system, which can produce excellent results than the earlier one. In the latter work, GAN models were implemented for anomaly detection in medical images and network intrusion. The GAN called BiGAN is used in this work and applied combined training for bidirectional mapping between the image space and the latent space which achieved better performance accuracy. In a research work by Akcay et al. [8], using conditional generative adversarial network (CGAN) has been used to develop an anomaly detection model which utilizes learning of high-dimensional image space and the inference of latent space. This model contains an encoder- to- decoder and a decoder - to - encoder networks. In the generator part, mapping of the input image to a lower dimension is carried out. Later, the lower dimension vector generated by the Generator network is in turn used to reconstruct the output image. This model achieves better efficacy over several benchmark datasets, domains and previous state-of-the-art approaches.

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Later in a research work conducted by Sabokrou et al. [9], reconstruction-based OCC network which consist of encoder-decoder architecture was developed. In this architecture, two deep networks were used. In that architecture, one network acts as a novelty detector, whereas the other network enhances the inliers samples and deforms the outlier class samples using adversarial learning technique. This framework can be incorporated in different domains for the application of anomaly detection in image and video processing system. Later, the attention techniques were introduced with the aspect of diminishing the quantity of parameters, thus improving the accuracy of the classification models [14]. Self attention Generative Adversarial Network (SAGAN) [15], proposed by Zhang, elucidated about the framework consisting of the technique of self-attention incorporated in a GAN framework. It achieved best GAN efficiency specifically on class-conditional image generation in ImageNet. Zhang, Yingying, et al.[16] Proposed an improvised self-attention mechanism embedding multi-heads which outperformed the earlier methods in improving the aspect of reconstruction quality and efficiency. In unified approach comprising GAnomaly and Adversarial One Class Classification, it is very tedious to perform the reconstruction process between the inliers and outliers class labels. For better reconstruction of inliers class samples, the visual attention mechanism is incorporated in to OCC networks. Apart from that, the newly proposed self-attention technique uses features in various latent subspaces to provide observation controls to improve the inliers class labels. It can be used in broad in various anomaly detection networks such as medical image analysis, security systems, etc.

II. Related Work

A. Adversarial Learning-based Network

GANs [19][20] is a great achievement developed for the purpose of performing data augmentation used in learning models. GANs can also be used as a classification model in the case of insufficient training data. GANs are unsupervised deep networks generally used for the data generation. The supervisory information is obliquely provided by an adversarial gaming between two networks: a generator (G) and a discriminator (D). In the training phase, G generates new data and D understands the new data generated by the G and evaluates the condition that the data is a real or a fake input.

B. Attention

Attention is one of the most important emerging technique in the area of machine learning. The attention mechanism has been stimulated by the biological organization of human being aimed at differentiating various organ substructures while handling huge volumes of information [23]. Visual attention is a technique which incorporates some cognitive operations for handling issues in large volumes of data in an efficient manner by extracting valid information and excluding invalid information. Attention is a amenable technique applied on regions of interest such as specific features of an object, or the whole objects. Attention mechanism is widely used in different domains such as computer vision, natural language processing etc,. In computer vision, visual attention mechanism is incorporated in to the neural network structure for achieving better performance results. In neural networks, attention mechanism performs various tasks such as image caption generation [25, 26], image-based analysis [27,28], machine translation [29], text classification [30,31], action recognition [32], speech recognition, recommendation [34], and graph [35] in enhancing performance. Apart from this, it also serves as a tool for elucidating neural network architecture behaviour.

TABLE I. ATTENTION MECHANISM AND TYPES BASED ON VARIOUS CRITERION

Criteria	Type
The Softness of Attention	Soft/hard, global/local
Forms of Input Feature	Item-wise, location-wise
Input Representations	Distinctive, self, co-attention, hierarchical
Output Representations	Single-output, multi-head, multi-dimensional

C. Attention Mechanism

The different approach of attention mechanism has been classified based on the aspects such as softness related to attention, different types of input features, various input representations and output representations. The self-attention network [36] encompasses an attention mechanism involving different sequence correlated with one another for generating a prototype of a same. It finds usage in machine reading comprehension, abstractive summarization in natural language processing, or image description generation. A multihead self-attention [37] consist of a network called Transformer and employs the data from various multi-subspaces to improvise the process of feature extraction . This multihead enhanced self-attention technique [38] shows exemplary performance results thereby improving the accuracy as well the reconstruction efficiency.

III. Adversarial Learning One-class classification (ALOCC) network

The Adversarial Learning One-Class Classification network contains two components ‘R’ called a reconstruction network and ‘D’ called a Discriminator network. The component ‘R’ reconstruction network is an encoder-decoder part,

The encoder part GE(z) is a convolutional network used for compressing noisy input image ‘z’ to feature vector ‘s’. The noisy image z is denoted as follows:

$$z = (x \sim pt\ ) + (\eta \sim N\,(0, \sigma^{2}I)) \tag{1}$$

In the above representation of noisy image z, x denotes original image, pt denotes the inliers class samples distribution, The parameter ‘η’ denotes the normal distribution noise .The standard deviation present in the normal distribution noise is denoted as ‘σ’. In ALOCC network, the image noises are employed to upgrade the

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robustness of the Reconstruction network ‘R’.

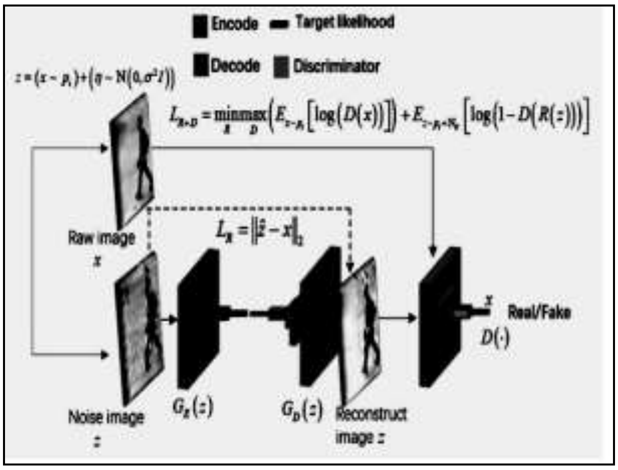

Fig. 1 Functionality of an ALOCC Network

The decoder network G_D (z) performs up scaling. In up-scaling, the vector s is converted to the reconstructed image zˆ. The discriminator D determines whether the reconstructed image zˆ is in line with the target class p_t. The component discriminator ‘D’ also evaluates the condition that if the input has been derived from the target class or not. The target class is denoted by p_t .

The ALOCC network, reconstruction and discriminator (R+D) are jointly adversarial learned in order to optimize a objective function represented as below,

$$L_{R+D} = min\ max\ (E_{x\sim p}t\ [\log\ (D(x))]) + E_{z\sim p}t + N\sigma\ [\log\ (1 - D(R(z)))] \quad (2)$$

The training process involves the task of integrating the loss L_{R+D} of joint network R + D and the contextual loss L_R between the original and the derived image in the ALOCC network.

The contextual loss L_R is denoted as follows,

$$L_R = ||z\hat{} - x2\ || \quad (3)$$

The overall loss function in an ALOCC network is represented as,

$$L=LR+D + \lambda\ \ LR \quad (4)$$

The trained network is represented as,

$$R(z;\ \theta_r) \quad (5)$$

The trained network is used to reconstruct and enhances the inliers class samples. The ALOCC uses $D(R(x))$ to represent OCC.

The complete OCC process is denoted as,

$$OCC\ (x) = \text{target}\ class\ if\ D(R(x)) > \tau \quad (6)$$

If D(R(x)) is higher than the τ, sample x is treated as an inlier class. If D(R(x)) is lower than the τ, sample x is treated as an outlier class.

In multi-head attention mechanism, input sequence is mapped to various subspaces based on the parameters, followed by attention mechanism employing scaled dot-product attention to its representation in each and every subspace. Then the output of each subspaces are concatenated together to generate the output. The multi-head attention mechanism imparts a unified approach to process information linearly from various representation subspaces achieved at different levels of positions [37].

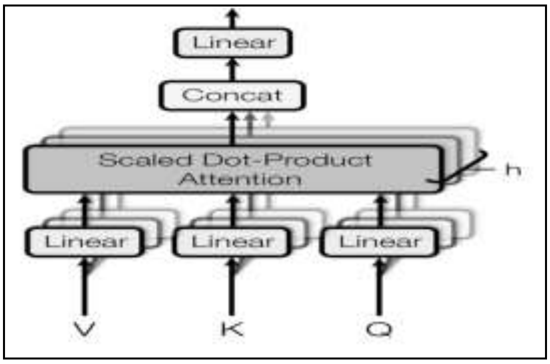

Fig. 2 Block diagram of a Multi-Head Attention mechanism.

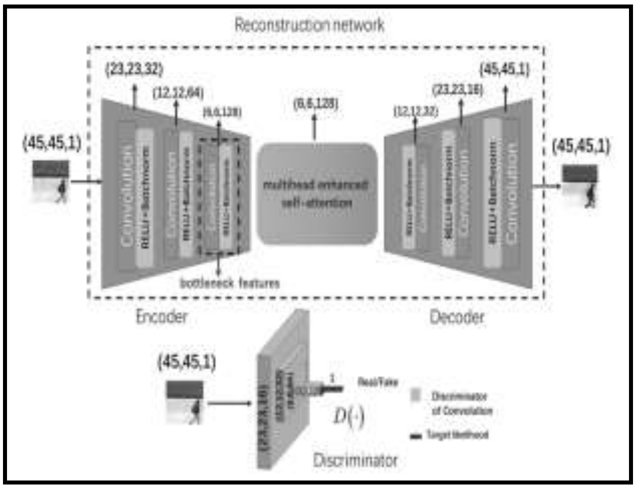

Fig. 3 Block diagram of a MDSAL-OCC network

In self-attention mechanisms, a single head performs feature learning at various subspaces, so it has to deal with issues such as handling different types of information, integrating representation in all subspaces for improving the contextual information. Multihead enhanced self-attention network can be applied to the concept of image attention [38].

IV. Multihead Driven Self Attention Adversarial Learning based One Class Classification (MDSAL-OCC)

Multi-subspaces features captures different range of correlations in various latent spaces and merging of representation leads to obtain an improved reconstruction. But if the heads are increased, the proposed attention

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mechanism will minimizes the dimensionality of a single head. If the number of heads is more, it will lead to insufficient quantity of relevant feature. Hence it has been inferred that the number of heads and convolutional channels automatically affects the performance of attention mechanism. Both the factors needed to be maintained in a bias condition. A simple image seldom requires more number of heads . The reason is that the multi subspace rrepresentations cannot able to extract more information from it because of over-fitted representations. The latter in turn leads to reduce the quality of reconstruction process. The proposed MDSAL-OCC overcomes the training problems of adversarial learning such as parallelism, GAN failure, vanishing gradient problem, and unbalancing between the GAN components. The proposed attention employs more 1 × 1 convolutions and two channels of self-representation. The channels are used to determine the attention map in a multi-feature space. In this mechanism, loss function is reduced. The minimized loss function is achieved in two aspects through reconstruction loss and contextual loss. In order to improve the performance of the reconstruction network, a new adversarial-balance loss in the discriminator loss is implemented. The objective behind the adversarial-balance loss is to reduce the disimilarity between the real and reconstructed fake images.

A. MDSAL-OCC in Fetal Congenital Heart Disease Detection

Multihead driven self attention adversarial learning based one-class classification network is exceptionally satisfactory in screening fetal congenital video slices. In the traditional ALOCC network, the encoder cannot does the task of extracting features from complex fetal ultrasound heart images. In the proposed MDSAL-OCC network, feature learning is done linearly through multihead attention mechanism. Screening videos in medical image analysis to obtain FCH video slices using the proposed ALOCC network are useful for the medical practitioners to easily extract the FCH images. The proposed mechanism also provides solutions for acquiring video slices from a video dataset. The acquired video slices both normal and diseased are used for data augmentation.

The proposed MDSAL-OCC model is an integrated framework combining convolutional network incorporating multi-heads in attention network. The proposed model needs to implement a consistent mathematical relation between the convolution layers and heads. The convolutional layer plays a significant role in constructing neural networks specific to image processing domain.

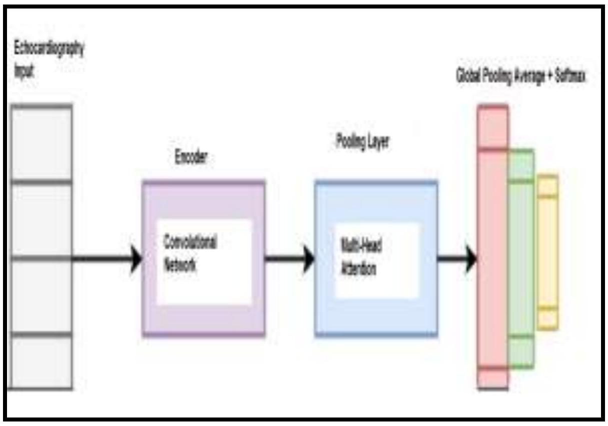

Fig. 4 Proposed MDSAL-OCC Model

In the proposed model, for processing an image of representation $W \times H \times C_{in}$

The CNN model incorporates several convolutional and sampling layers. The filters kernel sizes are represented as '$k \times k$'. Input feature is represented as C_{in} and output dimension as C_{out}. The bias vector is denoted by b. The self attention layer is implemented by the following functionalities such as D_k, denotes the key/query size, D_h, denotes the head size, N_h denotes number of heads and D denotes the output dimension .

The key is denoted as, $M_{key}^{(h)}$

The query matrix is denoted as $M_{qry}^{(h)}$,

The value matrix is denoted as, $M_{val}^{(h)}$ for each head h,

For concatenating all the heads together, the projection matrix denoted as *Mout* .

The n the layers in the models are parameterized as follows,

$$X_q = M_{qry} M_{key} M_{val}$$

Blocks	Parameters
Convolutional Blook	Input Conv. Layer 1 (Stride 1 x 1, Padding 'same') Batch Normalization ReLU 0.5 Dropout Conv. Layer 2 (Stride 1 x 1, Padding 'same') Batch Normalization ReLU Conv. Layer 3 (Stride 1 x 1, Padding 'same') Batch Normalization Softmax 0.5 Dropout Conv. Layer 4 (Stride 1 x 1, Padding 'same')
	Sequence Input
Multi-Head Block	Encoding Layers Heads (4 / 8) 0.3 Dropout
Output Block	Global Pooling Average Softmax

$$HeadsValue, H_q(h) = \sum_{[M]\times[H]} softmax(X_q^h) M_{val}^h$$

$$OutputValue, Y_q = concat(H_q^{(1)}, \ldots\ldots, H_q^{(N_h)}) M_{out} + b$$

Fig. 5 Summarization of the proposed model

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B. *Experiments*

For detecting fetal congenital heart disease, there are four views used in fetal echocardiography. The four views used in echocardiography are four chamber view, Three-vessel Trachea view, Three-vessel view and Five-chamber view. Among all the views, the four-chamber view was considered to be optimal one, since it has the capability to visualize the overall structure of the heart. The fetal echocardiography was taken during the second trimester anomaly scan. The fetal cardiac imaging is a tedious procedure to construct a consistent classification model to detect anomalies. For this model, we gathered the dataset from various diagnosis centers in and around our place of locality. The datasets were acquired from pregnant women of gestational age of 21-38 weeks. The dataset comprises of both normal and disease videos. Initial the dataset was preprocessed by converting the raw image to normalized image. Then cropping of ROI is done. Then the normalized image is converted to grayscale image. In the training phase, data synthesis using GAN is carried out. Data synthesis is done in order to adapt to GAN. The model is validated to ensure the strength of the model by increasing the training data in each class. In the training phase, epochs have been set to be 3000 and the epoch's interval has been set to be 300.

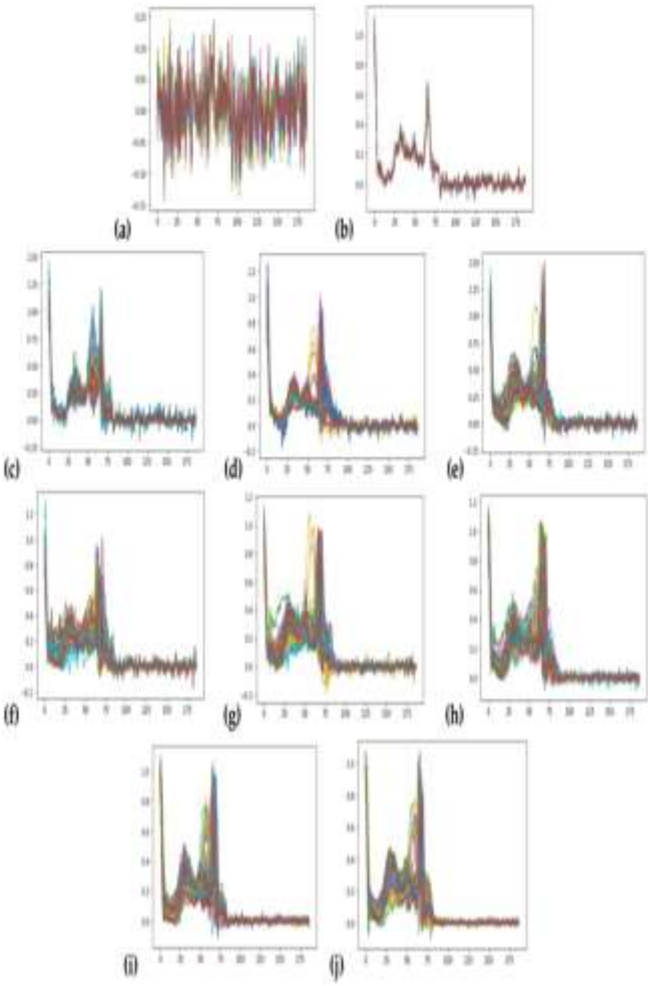

Fig. 6 Diagram depicting the GAN during Data Synthesis in 3000 Epochs.

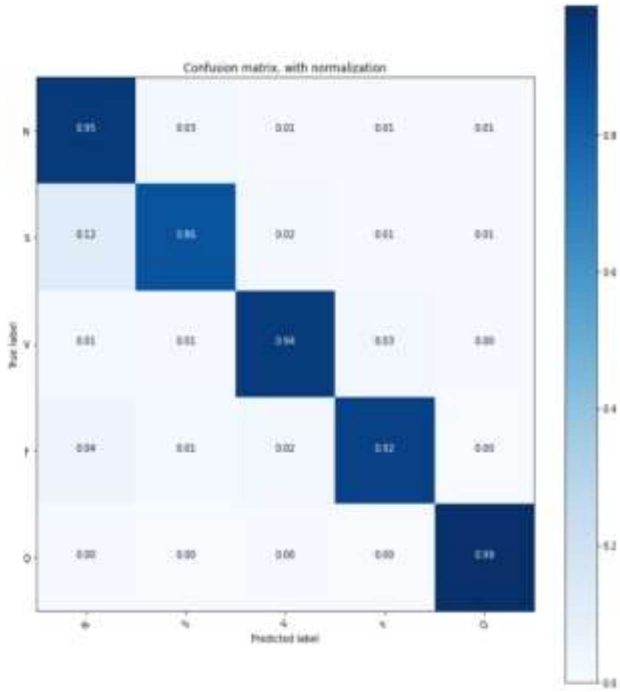

Fig. 7 Confusion matrix of our model.

The proposed model is a multi-classification model. It outperforms the general Adversarial one class classification. It achieved an accuracy performance of more than 85 % in detecting fetal congenital heart disease.

V. Conclusion

In this paper, we illustrated how the Adversarial learned One-class Classification network and described in detail about the attention and attention mechanisms. Then we presented a elaboration about the Multihead self attention network architectures used in machine vision and natural language generation and understanding. It has been presented about the various aspects of attention mechanisms provided for the generating a classification model in collaboration Adversarial Learned One-class Classification network. In conclusion, it has been explained about Multihead Driven Self Attention Adversarial Learning based One Class Classification (MDSAL-OCC) used in various fields of deep learning applications and specifically explained about the context with reference to medical image analysis domain. It has been inferred that MDSAL-OCC can attain predictive performances with equivalent model complexity (i.e., number of parameters).

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Review of Blockchain Technology with respect to Applications, Platforms and Architectures

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***Abstract* — Blockchain is a novel technique for securing digital data transmitted over the internet. The distributed database is used to store data in a digital format. Blockchain is well-known in a variety of fields including education, government, healthcare, and financial services. It relies on distributed ledger technology and establishes trust in digital data to provide secure services for digital information to record transactions. In a decentralised system, blockchain creates blocks for each transaction. The features of blockchain, as well as their platforms and applications, were explored in this case. Blockchain is a digital data transaction security method based on cryptography. A hash function connects the blocks and creates a database record.However it can be implemented in automated software. This survey describes the benefits of blockchain technology in a distributed system and their features in many facilities. It is more efficient than other security services, and sharing the information across a decentralised network . In a distributed system, blockchain enhances traceability and allows for immutable transactions. It is a system that allows remote nodes in a network to agree on something. Market places have recently adopted blockchain technology for critical applications. This section will inform us about the necessity of Blockchain in current trends.**

***Keywords* — Blockchain; distributed ledger technology, automated software, platforms**

I. Introduction

A computer network is a collection of computers that connect several nodes. The term "internet" refers to the connection between a network and the internet. A network is a computer system that has communication channels and transmission medium connected to it. Over the internet, a network can exchange resources. The internet was created in 1982, and it connects computers all around the world. Business agencies began using the internet in 1991 to share information and communicate with a large number of people. Web browsers, electronic mail, search engines and other internet services are examples. Communication, research, education, financial transactions and other current technology are all supported by these application services. The Internet is a worldwide information system that provides end users with unique resources and information. Internet Service Providers can give the user access to the information. During the transmission of resources over the internet,they need security services in order to secure the digital data.In the past year,multiple number of security techniques can be introduced to secure digitalized form of information. Recently, to introduce the word 'Blockchain Technology' is a newly security techniques to secure digital data from online hackers and malware attackers in decentralized network.The methodology as blockchain to serve digital verification and records of digital files and security mechanisms provide services to identify the status of digital data and protect them.In order to protect the resources over the network transmission,security mechanisms perhaps cryptography techniques.In which follows encryption and decryption,the technology to protect resources,devices over the network.

Blockchain is the decentralized system to provide the security services against unauthorized access to digital data.The most important aspects of blockchain are govern,protect,detect and respond.The service identity and manage security rules.In order to implement the security controls to reduce security risks.Blockchain respond and recover from threats,it involves the practice of hardware and software solution and they provide recent technological information,security services are confidentiality,integrity and availability.Blockchain technology were intrwoduced in 2009 by Satoshi Nakamoto.Initially it creates the digital cryptocurrency called Bitcoin.Blockchain is a structure that store transaction history of digital records known as Block,several database in public called as chain.Blockchain is a network connected through peer-to-peer nodes,the data in blockchain is referred to as digital ledger and it creates a decentralized distribution chain.

The Blockchain developed using cryptography, hash functions, digital signatures, and distributed consensus algorithms. The document's integrity is preserved by the transparent ledger, which builds trust in the asset. Third parties cannot interfere with a transaction that has already been registered. Permissioned and permissionless blockchain technology exist, with the permissioned blockchain providing additional blockchain security by allowing specific actions to be conducted only by identifiable participants. Permissionless blockchain is a sort of decentralised blockchain. Members have the ability to conduct all operations such as creating and validating transactions, smart contracts and participants set the layout and scale of the blockchain.

Blockchain Feature

We explored the context of blockchain technology and its uses in this paper. Blockchain is an technological ecosystem has a large number of data-gathering actions and monitoring devices. Recent techniques is efficient data-sharing with security services. Blockchain is a combination of peer-to-peer network,cryptography keys and digital ledgers. The cryptographic keys are used to create digital signature to provide unique identity is the important aspect in blockchain technology. The transaction in the blockchain are approved and verified in the distributed network. In this section,we discussed the following contributions of blockchain technology.

Immutability

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Blockchains [2] are immutable in nature, meaning they can't be updated or altered. Every node in the network contains a copy of the digital ledger and every operation checks its validity and adds to the ledger on a continuous bbasi. According to the technology, the blockchain enables transparency and proof of corruption, as well as backing up the key list. Integrity can be provided by the feature of immutability. It strengthens the system of trust and auditing, the information verification is essentially redundant. It maintains the full historical records and enables the shared source of truth. In the Bitcoin,it plays the core benefits for the businesses and immutable gains control of the hash power. Each block generates the alphanumeric hash value and digital signature for the previous block and the consensus righty maintains the originality of the digital data. The immutable nature bringing more efficient secure transaction.

Decentralized

Decentralized means that the network is maintained by a group of nodes with no central authority. The blockchain technology allows people to obtain information directly from the web. It distributes the common control over the decentralised structure on their assets using cryptocurrency technology. The decentralized nature has various drawbacks such as lower failure rates and greater user control, as well as digital data transparency and authenticity. The decentralization environment is inherently untrustworthy, in the distributed ledgers. Each member owns a copy of the exact same type of digital data. With the common view of data, it enhances data reconciliation and access to each entity. Decentralization can improve resource distribution performance and consistency while reducing the risk of catastrophic failure. In the blockchain uses the decentralized Application (dApp) and Decentralized Autonomous Organization (DAO) for the digital transaction.

Enhanced security

Using [3] encryption it ensures security over the internet built by cryptographic algorithm that provide the firewall.Every information is hashed cryptographically hide the true nature during the data transmission.The block in the transaction built by hash value, it is difficult to tamper the data due to mathematical algorithm.Digital data related to blockchain is cross-checked and remain backed in the network.Rapid advancements in digital data by implementing authentication and cryptography key mechanisms.The high level of security offered in blockchain to secured business records in immutable form,without require the third party trust and they can disrupt global services and solutions for business customers.It offers the validation and encryption mechanisms in a distributed system to enhance security in digital data storage.Blockchain is a revolutionary technology is used in industries,education and so many applications.

Distributed Ledgers

Every transaction is recorded in a public ledger that everyone in the system may access. digital transactions benefit from distributed computational power because they execute better results. Distributed ledgers are synchronous ledgers that are implemented by independent computers. It enables peer-to-peer communications and the sharing of digital data value. They have the technology infrastructure and standards in place to undertake simultaneous digital data validation access and recording in an immutable manner across many entities. It allows the secure transmission of digital data across a decentralized network. The data is stored in a secure environment using a cryptographic technique that follows the network's regulations. DLT (Distributed Ledger Technology) has a lot of promise for businesses, institutions and government. In addition to many industries such as micrisoft,IBM reaches the DLT rules over the blockchain.

II. Blockchain Architecture

Immutability, decentralization, transparency, distributed ledger and tamper-proof transactions are all aspects of blockchain. The blockchain in a peer-to-peer network is made up of a large number of nodes. Blocks, nodes and miners are the three components of the blockchain, every chain has several blocks and each chain is made up of three essential elements: data in the block, generation of the block and creation of the hash value for the blocks. Miners are individuals who mine digital data in a distributed system to create new blocks.

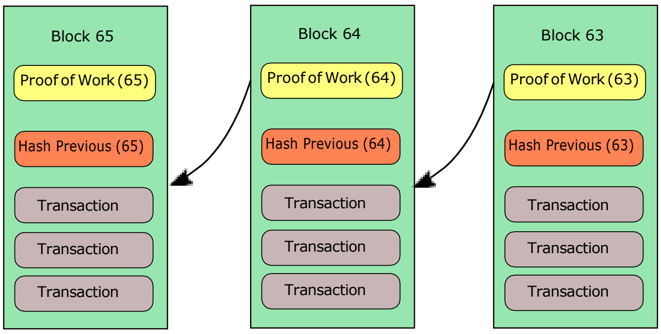

Fig. 1. Structure of Blockchain Technology

In the blockchain technology commit transaction stores list of blocks.The new block are grown appendendly,each block consist of two hash value as one for current block and another value for previous block. The hash value can be operated by SHA-256 cryptography algorithms to provide user security and ledger consistency. Blockchain distributes the user information in the open record format,it cannot be alter or eradicated by someone in it. The activity of book keeping mechanism can be followed in the process of each and every digital data in the network. The proof of work and proof of stake are the consensus mechanisms involved in cryptocurrency blockchain application achieve distributed consensus over the network. Due to the cryptocurrency techniques, to avoid the security issues over the network. It can be used for startup and business people, there is no possibility of corruptibility by the implementation of blockchain. The new method is an innovative technology and it provides self examining biological system. The five phases of blockchain are distribution, tokenization, encryption, immutability and decentralization. Blockchain sorted out the database, it keeps historical backups of every data.

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A blockchain protocol operates on a distributed system and peer-to-peer network to deliver ledger transactions across the network. The distributed ledger is based on pre-defined rules that are agreed upon by all system members. Blockchain is a new technology that eliminates risks and fraud in distributed applications by bringing transparency.

III. Related Surveys

Blockchain described the database system designed by unitary memory unity, the blocks are connect by hash identifier value for the previous block (Nikola Bozic, Guy Pujollie, Stefano Secci 2016). Blockchain technology is highly effort for shape the urban future and highly destructive (Charles Shen and Feniosky Pena-Mora 2018). Blockchain has become the security breaches and innovative potential and database structure using the format as STIX (Pieter Hartel, Quingze Hum 2018). Blockchain objects are inter connect and interact with environment to collect information, performed certain tasks (Tiago M.Fernandes-caramas and Paula Fraga-Lamas 2018).

The study "Securing digital data using blockchain technology" is based on papers obtained from Scopus, Web of Science, and a variety of open access journals. The first section describes blockchain criteria and features, while the second section discusses blockchain security applications in real-world settings such as healthcare, education, social media and contracts. Secure digital data, contract-based application between 2012 and 2019 that contains the consensus algorithm and SHA 256 security services are the subjects of the survey. Furthermore, the survey study provides a comprehensive overview of blockchain technology.

A. Government

Blockchain technology[19] can be used in government resource models to share information. It promotes the shift of government affairs from management to service by increasing trust in government resource sharing. The service-oriented e-government paradigm is built on blockchain. It creates the architecture for analysing interactions between the government and users. It detected the fault and ensures the security of distributed storage, consensus, plugins and asymmetric encryption. Blockchain can be used for information sharing with security service-oriented models thanks to a legal agreement. It allows the framework to provide legal agreement in government financial services. In a legal agreement, API provides the verification and voting system in the blockchain technology. Blockchain allows the transformation of smart services and attracts government attention. Distributed Ledger Technology can facilitate information sharing (DLT). The government sector keeps track of scattered transactions.

B. Finance

Blockchain shaping the financial and banking services of the future. The information is stored in GoogleLevelDB in a financial service. In this scenario, the stack is maintained by stacking blocks on top of each other, with the bottommost block serving as the foundation. The hash function can be used to identified each individual block. [20] The hash value sequence connected the other blocks to their parent block. The ancestor block of all other block is the Genesis block. The secure root is created by the structure of the genesis block and hash value. Genesis block is used in financial services as an SMS message. It satisfied the security services are authentication, integrity and non-repudiation

Decentralization, reliability and transparency are the characteristics of financial services.

The financial investors are provided by RES (Renewable Energy Sources) [21]. All the nodes in distributed system are monitored the performance of system. The smart contract with turing comprehensive language provided by blockchain technology linked to financial services and the digital tokens transferred under the smart contracts. Electricity Grids shaped Renewable Energy Sources. In a decentralized system, RES presents reverse power flow. DLS-OCS (Distributed Ledger Services for Online Contract Settlement) was used to do research for digital financial systems.

A. Healthcare

In the previous year, the proposed paper introduced MedRec, a decentralized record management system that included an Electronic Medical Records (EMR) system that shows an immutable log and easy access to the treatment site. As blockchain miners, design integrated manage sensitive information and the public health authority. Health records are in a jumbled state. The data is retrieved by the patient and shared on the decentralised system.

In [22], two sorts of chains are introduced: private and public in the side chain, which scanned the patients genuine IDs, while the main chain scannned the patients temporary IDs. The completed transaction is saved in a peer-to-peer network. In a distributed system, main chain transaction generates additional transaction. The medical institution keeps track of the timestamp, data type, data link, hash value, and prior the hash block. The transaction verification mechanism is described in this case.

The integrated design's underlying technique has evolved via several rounds of hash function such as mathematical processes and human fingerprints. The hash function can be quickly identified and replicated the data.

B. Education

In higher education, new technology is introduced. To make effective interaction between the faculties and students to store the record untampered and validated in centralization system. To enhance the education system by innovate the various method and contract based on blockchain. The learning data form the hub to the students and subjects. In [17] Learning Management System (LMS) and Learning Record Pools (LRP) provide availability, reliability and immutability,access control, security and privacy in learning process. The resources and study material in digitalized form as e-Books,video and audio to minimized the budget of governing body.

In the learning process, [18] uses computerised evaluation software for professional credentials. The term "electronic learning contract" refers to a contract between a teacher and a student. The periodic meetings are held to facilitate decision-making in the learning process. POA is an entirely consensus-based combination of quantitative and qualitative student evaluation. The student's curriculum evaluate their performance.

As a result, the blockchain is transformative in terms of enabling and coordinating economic activities. Intermediaries costs and time are reduced, making the transaction and information sharing easier and safer. To improve an ecosystem's trust, blockchain records are permanent and irresversible.

TABLE 1. COMPARATIVE STUDY OF EXISTING ARTICLES

Author Name and Year	Domain	Technique used	Para-meters	Limitations
Fedro Neves Maka, Muhammad Najib Razali Ruimiguel Dantas, Norkidayah Mohd Yunos (2020)	Land registration system	Symmetric and Asymmetric encryption Server Flask Application	Block mining	Issues in key management and scalability
Shu Yun Lim,Pascal Tankam Foksing, Abdullah Almani, Omar Musa, MiLss Laiha MatKiah, Tanpong Ang,Reza Ismail (2018)	Security	Identity management system, Trusted platfotm modulre, Mobile trusted module, Public key infrastructure	Proof of identity and membership, Cloud based solution (Blockchain as a service)	Key management problem,Issues in verification of user identity
Mohammad Jabed, Morshed Chowdhury, Alan Colman, Muhammad Ashad Kabir, Jan Han, Paul Sarda (2018)	Security	Personal dara store (PDS), Servuce based system	Reduce the turnaround time, Imoroves decision making and reduce overall cost	Data termination, Anonymity cannot keep it in longer time
WeiluChen, ZibunZheng,Jiahui Cui, Edith Ngai, PeilinZheng,YurenZhou (2018)	Data mining	Ethereum Virtual Machine (EVM), Classification model	Detect the ponzi-schemes, High accuracy, Feature Extraction	Opcode Ends up
Qiuhong Zheng YILI, Ping When, Xinghua Dong (2018)	Storage optimization	Inter planetary file system (IPFS)	Data compression speed up the process and security synchronization	Lot of hassles in installation and consumes lot of bandwidth
Yiwei Zhang (2019)	Data Manage ment System	Baen based technique	Guarantee of technical and management dimension	It is difficult to identify the personal Entry-Exit model
Muhame Turkanovic, Marko Holbl, Kriskjan Kosic, Marjan, Hericko, Aida Kamisalic (2018)	Education	European Credit Transfer and Accumulation System (ECTS)	Grading system offers a globally unified viewpoint for Higher Education Instituition (HEI)	There is no adaptation in EduCTX and prototype inefficient
Nurilla Mahamatov, Avaz Kuvnakov,Bakhtiyor Yokuboy (2021)	Education	Smart contract platform and Tokenization system	To fill the gap in the student knowledge data and to increase the transparency security	Outdated of relevant training program
n Duan, Ying Zhong (2017)	Learning outcomes and meta diploma	Electronic Learning Contract (ELC)	Qualitative and Quantitative combination of grade process	No autonomy
Nadeem Abdullah Makiberi (2020)	Blockchain based Application in Education	School Information Hub (SIH)	Reliability, Security and Data Veracity	Increase volumes of records slow down the block transaction
Asaph Azaria (2016)	Medical Data Access	MedRec and EMR system	Anonymized large-scale medical data	Difficult to make framework
Liviu Hirtan (2017)	e-health data access with privacy protection	Hyperledger fabric framework	Better quality medical service	Difficulty in integration process
Matthias Mettler (2017)	Healthcare	Gem health network	Counterfeit the pharmaceutical sector	Scale down potential mechanism
Asad Ali Siyal, Aisha Zahid Junejo, Muhammad (2018)	Healthcare	Electronic Health Records (EHR), Medical Fraud Detection mechanism	Secure data sharing, Personslized authentic, Autonomy, Manage storage capacity	Interoperability issues, Few focal points
Cornelius C.Agbo, Qusay H. Mahmoud, Jimikael Ekiund (2019)	Healthcare	Preferred Reporting Items for Systematic Review (PRISMA) Meta analysis and Systematix mapping technique	Improved data security and privacy, Availability and Robustness verifiability, and Data Trust	Interoperability issues, Need care coordination
Ayesha Shahnaz Usman Qumar Ayesha Khalid (2017)	Healthcare	Electronic Health Records (EHR), Consensus Mechanism	Scalability, secueity and Integral blockchain based solution	Interoperable timing issues, Discrepancies workflow breakup
Matthias Mettler (2016)	Blockchain in healthcare	Bitcoin and Hyperledger	Health informayion in a efficient secure environment	Strongly affect the balance of power
Mousumi Mitra, Aviroop chowdhury (2020)	Voting system	Fuzzy logic with blockchain validation system	One way views can be represented, Identify the constituency	Less quality of software application
Ashish Singh, Kakali Chatterjee (2018)	Voting system	Digital voting system, AES DES, Merkle root hash function	Voter confidentiality,secure from the existing attacks	Duplication and forgery
Jen-Ho Hslao, Raylin Tso, Chien-Ming Chen, Mu-En Wu (2018)	Voting system	Registration server, Authentication server, Voting website and Recording server	Anonymity of users,Identity,Verifiability of bullots	Malware attacks and Denial-of-service
Shireesh Apte, Nikolai Petrovsky (2016)	Supply chain	Mathematically linked trapdoor function	Caculating modulus function of the data	Difficult to compute in the opposite direction
XianglinBao, ChengSu, Yan Xiong, Wenchao Huang (2019)	Marketing	Federated Learning chain (FL chain)	Low latency, Reduce total time cost, Less power consumption	Multiple trainers results in abort training
Ozden Tozanli, Elif kongar Surendra M.Gupta (2020)	Marketing supply chain	Discrete event simulation	Optimal trade-in-to upgrade policy	Missing hard drives and supply disc drives
Yang Lu (2018)	Cryptocurrency	Simplified payment verification, Broadcast protocol, Merkle tree	Integrity, Non-repudiation, security, Timestamp	It offers the source without downloading the full blockchain

TABLE 2. COMPARISON BETWEEN BLOCKCHAIN DOMAIN

Author& year	Domain	Technolgy
Han Sun, Xiaoyue Wang, Xinge Wang (2018)	Healthcare	Chronological logical order method, Data Encryption method
Untung Rahardja, Achmad Nizar Hidayanto, Taqwa Hariguna Qurotul Aini (2019)	Education	Edu-tech model
Fedro Neves Maka, Muhammad Naji b Razali Ruimiguel antas,Norkidayah Mohd Yunos (2020)	Land registration system	Symmetric and Asymmetric encryption Server Flask Application
Mousumi Mitra, Aviroop Chowdhury (2020)	Voting system	Fuzzy logic with blockchain validation system
Arim Park, Huan Li (2021)	Marketing supply chain	Blockchain based supply chain
Abderahman Rejeb, John G.Keogh, Horst Treiblmaier (2019)	IOT based supply chain	Deploy Blockchain Technology with IOT
Yang Lu (2018)	Bitcoin	Simplified payment verification, Broadcast protocol, Merkle tree
Faiza Loukil Shirine, Ghadira-Guegan, Hiuloud Bookadi, Aloha &Nabila Benharkat, Elhadj Benkhelifa (2017)	IOT based blockchain	IOT device behaviour control

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TABLE 3. SUMMARY OF ALGORITHM USED

Author name & year	Algorithm	Domain	Disadvantages
Weizhi Meng Eimar Tischhausar Qungju Want, Yu Want Jinguang Han (2018)	DOMINO	Security	Overhead traffic, Limited signature coverage, Inaccurate profile, Massive false alerts
Weizhimeng Elmar, Tischhausor, Qingju Wang, Yu wang (2018)	DOMINO	Security	Overhead traffic, Limited signsture coverage, Inaccurate profile, Massive false alerts
Han Sun, Xiaoyue Wang, Xinge Wang (2018)	Encryption algorithm	Online education	Inefficient in control of academic identity
Fedro Neves Maka, Muhammad Naji b Razali Ruimiguel Dantas, Norkidayah Mohd Yunos (2020)	Encryption algorithm	Land Registration system	Issues in key management and scalability
	Hyperledger framework	Healthcare	Difficulty in integration process
	Hyperledger framework	Healthcare	Hyperledger framework

OUTCOME OF THE LITERATURE SURVEY

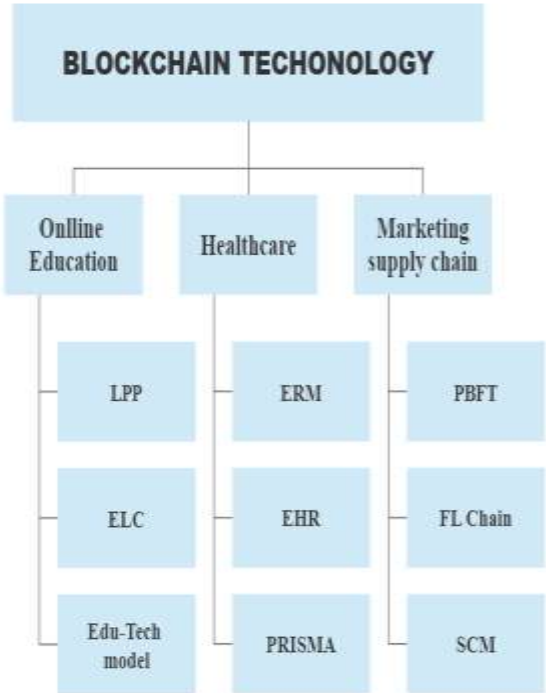

Fig 2. Blockchain Diagram for Literature Survey

According to a thorough analysis of the literature, a security method that is scalable, dreadfully inefficient, mutable, and not truly decentralised is required. Congestion in the network is a problem caused by the breakdown of the consensus mechanism in a current security measures. In the conventional system, network data loss is the result of the lack of chronological order. Therefore, this research suggests creating a blockchain technology that can address the shortcomings of current efforts.

IV. BLOCKCHAIN PLATFORMS

Blockchain is a network-wide distributed digital ledger. Platforms are decentralised and implemented as public and private blockchain. Public network release the data in public and the information is secure and immutable. Public blockchain creates the cryptocurrency with open source computing code. The major advantage of blockchain provide maximum security,open source environment, retrieves the anonymous,decentralized and transparency. Public blockchain limitation as data modification and uses private keys. The most common examples of public blockchain as Bitcoin and Ethereum.

A. Bitcoin

The first digital asset approaches based on the cryptocurrency mechanism were introduced in 2009, after Bitcoin's invention in 2008. ([5] Bitcoin is a peer-to-peer network that uses public key cryptography, a proof-of-work and proof-of-stake system to validate node processing, and a new block is generated every 10 minutes. The output for unspent transactions A byproduct of the bitcoin cryptocurrency, the UTXO paradigm offers transactions that handle independent data while avoiding heavy traffic in legal organisations. The blockchain is a public distributed ledger that stores transactions made by digital nodes using the cryptography method. Bitcoin generates rewards through a process known as mining, and these rewards can be used to exchange for goods, services, and other currencies. Several local and national governments use this technology.

B. Ethereum

In order to facilitate cryptocurrency transactions and apply the technology to regulate fraud, downtime, or interference from a third party, Ethereum launched decentralised digital applications, or Dapps, in 2015. [5] We are able to reach agreements, carry out transactions, and process the digital assets automatically by the vending machine thanks to Ethereum, which operates on a global network of computers. To achieve coordination between the digital transmission systems, the POW and alternate POS can be built using a consensus mechanism. Ethereum currently uses the Dagger-Hashimoto memory hard hash algorithm, which creates a lower block time than the other systems, leading to a higher rate of block stale.

Private blockchain design by private key access by single organization.The permission from the govern body of the blockchain to read and write on the ledger.The mechanism of blockchain access depends on the network creator.The benefits of private blockchain process the higher number of transaction per second and to reduce the consensus time,stability etc.The limitations of blockchain as private or permissioned as space complexity and reservation of block The most widely used private blockchain is Hyperledger.

C. Hyperledger

A cross-industry, global corporate blockchain system called Hyperledger was developed in 2016. Because consensus protocols require a network that may be customised, they can offer the Practical Byzantine Fault Tolerance (PBFT) consensus protocol to increase the network's latency. Hyperledger is a term for a permissioned blockchain where the participants in a consensus process are industry leaders in banking, manufacturing, the internet of things, and finance. To develop high-performance blockchain-based distributed ledger technology, Hyperledger fosters widespread collaboration. It serves as a focal point for distributed systems' digital data transactions and offers the framework and guidelines needed to build a blockchain. With everyone coming to a consensus, Hyperledger is able to create a commercial blockchain.

TABLE 4. COMPARATIVE STUDY OF BLOCKCHAIN PLATFORMS

Blockchain platform name	Blockchain platform type	Advantages	Limitations	Cost (Rs)
Bitcoin	Public	Maximum Security and open source environment	Uses private leys and data modification	26,87,285.13
Ethereum	Public	Autonomous and uses compuehensive set of tools	Platform generator is much more	1,92,569.90
Hyperledger	Private	High speed	Block reservation	19,885.69

V. CONCLUSION AND FUTURE SCOPE

Thus a review of a various blockchain technology with respect to platforms and applications is prescribed.We discussed multiple number of domains and their applications. The database records the digital data and stored in a blocks with the formulation of hash function. Blockchain completely depends on DLT technology,the data loss rate is minimized.The blockchain framework is a foundational technology,it is potential for engender applications.

Blockchain technology majorly lies in field of cybersecurity and its shows the unfold potential.And,there will be a huge demand for blockchain engineers,across all these markets.By 2024,blockchain is expected to become a 20 billion market.

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Brain Tumour Classification Using Deep Learning and a comparative study of Efficientnet

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***Abstract* — Brain tumors have garnered significant attention in recent times as one of the most lethal diseases affecting both children and adults. Most of the primary central nervous system cancers or CNS are found in the brain. With roughly 12,000 individuals receiving a diagnosis of a brain tumor each year. There are various categories of brain tumors including Benign, Malignant, Pituitary, Glioma and others. To enhance the life expectancy of patients, it is crucial to employ appropriate care, preparation, and accurate diagnostics. Magnetic resonance imaging (MRI) is widely considered to be the most effective method for detecting brain tumors. However, due to the intricate nature of brain tumors and their characteristics, manual examination can sometimes lead to inaccurate results. The utilization of an automated system for detecting and classifying brain tumors can help doctors and patients identify and categorize these tumors at an early stage, initiate treatment sooner, and reduce mortality rates. Deep learning research is rapidly advancing, with new algorithms being developed every day to enhance accuracy. We use a combination of deep learning techniques such as Convolutional Neural Networks (CNN) and Artificial Neural Networks (ANN) to accurately detect tumors. Our approach leverages the transfer learning technique to train a new CNN model on top of the efficientnetB0 base model, allowing us to alter the final layers to match the classes we want to identify and categorize, such as benign, malignant, pituitary, and normal. This approach allows us to improve the accuracy of tumor detection and classification. Also we have done a comparative study between the pre trained heavy weight model called as Efficientnet b0 and Efficientnet B1 and we found there is a significant increase in the model performance and accuracy.**

Keywords — Central Nervous System (CNS), Magnetic Resonance Imaging, Machine Learning, Convolution Neural Network, Artificial Neural Network, and Transfer Learning.

I. INTRODUCTION

The human brain is the most crucial and noteworthy organ in the body, with brain tumours being a frequent cause of brain dysfunction. Essentially, a brain tumour is an accumulation of cells that are growing uncontrollably, resulting in a lump or unhealthy cell growth in the brain. There are numerous types of brain tumours, including both noncancerous (benign) and cancerous (malignant) varieties. Primary brain tumours originate in the brain, whereas secondary (metastatic) tumours originate in other parts of the body and spread to the brain. The rate of growth for brain tumours can vary significantly. While benign tumours do not spread to other tissues and grow slowly, they can still cause major problems despite not being carcinogenic. Additionally, they typically have more distinct borders, which facilitates surgical excision, and they do not frequently reappear following removal. On the other side, malignant brain tumours can spread to other regions of your brain or central nervous system, are carcinogenic, develop quickly, and pose a serious risk to your life. The proper functioning of your nervous system is reliant on the growth rate and location of any brain tumours you may have. The type of tumour, along with its size and placement, are all factors that determine the available treatment options. Brain tumour cells consume the nutrients intended for healthy cells and tissues, leading to brain dysfunction. Currently, manual examination of a patient's MR images of the brain is required to identify the tumour's location and size, which is time-consuming and can result in inaccurate detection. Brain cancer is a severe disease that claims many lives each year, making early detection and classification methods essential. Deep learning algorithms have been shown to be effective in detecting brain tumours from medical images such as MRI and CT scans.[1] The use of MRI scans, a non-invasive procedure that utilizes a powerful magnet, radio waves, and a computer, allows for the structures and components inside the body to be viewed with stunning clarity. Open MRI devices, however, do not produce as sharp of images as closed-bore MRI equipment. The brain is a crucial and critical organ in the human body and brain tumours have emerged as one of the leading causes of brain malfunctions. A tumour is a cluster of cells that have grown in an uncontrolled manner and form a mass in the brain. There are various types of brain tumours, ranging from benign (non-cancerous) to malignant (cancerous). Primary brain tumours originate in the brain while secondary (metastatic) tumours are those that originate elsewhere in the body and spread to the brain. In contrast, malignant tumours can grow rapidly and spread to other parts of the brain or central nervous system, posing a major threat to one's life. The treatment options for brain tumours are influenced by their type, size, and location, as well as the patient's nervous system's ability to function. The growth of brain tumour cells eventually depletes the nutrients intended for healthy cells and tissues, leading to brain failure. Convolutional neural networks (CNNs) are commonly used in brain tumor detection due to their ability to automatically learn features from images.[2] Currently, clinicians manually examine patients' MRI images of the brain to determine the location and size of the tumour, which is a time-consuming process prone to inaccuracies. Early detection and classification of brain tumours are crucial for survival, and MRI scans are the preferred choice for imaging because they produce clear and detailed images without the use of radiation. Open MRI machines, which have larger spaces on two sides and reduce the claustrophobia commonly associated with closed-bore MRI scanners, are available for patients with a fear of enclosed spaces. However, open MRI machines may not produce as sharp images as closed-bore MRI machines.

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II. Overview of Data

A. DataSet Description

The primary source of data is from Kaggle. Brain tumours can be complex and unpredictable in terms of their size and location. This makes it challenging to fully understand the nature of the tumor. An experienced neurosurgeon is required for MRI analysis. In underdeveloped countries, the lack of skilled medical professionals and limited knowledge of malignancies can make it challenging to effectively analyse MRI results. This problem can be solved with a cloud-based automated solution. The dataset includes around 4,000 MRI images of the brain. There are 400 images designated for testing and 4,000 for training. A large dataset is necessary for proper training of a Convolutional Neural Network (CNN).

B. Contents of the Dataset.

• Glioma Tumour: A type of tumour called a glioma develops in the brain and spinal cord and arises from glial cells, which support nerve cells. Gliomas are classified based on their genetic characteristics, which can help predict their behaviour and effective treatment options.

• Meningioma Tumour: A tumour called a meningioma develops from the meninges, the membranes covering the brain and spinal cord. Although not strictly a brain tumour, it can affect nearby structures like nerves, blood vessels, or brain tissue. Meningiomas are most common in women and often found in older individuals. They grow slowly and may not show symptoms, thus, they may be monitored rather than treated immediately.

• Pituitary Tumour: Tumours of the pituitary gland are abnormal growths that affect the production of hormones. Most pituitary tumours are benign (noncancerous) adenomas and don't spread to other parts of the body. Treatment options include removal, hormone management, and growth control, and observation may be recommended.

• No Tumour: A tumour doesn't always indicate malignancy. The term "tumour" refers to a swelling of any kind, including benign or malignant cell growth. Technically, even a pustule can be considered a tumour.

This dataset contains 6 different features i.e. date, open, high, low, close, volume.

III. Motivation

The detection and classification of brain tumours are critical in providing effective medical intervention. In addition to detecting the presence of a tumor, the ability to accurately classify its type is crucial in determining the best course of treatment. For instance, it is important to determine if the tumor is malignant or benign. By analysing MRI images, our project seeks to revolutionize the current approach to brain tumor detection and classification. Transfer learning, where a pre-trained CNN is fine-tuned for brain tumor detection, has been shown to improve performance and reduce training time.[3]

The primary objective of our project is to develop a cutting-edge system that can accurately identify various types of brain tumours using MRI images of patients. Our goal is to create a system that is more efficient, accurate, and reliable than current methods. By leveraging advanced imaging techniques, our system will provide medical professionals with valuable insights into the characteristics of brain tumours. This will allow them to make informed decisions regarding patient care and treatment options.

Ultimately, our project aims to contribute to the advancement of medical science by improving the way brain tumours are detected and classified. Through the development of a sophisticated system that can accurately analyse MRI images, we hope to facilitate early detection and effective treatment of brain tumours. The system uses convolution neural network algorithms to detect tumor blocks and classify the type of tumor present in the image. The system is designed to be user-friendly, where doctors can simply upload an MRI image, and the model will predict the presence of a brain tumor and the type of tumor present, with high accuracy. This project has the potential to save lives by detecting brain tumours at an earlier stage, leading to early treatment and better outcomes. Brain tumours are a significant concern worldwide and are responsible for taking many lives every day. Our aim is to tackle this problem head-on by developing a reliable and innovative solution that can accurately detect and classify brain tumours. By doing so, we hope to help improve the lives of patients, and ultimately, save lives.

C. Application

Brain tumours are a pressing concern worldwide, causing many fatalities on a daily basis. Early detection of these tumours by patients, doctors, and healthcare specialists can significantly improve the chances of survival and lead to happier outcomes. Our aim is to develop a solution that is both innovative and reliable in detecting brain tumours. Our project involves the creation of a system where doctors can upload MRI images and the model will predict whether there is a presence of cancer and the type of tumor present. The current state of brain tumours is one of the most dangerous issues in the world and it has become a matter of great concern. However, early detection can be life-saving for many individuals. That is why we aim to create a solution that is both precise and dependable in detecting brain tumours.

D. Scope of the Project

With the help of the AI and DL we can use the methods and algorithms effectively for predicting and detecting diseases like these. Brain Tumor detection is one of the most important and efficient way to detect brain tumor. The main scope of the project is to deliver this product to health care services and health care workers and doctors for detecting brain cancer with high accuracy. If this project is made as a full-fledged product surely it will be a great success for the college and also we can make a good profit from it. Ensemble learning, where multiple CNNs are combined, has also been shown to improve performance in brain tumor detection [4]. Brain tumor detection is a crucial and effective method for detecting brain cancer, and with the use of AI and DL, we can utilize these techniques and algorithms for accurate predictions and diagnoses. Our

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project's main objective is to deliver this product to healthcare services, staff, and doctors for efficient brain tumor detection. If this project is developed into a full-fledged product, it will bring great success to the college and provide financial benefits. As a benefit to users, we can also offer a free trial period for those who want to test the product before committing to it.

E. Problem Statement

To counter this, we aim to bridge the gap and ensure that predictions and diagnoses are accurate and precise. By utilizing AI and DL technologies, we can assist or guide doctors in determining the type of cancer present in an MRI image and detect the tumour at an early stage. This will greatly increase confidence in the results, as these models are trained on vast amounts of data to achieve high accuracy and reliability. The outcome of this solution will be a higher level of trust in the doctors' diagnostics and the ability to provide appropriate treatment accordingly.

IV. LITERATURE STUDY

The use of deep learning for diagnosing and classifying brain tumours remains a prominent area of research. Early detection and treatment of brain tumours has the potential to save millions of lives each year. Researchers have explored using machine learning and deep learning algorithms to address medical image diagnosis problems. Convolutional Neural Networks (CNN), one of the most well-known deep learning algorithms, have yielded significant results in the field of brain tumour classification.

A. Works Related To Brain Tumour Classification Using Deep Learning Approach And Idea for transfer learning

If a tumour is detected early, doctors can treat the patient and improve their chances of survival. According to statistics, in 2016, over 200 studies were conducted using deep learning on medical images, with 190 of them utilizing CNNs. Some of the most widely used CNNs for classifying medical images include AlexNet, VGG, and GoogLeNet. This section delves into the recent studies used for categorizing brain tumours. The use of Generative Adversarial Networks (GANs) in computer vision is becoming increasingly popular. Data augmentation, where synthetic data is generated from existing images, has been shown to improve CNN performance in brain tumor detection.[5] These networks can be trained to generate a variety of images, including style transfer, image synthesis from noise, image-to-image translation, and image segmentation. In the field of medical imaging, where datasets tend to be smaller, GANs have gained traction as a solution. When it's not possible to gather multiple imaging modalities for each patient, CycleGAN, a novel algorithm, can be used to compensate for the missing data. In this research, we explored the different entropy functions used in MRI image analysis to segment and detect tumours. The choice of entropy function has a significant impact on the threshold values and, subsequently, the segmentation results. Attention mechanisms, where important regions in the image are highlighted, have been shown to improve CNN performance in brain tumor detection.[6] Gliomas, the most common brain tumours, are classified based on the presence or absence of mitotic activity, necrosis, and vascular growth, resulting in a WHO grade of II, III, or IV. Both types of brain tumours can be detected easily, but they grow in a diffuse, infiltrative manner and are accompanied by an increase in water in the area around the tumor. Early detection and classification of these tumours are crucial for effective treatment. With the help of advanced technological advancements in automated healthcare systems, medical professionals can now provide more effective treatment for patients. GANs, where synthetic data is generated by a generator network and evaluated by a discriminator network, have been shown to improve CNN performance in brain tumor detection.[7] This article presents a new MRI-based method for classifying and identifying brain tumours by combining the properties of deep convolutional neural networks (CNNs).

The MRI images undergo normalization and enhancement before being input into three different CNN models for feature extraction. The Fuzzy C-Means (FCM) segmentation method is used to divide the brain into tumor and non-tumor regions, and wavelet features are extracted using the multilevel DWT method. 3D CNNs, where image volumes are used instead of individual slices, have been shown to improve performance in brain tumor detection.[8] Finally, a Deep Neural Network (DNN) is employed for highly accurate brain tumor classification. This method of brain tumour classification and identification using deep CNNs is compared to other approaches such as KNN, LDA, and SMO. AlexNet filters were utilized in the convolution layers of the CDLLC with a size of 3 x 3. The training process employed SGD as an estimator and the activation function used was ReLU. Transfer learning combined with data augmentation has been shown to achieve state-of-the-art performance in brain tumor detection using deep learning algorithms.[9]

This study aimed to diagnose normal and malignant brains using Artificial Neural Networks (ANNs) and Convolutional Neural Networks (CNNs). ANNs, with their ability to learn and store information through multiple interconnected layers of neurons, were able to train on the training data using basic processing units. The idea of this project was to use transfer learning, which has been previously explored in the field of brain tumour diagnosis

V. PROPOSED METHODOLOGY

The main aim of the project is to deliver a useful and effective solution for doctors who need to detect and diagnose what type of cancer a patient has using the MRI scanned image photographs of the scan from the patient. This project mainly focus to improve the accuracy to the maximum extent and provide a reliable deep learning model which will effectively identify the cancer present in the tumour image. Deep learning-based brain tumor detection methods have the potential to significantly improve diagnosis accuracy and treatment planning for patients with brain tumours.[10] We have used a latest technique called as the transfer learning which will help us identify the model input more accurately.

DOI: rp-9788770040723.181

A. Transfer Learning

Transfer learning is a branch of machine learning that focuses on the reuse of knowledge acquired from one problem and its application to another, similar but unrelated problem. Deep learning algorithms have been shown to be effective in differentiating between low-grade and high-grade gliomas, which can help in determining the appropriate treatment for patients.[11] For example, the skills learned from identifying vehicles can be transferred to identifying trucks. This concept has similarities to the psychological literature on learning transfer, where knowledge obtained from one task can be used to improve efficiency in learning new tasks. In transfer learning, the learned features from a base network trained on a base dataset and task are transferred to a target network trained on a target dataset and task. The success of this process depends on the generalizability of the learned features, as opposed to being task-specific. Transfer learning is the process of training a base model with another model and then training our target model on top of the base model. Using a pre-trained model as the base model improves accuracy and efficiency in detecting new information.

B. Efficientnetb0

The efficientnetb0 model is the foundation of our transfer learning approach. Typically, convolutional neural networks (CNNs) are constructed with a fixed resource budget and then expanded as additional resources become available to enhance accuracy. The use of multi-modal imaging, such as combining MRI and CT scans, can improve the accuracy of brain tumor detection using deep learning. [12] For example, ResNet can be scaled from ResNet-18 to ResNet-200 by adding more layers, and GPipe recently improved a baseline CNN by a factor of four, resulting in 84.3% ImageNet top-1 accuracy. Traditionally, scaling a model involves arbitrarily increasing the CNN depth or width or using higher-resolution input images for training and testing. Although these methods increase accuracy, they require time-consuming manual adjustments and often yield suboptimal outcomes.

Our approach is different. In our ICML 2019 paper, "EfficientNet: Rethinking Prototype Scaling for Deep Neural Networks," we proposed a novel model scaling method that employs a simple yet highly effective compound coefficient to scale CNNs in a more systematic way. This allows for the expansion of CNNs in an ethical manner, achieving impressive accuracy without requiring laborious fine-tuning. Our approach revolutionizes the way we scale CNNs, making the process more efficient and effective. Our innovative scaling strategy, combined with the latest advancements in AutoML, has led to the development of a family of models known as EfficientNets that significantly outperform state-of-the-art accuracy while achieving up to 10 times greater efficiency.

To better understand the impact of scaling the network, we conducted a comprehensive analysis of the effects of scaling various model dimensions. While scaling individual dimensions can improve model performance, we discovered that to optimize network performance, it is essential to strike a balance between all network dimensions - width, depth, and image resolution - and the available resources. Our findings demonstrate the importance of a comprehensive and coordinated approach to model scaling, which can result in dramatic improvements in efficiency and accuracy. With our approach, we are redefining what is possible in the world of model scaling and making it easier for developers to build powerful, efficient, and accurate models for a wide range of applications.

C. EfficientnetB1

EfficientNet-B1 is a pre-trained computer vision model developed by Google Research that aims to improve image classification accuracy while reducing the amount of computation needed to process each image. It is part of the EfficientNet series, which is designed to perform well on a range of image sizes and is scalable to accommodate larger image inputs while maintaining high accuracy. EfficientNet-B1 has been trained on the ImageNet dataset, which consists of over 14 million images, and has achieved state-of-the-art performance on the benchmark leader board. The model uses an efficient scaling method that balances the depth, width, and resolution of the network to achieve a high accuracy-to-computation ratio. EfficientNet-B1 can be fine-tuned for specific applications by retraining its final layers, or used as a feature extractor by taking the activations from the intermediate layers. It has become a popular choice for many computer vision tasks such as object detection, segmentation, and classification

D. Efficientnet Architecture

The effectiveness of the models is largely influenced by the baseline network. To enhance performance, a new baseline network has been established by performing a neural architecture search with the AutoML MNAS framework. This framework optimizes both accuracy and efficiency to produce a more optimal result in terms of FLOPS. The architecture incorporates MBConv, which is similar to MobileNetV2 and MnasNet, and has a higher FLOP budget. This baseline network serves as the foundation for the creation of the EfficientNets series of models. The baseline network is a crucial component that determines the success of scaling up models.

Deep learning algorithms can also be used for predicting patient survival and disease progression based on brain tumor imaging data. [13] To achieve better performance and accuracy, we employed a neural architecture search using the state-of-the-art AutoML MNAS framework. The search resulted in a new baseline network that utilizes the digital inverted limit convolution (MBConv) layer, similar to MobileNetV2 and MnasNet. This layer allowed for a larger FLOP budget, leading to improved model performance. The new baseline network was then used to create the EfficientNets family of models, which are known for their superior accuracy and efficiency compared to traditional models. Additionally, this approach of using neural architecture search and baseline network scaling can be applied to various applications in computer vision and natural language processing, leading to improved model performance in these domains as well.

DOI: rp-9788770040723.181

E. Performance Of Efficientnet

The EfficientNets models were rigorously tested against other pre-existing CNNs on the ImageNet dataset. The results revealed that our models outperformed the competition with regards to accuracy and efficiency. By reducing the parameter size and FLOPs by a substantial margin, our EfficientNet-B7 model achieved a remarkable 84.4% top-1 and 97.1% top-5 accuracy on ImageNet, while also being 8.4 times smaller and 6.1 times faster than the prior Gpipe model. Transfer learning combined with domain adaptation can improve the performance of deep learning algorithms for brain tumor detection when transferring knowledge between different imaging modalities or institutions. [14] Additionally, our EfficientNet-B4 model leveraged a similar amount of FLOPs compared to the popular ResNet-50 model but delivered a significant increase in top-1 accuracy, from 76.3% to 82.6%. The success of EfficientNets on ImageNet is just the tip of the iceberg. To truly evaluate the potential of EfficientNets, we conducted experiments on eight popular transfer learning datasets. To support the machine learning community, we have open-sourced all EfficientNet models, along with the TPU training scripts and source code. The Keras efficientnet function returns the Keras object recognition model that is pre-trained on ImageNet and ready for dynamic weight and training data input. The efficientnet pre-processing is designed to fit the specific input format required by every Keras application.

VI. RESULTS AND EVIDENCE

The current system in medical image analysis has utilized GANs (Generative Adversarial Networks) to some extent, but they have fallen short compared to CNNs in terms of accuracy. To determine the final output, some researchers have turned to SVMs (Support Vector Machines). However, this approach has limitations in terms of both accuracy and processing time. The use of attention mechanisms in deep learning algorithms can help in identifying important regions in brain tumor images, which can aid in accurate tumor segmentation. [15] One commonly used technique for separating tumor and non-tumor regions in the brain is the Fuzzy C-Means (FCM) segmentation method. Although this method has some potential, it can be very complex and unreliable in practice. To overcome these limitations and improve the accuracy of medical image analysis, it may be necessary to adopt more advanced techniques and approaches that better balance accuracy and efficiency.

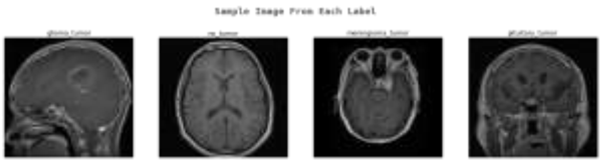

Fig 1. Sample image of dataset *(Contains Four classes)*

In the dataset sample image, we observe the presence of four distinct classes: glioma, meningioma, pituitary, and no tumour. These images will undergo a process of resizing and reshaping to meet the input specifications of the CNN model. Once the input is fed into the model, transfer learning will be applied, and the final layer will produce the desired output in the form of classified results. This process enables the efficient utilization of knowledge gained from previous similar problems to enhance the accuracy of the current task.

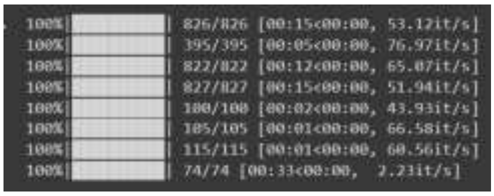

Fig 2. Data loading

The dataset consists of a total of 3624 images, which are divided into four classes: glioma, meningioma, pituitary, and no tumour. Each class is further divided into training and testing folders, with a different number of images in each folder. For example, the first folder, belonging to the glioma class, contains 826 training images and 100 testing images. The second folder, belonging to the meningioma class, contains 395 training images and 105 testing images. The third class, pituitary, has 822 training images and 115 testing images. The combination of deep learning algorithms and radiomics features can improve the accuracy of brain tumor detection and segmentation.[16] The fourth class, no tumour, has 827 training images and 74 testing images. These images will serve as the training and testing data for building a model that can accurately predict the presence of cancer and tumours. To prepare the data for model building, it must be first split into training and testing sets using pandas and a data frame. This will allow for the training of a robust and reliable model for future prediction tasks.

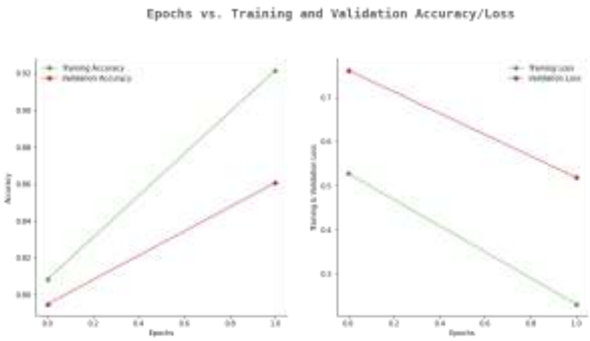

Fig 3. Accuracy of CNN

The Convolutional Neural Network (ConvNet/CNN) is a powerful Deep Learning tool that can analyse and differentiate various aspects of an input image. In the above image, we can see the accuracy comparison of a CNN model that was trained using an efficientnetB0 pretrained model as its base. Semi-supervised learning can improve the performance of deep learning algorithms in brain tumor detection by leveraging both labeled and unlabeled data. [17] The results are quite impressive, with a training accuracy of 92% and validation accuracy of 84% after only two epochs of training. The loss is also reduced to a low value of 0.1 for training and 0.55 for validation. This shows the remarkable performance of the CNN model from the first epoch to the second epoch. To further analyse these results, a confusion matrix can be used for comparison.

DOI: rp-9788770040723.181

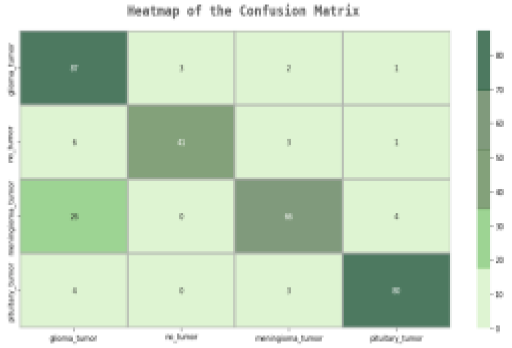

Fig 4. Heatmap of the confusion matrix for 2 epochs

The training process of a Convolutional Neural Network (ConvNet/CNN) becomes more effective as the number of epochs increases. An epoch is a complete iteration through the entire training set in the context of deep learning. More epochs provide the network with more opportunities to learn from the training data, resulting in better generalization. The number of iterations in an epoch is determined by the number of batches or iterations over the partitioned training data. The use of multiple epochs allows the network to revise its parameters and improve its performance, especially with large training sets. Additionally, heat maps can be used to help focus on important aspects of a dataset by using color-coding to visually represent the volume of data points.

Fig 5. 2 epochs training

From the above figure, it is evident that the training accuracy for 2 epochs is relatively low at 0.92, and the validation accuracy of 0.86 is not desirable for the CNN model. To ensure that the model can learn more effectively from the images, it is crucial to both increase the number of epochs and decrease the batch size. This way, the model will be exposed to more diverse training data and will have the opportunity to better understand and extract features and parameters for accurate output classification.

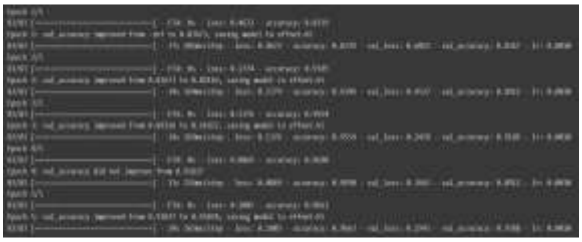

Fig 6. 5 epochs training.

By increasing the number of epochs to 5, we can observe the improved performance of the model. The results are remarkable, with a training accuracy of 0.9663 and a validation accuracy of 0.9388, both of which are great for a CNN model predicting brain tumours. The comparison of confusion matrices and classification reports of different epoch sizes will now be performed to understand the impact of epochs, verbose, and batch size on the accuracy of the model. These factors have a significant impact on the training and validation accuracy and must be carefully considered before training the model.

```
print(classification_report(y_test_new,pred))

              precision    recall  f1-score   support

           0       0.71      0.94      0.81        93
           1       0.93      0.80      0.86        51
           2       0.89      0.69      0.78        96
           3       0.93      0.92      0.92        87

    accuracy                           0.84       327
   macro avg       0.87      0.84      0.84       327
weighted avg       0.86      0.84      0.84       327
```

Fig 7. Classification report for 2 epochs.

The term "verbose" in programming refers to the production of extensive logging output. When verbose is set to true, the program provides detailed information about its actions. This can be useful for monitoring the progress of a neural network during training. By setting verbose to 0, no output will be displayed. Verbose mode is a common feature in operating systems and programming languages that provides additional information about the activities of the computer or program, including startup processes, software and driver loading, and comprehensive output for diagnostics. By increasing the number of epochs to 5, we can train the model and evaluate its performance with a classification report.

```
print(classification_report(y_test_new,pred))

              precision    recall  f1-score   support

           0       0.93      0.91      0.92        93
           1       0.96      0.94      0.95        51
           2       0.95      0.94      0.94        96
           3       0.96      1.00      0.98        87

    accuracy                           0.95       327
   macro avg       0.95      0.95      0.95       327
weighted avg       0.95      0.95      0.95       327
```

Fig 8. Classification report for 5 epochs.

To evaluate the performance of a classification algorithm, a classification report is generated to show the number of correct and incorrect predictions. The report is based on four metrics: True Positives (TP), False Positives (FP), True Negatives (TN), and False Negatives (FN), which are used to measure the accuracy of the predictions. Additionally, the classification report displays the model's precision, recall, F1 score, and support scores. Upon analysing the results of the trained model, we found that the accuracy was 0.84 after two epochs of training. The use of generative models, such as GANs, can generate synthetic images to augment the training data, which can improve the performance of deep learning algorithms in brain tumor detection. [18] However, by increasing the number of

DOI: rp-9788770040723.181

epochs to 5, the accuracy significantly improved to 0.95, indicating that the model's performance has improved considerably. To further elaborate, a classification report provides valuable information on the performance of a classification algorithm by breaking down the number of correct and incorrect predictions for each class in a dataset. Precision refers to the percentage of correct positive predictions out of all positive predictions, while recall refers to the percentage of correct positive predictions out of all actual positives.

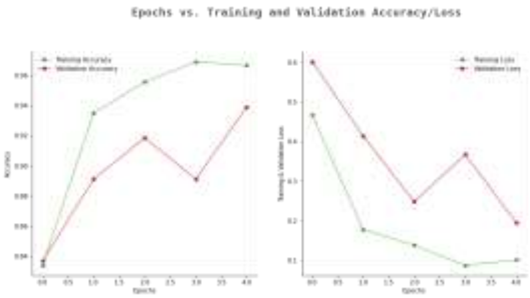

Fig 9. Accuracy comparison for 5 epochs.

The F1 Score, a combination of precision and recall, is used to evaluate the model's overall performance. In the context of machine learning, the accuracy of a model can be improved by increasing the amount of data used for training, increasing the number of epochs, and fine-tuning hyperparameters. The loss function is another important metric to monitor during training as it indicates how well the model is performing at each step. In the field of web analytics, heat map analysis is a method of visualizing user behaviour on a website by displaying the areas where users click or hover their mouse the most. This type of data can provide valuable insights into how users interact with a website and can be used to improve the site's design and user experience. By studying heat map data, web designers can identify which parts of a page are most engaging to users and optimize the layout and content to improve conversion rates.

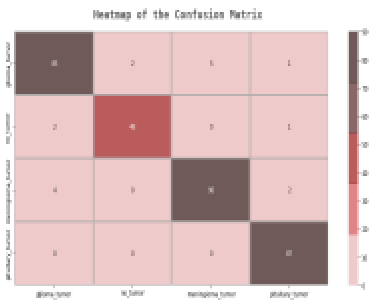

Fig 10. Heatmap for confusion matrix with 5 epochs

The graph shows that when it comes to image processing projects, especially in the domain of brain tumor detection and classification, the Convolutional Neural Network (CNN) outperforms other algorithms in terms of efficiency. This can be attributed to the CNN's ability to automatically learn and extract features from images, making it highly suitable for tasks that involve image data. However, it is important to note that the accuracy of the results can be further improved by increasing the amount of training data and the number of epochs used in training the model.

In the context of the MITRE heat maps, the color-coding system is designed to provide a visual representation of the level of confidence in the mapping of techniques to strategies. Lighter colours indicate a lower level of confidence, while darker colours indicate a higher level of confidence. This is an important consideration when using the heat maps to evaluate the effectiveness of different strategies and techniques, as it helps to identify areas where additional research or refinement may be needed. Overall, the heat maps can be a valuable tool for understanding the relationships between different techniques and strategies in complex domains.

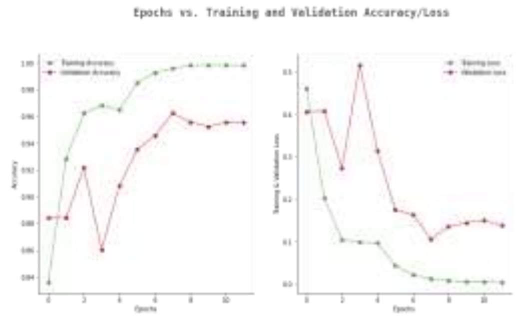

Fig 11. Accuracy comparison for 12 epochs from Effnet B0

By increasing the number of epochs from 5 to 12, we observed that the performance of the model improved significantly. The training accuracy reached 0.97, which is a highly impressive result. This indicates that the model is now better suited for the task of brain tumour detection and classification using deep learning. Deep learning algorithms can also be used to segment brain tumor regions for radiation therapy planning and monitoring, which can improve treatment outcomes. [19] The validation accuracy also improved and reached its highest value of 0.96. This further confirms that our model is performing well and is able to generalize well to new data. The training loss decreased to 0.05 and the validation loss decreased to 0.1. This suggests that the model is now able to learn the underlying patterns in the data more effectively. The classification report and the confusion matrix also indicate that the model is performing well, with a high precision, recall, F1 score, and support.

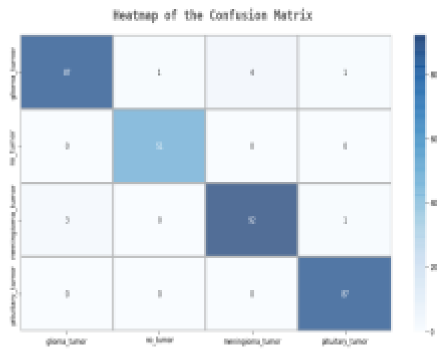

Fig 12. Heatmap for confusion matrix with 12 epochs

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A confusion matrix is an important evaluation metric for machine learning models, particularly in classification tasks. It provides an overview of the model's performance by comparing the actual and predicted values. By increasing the number of epochs from 5 to 12, we observe that the model's performance improves. This can be seen in the confusion matrix where the number of correct predictions (True Positives and True Negatives) increases, resulting in a higher accuracy of 97%. The confusion matrix helps us to understand the model's behaviour and evaluate its performance in a more visual manner. It is a crucial tool for debugging and optimizing the model's performance.

EfficientNet-B1 is a convolutional neural network architecture introduced by Google in 2019, as part of their EfficientNet series of models. It is designed to be more efficient than existing architectures, both in terms of computational cost and accuracy. The "B1" refers to the fact that it is the first model in the series, with subsequent models (B2, B3, etc.) having larger architectures with improved accuracy. EfficientNet-B1 is designed using a compound scaling method that balances accuracy and efficiency, by scaling the network's depth, width, and resolution. This allows the model to achieve high accuracy while using fewer parameters and less computation than other architectures. The architecture is built on top of MobileNetV2 and uses depth wise separable convolutions and a mix of global average pooling and global max pooling to reduce the computational cost. EfficientNet-B1 has been trained on the ImageNet dataset and achieved state-of-the-art performance on multiple benchmarking tasks. It is widely used in a variety of computer vision applications, such as object detection, image classification, and semantic segmentation, due to its efficiency and effectiveness. Deep learning-based methods have shown promising results in differentiating between true tumor progression and pseudo progression in patients with glioblastoma undergoing treatment, which can aid in clinical decision-making. [20] The confusion matrix can be used to evaluate the model's performance, showing the number of true positive, true negative, false positive, and false negative predictions.

FUTURE ENHANCEMENT

The With the introduction of EffNetB1, the accuracy of the model increased to 98%. This showcases the potential of using advanced deep learning algorithms in the field of brain tumour detection and classification. In the future, we can leverage large amounts of data and a range of CNN algorithms, including accurate efficient nets and pre-trained models like VGG16, to further improve the accuracy. By training the model for a higher number of epochs and fine-tuning the parameters such as batch size, we can achieve even better results. Additionally, there is a possibility to develop a system for the early detection of various types of brain cancers. With the advancements in technology, the training process can be completed quickly and the model can be prepared for prediction. AI has the potential to revolutionize this field and bring us closer to achieving a significant milestone in the area of brain tumour detection and classification.

CONCLUSION

The aim of this project is to achieve a precise and dependable detection and classification of brain tumours from MRI images using deep learning algorithms such as CNN. We will evaluate a range of algorithms with different feature engineering and training parameters and carry out a comprehensive comparison to determine which algorithm, with the optimal parameters, performs better than others. The field of brain tumour detection and classification has seen significant progress in the past few decades, with numerous researchers contributing to the cause. Our objective is to find a more efficient and accurate model, as well as a simplified and high-performance approach in this project In order to determine which algorithm with the best parameters outperforms other algorithms, we will also analyse multiple algorithms using a variety of feature engineering and training settings. From the above result and evidence we can infer that the EfficientNet B0 has performed well even in 5 epochs but when comparing it with the EfficientNetB1 the accuracy has increased to a significant amount to 98%. Thus, the Transfer learning technique is highly useful for this project. Our project aims to develop a highly efficient, accurate, and straightforward methodology. Based on the above results and evidence, we can conclude that the EfficientNet B0 model performed well even after 5 epochs. However, when compared with the EfficientNetB1 model, the accuracy increased significantly to 98%.

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A Comprehensive Study of Data Analytic Techniques for Sales Forecasting

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***Abstract* — Predicting the sales of a product or demand for a service is an utmost need in any industry. With the changes and increase in the channels and modes through which the products are sold, the prediction of sales in the future becomes tedious. The number of features that would help in predicting sales differs and increases. This leads to the usage of Machine Learning and Deep Learning Models in sales forecasting. A deep survey of various works that employ machine learning and Deep learning approaches for sales prediction is done and inferences are made. Every work studied has a list of models which are used as baseline models for comparison and the same is listed for better inferences. Works that address the problem of predicting the sales of new products are also discussed. A list of publicly available sales forecasting datasets is also given.**

Keywords—Sales forecasting, Machine Learning, Deep Learning, Time Series.

I. Introduction

The overall operations of any industry either service or product depend on the sales that they can make in the future. Hence, predicting sales will be an integral part of any system. The correctness of the sales predicted has an impact on both the internal and external processes of an organization. Any sales forecasting model should address two questions. First, the number of sales that will be made and the time in which they will be made. Sales forecasting is commonly done with the following Techniques,

- Time Series/Statistical Models
- Machine Learning Models
- Deep Learning Models

The conventional time series models [1-3] use historical sales data. But the historical data has certain drawbacks.

- Non Availability of Sufficient Historical Sales Data.
- Nonconsideration of the other factors that affect the Sales.

The former may be true in the case where new products are introduced and also when there are missing data for the existing products. The other problem is, historical sales data is not the only factor that can be used to predict future sales. Various other factors have an impact on sales. This includes basic data such as the seasonal data and leaves data in most cases and more complex data such as the features of the images which are required in the fashion industry. The models that address these issues should be capable of handling multivariate data and also possess efficient feature engineering.

These requirements are addressed by machine learning and deep learning models. The objective of this work is to study the available machine and deep learning approaches. The models studied are observed to be applied in the various datasets and the commonly available public datasets are [4-13]. This includes commonly used datasets such as the Walmart dataset, Rossman dataset, multivariate dataset as well as time series data.

The paper is organized as follows. The next section gives a comprehensive list of machine learning algorithms and the observations made from them. Similarly, the third section gives the list of deep learning approaches and the inferences made from them. The fourth section gives a summary of the inferences made. The final and fifth section gives the conclusion.

II. Machine Learning Approaches

[14] Applied five different regression techniques and 7 different Time Series Analysis methods in the Walmart dataset for predicting the sales. The models are implemented in the azure machine learning model. The performances of the models are compared in terms of different performance parameters and Boosted decision tree model performs than the other models. The models are used to predict the number of weekly sales. [15] Uses Rossmann Data for sales prediction. 15 features are used. As part of the features, the significance of the individual parameters is also analyzed by the users. Three different Machine Learning Models are used, LR, RF, and XGBoost. XGBoost performs well than the other two models. [16] Predicts the sales of the magazine using the Hearst Dataset. The work employs support vector regression. [17] Claims they have incorporated a better feature engineering approach for sales prediction in the Walmart dataset and applied three machine learning models. The catBoost model performs better than the linear regression and support vector regression models. [18] Uses both the time series models and the machine learning models for sales prediction in the automobile industry. The model is trained and tested with data that contains yearly, quarterly, and monthly features. The forecasting model seems to perform well in the case of monthly forecasting. Another Model that uses the Walmart dataset is [19]. It concludes that the LightBGM model performs well than a model called the prophet model which is a blended approach of time series and machine learning model.[20] uses the recursive feature elimination method for removing unwanted features and extracting only the necessary features from the Walmart dataset.

Three different machine learning Models are compared and LightBGM is found to perform well among the three models.

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[21] Have worked on individual oral care products and predicted their sales in the future using a back propagation neural network model. The comparison is made between the individual products.[22] have made a detailed exploratory data analysis of the E-Fashion Store for retrieving the appropriate features. They have compared three different machine learning models and found Gradient Boosting tree performs well. [23] Combined the XGboost and LightGBM models to create a hybrid model for detecting Walmart sales. An effective feature engineering approach is also applied which extracts features from past data. The combined model performs well than the other machine-learning approaches. In [24] in addition to making a sales forecast in general, analysis is made to identify the factor that drives high sales of medical products. Two factors, distribution channels, and marketing campaigns are considered and the corresponding sales can be predicted. Stacking of different machine learning models is used in [25] for predicting sales. Stacking helps in improving the accuracy by considering the variations in results obtained in the previous models. [26] Also uses the stacking approach and achieves better accuracy in predicting the sales of auto parts. In this case, as in various stacking processes, the dataset is split into different groups and used for training the individual models separately. The outcome of which is used at the next level. To the best observation made, [27] is the only work that uses multivariate adaptive regression splines for sales forecasting. The model is compared with the various machine learning models. In addition to predicting the sales it also clearly defines the relationship between the impacting factors and sales. [28] Uses particle swarm optimization with the various machine learning models and the Naïve Bayes algorithm is found to provide better results than other models.

Comparison is also made with the stand-alone conventional models. [29] Uses various machine-learning approaches for forecasting the sales of the components of the truck. [30] Proposes a model called the ForeXGBoost algorithm which combines the efficient missing value filling and feature extraction methods with the XGBoost model to predict the sales of passenger cars. This is the best performing model in the vehicle sales forecast competition.

[31] Combines various machine learning models to forecast drug sales. Around nine variants including the individual and combined models are experimented with and compared for better results in predicting the sales seasonally and in nonlinear trends. Holt-Winter's model is a traditional approach that is best suited for handling the trends of sales data as well as seasonal data. [32] Builds a neural network with Holt-Winter's model as its base. It roves to provide better results in predicting the sales of the wheel covers. [33] Compares various machine learning models for predicting the sales of retail stores.XGBoost algorithm along with efficient Feature Engineering is used for predicting the sales of Walmart data [34]. The model is compared with two other models and found to produce better results.

21 machine learning models are studied. The keywords used for retrieving the papers are “Sales Forecasting with Machine Learning", and "Sales prediction". The search is made in Science Direct, IEEE Xplore, and Google Scholar. The models are summarized in Table 1. The observations made are summarized below. The commonly used dataset is Walmart dataset as observed in “Fig. 1”.

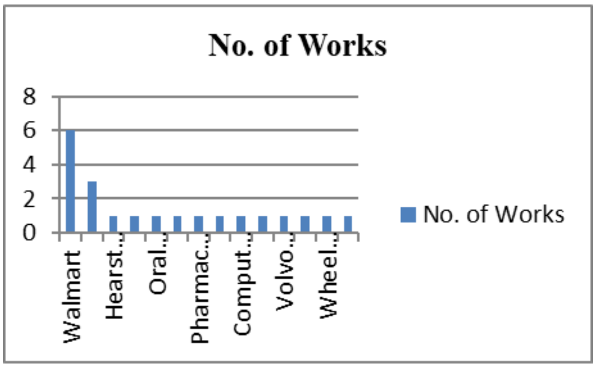

Fig. 1. Usage of Different Datasets

It has been noted from the figure that the Walmart dataset is the most commonly used and hence the results obtained with them are analyzed further. The best-performing models observed in the various works and depicted in table 1 are summarized in “Fig. 2”.

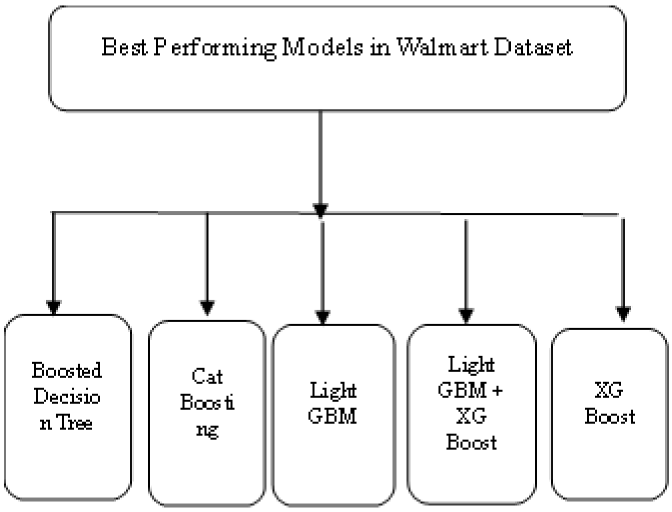

Fig. 2. Best Performing Models of Walmart Dataset

After doing cross-validation tuning across the pertinent algorithm's parameters, the comparison of five distinct methods on a test set is shown.

	Boosted Decision Tree	Cat Boosting	LightGBM	XGBoost	LightGBM + XGBoost
Retail Sales data (Walmart)	0.9614	0.9617	0.9600	0.9600	0.9623
Auto parts sales data	0.9455	0.9534	0.9453	0.9438	0.9536
Fashion store datatset	0.9826	0.9833	0.9851	0.9814	0.9856
Grocery data (Big-mart)	0.8739	0.8767	0.8732	0.8751	0.8771

Fig. 3. Cross-validation of five algorithms

When compared to the other algorithms, CatBoost Algorithm was more complicated, which meant that the

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final model almost always contained more trees and a deeper layer. The best option will be the LightGBM model if training speed is the only deciding factor.

Compared with all other combined Boosting algorithm outperforms the competition in the Retail dataset by a significant 0.8–1% margin. The discrepancies are less pronounced in the other datasets.

TABLE I. SUMMARY OF MACHINE LEARNING MODELS USED FOR SALES FORECASTING

Ref	Title	Dataset	Methods Used	Performance Parameters	Best Performing Model
14	Benchmarking of Regression and Time Series Analysis Techniques for Sales Forecasting	Walmart Dataset	**Time Series** ▪ SARIMA ▪ Non-SARIMA ▪ Seasonal Exponential Smoothing ▪ Non-Seasonal Exponential Smoothing ▪ Naïve Method ▪ Average Method ▪ Drift Method **Regression Methods** ▪ Linear Regression ▪ Bayesian Linear Regression ▪ Neural Network Regression ▪ Decision Forest Regression ▪ Boosted Decision Tree Regression	Mean Absolute Error Root Mean Square Error Coefficient of Determination	Boosted Decision Tree Regression
15	Sales Forecasting for Retail Chains	Rossmann Data	Linear Regression Random Forest XGBoost	RMPSE	XGBoost
16	Support Vector Regression for Newspaper/Magazine Sales Forecasting	Hearst Dataset	Support Vector Regression	Euclidian Distance between Actual Sales and Predicted Sales	Support Vector Regression
17	Sales Forecasting Based on CatBoost	Walmart Dataset	CatBoosting Linear Regression Support Vector Machine	RMSE	CatBoosting
18	General Sales Forecast Models for Automobile Markets and their Analysis	US-American Automobile Market	Ordinary Least Square SVM, DT, KNN, RF	MAPE	Support Vector Machine
19	Application of Machine Learning Model and Hybrid Model in Retail Sales Forecast	Walmart Dataset	Time Series Model Prophet Model LightGBM Model	RMSE	Light GBM
20	Sales Forecasting Based on LightGBM	Walmart Dataset	Logistic Regression Support Vector Machine LightGBM	RMSE	Light GBM
21	Oral-Care Goods Sales Forecasting Using Artificial Neural Network Model	Oral care products	Back Propagation Artificial Neural Networks	MAD MSE RMSE	Back Propagation Artificial Neural Networks
22	Intelligent Sales Prediction Using Machine Learning Techniques	E-Fashion Store dataset	Generalized Linear Model Decision Tree Gradient Boosted Tree	Accuracy Error Rate Precision Kappa	Gradient Boosted Tree
23	A hybrid machine learning model for sales prediction	Walmart Dataset	Linear Regression Support Vector Machine LightGBM XGBoost LightGBM + XGBoost	RMSE	LightGBM + XGBoost
24	Analysis of Drug Sales Data based on Machine Learning Methods	Pharmaceutical Sales Data	Linear Regression, RandomForest, Neural Networks Support Vector Regression Levenberg-Marquardt algorithm	MAPE MSE RMSE	Random Forest
25	Machine-Learning Models for Sales Time Series Forecasting	Rossmann Store Sales	Extra Tree, ARIMA, Random Forest, Lasso Neural Network Stacked Model	Mean Absolute Error	Stacked Model
26	Auto Parts Sales Prediction Based on Machine Learning for small data and a long replacement cycle	Auto Parts Sales	Linear Regression Support Vector Regression Stacked Model	-	Stacked Model
27	Sales forecasting for computer wholesalers: A comparison of multivariate adaptive regression splines and artificial neural networks	Computer Whole Sales	Support Vector Machine Back propagation Neural Network Cerebellar Model Articulation Controller neural network Extreme Machine Learning ARIMA Multivariate Linear Regression multivariate adaptive regression splines	RMSE MAD MAPE RMSPE	multivariate adaptive regression splines
28	A study on forecasting big mart sales using optimized data mining techniques	Grocery Data(Big Mart Dataset)	DT, RF, NB, Naive Bayes Random Forest + Particle Swarm Optimization Naïve Bayes +Particle Swarm Optimization	RMSE	Naïve Bayes + PSO
29	Forecasting Sales of Truck Components: A Machine Learning Approach	Volvo Truck Components Dataset	Support Vector Machine Regression Ridge Regression Gradient Boosting Regression Random Forest Regression	MAE RMSE	Ridge regression
30	ForeXGBoost: passenger car sales prediction based on XGBoost	Car Sales Data	Linear Regression Model Light Gradient Boosting Logistic Regression Gradient Boosting Decision Tree DT, SVM, XGBoost ForeXGBoost	logarithmic difference square root (LDSR) RMSE MAE	ForeXGBoost
31	Forecasting of sales by using a fusion of Machine Learning techniques	Rossmann	ARIMA, ARNN, SVM XGBoost ARIMA and ARNN ARIMA and XGBoost ARIMA and Support Vector Machine STL Decomposition (ARIMA, Snaive, and XGBoost)	MAE RMSE	STL Decomposition (ARIMA, Snaive, and XGBoost)
32	A Neural-Network-based Forecasting Algorithm for Retail Industry	Wheel Cover Sales Data	Holt-Winter's model Holt-Winter's model with ANN	MSE	Holt-Winter's model with ANN
33	Sales-forecasting of Retail Stores using Machine Learning Techniques	Retail Store Data	Linear Regression Polynomial Regression Lasso Regression Ridge Regression Ada Boost GradientBoost	RMSE R^2	GradientBoost
34	Walmart Sales Forecasting using XGBoost Algorithm and Feature Engineering	Walmart dataset	Logistic Regression, Ridge Regression, XGBoost	RMSSE	XGBoost

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The number of times the common machine learning models are used and tested in various studies is summarized in "Fig. 4". There are also models that are not specified in the figure but are used in a couple of works.

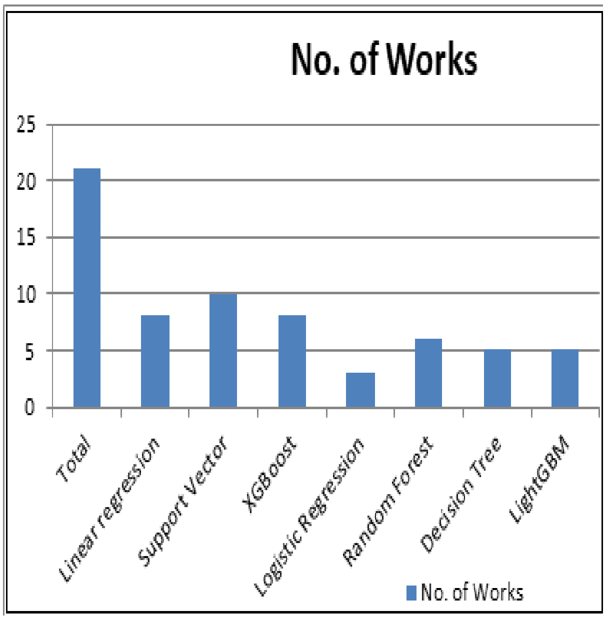

Fig. 4. Usage of Machine Learning Models

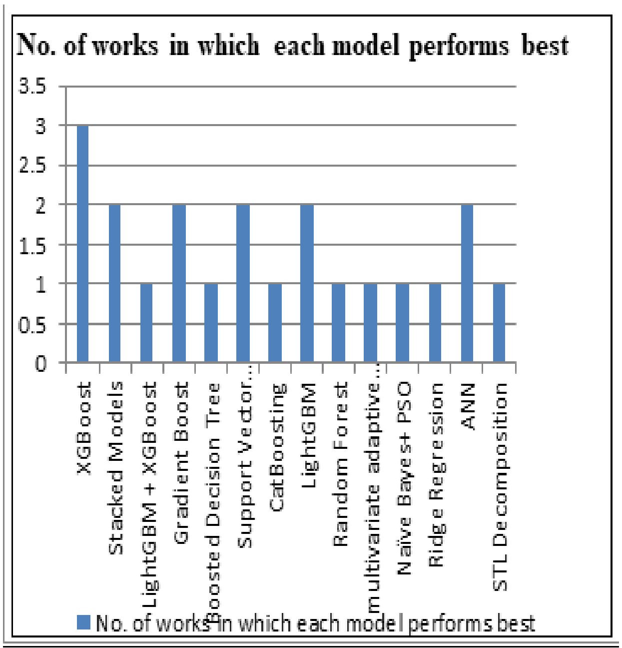

Fig. 5. No. of works in which each model performs best

The number of times a particular machine learning model performs well is given in "Fig.5." Although the datasets employed are different, this data would help in getting a general observation on the best-performed models.

III. Comparative Study of Deep Learning Models

With the trend of E-Commerce applications and the increase in the size of the data employed for forecasting, the usage of Deep Learning approaches in sales forecasting increases. TABLE II summarizes it.

TABLE II. Summary of Deep Learning Models Used for Sales Forecasting

Ref	Title	Dataset	Methods Used	Performance Parameters	Best Performing Model
35	Study on convolutional neural network and its application in data mining and sales forecasting for E-commerce	Alibaba E-Commerce Dataset.	ARIMA MBGRT PDNN CNN	MSE	CNN
36	An Aggregate Store Sales Forecasting Framework based onConvLSTM	Not Specified	ARMA ARIMA RNN CNN+LSTM	RMSE MAE MAPE	CNN+LSTM
37	Exploring the use of deep neural networks for sales forecasting in fashion retail	Fashion Retail Dataset	Decision Trees Random Forest Support Vector Regression Artificial Neural Networks Linear Regression Deep Neural Networks	R2 RMSE MAPE MAE MSE	Deep Neural Networks
38	Contribution to sales forecasting based on recurrent neural network in the context of a Moroccan company	-	RNN (LSTM) ANN RNN	RMSE	RNN(LSTM)
39	Approaching sales forecasting using recurrent neural networks and Transformers	CorporaciónF avorita Grocery Sales data	Variants of RNN and Transformers	RMSLE RMSWLE MALE	-
40	LSTM with particle Swam optimization for sales forecasting	Sales of Cars Sales of Medicines And Other Datasets	LSTM LSTM with PSO Machine Learning Models	RMSE MAE RAE RRSE	LSTM with PSO
41	Forecasting of Non-Stationary Sales Time Series Using Deep Learning	Rossmann store sales data set	Deep Learning with Trend Correction Layer	RMSE	Deep Learning with Trend Correction Layer
42	A Network-Based Transfer Learning approach to improving Sales Forecasting of New Products	Food Data	Deep Neural Network Deep Neural Network with Transfer Learning	MSE	Deep Neural Network with Transfer Learning
43	Sales Forecasting Using Deep Neural Network And SHAP techniques	Walmart Sales Data	Deep Neural Network Linear Regression Support Vector Machine	RMSE	DNN
44	Clothing Sale Forecasting by a Composite GRU–Prophet Model with an Attention Mechanism	Cloth Sales	Prophet + GRU RNN LSTM Prophet ARIMA	RMSE MAE	Prophet + GRU
45	Automatic Sales Forecasting system Based on LSTM Network	Walmart Sales Data	LSTM SVM Linear Regression	RMSSE	LSTM
46	Forecasting New Apparel Sales Using Deep Learning and Nonlinear Neural Network Regression	Fashion Retail Dataset	V3 Inception + NN	MSE RMSE MAE R^2	V3 Inception + NN
47	A Deep Learning Approach for the Prediction of Retail Store Sales	Supermarket Data From Japan	Deep Learning Approach with L1-Regularization Logistic Regression	Accuracy	Deep Learning with L1-Regularisation
48	Accurate Demand Forecasting for Retail with Deep Neural Networks	Two retail store Dataset	Structural Temporal Attention Network Ridge GRU LSVR	RSE	Structural Temporal Attention Network
49	CNN-GRU-AM for Shared Bicycles Demand Forecasting	Shared Cycle usage Dataset	LSTM GRU CNN GRU and CNN CNN +GRU +AM	RMSE MAE MAPE	CNN +GRU +AM

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Ref	Title	Dataset	Methods Used	Performance Parameters	Best Performing Model
50	A hybrid deep learning framework with CNN and Bi-directional LSTM for store item demand forecasting	Store Item Demand Forecasting Dataset	Stochastic Gradient Descent, KNN Random Forest, XGBoost Linear Regression. CNN-LSTM, CNN-BiLSTM	MAE MAPE R^2	CNN-BiLSTM
51	Forecasting pharmacy purchases orders	Pharmacy Purchase Dataset	SARIMA Prophet LR, RF, LSTM	Accuracy	SARIMA
52	Retail Demand Forecasting: a Comparison between Deep Neural Network and Gradient Boosting Method for Univariate Time Series	German Retail Store Data	Deep Neural Network Gradient Boosting	MAE RMSE	Deep Neural Network
53	Retail Demand Forecasting using CNN-LSTM Model	Data from 10 Stores	MLP, LSTM, CNN CNN+LSTM	RMSE	CNN + LSTM
54	Forecasting of Sales Based on Long Short Term Memory Algorithm with Hyperparameter	Sales Data	LSTM	RMSE	LSTM
55	A Sales Prediction Method Based on LSTM with Hyper-Parameter Search	Rossman data	Machine Learning Models LSTM LSTM with Hyperparameter Search	RMSPE MAPE	LSTM with Hyperparameter Search
56	Future Sales Prediction For Indian Products Using Convolutional Neural Network-Long Short-Term Memory	Bigmart Dataset	CNN +LSTM	Precision	CNN+ LSTM

[35] uses the capability of the convolutional neural networks to extract the features effectively from the available dataset and predict the sales forecast. [36] Uses a novel model that combines the convolutional neural networks and LSTM. It differs from the other works in the way that it also considers the sales data of the neighboring stores along with the sales data of the considered store. The combined model is compared with the other statistical model and the individual RNN model and the combined model perform well. [37] Designed a deep neural network model for forecasting sales in the fashion retail market. The preprocessing includes various aspects such as the aspects of the company and the domain expert's decision. The deep neural network model performs well than the other machine learning models. [38] Have tested various variants of the recurrent neural network model for forecasting sales. RNN with LSTM is found to perform well when compared with conventional artificial neural networks and RNN.[39] have developed a model for predicting sales at three different levels, Item, day, and store levels. It employs RNN and Transformers and also introduced the concept that using dynamic time for learning to avoid overfitting. [40] Uses particle swarm optimization for selecting the features from the sales dataset and LSTM for Training and Sales Prediction. The approach is tested with different datasets and compared with different machine learning models. [41] Introduces a layer for correcting the trend with the help of the predicted sales value and the weight value. This results in better accuracy. To address the problem of forecasting the sales of the newly introduced data, [42] introduces the transfer learning approach in deep neural networks.

The model is trained with the existing products and used for predicting the sales of the new products. [43] Designed a deep neural network model for forecasting the sales of Walmart data. An effective visualization mechanism is also used for enhancing the model. The deep neural network performs well than the linear regression model and support vector machine. [44] Combines the prophet model with the gated recurrent unit for predicting the Sales of the clothes. The combined model performs well than the other individual deep-learning approaches and Time series Models.

[45] Uses LSTM with hyperparameters tuned with search grid optimization for predicting Walmart sales. Since the sales of the products like fashion clothes depend on the style and other similar attributes, [46] uses image features as parameters along with sales history data for predicting future sales.

A variant of the CNN model is used for feature extraction and a neural network is used for prediction. [47] Uses a deep learning approach with L1 regularization for predicting the sales of the supermarket data. [48] Proposed a model which combines the concepts of gated recurrent unit, Auto regression, and Attention models to create a prediction model which takes into consideration the structural and temporal details of the products and the relation between them. [49] Also uses multiple deep learning approaches for predicting the sales, CNN for extracting the Features, Gated recurrent unit, and attention mechanism for finding the relations at the consecutive levels. This is used in the service industry for forecasting the demand for shared bicycles. While most of the works combine CNN with LSTM, [50] combines CNN with Bi-LSTM for predicting the demand for store items. The model is found to perform well than the CNN-LSTM and other machine learning algorithms. [51] Has been the only work that predicts the demand for Pharmacy products. Prediction of the weekly demand and daily demand is made and it is observed that the former performs well than the latter model.

When most of the works use multivariate data for forecasting [52] and compare the performance of the deep neural networks and Gradient Boosting algorithm in predicting the sales with the univariate data. [53] Combines CNN with LSTM for predicting the sales data of different stores. A new activation function called the Swish activation function is employed which results in better performance. [54] Tested LSTM for predicting sales. The work compared various LSTM models that are differentiated by the number of hidden layers, number of epochs, size of the batch, etc.[55] also uses hyperparameter tuning in LSTM for making a better prediction. [56] Combines convolutional neural network and long short-term memory for predicting the sales of the big mart dataset. Both historical sales data and time series data are used.

The following are inferred from the study made with the deep learning works. The commonly used model is LSTM. LSTM is used in combination with other models for better performance. As a surprise in a specific case of predicting the sales of the pharmacy products, the

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conventional SARIMA performs better than the Deep learning models. As stated earlier, with the increased usage of e-commerce sites, the decision of the users to buy a product depends on the characteristics of the products as in the case of fashion products, Deep learning models are useful. Consider an e-commerce site that sells apparel, the buying decision may depend on the color and style. Such parameters should also be considered for sales prediction. This demands a mechanism to extract features efficiently. CNN plays the role. The such basic architecture is shown in “Fig. 6”.

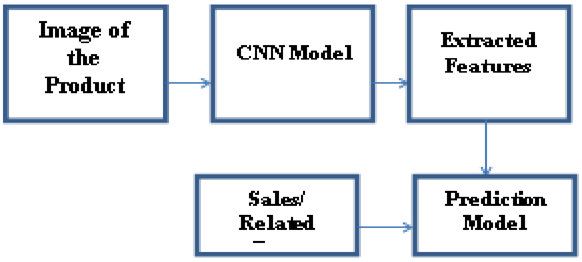

Fig.6. Basic Architecture of Feature Extraction and Prediction

Another Key problem is the prediction of sales of the new products. This is solved by the concept of Transfer Learning. The features learned from the previously existing products are applied to the new similar products. The basic architecture is shown in “Fig. 7”.

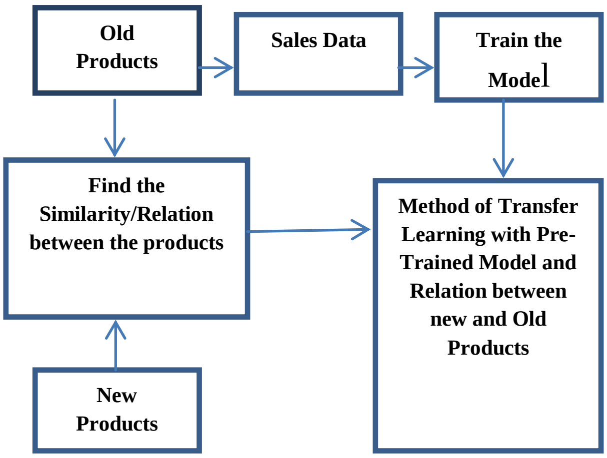

Fig. 7. Architecture of Transfer Learning approach

When the transfer learning approaches are studied, it has also been noted that it is not the only approach to handling new products. Earlier, combined models [57,58] which use clustering for identifying the relationship between the products and regression for prediction are used for addressing this issue.

With the introduction of e-commerce sites, another parameter called the reviews from the users has also gotten attention in predicting sales. Every product displayed on the e-commerce site is reviewed and commented on by the buyers. It could be either positive reviews or negative reviews. The important part of the process is to identify the sentiment of the review as either positive or negative. Although many works have used this approach[59-64], these works are not in the scope of this work.

IV. INFERENCES

The following inferences are made from the above-discussed works.

- In the case of machine learning models, XGBoost performs well than the other models in a few works.
- The usage of stacked models increases the performance
- In predicting the sales of new products, clustering is combined with regression models to achieve better performance
- In the case of the deep learning approaches, LSTM plays a key role in making predictions.
- Deep Learning approaches address the problem of predicting the sales of new products with the Transfer learning approach
- In the case where the image features are also included as the parameter for sales prediction, Convolutional neural network models are used for feature extraction.

V. CONCLUSION

State of art machine learning and deep learning approaches are studied. Problems with the time series data and models are stated. The need for machine learning models and deep learning models in sales forecasting is also discussed. The commonly used datasets and the best-performing model in each of the datasets are given. The changes that have occurred in the sales of the products and the resulting needs to be incurred in the sales prediction approaches are also discussed. The available solutions for them are also illustrated.

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Evaluation of the Speakers' Attitudes Expressed in their State of the Union

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Abstract **— The implications and implementations of the data science and machine learning frenzy as it sweeps the country are broad. Each of them is examined in this study through the prism of a national issue, at least in the United States. The words used by past Presidents of the United States are the subject of this discussion. The focus of this research is on Natural Language Processing and its applications in important historical speeches. Natural Language Processing serves as an effective method for the analysis of text-based data. Using Natural Language Processing, sentiment analysis was used on the collection of different Addresses to achieve a better understanding of the tone used by various Presidents over the course of history. This sentiment analysis provided a collection of sentiment-based scores about important topics and issues in the United States. A feeling can be expressed via natural language processing (NLP). The Addresses were analyzed with the purpose to attain a deeper and broader understanding of the tone used throughout history by presidents.**

Keywords — Natural Language Processing (NLP), Latent Semantic Indexing (LSA), Bidirectional encoder representation from the transformer (BERT), Graphical User Interface (GUI), Hypertext Markup Language (HTML), Extensible Markup Language (XML)

I. Introduction

Elections contribute a significant amount to proper democratic governance. In light of the fact that a directly democratic form of governance in which political decisions are decided directly by the entire assembly of qualified people is unachievable in most present environments, ballot government should be carried out through intermediaries. Democratic institutions give the public the ability to pick their leaders and hold them accountable for their actions while in office. Elections contribute to the soundness and legitimacy of the social and political system by creating an enabling environment for participation.

All of the Presidential State of the Union addresses were gathered and processed as the core textual data. We obtained the text from a Presidential Address Repository. To make processing easier, the text was divided into individual text files for each individual address from a big text file that comprised every speech. The previous works are listed so that readers can quickly see what's been done.

Vader et al., in his work discussed the practical applications of sentiment analysis face significant obstacles due to the fundamental nature of social media information. The author explores various techniques to understand the behavior of the sentiments using the features of data points from text, moreover, the high frequency of words in the data corresponding to adjectives or helper verbs affects the model on a larger scale than expected. Researchers build and try to validate a top-tier collection of language features that are specifically tailored to sentiment in blog-type contexts using a merging of qualitative and quantitative methodologies. Then, consider five broad pillars that include grammatical and language patterns for expressing and highlighting sentiment intensity, in addition to these lexical aspects [6].

Helen Balinsky et al., proposed text summarization by computer is a difficult problem to solve. In recent times, the text available electronically has massively increased. As a result of this growth, the demand for automatic text summarizing methods and tools is increasing. Data compression can be regarded as a sort of automatic summarization. To get compression, improvement in modeling and implementation to reduce noise in the data and create networks with more depth [7].

Muhammad Fachrie et al., used data from the General Election Commission to investigate the use of Machine Learning (ML) to forecast candidate win in Indonesian Regional Elections (KPU). Each candidate's political party affiliations are included in the data. The researchers built a Machine Learning model-based data provided by official institutions to predict the winner of each candidate in a regional election in Indonesia, rather than using social media data as in previous studies. The forecast is a classification-type task with two categories: 'win' and 'loss.' [8]

II. Dataset Description

The data is collected from various online resources such as using a web crawling-based technique. In web crawling,

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data from a website is fetched using a script that renders HTML content and converts it to text-based content. After conversion to text-based content, it is then downloaded in the desired format such as pdf, XML, etc. After fetching the data from the source, it is subjected to a data cleaning process. In data cleaning undesired text, spaces are removed and converted into a table format so that it can be subjected to a model for training. This data is also segregated based on the parties i.e., democratic and republican as shown in Figure 1.

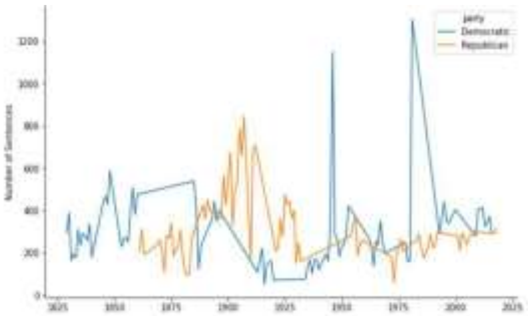

Fig. 1. Number of sentences used by each political party

Data is then analysed based upon the number of sentences and to which party they belong, in order to understand dataset composition of both parties Vs timeline as shown in Figure 2.

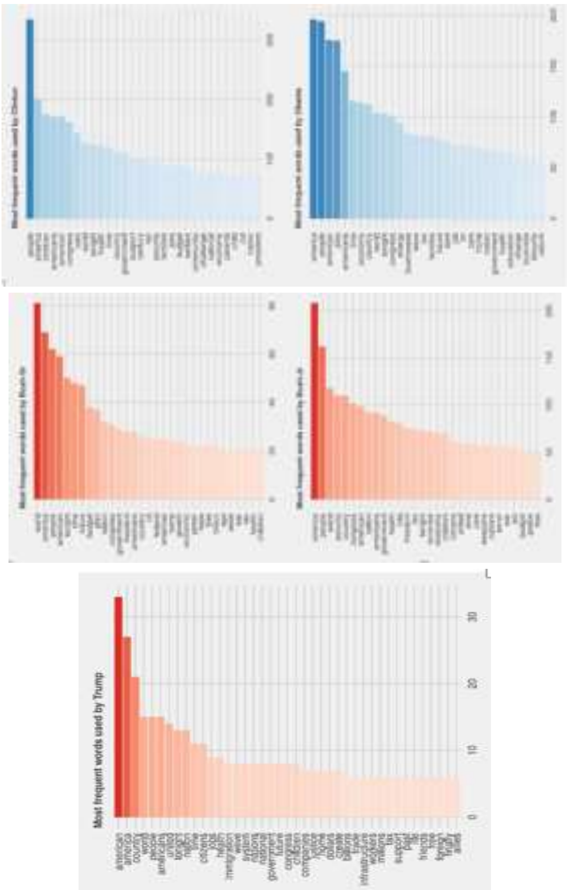

Fig. 2. Most frequent words used by each President

This figure shows how the number of sentences vary compared to the timeline of their delivery. Using this chart it can be concluded that the data is well balanced and does not have significant bias towards a particular label. The density of words Vs sentences is plotted in Figure 3, to check in which range our data lies. Only 91 words or fewer make up 99% of the data. Data padding is therefore done to this length to guarantee consistency throughout.

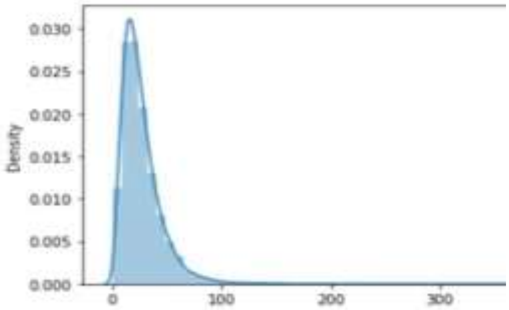

Fig. 3: 99% of all SOTU sentences are under 91 words

To classify the sentiment of a given text the following processes are used:

i. Data preparation

Data set is scraped from online resources using web scraping libraries in .py format. once data is extracted it is subjected to a data cleaning process where each data point is scanned and type errors, redundant spaces are removed, and these data points are made in the form as to map them into a pandas data frame so they can be easily interpreted by the model for use. Then each data point is subjected to frequency check, null imputation, and data process. Each process such as cleaning, stemming, and lemmatization / lemma formation. When web-scraping, we make use of a library called "When web-scraping, utilize a "regular expression." "to substitute and replace data in order to eliminate unwanted phrases The stop word is then eliminated from the sentence by combining all these techniques data is converted to form which can be used by the model, further techniques have been discussed below.

ii. Text Input

Any data that is entered into a model must be in vector format. The following transformations will be carried out:

- Remove all numbers and punctuation.
- Change all of the words to lowercase.
- Remove any stop words (for example, the, a, that, this, it, etc.).
- Texts are tokenized.
- Using a bag-of-words format, convert the sentences into vectors.

iii. Tokenization

Each word in the sentence has meaning and tries to interpret something that might or might not be important to the context. Tokenization helps us in breaking sentences into words also known as tokens which represent one keyword in the data point. Each token has some meaning

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associated with it and hence affects model training according to the weight assigned to them.

iv. Stop Word Filtering

In all human languages, there are a plethora of stop words. These words add unnecessary overhead while training the model. They don't impact the model but increase the size of the dataset. Removal of stop words is very important to make the model more robust and faster. Many libraries such as sklearn python library help in performing this task after the removal of stop words unnecessary data are removed and model accuracy and training become more robust.

v. Negation Handling

Sentiment Analysis includes a sub-task called negation handling. In written literature, negatives play an important role. Contrary terms in sentences frequently shift the sentiment of the sentence while the opposite makes it more aligned so both things have equal importance. Negation handling is important so that the context is well balanced and the model does not become biased towards negation.

vi. Stemming

Stemming is a method that involves converting the words which have similar meanings, such as eat, ate, eaten, eating, and will eat, but are represented differently in the dataset. So here stemming is a method of mapping each of these words to eat so that they correspond to similar things and the model can understand that they have the same meaning in the context which was different earlier as in data representation.

vii. Classification

Using a plethora of machine-learning or deep-learning models to classify sentiment.

III. METHODOLOGY

3.1 Text Summarization

The process of shortening the text so that it is presented in a summarized fashion is known as text summarization. Text summarization is done in such a way as to ensure the summarized part can describe the whole text in a brief manner. Text summarization becomes very important when the given text is very long, for companies that show news updates, summarizing text is important for adding more users to the platform more features need to be added that can interact with users and their emotions by interpreting sentiment in a concise manner. To automate the process of text summarization, Machine learning and deep learning-based techniques involve natural language processing. Using these techniques, automatic text summarization can be performed. There are two major types of text summarization:

- Abstractive Text Summarization
- Extractive Text Summarization

3.2 Abstractive Text summarization

In this technique, data is interpreted using advanced natural language processing-based approaches and then it tries to extract information and summaries it in such a way that the summarized part may or may not appear in the text but presents a clearer summarized text as shown in Figure 4. The part presented in the summarized version consists of the most critical information around which the whole context revolves. This technique takes advantage of sequence-to-sequence models which helps them understand the context line by line. Recent developments have helped this technique to improve its accuracy to a greater extent but this technique is still far from reaching the level where it can be used in a real-time production-based environment. Lots of researchers have recently taken a keen interest in this field and improvements are being made incrementally

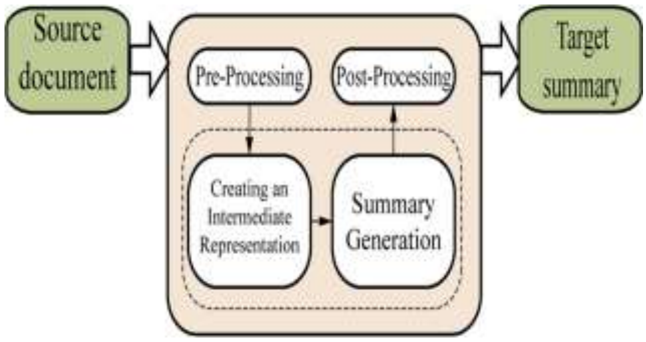

Fig. 4. Abstractive Text summarization

3.3 Extractive Text Summarization

According to this technique, direct sentences are chosen from the text. In this method, scores from the text content are directly correlated with the scoring algorithm to provide a summary based on those results. It contains the most important information from the text and can include pagination. A high probabilistic score ensures that the sentence will be chosen for the summary. Probabilistic scores are used in the scoring process. Summary is generated from top s sentences where s is the hyper parameter that can be adjusted based on the model performance and accuracy as shown in Figure 5.

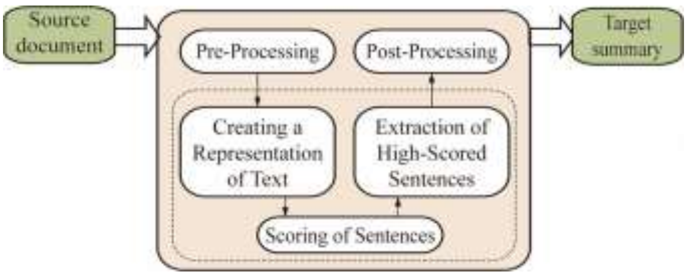

Fig. 5: Extractive Text Summarization

3.4 Lex rank

It is a graph-based approach that is used for summarizing text. It takes in any kind of text and converts it to summarized text. It detects relationships in the graph using clauset Newman algorithm. Its working can be classified into 7 stages.

- Input Document
- Document Cosine similarity score

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- Sentence converted to word embedding
- Adjacency matrix score
- Eigenvector Score
- Connectivity matrix
- Output document

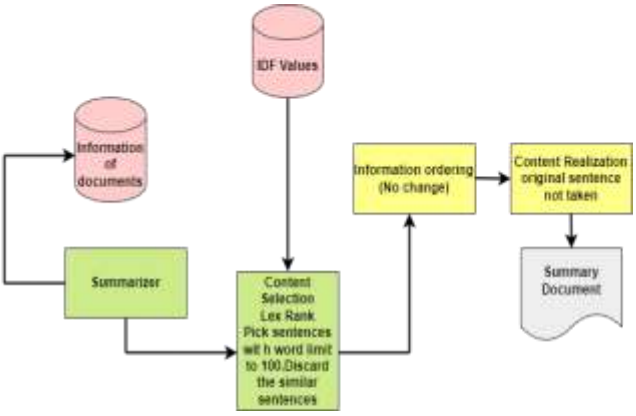

Fig. 6: Lex Rank summarizer

3.5 *Luhn*

Luhn text summarization is a method that aids in text summarization and is based on the TF-IDF approach. This method summarizes sentences based on the significance of the root words present in the sentence. After scoring these sentences then only the summarization is done. After scoring the sentences, ranking is done, and based on ranking text summarization is concluded.

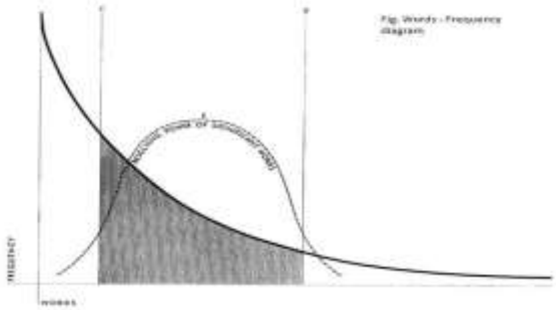

Fig. 7. Luhn summarizer

3.7 *Latent Semantic Indexing (LSA)*

LSA is Latent Semantic Indexing. It relies on extractive-based summarization. This technique tries to identify relationships between different words in sentences using a technique known as SVD i.e. Singular value decomposition. Using this it tries to weigh the importance of each word and then produce the desired ranking of words and summarizes the top ones.

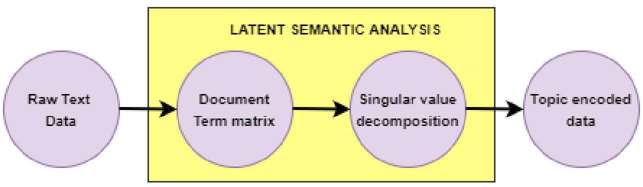

Fig. 8. LSA Summarizer

3.8 *Text Rank*

As the name implies, it is a ranking-based text summarization technique. It relies on extractive-based summarization. Using a graph-based unsupervised method, it breaks each sentence down into its constituent words and rates them. This technique produces superior results for the current problem statement.

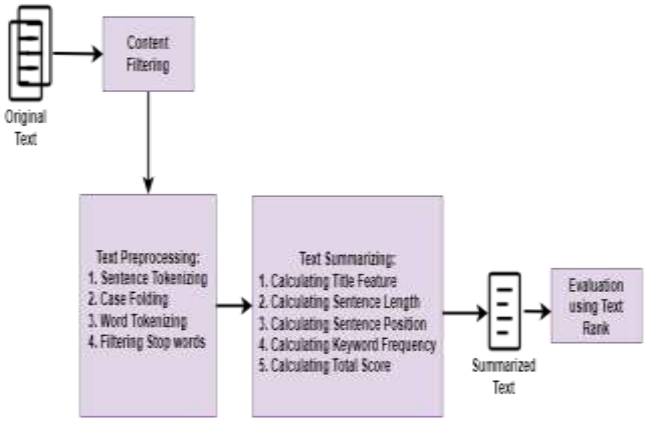

Fig. 9. Text Rank

3.9 *Bidirectional encoder representation from the transformer (BERT)*

BERT stands for Bidirectional encoder representation from the transformer and is a pre-trained model developed by Google. This model comprises an encoder with the same structure as the transformer. It has 12 multi-heads, an embedding dimension of 784, and 12 repeated blocks. An even bigger configuration is available for this model known as BERT-Large. This model is used for training purposes and produces state-of-the-art results. The model learns on the training dataset using a transfer learning-based technique. All the data points are preprocessed using natural language processing and then passed in as input to the model. The model tries to learn the features of the data and then can be tested in real-time to produce desired results.

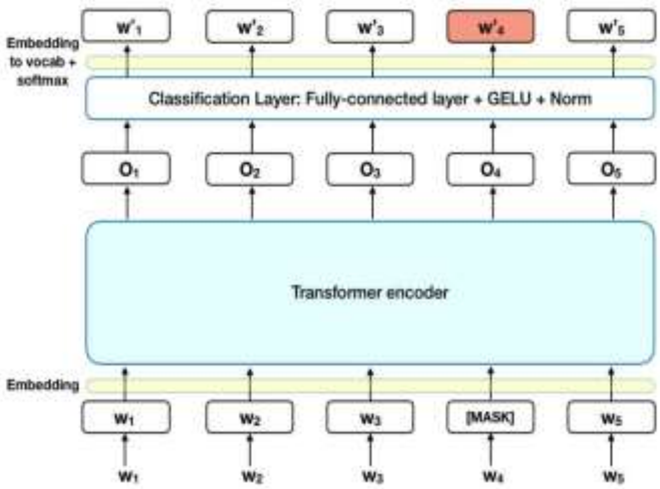

Fig. 10: BERT model

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IV. Simulated Results

The significance and goal of the SOTU speech are important because it has a big impact on the content and message of presidential addresses. There are 26 Republicans and 16 Democrats, therefore it's important to note that the parties have 62 percent and 38 percent of the vote, respectively. The results here depict a text summarization of the president's speeches at the state of the union. All the speeches have been summarized using 4 major techniques: Luhn, lex rank, LSA, and Text rank. Although each technique for condensing speech has its own advantages, Text Rank yields the best results when used with this dataset.

Sentiment analysis is done on the president's speech and sentiment accuracy is depicted along with the label whether it is positive or negative. This sentiment accuracy shows how much the model is sure that a given label is valid or not. This functionality has been created for testing in real-time. A GUI has been developed to display the results. In fact, it takes in the input text and speech, produces it in real time with the aid of a trained model, and displays the outcomes as a pop-up.

TABLE 1: Simulated Results of Sentiment Analysis

Data	Sentiment	Accuracy
Barack Obama, 2012 I'm proud to announce that the Department of Defense, the world's largest consumer of energy, will make one of the largest commitments to clean energy in history with the Navy purchasing enough capacity to power a quarter.	Positive	93.97%
George W. Bush, 2012 I ask Congress to move forward on a comprehensive health care agenda with tax credits to help low-income workers buy insurance, a community health center in every poor country, improved information technology to prevent medical error and needless costs, association health plans for small businesses and their employers, expanded health savings accounts, and medical liability reform that will reduce health care costs and make sure patients have the doctors and care they need.	Positive	91.88%

V. Conclusions

Firstly, text analysis is done where the frequency of words, the density of sentences, and their importance were analyzed using natural language processing techniques. Understanding the dataset, and tradeoffs were covered. Secondly, text summarization was covered using different techniques such as Luhn, Text Rank, LSA, and Lex Rank. Both the summarization i.e. extractive and abstractive techniques were covered. Thirdly, Sentiment analysis was performed, and both machine learning and deep learning techniques were used. BERT model is used for conducting real-time sentiment analysis and UI is made for real-time testing of models. In the future, more datasets can be incorporated to train BERT Large versions. Multiple labels can be included such as very negative, negative, positive, and very positive. Other models can also be incorporated and reinforcement learning can also be applied by making sentiment analysis fun and interesting. Moreover, semi-supervised learning techniques can also be used to train the model on an unlabeled dataset.

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Utilizing Machine Learning Techniques such as Object Detection and Segmentation to Facilitate Workplace Safety

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Abstract— **The study proposes an efficient method that employs the power of "machine learning" to make the "workplace safer" through the use of "computer vision" or image processing. It employs the "object detection" and "image segmentation" algorithms, which have been trained to detect workplace dangers such as an employee not wearing the safety equipment properly, and then the object detected is passed to the image segmentation part of the algorithm, which is used to highlight the object that causes the abnormality in the workplace environment, "Mask Region-Based Convolutional Neural Network" is an efficient algorithm to detect objects, classify, and to produce pixel-wise mask. If the system detects an abnormality, it sends a warning via the cloud to an application where the administrator can take action to remedy the problem as soon as possible. It also alerts nearby people to solve the situation. It also makes use of an existing surveillance camera, making this system relatively simple and cheap to set up. Thus, this system takes advantage of the capabilities of machine learning and computer vision to improve worker safety and avoid accidents by alerting the employee who is not taking proper safety measures in the workplace atmosphere.**

Keywords— ***Machine Learning, Image Segmentation, Object Detection, Mask Region-Based Convolutional Neural Network, Workplace Safety, Computer Vision.***

I. INTRODUCTION

Machine learning has huge potential for use in workplace safety. Machine learning might be used to discover potential workplace safety issues, predict when accidents are likely to occur, and develop new strategies for preventing mishaps. Machine learning may be used to improve workplace safety by automating risk assessment and detection operations. By recognizing and monitoring things and people in an environment, object detection and segmentation can help to improve workplace security. An object detection system can be used to scan an environment for possible dangers. Security professionals can be informed when a possible danger is discovered and take the necessary action by recognizing and monitoring items and individuals in a monitored area.

Artificial intelligence is being used to improve workplace safety in a variety of ways. AI tools are employed to collect, process, and store real-time data and safety information. Automatic categorization algorithms are used by safety analysts to detect accidents or events (or possible accidents) in a certain location or with specific personnel. These algorithms may also be used to identify possible risks by analyzing certain patterns of behavior, such as those that signal exhaustion or stress.

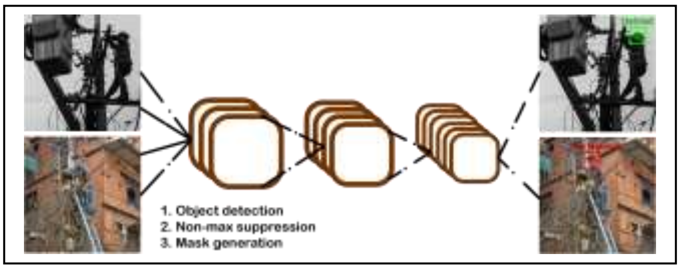


Fig. 1 Overview

A. Need For Ml In Workplace Safety

When it comes to sensitive situations, workplace safety is extremely important for the following example: -

- Dangerous chemical spills in the chemical industry
- On construction site employees not wearing safety helmets
- In the lab researchers not wearing safety jackets and glasses.

Human surveillance isn't even practical in some places, like: -

- Nuclear power plants
- In vast places where a lot of labor is required for surveillance, humans watching an environment for a long time causes many errors.

On the other hand, machine algorithms can be used for long-term surveillance with higher accuracy.

B. Objective Of The Project

The goal of workplace safety is to keep employees safe while they are at work. This includes the following: -

- Provide a safe working environment.
- Ensuring that employees are wearing proper safety equipment.
- Preventing the organization from being negatively impacted.
- Preventing harm to employees.
- Protecting organizational property due to accidents.
- Eliminating the death rate due to workplace accidents.

II. Literature Survey

Annotated pictures are required for training in a deep learning-based workplace safety strategy. Engineers have difficulties when annotating photos with annotations indicating violations of safety norms. The true-negative rate of majority vote-based crowdsourcing annotation is low.

Artificial intelligence is increasingly being utilized to detect safety infractions in public spaces. A Bayesian network model is utilized to predict the likelihood of an accident occurring. The model predicts the likelihood of future incidents using data from previous accidents [1]. AI can detect trends that people may miss, such as harmful working conditions or defective equipment. To effectively detect safety violations in public spaces using the input data, a Bayesian network model may significantly raise the genuine negative rate of annotation.

This strategy can be utilized in our model to determine the probability of the predicted bounding box, in the model we utilize this data to perform non-max suppression to discover the best-fit bounding box for a specific item.

The main challenge with picture segmentation is that training time on a high-quality image dataset is long. This technique addresses this issue by stacking the entire problem into four layers.

The split/merge technique is used to suggest a four-layer picture segmentation procedure. The watershed algorithm is used to divide a picture into many sections in the first layer [2]. In the second layer, a co-evolutionary mechanism is used to produce final segment centers by combining related main areas. In the third layer, a meta-heuristic method connects the remaining areas to their corresponding determined centers using two operators. An evolutionary method is utilized in the last layer to integrate the generated comparable and nearby areas.

This model is used to comprehend the divide and concur technique, which swiftly generates predictions on the input image. This method also provides predictions on a wide range of images, including greyscale, colorful, and even textured images.

Due to picture speckles and pixel similarities, image segmentation is extremely challenging in crowded tiny images. This suggested method employs a Convolutional neural network (CNN) to build a region-based segmentation that is effective at recognizing segmental events in pictures with a high degree of pixel similarity.

Convolutional neural networks are fed images as input. In architecture, image input is given as a matrix, and the input enables regions to be analyzed by filtering and shifting scanning the whole matrix [3]. This is how the working time and savings from convolution computations are calculated. The pooling strategy is used to mix images while the convolution procedure is used to scan the image. The final stage produces Rectifier Linear Negative Interference that Interferes with the Image (ReLU). Completely Connected Layer. The prediction layer (FCN) is reached, and an estimate of the item or area is generated.

The region-based object detection is a fundamental building block for developing a Mask region-based convolutional neural network. The main difference between these architectures is that it loses a lot of information during the pooling process, resulting in the generation of harsh edges on the feature map so we use RoI Align for the pooling process which does not produce any data loss with the help of non-quantized strides.

Image segmentation may be carried out using a variety of approaches with varying degrees of accuracy and precision. This study compares techniques used for Image Segmentation Based on Edge Detection.

The proposed image segmentation model is based on edge detection and a convolutional neural network.

The suggested approach employs edge detection to determine the borders of various objects in an input picture. It then uses a convolutional neural network to categorize the various items based on their borders and appearance [4]. The architecture of the network is made up of convolutional layers, a pre-trained model, and two fully-connected layers with a SoftMax layer in between.

This study compares the impact of different thresholds on the canny operator. As a result, these tests receive varied results. Canny outperforms the other approaches, and the low and high thresholds can affect edge accuracy.

Object detection and image segmentation in real-time with high-resolution resources is difficult in complicated crowded contexts. This suggested methodology employs an ideal strategy to generate a class, bounding box, and mask for the identified item in real-time on extremely high-resolution resources.

A precise mask region convolutional neural network (precise Mask R-CNN) is proposed for object recognition and instance segmentation in high-resolution images. This model makes use of RoI Align, which employs a non-quantized stride to provide lossless feature map pooling [5]. Each time an item appears in the image, this model creates segmentation masks and bounding boxes for that particular occurrence.

This model is used to identify infractions in the workplace, such as determining if an individual is wearing a helmet correctly on a construction site. The algorithm's object recognition component aids in locating the anomaly-causing item, and its mask creation component is used to draw attention to the specific anomaly-causing event.

III. PROPOSED METHODOLOGY

Workplace security with humans will be labor-intensive, yet fault tolerance will be high. This proposed system uses data science and machine learning methods to monitor its surroundings for abnormalities using object detection and image segmentation algorithms. The initial stage in image segmentation is object detection; at this point, anomalies are also discovered, and a mask must be constructed; the major goal of instantaneous image segmentation is to emphasize the event that triggers the anomaly and the segmentation is carried out with the architecture of Mask Region-Based Convolutional Neural Network which takes input frame detected by the object detection phase of the algorithm.

A. Object Detection Phase

The video stream from the surveillance camera is split into individual frames and then resized to fit the input frame size supported by the constructed Mask Region-Based Convolutional Neural Network. The parsed frames are passed through a series of convolutional layers to generate a feature map for those input frames. Using the feature map, object detection can be carried out using the Region Proposal Network (RPN), Then it is passed to the RoI Align then to CNN architecture to classify the object, and regression to define the boundary of the detected object. It is qualified if the predicted boundary box and the actual boundary box have more than 50% value on Intersection Over Union (IOU) during the training phase. Non-max suppression is employed because the RPN will predict several boundary boxes for a single object. Non-max suppression looks at the output accuracy for each bounding box for an object and selects the box with the highest accuracy as the resultant bounding box for that specific class.

B. Segmentation Phase

The segmentation section takes the feature maps and passes them to the RoI Align for pooling, which resizes the feature map created by the Region Proposal Network (RPN) to a fixed-size feature map before passing them to the fully connected convolution layer for image segmentation. The segmentation algorithm is a binary classification algorithm that takes each object in the feature map and generates a binary mask for the object and the background. Finally, the object detection step of the algorithm returns the class and the boundary box, and the mask is applied on top of the object.

C. Advantage of the proposed system over the existing system

The proposed system can be implemented in a workplace for cost-effective monitoring, reducing the amount of labor required for surveillance. Some existing methodologies only detect abnormal workplace instances, but the proposed system highlights the instances with the mask generation part of the algorithm and generates real-time alerts.

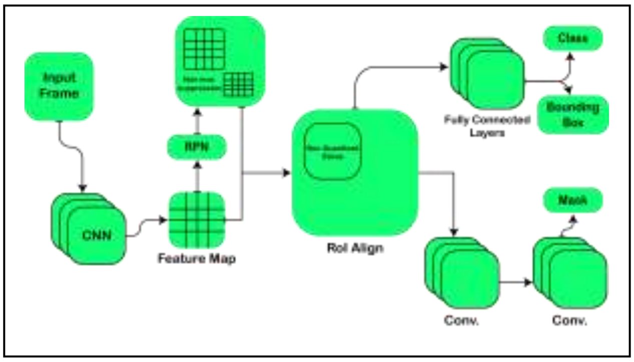


Fig. 2. System Architecture

IV. SYSTEM STRUCTURE

The proposed system takes the camera feed to manipulate each frame to the desired format then pass to the machine learning model to classify and segment the image frame finally classification of alerts and warnings is passed to the dashboard of the application.

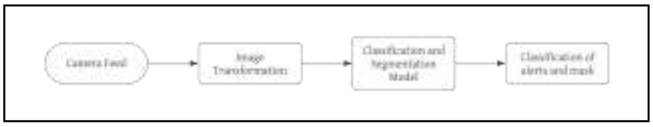


Fig. 3. General WorkFlow

A. Admin Dashboard

The system administrator may construct a new host network for their organization and then configure all of the surveillance cameras. Once configured, the administrator can watch live forecasts and can receive alerts & warnings.

B. Employees Dashboard

Each employee in an organization may connect to their organizational network to receive live feeds, the location of the anomaly that causes events, alerts, and warnings.

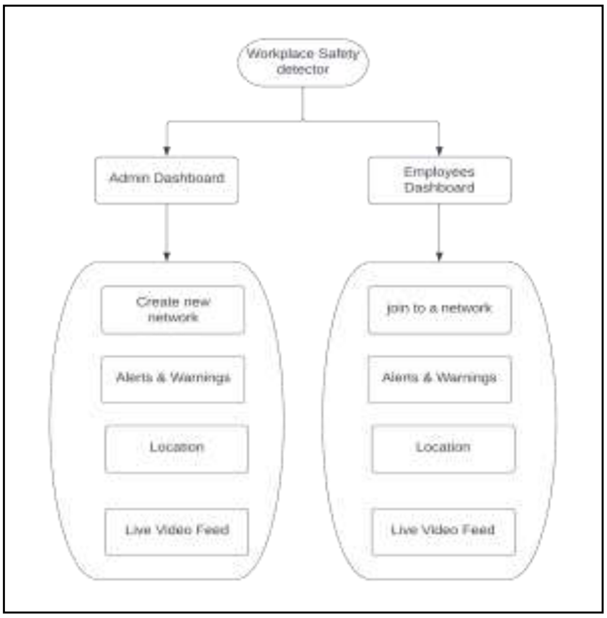


Fig. 4. Application Dashboard

C. *Mask RCNN To Generate Alerts and Mask*

The processed image from the surveillance camera is fed into the Mask Region-Based Convolutional Neural Network for the generation of the mask, boundary box, and classification of alerts, warnings, and suggestions and to forecast prediction.

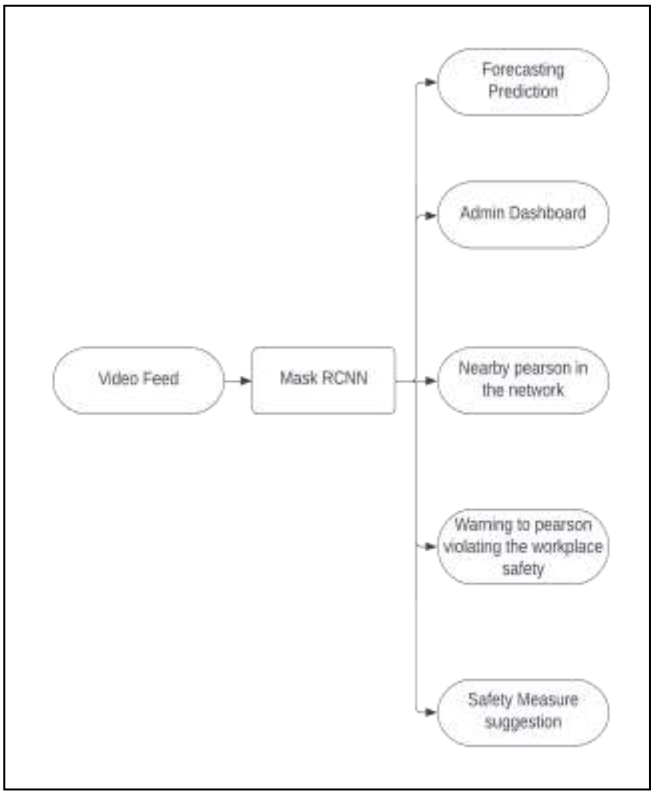


Fig. 5. Algorithm's Outcome

V. Module Description And Performance

The methodology proposes several layers to provide great modularity

- Image Transformation
- Object Detection
    - Feature Map Generation
    - Region Proposed Network
    - Non-max Suppression
    - Classification
    - Regression
- Image Segmentation
    - RoI Align
    - FC Layer (Mask Generation)
- Desktop Application (Server)
- Mobile Application (Users in the network)

D. *Image Transformation*

The process of extracting, resizing, and recoloring a picture that is in the desired output format for a trained model is known as image transformation.

The following processes are done in the image transformation module: -

- The video feed from the surveillance camera is collected and the frame rate is trimmed to the desired level
- The FPS trimmed video then pass for extraction of each frame in the video.
- The extracted frames or images are converted to greyscale by normalizing the RGB values between 0 to 255
- The grayscale image is then resized to match the required input resolution by the trained model.
- The reshaped images are then flattened to load into a data loader.
- Then the appropriate images with their paired annotation

E. *Object Detection*

Detecting instances of semantic objects of a specific class (such as people, buildings, or cars) in digital images and videos is the task of object detection, a branch of computer science related to computer vision and image processing. Well-researched object detection domains include pedestrian detection and face detection. Application areas for object identification in computer vision include picture retrieval and video surveillance.

The following process is carried out in the object detection module: -

- Feature Map Generation:

Apply filters or feature detectors to the input picture using the activation function to build feature maps or activation maps. Feature detectors or filters aid in the identification of various characteristics in a picture, such as edges, vertical lines, horizontal lines, bends, and so on.

- Region Proposed Network:

A Region Proposal Network, or RPN, is a fully convolutional network that predicts object limits and scores at each place at the same time. The RPN is fully trained to create high-quality region suggestions. RPNs are intended to anticipate region proposals with a broad range of sizes and aspect ratios efficiently. Anchor boxes are used as references in RPNs at various scales and aspect ratios. The technique is conceptualized as a pyramid of regression references that avoids enumerating pictures or filters with different scales or aspect ratios.

- Non-max suppression:

Non-Max Suppression (NMS) is a computer vision approach that is employed in a variety of jobs. It is a type of algorithm that selects one entity (e.g., bounding boxes) from a set of overlapping entities. To achieve the desired outcomes, we may pick the selection criteria. Most typically, the requirements are some type of probability number and some form of overlap measure (e.g., Intersection over Union).

- Classification

The pooled feature map is used to classify the object that which class it belongs.

- Regression

The detected object will have a bounding box this was detected by the regression.

F. Image Segmentation

Image segmentation is splitting a digital image into several image segments, also known as image regions or objects, in digital image processing and computer vision (sets of pixels). The purpose of picture segmentation is to simplify and/or transform an image's representation into something more relevant and easier to examine. Image segmentation is commonly used to find objects and boundaries (lines, curves, and so on) in pictures. Picture segmentation is the process of labeling every pixel in an image so that pixels with the same label have specific properties.

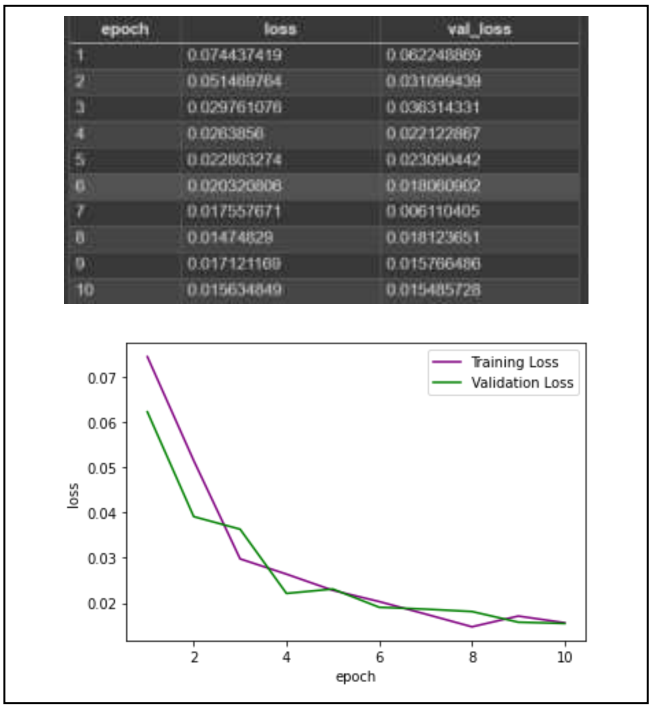
G. Desktop Application

The desktop application is used to process the input feed in real-time with the proposed machine learning algorithm and push the prediction to the user end (Mobile application) through the cloud.

H. Mobile Application

The mobile app fetches information from the cloud database and storage to display the alerts, and live video feed and to specify the location where the anomaly is detected

I. Performance



epoch	loss	val_loss
1	0.074437419	0.062248869
2	0.051469764	0.031099439
3	0.029761078	0.036314331
4	0.0263856	0.022122867
5	0.022803274	0.023090442
6	0.020320808	0.018060902
7	0.017557671	0.006110405
8	0.01474829	0.018123651
9	0.017121169	0.015766486
10	0.015634849	0.015485728

Fig. 6. Graph Epoch Vs Loss

VI. Conclusion

AI technology can assist to improve safety by automating procedures and delivering alarms, when possible, risks are recognized; but, in bigger areas, human-based surveillance may not be effective so machine learning algorithms can be utilized to rapidly discover patterns and trends in workplace safety incidents, assisting in the addresses these issues of potential safety dangers. This could result in the development of preventative measures and the implementation of improved safety regulations.

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Diabetic Retinopathy Detection and Classification with the Aid of Deep Convolutional Neural Network (DCNN)

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***Abstract* — The prevalence of DR is steadily rising, which necessitates the automatic disease severity extraction and classification. About 2% of those with this illness are entirely blind as a consequence of the diabetic mellitus problem and 10% get vision impairment after 15 years of diabetes as a result of the DR complication. It is also a significant contributor to blindness in both middle aged and older age groups. The patient may develop to severe stages of irreversible blindness if the condition is not detected early. The growing number of diabetic patients face a major issue due to a lack of ophthalmologists. It is suggested that an automated DR screening system be created to aid the ophthalmologist in making decisions. One of the primary symptoms of the DR is hard exudates. The detection of hard exudates is crucial for screening purposes and aids in disease monitoring and diagnosis. Thus, utilising Lloyd's clustering technique, this work offered a unique techniques to segment the exudates and irregularities in DR were found.**

Keywords— Diabetes Mellitus, Cat Swarm Optimization,, Diabetic Retinopathy, Mean Squared Error.

1. Introduction

The primary consequences of diabetes mellitus are DR. For working people, it is the main source of acquired blindness. Before the age of 50, DR is the main ocular pathologic cause of blindness in adults of working age. To diagnose DR, ophthalmologists typically look for haemorrhages, exudates and micro aneurysms. Ophthalmologists are able to identify microaneurysms and haemorrhages utilising fluoresce in angiograms. NPDR and PDR are two general categories for DR. The stages of DR can be determined based on the presence of characteristics on the retina. Diabetic Macular Edoema (DME) is the main cause of people with diabetes for losing their central vision. DME is characterised by Hard Exudates (HE), macula-regional blot Diabetes affects the blood vessels in the human retina. DR is one of the main causes of vision loss and patients might avoid losing their vision if the disease is not identified earlier a dot-like appearance. It may results in detachments, optic nerve ischemia, vitreous haemorrhage or retinal vascular occlusions. In the recent years, DL techniques have been widely used for a variety of automatic classification problems. When classifying images, the typical process entails first extracting the crucial features using a set of convolutional layers and then using these features, classification is carried out. Thus, an innovative hybrid classification method is suggested in this work to identify DR in order to avoid above discussed problems.

1.1 Proposed System Model

The two main subgroups of DR disease are PDR and NPDR. Mild Non-Proliferative Retinopathy, Moderate Non-Proliferative Retinopathy, Severe Non-Proliferative Retinopathy and Proliferative Retinopathy are the four stages of the DR classification. The ML technique was used to recognise these four steps. It is crucial to classify and forecast normal and abnormal circumstances in the DRearly. Numerous different classifiers are discussed in the literature for the detection of DR, but they fall short of flawless detection. The suggested methodology introduces the DCNN based methodology to address these shortcomings. Figure 7.1 depicts the block diagram of the suggested technique.

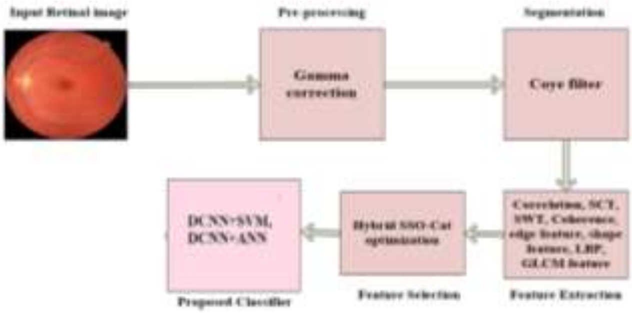

Fig. 1. Architecture of the proposed system

The open source system is used to acquire the retinal image datasets. Five distinct processes, including

- Pre-processing,
- Segmentation,
- Feature Extraction,
- Feature Selection and
- Classification

are included in the proposed system's design. Gamma correction is used at the pre-processing stage to get rid of noise in the input image. Unwanted noises are eliminated and increased contrast is accomplished with the use of pre-processing techniques, which are crucial for the prediction and classification of DR. Important features should be retrieved from the segmented image to detect DR. The features like Correlation, SWT, LBPetc., are retrieved from the segmented image. Among those, the essential features are chosen from the retrieved features with the aid of the hybrid SSO with Cat optimization technique. Finally, the DCNN classifier receives the extracted features as input to make predictions. Features are used to train the classifier during the training phase and retinal images are used during

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the testing phase to achieve the best results. UNet and modified Unet models are considered for classification in the suggested system.

1.2 Pre-processing Phase

The pre-processing stage is crucial for DR prediction because it removesnoise present in the input retinal image. The local brightness and contrast variation will not be homogeneous in retinal pictures. At certain points, the illuminations may be greater. Retinal imaging cannot show lesions clearly in low contrast and low brightness conditions. It is best to improve image clarity based on colour and quality. Pre-processing techniques are therefore crucial for enhancing image contrast and reducing noise. Gamma correction is applied to the input retinal image during pre-processing.

1.3 Segmentation Phase

The retinal image should typically be a light-sensitive tissue lining the inside surface of the eye. It can also be a layered structure with multiple layers of neurons connected by synapses. In the middle of the nasal side, the central retinal and vein retinal artery are present close to one another. When compared to the other portions of the retinal images, the segmented images include information. The blood vessels can serve as a marker throughout the segmentation process and helps to classify the severity of disorders. Edges from the retinal image are emphasised in the first stage. Following edge enhancement, retinal images can be converted to grayscale to remove uneven noise using filters and histogram equalisation.

1.4 Coye Filter

Coye filter is a novel method for segmenting retinal blood vessels in which cosiders RGB of the retinal image rather than only the green channel. The RGB image is transformed into a grey image and then PCA is used to find hybrid lesions. Following is the algorithm of Tyler Coye adopted for segmentation of images.

Coye Filter Algorithm

1 Consider retinal RGB image.
2. Apply CLAHE over gray image to increase contrast.
3. Remove the background by using an average filter and comparing the grayscale and average filtered images.
4. Binarize the image.
5. Divide the blood vascular network into segments

II. Feature Extraction

For the purpose of illness prediction, many features are retrieved from retinal images. With the use of various feature extraction approaches, which are described below, the characteristics are extracted:

2.1 Correlation

The similarity between the grayscale distribution of microaneurysms and the Gaussian function can be evaluated using the correlation coefficient. The correlation coefficient will be high if the two images coincide and low if they don't. The coefficient's ranges from 0 to 1. The following are the definitions of the correlation coefficient:

$$r = \frac{\sum m \sum n (A_{mn} - \bar{A})(B_{mn} - \bar{B})}{\sqrt{\sum m \sum n (A_{mn} - \bar{A})^2 \sum m \sum n (B_{mn} - \bar{B})}}$$

Where,

A and B - mean.

Different sigma values for the Gaussian kernel are needed because microaneurysm sizes may vary.

1.2.2 Discrete Cosine Transform (DCT)

The discrete cosine transform of an image, is defined by,

$$F(u,v) = C(u)C(v) \sum_{X=0}^{(N-1)} \sum_{Y=0}^{(N-1)} f(x,y) \cos \frac{(2x+1)u\pi}{2N} \cos \frac{(2Y+1)v\pi}{2N}$$

The inverse transform is defined by,

$$F(x,y) = \sum_{X=0}^{(N-1)} \sum_{Y=0}^{(N-1)} C(u)C(v)f(u,v) \cos \frac{(2x+1)u\pi}{2N} \cos \frac{(2Y+1)v\pi}{2N}$$

Where,

$$C(u) = C(v) = \frac{1}{\sqrt{N}}, for\ u, v = 0$$

$$C(u) = C(v) = \frac{1}{\sqrt{N}}, for\ u, v \neq 0$$

2.2 Stationary Wavelet Transform (SWT)

The fundamental idea behind the wavelet transform is to visualise any function as a superposition of waves created by stretching and shrinking the mother function. To make the wavelet decomposition invariant, the Stationary Wavelet Transform (SWT) was developed. The SWT approach is characterised as follows.

$$v^i = \frac{\mu^i}{\sigma^i} (i = 1, \ldots..7)$$

where

,- mean and standard deviation.

2.3 Shape Features

Shapes can be described using a few basic geometrical characteristics. Simple geometric features are employed as filters to weed out false positives or in conjunction with other shape descriptors to distinguish shapes because they can only distinguish shapes with significant variances. Center of gravity, digital bending energy, circularity ratio, etc., are some of the shape attributes. In this work,

DOI: rp-9788770040723.185

Eccentricity, solidity and circularity are taken into consideration as shape characteristics. The ratio of the distance between the main and focal axes of an ellipse can be used to define eccentricity. It ranges from 0 to 1. The formula utilized to calculate shape characteristics can be expressed as

$$Ecentricity = \frac{\sqrt{(major\ axis^2 - minor\ axis^2)}}{major\ axis}$$

$$Circularity = \frac{area\ of\ shape}{area\ of\ bounding\ circle}$$

$$Solidity = \frac{area}{convex\ area}$$

Many properties that are computed based on these aforementioned formulas are believed to be the major features for recognising DR situations. The following is an explanation of how the LBP characteristics are utilised to extract features from input retinal images:

2.4 Local Binary Pattern (LBP)

An image is converted into an array of integer labels using the LBP approach, which trains the texture image's pixel-level in detail. These labels can be seen as a histogram, which can be used to determine the texture of the image under analysis. LBP has two key characteristics that make it appealing for describing textures. It is invariant to monotonic grey level variations, such as those brought on by changes in illumination and it is computationally simple. The operation of LBP is depicted below.

$$s(x) = \begin{cases} 1, if \quad x \geq 0 \\ 0, otherwise \end{cases}$$

III. Feature Selection

Utilizing the various feature extraction approaches stated above, the features are extracted. With the help of a hybrid SSA-CSO optimization technique, necessary features are selected from among the many retrieved features. With the aid of the CSO algorithm, the SSA can be further enhanced in order to update the salps process. The required features can be quickly and efficiently chosen from the entire list of features. The following section contains a presentation of the SSA and CSO algorithms.

3.1 Salp Swarm Algorithm (SSA)

The salp swarm algorithm was created by Mirajalili to address optimization issues. In this case, SSA is used to choose the necessary features from the features collection. In essence, the salp belongs to a family called Salpidae. The SSA is based on the salps' swarming behaviour. They are able to set up cooperative chains while foraging in deep oceans. Through pursuing the food source, salps use this behaviour to get greater kinetic energy. For escaping from the local optima problem in the optimization, the salp chain can be used as a guide. The salp in the SSA algorithm is made up of two distinct classes that are dependent on both followers and leaders. At the top of the chain, the leader salp is situated, and the followers obey him. Members of the chain are also referred to as the followers. While the followers make use of their fellow followers, the leader salp aids the direction and movement of the swarm. The design of salp chain is illustrated in the Figure 7.2.

Fig. 2 Structure of Salp chain

For searching in an n-dimensional space, each salp's position vector is described. The SSO's initial population is made up of N salp and d dimensions. The below equation is the N-dimensional matrix that represents the salps' location vector:

$$Y_i = \begin{bmatrix} Y_1^1 & Y_2^1 & \cdots & Y_d^1 \\ Y_1^2 & Y_2^2 & \cdots & Y_d^2 \\ \vdots & \vdots & \cdots & \vdots \\ Y_1^N & Y_2^N & \cdots & Y_d^N \end{bmatrix}$$

All slaps are directed to the food supply. The following equation describes the leader's position:

$$Y_j^1 = \begin{cases} E_j + D_1((UB_j - LB_j)D_2 + LB_j) & D_3 \geq 0.5 \\ E_j - D_1((UB_j - LB_j)D_2 + LB_j) & D_3 \leq 0.5 \end{cases}$$

Where,

and - random vectors generating values which mentioned as the limit [0, 1],

- upper limit of jth dimension,

- the lower limit of jth dimension,

- Position of food source,

- Leaders position of salp and the core parameters of is described as

$$D_1 = 2e^{\left(\frac{4t}{T_{max}}\right)^2}$$

Where,

- exploration and exploitation tendencies of SSO algorithm in balanced state,

- iteration

- maximum number of iterations.

Additionally, the position of follower salps can be expressed as.

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$$Y_j^i = \frac{Y_j^i + Y_j^{i-1}}{2}$$

Where,

- start of ithsalp at the jth dimension.

3.2 Cat Swarm Optimization (CSO)

In CSO, the initial number of cats will be chosen. Every cat has a unique position made up of M dimensions, velocities for each dimension, a fitness value that shows how well the cat has adapted to the fitness function, whether the cat is searching or tracing. The best position in one of the cats would be the final solution because CSO retains the best answer till the end of iterations.

Seeking Mode

This model is intended to represent the scenario of the cat, which is lazing around, scanning its surroundings and looking for a new spot to settle down in.

$$P^i = \frac{|FS_i - FS_b|}{FS_{max} - FS_{min}}, where, 0 < i < j$$

The mutative ratio for the chosen dimensions is announced by SRD. When a dimension is chosen to change in searching mode, the difference between the old and new values won't be outside of the SRD defined range. The CDC reveals how many variables will be changed. All of these elements are significant contributors to the searching mode. The value of SMP will not be impacted by whether the SPC value is true or not.

Tracing Mode

Simulating the case of the cat when tracing some targets is the tracing mode. Once a cat enters the tracing mode, it moves in all directions at its own speeds. The following is a description of the tracing mode:

$$V_{k,d} = V_{k,d} + r_1 \times c_1 \times (X_{best,d} - X_{k,d}) \quad where\ d = 1,2, \ldots .M$$

Process of CSO algorithm

Step 1: To update the salp position, create N cats in the process.

Step 2: Distribute the cats randomly over the M-dimensional solution space. At random, choose values for each cat's velocity that fall within the range of its maximum velocity. Select a random number of cats, place some of them in seeking mode according to MR, and others in tracing mode.

Step 3: Assess each cat's fitness value by plugging their locations into the fitness function and memorise the best one.

Step4. Reposition the cats in accordance with their flags. Apply the cat to the searching mode process if cat is in that mode. If not, apply the cat to the tracing mode process.

Step 5: Select the same number of cats this time, place them in tracing mode in accordance with MR and the remaining cats in seeking mode.

Step 6: Verify the termination condition. If it is met, end the programme. otherwise, go back and repeat steps 3 through 5.

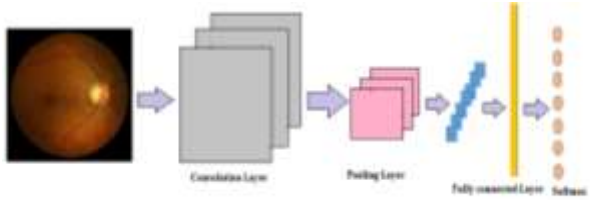

Fig. 3 Architecture of the DCNN network

UNet

The need for localization in biomedical image processing necessitates the implementation of deep learning algorithms to acquire required output. However, Standardized CNN are ineffective for biomedical image segmentation because they are designed for classification tasks, such as assigning a class label to each image rather than identifying the segmented region. Hence, a deep learning methodology based on fully CNN named U-Net model was developed for segmentation purpose.

comprises two 3 × 3 unpadded convolutions, trailed by a rectified linear unit (ReLU) and a 2 × 2 max pooling operation which can be utilized for down sampling.

Fig. 4 U-Net architecture

In this study, during every downsampling stage, the feature channels number is increased. An unsampled feature map followed by a 2X2 convolution network reduces the feature channels to half the number. However, the loss occurring at the boundary pixels necessitates cropping technique. Thus, a 1x1 convolution is incorporated at the last layer of the topology, which converts 64 component feature vector into the anticipated number of classes. As a result, U Net networks are divided into two parts:

Modified UNet algorithm

Patch-based networking is suggested in this network architecture. The encoder path is on the left side, while the decoder path is on the right, much like in the original U-Net architecture. To create multichannel encoder feature maps, each encoder layer conducts convolution (with batch normalisation and rectified linear unit (ReLU) activation) and densely connected convolution. Thus, the down sampling operation follows this.

The decoder path up-samples the feature maps using the deconvolution layer. The skip connections combine the encoder path's feature map with the appropriate up-sampled decoder feature map. A softmax function activates the feature maps. It is possible to derive two channel probabilities: one for vessels and the other for non-vessels.

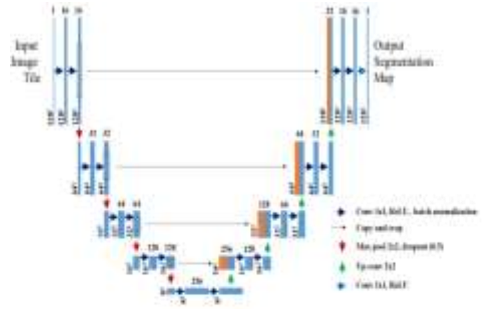

Fig. 5 Network architecture of the modified U-net

III. Results and Discussion

Table 1.1 displays the effectiveness of the proposed method's on the messidor dataset. Figure 1.8 displays the segmentation results of the two chosen images The original retinal and ground truth images are displayed in Figures 1.8(a) and (b). The segmentation results of the traditional UNettopology are shown in Figures 1.8(c1) and 1.8(c2), while the segmentation results of the modified UNet topology are shown in Figures 1.8(d1) and 1.9(d2). The segmented images demonstrate how effectively the proposed approach can identify retinal blood vessels.

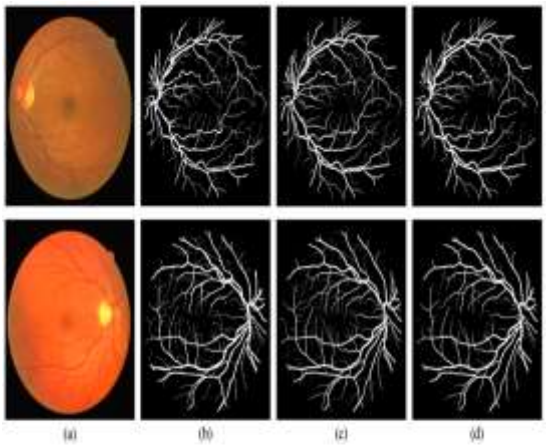

Fig. 6 Segmented analysis of proposed topologies

TABLE 1.1 Performance Measures (Hybridized CNN)

S.No	Classifier	Accuracy	Sensitivity
1.	DCNN (modified Unet)+SVM	98.12%	96.59%
2.	DCNN (modified Unet)+ANN	92.56%	88.25%
3.	DCNN (Unet) + SVM	97.45%	96.29%
4.	DCNN (Unet) + ANN	91.13%	86.51%
5.	DCNN+SVM	97.38%.	96.07%
6.	DCNN+ANN	90.19%	85.29%

The accuracy and sensitivity of the proposed topology is discussed in the table 1.1. From the table 1.1, it is observed that the accuracy of the proposed topology with DCNN and SVM classifier is about 97.38% and it outperforms than ANN. Similarly, the SVM with Modified Unet is 98.12%. The accuracy obtained with traditional Unet is 97.45%. Hence, it can be concluded that the proposed topology with modified Unet as classifier will exhibit higher accuracy. While considering the sensitivity, it's about 96.59% for modified Unet, 96.29% for traditional Unet and 96.07% for DCNN.

Thus, the results demonstrated that the proposed method extracted the blood vessels quite skillfully and precisely. The hybrid classifier comparison demonstrates that the DCNN with modified Unet and SVM outperforms all other known topologies.

IV. Conclusion

In this study, the DCNN based algorithm is used to detect and classify DR. Gamma correction is used at the pre-processing stage to get rid of noise in the input images. The Coye filter is introduced during the segmentation process. With the aid of a hybrid Salp Swarm Optimization (SSO) and Cat Swarm Optimization (CSO) method, the necessary features are chosen from the extracted features. Following extraction, the blood vessels is identified using a DCNN, which combines the U-net and modified U-net structures. The hybrid classifier comparison demonstrates that the DCNN architecture with modified Unet and SVM outperforms than all other known topologies.

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Secure Data Transmission in Healthcare Monitoring Systems using Advanced Encryption and Decryption Techniques

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***Abstract* — With the advancement of the Medical Internet of Things (MIoT) technologies, the accurate and continuous monitoring of the patients has become easy. A Smart Healthcare monitoring system is capable of monitoring different vital body signs such as blood pressure, heart rate, oxygen level and temperature. The sensors used in the monitoring system will capture the physiological signals and then the data can be sent to the cloud through IoT. Then the doctors or consultants can access the data from the cloud when needed to analyse the patient's condition. When sending the data to the cloud as such is prone to various attacks and can lead to misuse. So, it is advisable to use any of the techniques that are already available to prevent such attacks. One is, to encrypt the data that is being sent and then store the data. This type of system should follow certain rules to provide better security and also provide privacy to the data. This paper discusses the importance of encryption and decryption of data in a healthcare monitoring system. Healthcare monitoring systems are used to collect and analyze patient data, which is often sensitive and private in nature. Therefore, it is critical to ensure that the data is protected from unauthorized access or interception. The paper explores various encryption and decryption techniques that can be used to secure healthcare data, including symmetric and asymmetric encryption methods. Additionally, the paper discusses the challenges and limitations associated with the implementation of these techniques in healthcare monitoring systems. The study concludes that encryption and decryption of healthcare data is necessary to protect patient privacy and ensure the confidentiality of their sensitive information. Moreover, the study recommends that healthcare providers implement strong encryption and decryption techniques to ensure the security of patient data.**

Keywords—MIoT, Encryption, Decryption, healthcare monitoring, Unauthorized access

I. INTRODUCTION

The health care system has long struggled with issues like illegible diagnoses printed on paper, difficulty for healthcare professionals in accessing patient data, and a lack of resources (staff, time, and space) for patient monitoring. Hospitals and other healthcare centers have seen a significant increase in the use of healthcare monitoring systems, and many nations across the world are now very concerned about portable healthcare monitoring systems with emerging technology. The development of Internet of Things (IoT) technologies makes it easier for healthcare providers to move from in-person consultation to telemedicine. The health care delivery process will gain a lot from these technologies. These days, patient records are kept in digital form for subsequent use and easy access by anyone to assess the patient's condition. The storing of patients records in digital format is called Electronic Health Record (EHR). The electronic health record (EHR) or electronic medical record (EMR) is a computerised repository for data, diagrams, patient medical information, prescriptions, hospital or clinic records, radiological images, billing data, and other sensitive patient data. These records can also be shared among the health care providers and consultants with ease of access. However, there are a variety of security and privacy considerations that must be considered in order to promote and maintain essential medical ethical values and social expectations, even though these data are more practically useful than the traditional paper records.

The Electronic Health Records should follow certain security and privacy regulations and should ensure that the data that is being stored should be used for the right purpose and should ensure the privacy of the patient's personal information. Data security and privacy may be seriously jeopardised since they are sent electronically across the internet. Security is defined by the point at which access to someone's personal information is restricted and permitted for those with the required authorization. A person's right to decide for themselves when, how, and to what extent their personal information is shared or transmitted by others is referred to as their right to privacy. Sensitive information can be stolen via eavesdropping and skimming the sent data. Hackers gain access to the electronic health data information through data mining, which they may use to analyze patient data and spot trends and links. Using the data, they may classify and characterize the patients. Discriminatory and exclusionary consequences may result from this.

The use of lightweight, hardware-based authentication is one strategy that shows promise for data security. When the data is encrypted, others cannot access the data and make drastic changes to the data. In this way, it provides security and privacy of the data. The health care monitoring system usually consists of various sensors collecting data from the patient and all the sensors are connected to a microcontroller, where the data is converted to suitable format and stored for later purpose. The data that is being collected from the sensor, are encrypted by the microcontroller and then only the data should be sent to the cloud to store the data. Without encrypting the data, hackers can get access to the data and can change the data. If the data is encrypted, the hackers cannot formulate the data, so they would not be able to change the data. So, we proposed a system where the data being sent from the sensor to the server is encrypted first and then sent to the cloud.

Encryption and decryption are two fundamental concepts in information security that are used to protect sensitive data from unauthorized access or interception. Encryption involves converting plaintext or readable data into ciphertext or coded data, using a mathematical algorithm and a secret key. The ciphertext can only be read by someone who possesses the secret key to decrypt the data. Decryption, on the other hand, is the process of converting ciphertext back to its original plaintext form, using the same algorithm and the secret key that was used for encryption. By encrypting data, sensitive information can be protected from unauthorized access or interception, ensuring its privacy and confidentiality.

II. LITERATURE REVIEW

The first official encryption algorithm that was used was Data Encryption Standard (DES) [1] algorithm. Developed by IBM in 1975, Can be implemented in special purpose electronic devices, to provide cryptographic protection to binary coded data. This algorithm uses a single key for both encrypting and decrypting the data. The major drawback of this method is the small key size of 56-bit. This encryption algorithm is outdated as it became easy to break the encryption with the keys. So, to improve the existing method, Triple-DES [2] was developed. In this method, the data is encrypted three times using the same key, so it can improve the efficiency and makes it difficult to break the encryption. The major setback of this method is the processing time as the data should be encrypted three times.

In the year 1997, Joan Daemen and Vincent Rijmen developed a better and efficient encryption algorithm compared to the DES algorithm, which is called Advanced Encryption Standard (AES) [3] algorithm. It became the successor of the DES algorithm. In this method, different key sizes of length – 128 bits, 192 bits, 256 bits are used. Due to the increased key size, it makes it difficult to crack the encryption. Xin Zhou and Xiaofei Tang in their paper [4], talked about the implementation of the RSA algorithm, which is another Asymmetric encryption algorithm, that uses public key to encrypt the data and private key to decrypt the data. The public key is a product of two non-negative prime numbers. Their proposed method is easy to implement and difficult to crack the algorithm. Rajan and Geeta, in their paper [5] proposed a method to encrypt the data stored in files and can be shared with others. They used the RSA algorithm to encrypt the data. So that the data in the file is immune to any attacks and data leakage. The only drawback of their method is, they can only encrypt only one file at a time.

Mousa and Hamad [6], in their paper, talked about the RC4 encryption algorithm. RC4 is a stream cipher encryption algorithm. It uses a key of variable-length and also it encrypts one byte at a time. The data stream is simply XORed with the generated key sequence. This method is easy to use and fast, but it is an insecure algorithm.

Blowfish encryption algorithm [7] is a symmetric-key block cipher algorithm founded in the year 1993. It provides a successful rate of encryption at software level. But it was preceded by the AES algorithm [3] since it is similar to the DES algorithm [1]. It is an open source, non-patented and freely available for use and modifications. It uses the same key for both encrypting and decrypting the data. Blowfish is faster compared to other block cipher algorithms as it takes advantage of the built-in instructions imposed on the microprocessors for basic operations like bit shuffling. Blowfish algorithm found to be secure after several tests. Homomorphic encryption algorithm [8] is a type of encryption algorithm where the data can be used to perform computational analysis even if the data is encrypted. The patient's data that is being collected are sent to the cloud after encrypting to perform analysis on the patient using those data. There is no need to decrypt the data first to analyse the data, so it can prevent misuse of data, while storing in the cloud. But this process is slow since computation should be made on encrypted data.

Diffie-Hellman protocol [9] is an encryption algorithm where two users exchange a secret key among themselves and that key is then used to encrypt the message that they want to share among themselves. The protocol uses the multiplicative group of integers modulo p and g, where p is a prime number and g is a primitive root modulo of p. This protocol itself is limited to only the exchanging of the keys between the two users. Secure Hash Algorithm [10] is a cryptographic hash function algorithm which uses hash function to map the data of arbitrary size to a bit array of fixed size called hash value. It produces a message digest of larger hash value. The family consists of various versions of varying output size with increase in security and immunity to attacks. Currently SHA-3 is the latest version of the SHA family.

Searchable Symmetric Encryption [11] is an encryption algorithm, where it is easy to search over a collection of encrypted files even without decrypting the files first. With the encryption key and keyword that need to be searched, a search token is generated and using that searching is done. It is useful in implementing cloud storage servers, where the servers are unreliable and cannot be trusted. In this paper [12], they proposed a method to perform predictive analysis tasks on encrypted data. It is achieved by using a Homomorphic encryption scheme to encrypt the data and then the data can be used to perform analysis. As already said in [8] this method is incredibly slow and has performance issues. In this paper [13], they proposed a simple and efficient method to construct a Chosen-Cipher Attack (CCA) secure public key encryption scheme from an already existing Chosen-Plaintext Attack (CPA) secure Identity-Based Encryption (IBE) scheme. Their method produces an efficient and secure encryption scheme compared to the original approach. Identity-Based Encryption scheme [14] is a symmetric encryption, where the identity of the user can be found using unique information and is used as the public key for encryption. Then a Private Key Generator generates a private key, which is used for decrypting the data. The scheme is pre-defined by a set of four algorithms that form a complete IBE system. This method is secure and efficient.

Electronic Health Record Systems are used to collect the data from the patients. The data is collected by the IoT devices that consist of various sensors, that are then sent to the cloud to store the data. But the system should follow certain security and privacy policies and the issues related to these systems is explained in the paper [15], along with various measures to follow to prevent security issues. In the paper [16] they talked about the challenges of protecting the patient's data stored in the electronic health record systems. Access control can be enforced to protect the data. Where the patient themselves can generate and store the encryption keys and can share the data to others to perform actions like searching for certain data in the records.

III. Problem Statement

A healthcare monitoring system is a technology-based platform that is designed to collect and analyze patient data. It is typically used in clinical settings to monitor patient health status, track the progress of treatment plans, and provide insights into patient care. The system typically collects data from a variety of sources, such as medical devices, electronic health records, and patient self-reports, and uses algorithms and analytics to provide insights and feedback to healthcare providers. Healthcare monitoring systems can be used in a variety of contexts, such as in hospitals, clinics, and home health care settings. They are particularly useful in managing chronic diseases, such as diabetes, heart disease, and hypertension, where regular monitoring is necessary to ensure optimal patient outcomes. By providing real-time insights into patient health status, healthcare monitoring systems can help healthcare providers to identify potential health problems and take preventive measures to avoid complications. However, the use of healthcare monitoring systems also raises concerns about patient privacy and data security. The data collected by these systems is often sensitive and private in nature, and must be protected from unauthorized access or interception. This is where encryption and decryption of data comes into play, as an essential component of securing patient data in healthcare monitoring systems.

With the widespread use of healthcare monitoring systems, sensitive patient data is being collected and transmitted over networks. However, this data is at risk of being intercepted and accessed by unauthorized individuals, posing a serious threat to patient privacy and confidentiality. Thus, there is a need for effective methods of securing healthcare data to ensure its privacy and confidentiality. This paper aims to address this problem by exploring various encryption and decryption techniques that can be used to protect healthcare data in monitoring systems, and by analyzing the challenges and limitations associated with their implementation in this context. The data that is sent by the microcontroller, which is collected by sensors, needs to be encrypted in order to stop the hackers from accessing the data and using it for their own purpose and also to stop leakage of data. Before transmitting the information to the server, the data needs to be encrypted in order to be stored in the cloud and used for analysis. When the data is encrypted, the data cannot be easily used and the hackers cannot decrypt the data without necessary keys. When the data is encrypted using various keys, the keys should be protected at all cost. If the keys get leaked, then it can be used to decrypt the data and the data can be used for illegal purposes. The data can be encrypted and decrypted using a variety of techniques that are available.

In the Healthcare Monitoring system, Cyber-attack is a major concern. The data that is being sent and stored should be protected from intruders. The data may contain important information about the patients and important medical records which when leaked can cause consequences to the patient and the health care providers. So, it is important to safeguard the data. The hackers can steal the data using different ways. The health care providers should be able to provide various protection methods to protect their client's data. In this paper, we talked about various encryption algorithms that are available for using and made a comparison to find the best and efficient algorithm.

IV. Methodology

Encryption and Decryption is one of the methods that can be used to ensure the security and privacy of personal data that are collected from various sources which need to be kept safe from leaking and being misused or altered. There are various encryption algorithms available for use. Primarily it is of two types, based on how many numbers of keys are used to encrypt and decrypt the data. They are Symmetric and Asymmetric encryption algorithms. Symmetric encryption algorithm uses only a single key for both encrypting and decrypting the data. Whereas in Asymmetric two keys are used, one for encrypting, which is called a public key, and the other for decrypting, which is called a private key. These keys should be protected from getting leaked so that intruders cannot access the data.

The healthcare monitoring system usually consists of a microcontroller and various sensors to read the data. The sensors will read the data and send it to the microcontroller, which will convert the data to suitable format for processing the data. The server will create a key which can be used for encrypting and decrypting the data. Then the server will send the key to the microcontroller and using that, the microcontroller will encrypt the data and send the encrypted data back to the server. Now the server will use the same key or private key based on the algorithm used and will decrypt the data. The communication between the microcontroller and the server is achieved using socket programming. If an Asymmetric encryption algorithm is used, then the server has to create both the public and private key, and should send only the public key and keep the private key safe. Some examples of symmetric encryption algorithms are DES, AES, Salsa20 and an asymmetric encryption algorithm is RSA, which is discussed in this paper. Using a raspberry pi and a temperature sensor to read the patient temperature, the raspberry pi will encrypt the data and send it to the server.

In this paper, we have taken DES, AES, RSA, ARC2, Salsa20 and Blowfish encryption algorithms and recorded the time taken by each algorithm to encrypt and decrypt the data. We used Python as the programming language as it is easy to use and also has a cryptographic library that can be used for encrypting and decrypting the data. First, we implemented a simple encryption and decryption program for each of the above-mentioned algorithms. Then using the timer package library present in python, is used to find the time taken by these algorithms to encrypt and decrypt a large sized data and the findings are recorded. Then using the socket package library present in python, a simple server side and client-side communication is established where the server and client can send data back and forth. Using this program, first the server will open a port for clients to connect to, and then will create a key for encrypting and decrypting and when a client connects to the server, the server will send the key to the client, then the client-side program will use that key and will encrypt the sample data. The encoded data will be sent back to the server, and the server will use the same key or a private key to decrypt the data. Just like before, the timer package is used again to find the total time taken for encrypting and decrypting the data. The timer starts when the client establishes a connection with the server, and will stop when the server decrypts the encoded data sent by the client.

The Raspberry Pi is a single-board miniature computer that can be used for a variety of purposes. It can read data from various sensors and also convert data received from the sensor to a suitable format using the package libraries available. The values from the sensor can be read and converted into the appropriate format inside the raspberry pi using the gpio module package in Python. In this example, the raspberry pi will act as a client, which will connect to an external server running on a computer. The raspberry pi will read the sensor values and using the key it received from the server, will encrypt the data and send the encrypted data back to the server.

V. RESULTS AND DISCUSSIONS

Some of the algorithms used in this experiment are no longer used in the real-world situations, and are taken into comparisons as new encryption algorithms are developed to overcome the issues and backdrops of old encryption algorithms. DES is no longer in use, as it uses a short key length, the data can be hacked with brute force attack. To overcome this, AES was developed, which uses long key length. AES is considered as the base standard algorithm for encryption, since it is very fast and secure. RSA is an asymmetric encryption algorithm that uses two keys instead of one key, to ensure more security. RSA is the most widespread and used encryption algorithm. From this experiment, we recorded that even though RSA is secure and reliable, due to the computational need to find the keys, it is a slow encryption algorithm compared to another encryption algorithm. Even RC2 is never cryptographically broken, but it is slower compared to AES. The only issue with the Salsa20 encryption algorithm is that it doesn’t guarantee the authenticity of the encrypted data. We can overcome this issue by using Message authentication code to ensure the authenticity of the data. The Blowfish encryption algorithm uses key lengths of varying size, even though it is secure and fast, but a long key should be used to withstand a brute force attack. We plotted graphs to show the time taken by each algorithm to encrypt and decrypt the data.

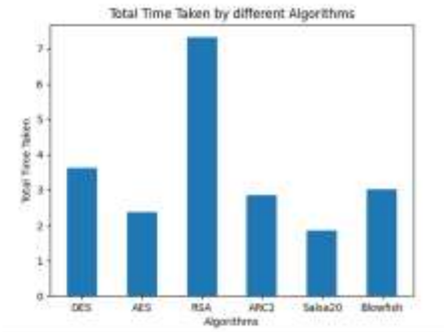

Fig.1. represent the time by algorithm during encryption

From this graph Fig 1, we can see the total time taken by each algorithm to encrypt the data on the raspberry pi and send the encrypted data back to the server and the server will decrypt the data. RSA takes the longest time, while AES takes the least time to encrypt and decrypt the data.

Time taken by different algorithms to encrypt and decrypt a large sized data. The RSA algorithm cannot encrypt large sized data. Again, AES takes the least time.

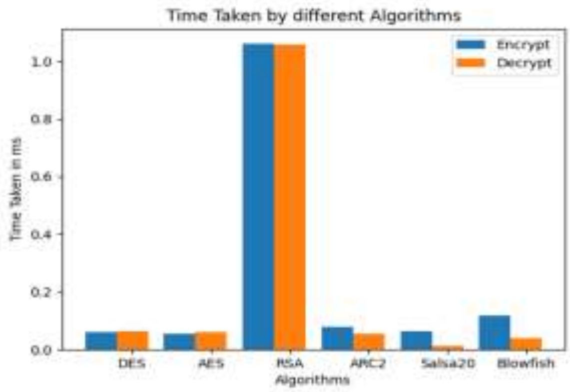

Fig.2. Represent the time by algorithm during decryption

The graph Fig 2, shows the separate time taken by the algorithm to encrypt and decrypt the data. RSA takes the longest time due to the computations needed to encrypt and decrypt the data. From this experiment, we can conclude that AES is one of the best algorithms to use, RSA is secure but is slower compared to other encryption algorithms.

VI. CONCLUSION

As we go into this new age of IoT, we can see the development of new technologies that can make our lives easier and can help us in a lot of ways, especially in real-time healthcare monitoring. If the security is exploited in this field, it can lead to huge problems. Especially when it involves life support. In conclusion, the importance of encryption and decryption of data in healthcare monitoring systems cannot be overstated. Healthcare data is sensitive and private, and thus needs to be protected from unauthorized access or interception. This paper has explored various encryption and decryption techniques that can be used to secure healthcare data, including symmetric and asymmetric encryption methods. Therefore, securing the data becomes important and comes to play in this scenario. Any breach in security in any of these systems or even intervention can lead to loss of life or any other serious consequences. Therefore, it is also important to implement error checking whether if the data is intervened by a middleman or the third person apart from sensor and server, with just encryption, there is no way the server or sensor can know that there is any intervention in data. With the help of error checking or intervention checking algorithms, one can assure an extra layer of security in these cases. Overall, this paper has provided valuable insights into the importance of encryption and decryption of data in healthcare monitoring systems. It is hoped that the study's findings will inform policy and decision-making in this area, and contribute to the development of more secure and privacy-conscious healthcare monitoring systems.

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PHSRS: The Privacy-preserving Healthcare Service Recommender System

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***Abstract*—An immense interest is shown to E-Healthcare systems as medical service recommendation increases with the advancement of technology and internet facility. It assists elderly people and other patients to discover professionals. Besides that, recommending personalized professionals and ensuring privacy remains great challenge. In an aim to increase the accuracy of the recommendation generation process, similarity between user's expectation and experts' knowledge is discovered and used along with expert's reputation score. Multiple user feedbacks are used to determine the reputation scores of doctors. On the basis of the curve-based cryptosystem and truth discovery technology, privacy-preserving recommendation method is proposed to compute reputation and similarity scores. In order to demonstrate its security proficiency, a detailed security analysis is provided.**

***Keywords*—Recommender system, Healthcare service, privacy preservation, curve-based cryptography**

I. Introduction

Due to the rapid development of E-healthcare systems [1], online healthcare service recommendations have become fundamental part of everyday life. Here, user can submit their symptoms, doubts and necessity to a medical server, and then the server suggests most appropriate professionals in accordance with those requirements to the corresponding users. Healthcare service recommender systems are automated tools that use machine learning and artificial intelligence (AI) to make tailored healthcare suggestions to individuals. By making timely and accurate suggestions based on patient data, medical records, and other pertinent information, these systems have the potential to enhance healthcare outcomes. There are several kinds of healthcare recommender systems that can be applied in various contexts, including telemedicine platforms, patient-facing applications, and clinical decision support systems.

Algorithms are used by clinical decision support systems to offer real-time guidance on medication, diagnosis, and therapy to healthcare professionals. In order to enhance patient safety and lower medical errors, these systems can also offer alerts and reminders. Applications geared for patients are created to enable users to actively participate in their health management. They offer customized advice on food, exercise, medication adherence, and disease management based on information about the patient's medical history, lifestyle, and preferences. To assist patients in achieving their health objectives, these applications can also offer them feedback and educational resources. To offer patients remote healthcare services, telemedicine platforms employ healthcare service recommender systems. Based on patient data and symptoms, these platforms can offer personalized suggestions for a diagnosis, a course of action, and a prescription. Additionally, they can offer patients virtual follow-up care and monitoring, lowering the need for in-person visits and enhancing access to healthcare.

The capacity of healthcare recommender systems to enhance healthcare outcomes by offering personalized recommendations that are suited to specific patient needs is one of their main advantages. These systems can assist healthcare professionals in making better judgements, enhancing patient safety, and minimizing medical errors by utilizing patient data and other pertinent information. Better health outcomes can result from empowering patients to have a more active part in their own health management. Healthcare recommender systems do have several difficulties, though, including assuring data confidentiality and privacy, overcoming algorithmic biases, and guaranteeing that recommendations are founded on the most recent and correct medical knowledge. For healthcare recommender systems to be successfully implemented and adopted, several issues must be resolved.

Numerous studies were carried out to design a reliable healthcare recommendation system, some uses reputation score as basis for recommendation [2, 3], while others place greater emphasis on users interests and needs [4]. In former type, service requested users will be directed to the professionals who have high reputation score. In later type, most appropriate professionals will be suggested based on users' requirements. It is evident that the recommendation accuracy may be compromised if only the reputation or user need is considered for recommendation generation process.

In fact, reputation is derived from other user's feedback. Sometimes, it may reflect irrelevant medical services required by the target user. Since, false feedback that has been entered maliciously by them can have a negative impact on the professional's reputation [5]. Thus it is important to filtering it. Similarly, recommendation of professionals based on the similarity score of user needs may result in the recommendation of doctors who provide poor quality service

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[6]. Thus, it is necessary to consider both similarity score of user needs and the aggregated service feedback from multiple users to obtain high-quality medical services.

More importantly, the system should be capable enough in filtering redundant feedback received from malicious users, whether it is positive or negative. Besides the accuracy of the recommendation generation process, sensitive information of both the user and professional must be protected from disclosure. Here, a fundamental cryptographic primitive called key management can be used to ensure security [7, 8], but it alone is inadequate to achieve privacy-preserving recommendations. In addition, due to their expensive computational requirements, they are not practical for system with increasing number of users. In an attempt to address the challenges of existing recommender systems, a privacy-preserving online healthcare service recommender system (PHSRS) is proposed. The major contributions are:

- The PHSRS scheme takes both the similarity score of user needs and reputation score of the doctors as the basis for medical service recommendations.
- The PHSRS scheme not only provides accurate professional recommendations but also protects the privacy of both the doctor and user's sensitive information.
- In this scheme, users' needs and demands, and the professional's information are compared in the form of Ciphertext, not as plaintext.
- It discovers and filters feedback from malicious users, and assigns different weights dynamically.
- To demonstrate the efficiency, the proposed PHSRS scheme is compared to that of other related schemes.

The remaining sections are organized as: Section II describes the currently available literature-based solutions. Following that, Section III presents the healthcare service recommender system design goals and Section IV presents preliminary of the proposed work. Section V defines in detail about the proposed PHSRS scheme, and Section VI provides a thorough evaluation of the performance. Finally, Section VII draws the conclusion.

II. Related Works

The protection of one's privacy and anonymity has become a topic of widespread interest among the research communities of healthcare recommender system. If a user's privacy is breached, an adversary may be able to discern the victim's way of life, their routines, and even in some instances, the location of a remote user. Li et al. [6] introduced privacy-preserving online service recommendations for social communities. Here, interest-based pseudonyms were used to protect user identity from the server, but it is unfit for recommending professionals. An online friend suggestion based on user's trust relationship and social attributes has been proposed by Ma et al. [9] in a private manner. However, it cannot be used to generate doctor recommendation as there are no direct relationship between user and doctor in healthcare systems. To make accurate healthcare service recommendations, both reputation and similarity score need to be calculated.

Huang et al. [10] proposed privacy-preserving vector similarity computation model. However, this approach is not efficient as it involves users, trust authority and server to calculate similarity. A disease prediction scheme based on matrices is proposed by Zhang et al. [11]. To calculate reputation scores, Hu et al. [12] uses Dirichlet distribution and proposed a privacy-preserving communication scheme for vanets. However, due to the dynamic nature of users' feedback scores, the scheme is inaccurate. Furthermore, the server processes users' raw data and raise privacy concerns. Recently, numerous models have been introduced to protect user's privacy.

A privacy-preserving scheme for truth discovery (PPTD) was proposed by Miao et al. [13] to preserve user's sensitive data in the cloud. Unfortunately, their scheme becomes less effective as number of user increases. Zhang and colleagues [14] introduced privacy protected truth discovery (LPTD) scheme for fog-cloud platforms and they claimed that their scheme is lightweight. Kang et al. [15] used pseudonyms to preserve private information of fog computing users. An attribute-based protection scheme is proposed by Li et al. [16] to share data in cloud. However, this encryption model is not meant for truth discovery. Minding the above mentioned limitations, a new recommender solution is developed based on professional's reputation rate and user needs while filtering malicious user feedbacks. Throughout the system, the communicating participant's information should be secure and protected from malicious activities.

Various methods such as attribute-based encryption [21], differential privacy, identity-based encryption, elliptic curve cryptography, and k-anonymity or zero-knowledge proof are utilized to address privacy [22]. Hashing and cryptographic methods, primarily the SHA-256 or SHA-512 hashing algorithms, are used by blockchain technology to secure data transferred between nodes connected to a network. Due to the possibility of performance degradation, a suitable privacy preserving strategy must be carefully considered [23, 24].

The Curve-based cryptosystem [17] has attracted a lot of interest because of its lightweight operations. It's widespread because of the low cost operations, less memory requirement and low communication overhead. It offers faster processing, and also requires smaller key sizes than other public key cryptosystems. The curve-based cryptosystems have exponential complexity. At a given level of security (2^n), the key size grows as n^2 for curve-based cryptography, but it grows as n^3 for classical cryptosystems. As a consequence, curve-based cryptosystems are now advised to be used for new products where backward compatibility is not necessary. The security of ECC depends on the mathematical complexity of breaking elliptic curve discrete logarithm problem (ECDLP) [18]. For instance, the security offered by a 1024-bit RSA key is equivalent to that of a 160-bit elliptic curve key. Since then, numerous studies have been done to employ the ECC on recommender system to ensure privacy protection.

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III. Design Goal

The main goal is to design a secure and reliable privacy-preserving healthcare service recommender system, where the curve-based cryptosystem is used to protect sensitive information from malicious activities and unauthorized access.

A. Privacy Preserving Recommender System

The key challenge of any service oriented recommender system is the privacy preservation. As a result of the sensitive personal and medical data that healthcare service recommender systems handle, privacy-preservation plays a major concern. The information found in healthcare data can be used to determine a patient's identity, treatment history, and personal preferences. As a result, it is essential to make sure that sensitive data is shielded against misuse, disclosure, and illegal access. One of the crucial privacy-preserving strategies for healthcare service recommendations is the user anonymity. De-identifying healthcare data is taking out any personal identifiers or protected health information (PHI). Techniques like data masking, perturbation, or aggregation can be used to accomplish data anonymity. It lowers the possibility of re-identification and safeguard patient privacy.

Secure data storage is the other essential privacy-preserving measure. To avoid unwanted access or disclosure, healthcare data should be stored securely. This can be done by utilizing secure authentication methods, encrypting data in transit and at rest, and putting access control measures in place. For healthcare service recommender systems, secure data sharing mechanisms must be put into place to exchange healthcare data between healthcare service providers and seekers. These protocols should make sure that the data is sent securely and that only authorized people may access it.

The recommendation algorithm should respect user privacy while generating personalized healthcare service recommendations. Transparency and accountability are also essential for maintaining privacy in healthcare recommendation systems in addition to cryptographic mechanisms. These systems ought to be open about how they handle data and include detailed descriptions of the methods they employ for gathering, storing, and using it. In conclusion, to safeguard sensitive healthcare data from illegal access, disclosure, or misuse, healthcare recommender systems must integrate effective privacy-preserving procedures. A well-modeled healthcare service recommender system should preserve patient's privacy while offering personalized and useful healthcare suggestions by putting these precautions in place.

B. Role of Cryptosystem in Privacy Preserving Recommender Systems

To protect patient privacy, healthcare service recommender system uses various cryptosystems to safeguard the private and sensitive information from unwanted access or disclosure. Secure multi-party computation, differential privacy, homomorphic encryption, and other cryptographic methods can be utilized to ensure that private health information is shielded from illegal access and exposure while generating customized recommendations. These methods are crucial for safeguarding patient privacy and fostering confidence in healthcare recommendation systems. One of the fundamental cryptographic primitive utilized in privacy-preserving healthcare recommender system is the encryption algorithm. Sensitive data can be protected both in transit and at rest by using encryption algorithms to avoid interception or eavesdropping and to guarantee that only authorized users can access it.

Homomorphic encryption is another cryptographic method used in healthcare recommendation systems that protect patient privacy. By enabling computations on encrypted data without first decrypting it, Homomorphic encryption protects the confidentiality of the data. Using this method, it is possible to perform computations on personal healthcare information like patient records or medical histories. Another cryptographic method used in healthcare recommendation systems that protect patient privacy is secure multi-party computation. In this method, several parties can compute a result without disclosing their inputs to other. This method can be used to create collaborative recommender systems for healthcare where several healthcare professionals can work together to offer personalized recommendations without disclosing any patient-specific information.

Another crucial cryptographic method utilized in privacy-preserving healthcare recommendations is differential privacy. Differential privacy guarantees data anonymity, preventing person identity while facilitating personalized recommendations. Through the use of differential privacy, patient privacy can be protected by introducing noise or other disturbances to the data while maintaining its overall quality. Through literature analysis, it is found that among currently available public key cryptosystems, curve-based cryptosystem has shown a lot of promise in terms of both security as well as speed. This is because of its smaller key size to provide equal level of security as other cryptosystem provides which means less computation. The algorithm uses robust security based on the computational complexity, key generation, curve selection, point multiplication for encryption, and point addition for decryption. Due to its tiny key size and quick computation time, it is employed in the proposed privacy-preserving healthcare service recommender system.

IV. Preliminaries

The cryptosystem used to protect the sensitive information and the truth discovery approach used to calculate the weight of similar users are defined in this section for better understanding of readers.

C. Truth Discovery

To resolve the conflicts of noisy data, truth discovery approach is used in various applications. Once the algorithm begins, then the ground truths are randomly assigned and the weights will be updated iteratively till convergence has been achieved. The higher weight will be given to the user whose data is nearer to previously determined ground truth. The

DOI: rp-9788770040723.187

distance between the current user data and ground truth is calculated as:

$$d\left(x_o^u, x_o^*\right) = \frac{\left(x_o^u - x_o^*\right)^2}{std_o} \quad (1)$$

where o represents the object, x_o^* is the ground truth, x_o^u is user data and std_o represents the standard deviation of object o for all users u.

D. Overview of Elliptic Curve Cryptosystem

Public-key cryptography known as elliptic curve cryptography (ECC) makes use of the characteristics of elliptic curves to produce safe encryption methods. It generates the key pair as the initial stage in the ECC process. The public key is produced from the private key via a mathematical formula, whereas the private key is a secret number that is generated at random and kept hidden by the owner. While the private key is required for decryption, the public key is utilized for encryption. The curve must be carefully selected to guarantee that it possesses specific mathematical characteristics that make it appropriate for use in cryptography. Fig. 1 gives the graphical representation of an elliptic curve over the finite field F_q.

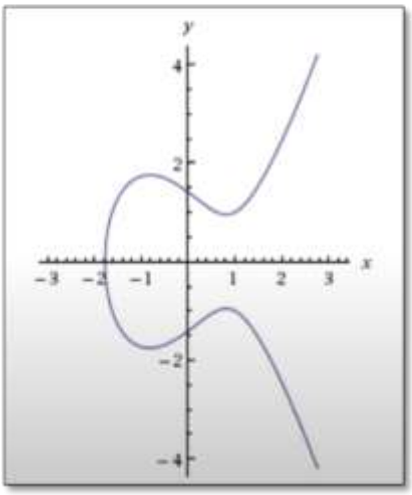

Fig. 1. Graphical Representation of Elliptic Curve

In ECC, the plaintext message that is being encrypted is represented by the scalar value. During encryption, a point on the elliptic curve is multiplied by that scalar value. A new point on the curve i.e. the Ciphertext is produced as a result of the multiplication. During decryption, the ciphertext point on the elliptic curve is added to get the original plaintext message. Due to the challenging mathematics required to calculate the private key from the public key, ECC is thought to be safe.

E. Arithemtic operations of ECC

With a smaller key size ECC offers comparable security than other public key cryptosystems like RSA. A non-singular curve with the equation $y^2 = x^3 + ax + b \bmod p$, with the discriminate $4a^3 + 27b^2 \bmod p \neq 0$, is known as an elliptic curve $E_p(a, b)$ defined over a prime field F_p. The three fundamental arithmetic operations carried out on the ECC are

- **Point multiplication:** addition of a point in k times
- **Point addition:** addition of 2 different points
- **Point doubling:** addition of same point

Assuming there are two points on the curve, then point addition is $P_3 = P_1 + P_2 \bmod p \in E\left(F_p\right)$. The same point is added twice $P_3 = P_1 + P_1 \bmod p \in E\left(F_p\right)$ in point doubling, whereas the same point is added k times $P_3 = kP_1 \bmod p \in E\left(F_p\right)$ then it is called as scalar multiplication.

F. Elliptic Curve Cryptosystem

The PHSRS scheme achieves privacy preservation using Elliptic curve cryptosystem. It comprises of key generation, encryption and decryption algorithms.

- **Key Generation:** The domain parameters that are made publicly available for key generation are the prime p, elliptic curve E, and the generator point P. Let us assume that the point P is on the curve $E(F_P)$, then the cyclic subgroup fabricated by P is given as $\langle P \rangle = \{\infty, P, 2P, 3P, \cdots, (n-1)P\}$. Now, the key pair is generated by uniformly selecting the random integer $k \in [1, n\text{-}1]$ as a private key, and its equivalent public key P_k is computed as P_k = k × P. The security of an elliptic curve cryptosystem relies on the hardness of computing k from P_k though provided with P which is called the ECDLP.
- **Encryption:** The data M which is to be protected is initially converted into the point on the elliptic curve P_M. Then it is encoded into its corresponding Ciphertext C which is the pair of points (C_1, C_2) as follows:

$$C = \left(C_1, C_2\right) = \left(kP, P_M + P_k\right) \quad (2)$$

- **Decryption:** With the Ciphertext C, the following actions are performed to retrieve the plaintext P_M. Finally the point P_M is then decoded to the original data M.

$$\begin{aligned} P_M &= \left(C_2 - k \times C_1\right) = \left(\left(P_M + kP_k\right) - \left(k \times kP\right)\right) \\ &= P_M + kP_k - kP_k = P_M \end{aligned} \quad (3)$$

G. Elliptic Curve Discrete Logarithm Problem

The elliptic curve discrete logarithm problem (ECDLP), which is the problem of separating the private key from the public key, determines how secure ECC is. For an elliptic curve $E\left(F_p\right)$, determining an integer $k \in [0, n-1]$ from $Q = k \times P$ is difficult, provided a generator point $P \in E\left(F_p\right)$ and the resultant point $Q \in \langle P \rangle$. Even for large

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key sizes, the ECDLP is thought to be computationally infeasible.

V. Privacy-Preserving Healthcare Service Recommender System (PHSRS)

The privacy-preserving online healthcare service recommender system (PHSRS) is designed, where the user submits the service request through public network to the medical server, following that server suggests the professionals based on their requirements. After that, the user will provide feedback regarding the received service quality to compute particular professional reputation rate. The formal PHSRS model is demonstrated in the Fig. 2, which consists of User, Medical server and the Trusted Authority.

- Users are the person who needs medical advices and they must own smart device to send the request and to receive the recommendations. Following that, the user provides feedback in order to assess the quality of service they received.
- Trusted Authority is in charge of managing and distributing the key resources to users and medical servers.
- After receiving the service request, the medical server calculate the similarity score between user needs and professional's attribute, then responds to user with suitable doctor suggestion. And then collects the feedback from them to calculate the reputation scores of doctors.

Fig. 2. The PHSRS System Architecture

The proposed privacy-preserving healthcare service recommender system (PHSRS) consists of system initialization, professional recommendation, and reputation score computation phases. These are explained in detail the following subsections.

H. System Initialization

Trusted authority (TA) is the one who is completely believed by all the participants of PHSRS scheme. Initially, TA selects the global parameters like elliptic curve, generator point and then generates the key pairs based on the security parameter. Finally, TA distributes these key pairs to the appropriate user and medical server, respectively.

I. Doctor Recommendation

The entire process can be broken down into three parts: sending the requirements, calculating the similarity, and recommending the professionals. Each participant should prove their authenticity before taking advantage of the service provided by the PHSRS system. After successful authentication, the user sends their perturbed demand vectors to the medical server through public network without expressing their identities for recommendation generation. Each user has their own demand vectors $\vec{A_i} = \{a_1, a_2, \cdots a_n\}$, includes name of the hospital, information about the department, the type of disease, and so on. Similarly, the doctor's attribute vector $\vec{B_i} = \{b_1, b_2, \cdots b_n\}$ includes information about the hospital name, the type of treatable disease, and so on. Then the distance between professionals attribute vectors and users demand vectors are calculated as follows:

$$sim = \sum_{i=1}^{n} \left(a_i - b_i\right)^2 \qquad (4)$$

Finally, the doctors are selected whose similarity score is greater than the threshold value. Then the top listed professionals with highest reputation score is recommended to the user.

J. Reputation Score Computation

Following the service recommendation, the user will provide a feedback to assess the quality of the healthcare service provided by the particular professional. This feedback is then utilized to determine the doctor's overall reputation score. In this phase, the medical server will aggregate all the feedbacks received from multiple users and compute the truth value. With that truth value, the reputation score of doctor will be determined. In truth value calculation, different weights are assigned dynamically to each user feedback, and update them constantly based on multiple user feedbacks. To compute specific professional's reputation score, truth values obtained from various time periods were used.

VI. Performance Evaluation

The performance efficiency of the PHSRS scheme is evaluated in terms of the running time required to suggest relevant professionals. Here, 10 iterations are performed on the system with 2.5GHz Intel i5 processor and 8GB of RAM. The proposed PHSRS scheme is compared with other two related schemes, like PPMR [19] and FSSR [10] to demonstrate the efficiency of PHSRS. FSSR recommends a doctor based on only the user similarity. In PPMR, unlike FSSR, both user similarity and doctor reputation score are taken into account. It is observed from the Fig. 3 that the time taken for recommendation generation increases with the increasing number of professionals. This is because, the medical server needs to compute the similarity score between user's demand vectors and each professional's attribute vectors. And the time required to doctor recommendations based on reputation score is less when compared to user similarity score, because the medical server selects only the doctors with high reputation rate.

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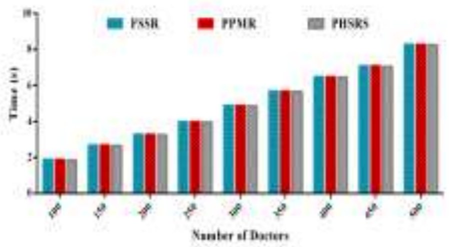

Fig. 3. Running Time Required to Recommend Doctors

Initially, the truth value of several user's feedback from various time period is obtained before computing the the reputation rate of professionals. The running time required for discovering the truth values of existing PPTD [20] and PPMR [19] schemes and the proposed PHSRS scheme is compared and depicted in the Fig. 4 with different number of users. It is clear from the Fig. 4 that the running time consumed by PHSRS is significantly less when compared to the schemes PPTD and PPMR with the increasing number of online users.

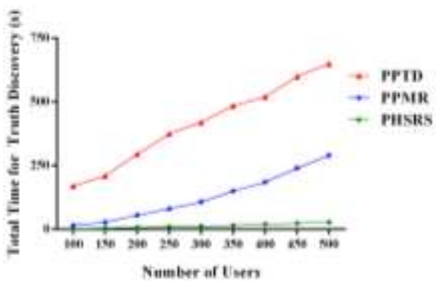

Fig. 4. Comparing the running time required to discover truth values

The running time required to discover truth values increases linearly with the increasing number of online users as seen in Fig. 4. Similarly, Fig. 5 depicts the total time required for calculating the reputation score with different number of truth values obtained from various time periods. It clearly shows that the time taken to compute the reputation rate is comparatively small when increasing the users from 100 to 500, confirming the performance effectiveness of the PHSRS scheme. As a result, as the number of service seekers grows, PHSRS becomes more proficient.

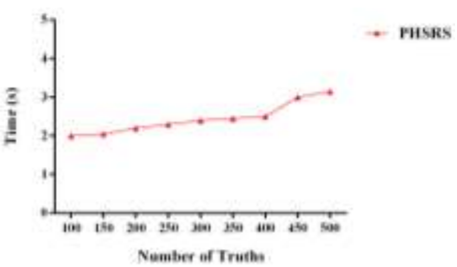

Fig. 5. Time Required to Compute Doctor's Reputation Score

VII. Conclusion

The privacy-preserving online service recommendations for E-healthcare system is proposed to assists users in discovering a appropriate doctor based on their needs, interests and reputation rate of doctors. In comparison to the existing associated online medical recommendations schemes, the proposed PHSRS scheme is more efficient and accurate. In order to achieve secure recommendation services, the privacy-preserving system were developed which prevents the unauthorized user from accessing the user's private data. A thorough performance analysis demonstrates that PHSRS is efficient and can provide reliable online service recommendations.

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I Know How You Are Feeling Now: A Multimodal Approach to Emotion Detection Using Transfer Learning

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Abstract **— Understanding Human has been a persistent pursuit of all Human being. Identifying human Emotions is the First step towards the same. We have developed a Transfer learning based Deep Neural Network model which works on multimodal data such as Text, Images, Video and Audio for the purpose of Emotion detection. Out of several emotional Models available in the Literature of psychology we have taken Plutchik wheels of Emotion as the base model to categorize the predicted emotions.**

Keywords — ***Emotion Detection, Plutchik Model, BERT, CNN, Multimodal data, Cognitive Psychology***

I. Introduction

Since time Immortal Understanding Human emotion has been a continued interest of human beings. In recent times there has been tremendous interest among researchers, to understand Human Emotions and their mind-sets at any point of time. There are several Emotional Models in the History of Neuropsychology or Cognitive Psychology. We have considered Plutchik wheels of Emotion due to its representation in the form of Wheel depicting Opposite Emotion on opposite arc of the wheel. In Plutchik Wheel Function Broad basis of classification can be Positive or Negative emotions, verbal or non-verbal, basic or complex [10]. Understanding of these emotions can only be done by observing Multimodal Data. Multimodal [11]data Include data collected from Audio, video, Text, Biomarkers, Brain Signals, Body gestures, Voice, Eye contact, Interpersonal distance(space) and many more. Thus true identification of human emotions is possible only through the study of Multimodal data.

Collecting the multimodal data, its storage, computation, & final Interpretation of the result of Combination of Multimodal data is another challenge, towards human emotion detection process. So usage of machine learning models with transfer learning based deep neural network seems to be one of the good solution to this problem [12,13].

Multi-modal data can present several challenges, including:

i) Integration: Combining multiple data sources and ensuring they are compatible and complement each other can be difficult.

Alignment: Ensuring that the different modalities are aligned in time and space can be a challenge.

ii) Missing data: Some modalities may not be available for certain instances, which can result in missing values and biases in the data.

iii) Heterogeneity: Different modalities can have different characteristics and distributions, which can lead to difficulties in modelling and representation.

iv) Interpretability: Models that integrate multiple modalities can be complex and difficult to interpret.

v) Annotation: Collecting and annotating multi-modal data can be time-consuming and expensive.

Multimodal approaches to emotion detection involve using multiple sources of data to detect emotions in an individual. This can include using information from audio, video, text, physiological signals, and other sources. The following are some common multimodal approaches used for emotion detection:

i) Audio-Visual Emotion Recognition: This approach combines audio and visual cues to detect emotions, such as facial expressions and vocal intonation.

ii) Physiological Emotion Detection: This approach uses physiological signals, such as heart rate and skin conductance, to detect emotions.

iii) Text-based Emotion Recognition: This approach uses natural language processing techniques to analyse text data, such as written or spoken words, to detect emotions.

iv) Hybrid Emotion Detection: This approach combines multiple modalities to achieve better accuracy in emotion detection.

v) These approaches have been used in a variety of applications, including human-computer interaction,

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affective computing, and psychology research. The choice of approach depends on the specific requirements of the application and the available data.

Off course Multimodal Data along with Transfer Learning Methods Appear with its own set of Problems of combining the results of Multimodal Data using Multiple Deep Learning Approach [1]. Over all approach to this Problem of Emotion Detection has led to the Following Research Questions:

RQ1). What are the Verbal and Non Verbal Indicators of Emotion Detection?

The Verbal indicators of emotion include:

1. Tone of voice: The pitch, volume, and inflection of a person's voice can convey different emotions. For example, a high-pitched, excited tone might indicate happiness, while a low, monotone voice might indicate sadness.
2. Word choice: The words a person chooses and the way they put them together can reveal their emotions. For example, someone might use more negative or angry language when they're feeling frustrated or upset.
3. Speech rate: The speed at which a person speaks can also convey emotions. For example, someone might speak quickly when they're excited or anxious, or slowly when they're sad or tired.
4. Pauses: A person's use of pauses in their speech can reveal their emotions. For example, someone might pause before speaking if they're feeling hesitant or uncertain.

Nonverbal indicators of emotion include:

1. Facial expressions: The way a person's face looks can reveal their emotions. For example, a smile usually indicates happiness, while a scowl usually indicates anger or frustration.
2. Body posture: The way a person holds their body can convey emotions. For example, someone who is happy or relaxed might stand or sit with good posture and open body language, while someone who is anxious or upset might slouch or cross their arms.
3. Gestures: The way a person moves their hands and arms can reveal their emotions. For example, someone who is excited might wave their arms around, while someone who is angry might clench their fists.
4. Eye contact: The way a person looks at others can convey emotions. For example, someone who is happy or confident might maintain strong eye contact, while someone who is anxious or uncertain might avoid eye contact.

It's important to note that these indicators can vary from person to person, and that it's often necessary to consider multiple indicators in order to accurately interpret someone's emotions. During our exploration we came across several theories of Psychology. Following are the Psychological Models Behind the Emotion Detection Model.

1) Shaver [15] out of 135 Emotional words they developed Abstract to concrete Emotional Hierarchy consisting of finally Synthesized to 6 emotions such as sadness, anger, fear, surprise joy, love.
2) OCC Model[16] : consist of 22 Emotion Type , Finally Merging & labelling into six Broad classes: They are the following six kinds of emotion groups and each of them includes several basic emotions: fortune-of-others (happy, resentment, gloating and pity), well-being (joy and distress), attribution (pride, shame, admiration, and reproach), attraction (love and hate), prospect relevance (satisfaction, fear, relief, and disappointment) and well-being/attribution compounds (gratification, remorse, gratitude, and anger)
3) Ekman's [17] emotion model very similar to Shaver's model, who claims to give more discrete measureable 6 classes of Emotions such as anger, fear, disgust, joy, sadness, and surprise
4) Alena [18] proposed measuring each emotion word into values of nine basic emotions: Anger, disgust, fear, guilt, interest, joy, sadness, shame, and surprise
5) Plutchik [29] Model has represented the collection of 32 micro emotions into 8 macro emotions based on Positive and Negative emotions. These are: Joy versus sadness; anger versus fear; trust versus disgust; and surprise versus anticipation. These emotions have been represented in form of "Wheel of Emotions" where positive joy versus sadness and Negative emotions are placed on the opposite sides of the wheels.

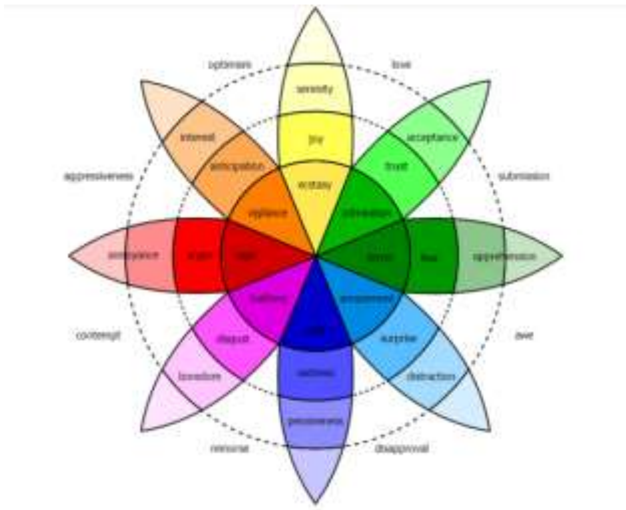

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Fig. 1. Plutchik's wheel of Emotions [29]

We are going to use Plutchik psychological model for our deep learning based emotion detection. This has been chosen because of the discreetness and placement of the positive & negative emotions on the opposite side of the wheel which help us identify the relative radian value of the emotions being considered.

For our current work we have considered following basic type of Data for the Multimodal Approach:

1) Text

DOI: rp-9788770040723.188

2) Audio
3) Video/ Images

RQ2) What are the common retrained model for different types of Emotion Detection Input

2.1 Text Based

1) For Text Input the such as RoBERTa ((Robustly Optimized BERT Approach), popular PreTrained Models are: BERT (Bidirectional Encoder Representations from Transformers) and its variants ALBERT (A Lite BERT).

BERT is a pre-trained language model developed by Google that can be fine-tuned for various natural language processing tasks, including emotion detection.

ALBERT is a pre-trained language model developed by researchers at Google that can be fine-tuned for various natural language processing tasks, including emotion detection.

RoBERTa: RoBERTa is a pre-trained language model developed by researchers at Facebook AI that can be fine-tuned for various natural language processing tasks, including emotion detection.

Other popular LLM (Large Language Model) based pre trained model for NLP based emotion detection are GPT2, ELMo, XLNet

GPT-2: GPT-2 is a pre-trained language model developed by OpenAI that can be fine-tuned for various natural language processing tasks, including emotion detection.

ELMo: ELMo is a pre-trained language model developed by researchers at the University of Washington that can be fine-tuned for various natural language processing tasks, including emotion detection.

XLNet: XLNet is a pre-trained language model developed by researchers at Carnegie Mellon University and Google that can be fine-tuned for various natural language processing tasks, including emotion detection.

2.2 For ECG Signals

There are several pre-trained models that have been developed to work with brain signals, such as electroencephalography (EEG) data, for tasks such as emotion detection, mental workload assessment, and diagnosis of neurological disorders. Here are a few examples:

i) DEAP: DEAP is a pre-trained model developed by researchers at the University of Toronto that can be used to classify emotions based on EEG data. The model was trained on a dataset of EEG recordings collected from 32 participants while they watched emotionally-evocative videos.

ii) BCI-DNN: BCI-DNN is a pre-trained model developed by researchers at the University of Freiburg that can be used to classify mental workload based on EEG data. The model was trained on a dataset of EEG recordings collected from 23 participants while they performed a visual search task under different levels of mental workload.

iii) E-LSTM: E-LSTM is a pre-trained model developed by researchers at the University of California, San Diego that can be used to classify neurological disorders based on EEG data. The model was trained on a dataset of EEG recordings collected from patients with various neurological disorders, including epilepsy, Alzheimer's disease, and Parkinson's disease.

2.3. For Audio or sound data

VGG-Voice: VGG-Voice is a pre-trained model developed by researchers at Oxford University that can be used to classify speaker identities based on voice data. The model was trained on a large dataset of voice recordings and has achieved high accuracy on speaker identification tasks.

i) Deep Speaker: Deep Speaker is a pre-trained model developed by researchers at Baidu that can be used to classify speaker identities based on voice data. The model was trained on a large dataset of voice recordings and has achieved high accuracy on speaker identification tasks.

ii) Audio Set: AudioSet is a pre-trained model developed by researchers at Google that can be used to classify audio events in a wide range of categories, including speech, music, and environmental sounds. The model was trained on a large dataset of audio recordings and has achieved good performance on various audio classification tasks.

iii) SoundNet: SoundNet is a pre-trained model developed by researchers at the University of Cambridge that can be used to classify audio events based on spectral features extracted from raw audio waveforms. The model was trained on a large dataset of audio recordings and has achieved good performance on various audio classification tasks.

2.4. Video/ Facial Expression

i) Facial Action Coding System (FACS) model and the DeepMoji model. Facial Expression Recognition (FER) models: These are pre-trained models that have been specifically developed to classify facial expressions in video data. Examples include the VGG-Face model mentioned earlier, as well as models such as FER2013 and FERPlus. These models typically use convolutional neural networks (CNNs) trained on large datasets of images and videos of facial expressions.

ii) Action Unit (AU) models: These are pre-trained models that have been specifically developed to classify facial action units (AUs) in video data. AUs are specific facial movements that can be used to identify and classify emotions. Examples of AU models include the Facial

iii) Video Classification models: There are also more general pre-trained models that have been developed for video classification tasks, which can potentially be fine-tuned for emotion detection. Examples include models such as 3D ResNets and I3D, which use 3D convolutional neural networks (CNNs) to classify video frames.

DOI: rp-9788770040723.188

RQ:3 common data set needed for handling multimodal data for emotion detection

There are several common datasets that can be used for handling multimodal data for emotion detection. Here are a few examples:

1. AFEW: The Acted Facial Expressions in the Wild (AFEW) dataset is a collection of videos of facial expressions in naturalistic settings. The dataset includes annotations of facial action units (AUs) and basic emotions.
2. EmotionX: The Emotion dataset is a collection of audio, text, and video data annotated with emotions and sentiments. The dataset includes a variety of data sources, such as social media posts, customer service conversations, and movie scripts.
3. MOSI: The Multimodal Opinion Sentiment and Influence (MOSI) dataset is a collection of video and audio data annotated with sentiments and opinions. The dataset includes a variety of data sources, such as political speeches, news articles, and movie reviews.
4. IEMOCAP: The Interactive Emotional Dyadic Motion Capture (IEMOCAP) dataset is a collection of audio, video, and text data annotated with emotions and sentiments. The dataset includes dyadic conversations between two actors in a variety of settings, such as customer service and therapy sessions.

RQ4: Which Approach should we use for Combining the Multimodal Models

There are various approached to Combine the Multimodal Data.

There are several ways to combine multimodal data, depending on the type of data and the task at hand. Some common techniques include:

i) Feature concatenation: This involves concatenating the feature vectors of the different modalities and feeding the resulting concatenated vector into a machine learning model. This is a simple and straightforward approach, but it assumes that the different modalities are independently informative and that their feature spaces have the same dimensionality.

ii) Feature fusion: This involves combining the feature vectors of the different modalities at a higher level, such as by training a fusion model that takes the feature vectors as input and produces a fused representation. The fused representation can then be used as input to a downstream task-specific model. This approach allows for more complex interactions between the modalities but requires more data and computational resources.

iii) Multi-task learning: This involves training a single model to perform multiple tasks, where each task is associated with a different modality. This can be useful when the modalities are related and when the shared representations learned by the model can improve performance on all tasks.

iv) Attention mechanism: Attention mechanisms allow the model to selectively focus on certain parts of the input data, which can be particularly useful when the different modalities contain complementary information. Attention mechanisms can be used as a form of feature fusion, where the attention weights learned by the model indicate the importance of each modality for a given task.

v) Generative models: Some multimodal tasks such as image captioning, text-to-speech, etc. can benefit from using Generative models such as GANs, VAEs etc. to generate one modality from another.

Our Process Model is as follows: Live data i.e., Audio, Video & Text data of an individual is collected and passed through the respective pre-trained model. Finally, 8 basic emotions according to Platchik model is predicted.

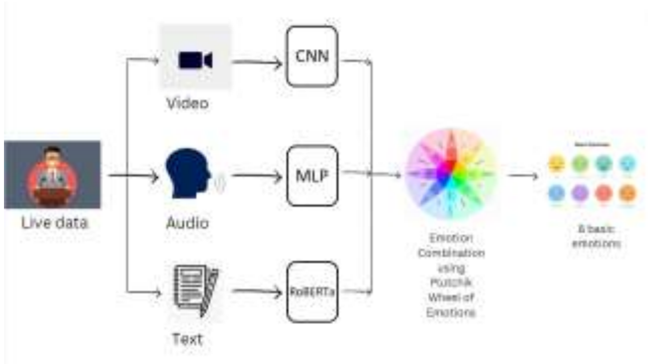

Fig. 2: Our Process Flow Model

Figure3: Pipeline Diagram of the various stages of Emotion Detection in our Model

Input Data Block	Transfer Learning Block	Combining the output predicted emotion of individual TL model to Final Classifier(SVM/ DT/Ensemble)	Final Emotion Detection Block
Stage 1	Stage2	Stage 3	Stage 4

Phase 1: Step1: Collect Multimodal Data Collection phase:

a) Video data from camera of the device (Laptop, Mobile….)

b) Voice Data from Microphone of the device

c) Text Data from the Manuscripts or Blogs (By web scarping/content scraping data using Tools like UIPath or Blue Prism)

d) Many Physiological Data such as Biomarkers data ECG / Skin conductance, Heart Rate, Movement, Speech Patterns

Input Data $_{video}$
Input Data $_{acoustic}$
Input Data $_{text}$
Input Data $_{ecg}$
……….

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………..

(ID video, ID accostic, ID text, ID ecg)

Phase 2/Step 2: Usage of Transfer Learning (Pre Trained Models)

a) Transfer Learning (For Video take Pretrained Models like CNN / VGG16/ VGG32 available in Keras/ Tensor flow Library

b) For Text data Use pertained Models like BERT / Distil BERT / RoBERT/ AlBERT available in Hugging Face Library

c) For Voice Take Pretrained Model such as DEAP, E-LSTM,

Transfer Learning $_{\text{video}}$
Transfer Learning acoustic
Transfer Learning text
Transfer Learning ecg

....

………..

(TLvideo,TLAccostic, TL text, TL ecg)

Step3:

Step3: Combining the Individual TL output to classifier like SVM/Decision Tree/ Random Forest/ Ensemble (Bagging / Boosting) to Final result by Multiplicative/ additive or Concatenation / methods

Phase 4/Step4 Final Prediction of Emotions: Combining the Individual TL output to classifier like SVM/Decision Tree/ Random Forest/ Ensemble (Bagging/ Boosting) to Final result by

Multiplicative/ additive or Concatenation / methods (Joint, coordinated or Encoder Decoder Methods)

E_{1joy}
E_{2trust}
$E_{3Surprise}$
E_{4Anger}
$E_{5sadness}$
$E_{6Disgust}$
$E_{7Anticipation}$
E_{8Fear}

Collecting input from various sources of data such as Image, Voice, Physiological data (such as ECG,), Pass it through Individual pretrained Neural network (CNN or and do fine Tuning of parameters at the Output stage of Data Through the Network.)

V. Conclusion

In this work we have considered one of the BERT refined Model called Distill BERT. Distill BERT is smaller, faster, cheaper and lighter version of BERT for text, for video and image popular pre - trained models such as CNN with VGG16 have been used. For acoustic data we are using Librosa Python Library and finally not early but late combination of various model is being done. Final different type of emotions detected is based on Platchik's model ie "wheel of Emotion Model". Future scope of the work can be towards transformer/ Attention mechanism/ (Product Comparison) ie finding Common vector space & Reducing Heterogeneity Gap

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RESPIRONET: Leveraging UNET Architecture for Effective COVID-19 Severity Prediction from Pulmonary CT Images

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***Abstract*—Covid-19, the most deadly word in recent years which worst hit the entire world, is still prevailing as a variant of concern. As the transmissibility of the virus is high, a quick and efficient approach to detect the presence of COVID and to give medical attention to those patients is of paramount importance. The research work proposes an effective deep neural network approach to quantify the severity score of COVID-19 infection from CT Lung images. Leveraging the Computer Vision techniques, semantic segmentation (SegNet) was applied to CT images to extract the lungs. Subsequently, a deep convolutional Encoder-Decoder Architecture was developed to assess the severity score of lung infection. Furthermore, to be well-balanced in accuracy and computational speed, various hyper parameters were investigated to build the effectual model. Evidently, as the severity classification (Mild, Moderate, and Severe, Critical) is preceded by lung extraction, the proposed framework for GGO segmentation demonstrates the ability to generate results with state-of-the-art segmentation accuracy of 96% and prediction accuracy of 98.9%.**

Keywords*— *COVID-19, Semantic Segmentation, CT images, UNET, transfer learning, Hyper parameters, Severity score.

Graphical Abstract

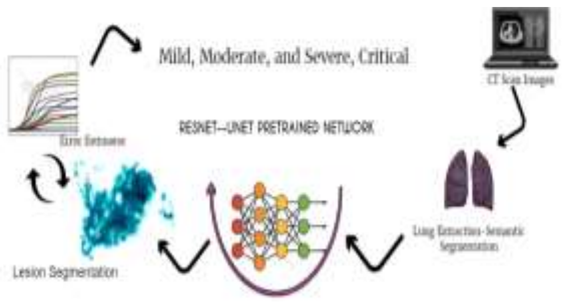

Fig.1. RESPIRONET: COVID -19 Severity Prediction Model

I. Introduction

The European Center for Disease Prevention and Control reported a total of approximately 289 million covid cases and around 5.4 million reported deaths worldwide since the start of 2022. [27].The deadly virus transcended at an unprecedented speed, overwhelming the health care support system. This necessitates an efficient triage system to quantify the severity score of COVID-19. Initially, the virus presence is confirmed with a positive reverse transcription-polymerase chain reaction test with oral and nasopharyngeal swab samples. The insufficient viral load in the swab samples decreased the sensitivity of the test down to 60 to70 %. This inefficiency during the earlier stages of the infection can be addressed through Radiology tests. Radiological studies have investigated different modalities like ultrasound, chest x-ray, or positron emission tomography/computed tomography (PET/CT) scan. The Radiological Society of North America, in their research journal 'Radiology', highlighted the importance of CT imaging for disease detection. They confirmed that the images are key components for the disease diagnosis. The clinical features of 41 patients initially admitted in Wuhan had abnormalities on their CT scan images

CT scan images have manifested to be more effective for the diagnosis, to determine the severity, and to guide the treatment procedure. The severity of Covid19 can be mild, moderate, or severe. The radiographic evidence is absent for mild cases but is significant for moderate and severe infections. Recent studies on biomedical computer vision have witnessed a considerable rise in the use of Convolutional Neural Network (CNN) and it has substantiated to be the best performer for skin lesion classification, breast cancer detection, brain tumor detection and Tuberculosis detection. In this context, our research study presents an efficient model by exploiting the variants of the CNN to identify and quantify the CT Lung images to isolate critical patients.

Abbreviations

COVID 19 Coronavirus Disease 2019
CT scan Computed Tomography Scan
CNN Convolutional Neural Network
GGO ground-glass opacity
RESPIRONET
SSP Severity Score Prediction
SSR Severity Range Prediction

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II. Related Work

COVID-19 disease was declared a global pandemic, which negatively impacted human life in many aspects. Research work on COVID-19 is being successfully carried out in many directions. TB screening, lung cancer diagnosis and, lung nodule detection, are other kinds of lung-based diseases, but covid-19 is something different as well as so easy to spread over the humans. Doctors identify the morphological patterns of the lesions in the lungs to predict COVID using the Chest scans such as X-rays and Computer tomography (CT) scans [8]. Classification, object identification, and picture segmentation are few computer vision applications where ML and DL approaches have demonstrated ground-breaking performance. [1]. Enormous studies are conducted on how to spot COVID-19 disease using CT scan images and chest X-ray images. Many research works on CT scan-based diagnosis are conducted and published in international journals.[2]. Rahman et al. proposed a system to contain the spread of COVID-19 by performing face mask detection in a smart city [3]. Harmon et al. [4] trained and validated a series of deep learning networks. Wang et al. [6] employed a deep regression framework for automatic pneumonia identification by integrating clinical information like age, gender, past medical history, etc., with the CT scan images. Visual features are extracted from CT scan images using RNN (Recurrent Neural Network) and ResNet50. Generally, clinical details like fever, cough, and difficulty in breathing are collected from the patients. They are analyzed together with the demographic features like age and gender using LSTM (Long Short Term Memory). In the end, a regression framework was enrolled to classify the suspected patient as Community-acquired pneumonia (CAP) or not [1]. Qiblawey et al. proposed a framework and evaluated over 900 clinical cases and achieved remarkable accuracy level. In line with that Mei et al. [5] proposed a mixed AI algorithm that combines clinical data with the results of a chest CT. To differentiate COVID-19 patients from non-COVID patients, clinical indicators such as fever, coughing, irregular breathing, and laboratory testing are used. The joint model achieved high discriminative performance with 0.92 area under the curve (AUC) outperforming senior radiologists. The potential pitfall of the combined system is the availability of clinical information when a huge number of patients are waiting to be diagnosed, moreover, this method is not able to show the infected area of the lung [1]. Pedro Silva et al.[7] proposed a model for the detection of COVID-19 patterns in CT images namely Efficient vidNet. Soares et al. [8] made a public repository of CT scans dataset, consisting of 2482 CT scans taken from hospitals in the city of Sao Paulo, Brazil. They have reported an accuracy, sensitivity, and positive predictive value of 97.38%, 95.53%, and 99.16%, respectively.

Following the monumental victory of deep learning techniques and its applications in medical image analysis, researchers have used radiology reports such as CT-scans and x-rays to detect COVID-19 [9]. CNN was utilized by Chowdhury et al. [10] to create their diagnosis model from chest x-rays. More number of research work was carried out based on pre-trained networks that were used to diagnose COVID-19. [11–13] used ResNet and obtained accuracies of 96%. Li et al [12] used DenseNet121 on X-ray images and achieved an 88% accuracy with AUC score of 0.97. A lesion identification approach was proposed by Zhou et al. [13] for estimating COVID-19 infection areas from the chest CT scans. Rahaman et al [14] examined 15 various pre-trained CNN models and found that VGG-19 had the highest classification accuracy at 89.3%. InceptionResnetV2, DenseNet201, Resnet50, MobilenetV2, InceptionV3, VGG16, and VGG19 were employed by Asnaoui and Chawki [15]. The highest accuracy of 92.18% was obtained using InceptionResnetV2. Wu et al [16] implemented multiple CNN models to categorize COVID-positive individuals from CT scan images. A 3D deep CNN (DeCovNET) was proposed by Wang et al [17] to detect COVID-19. He et al [18] introduced a small dataset of lung images in CT scans and put forward an approach named Self-Trans i.e. self-supervised learning with transfer learning.

III. Motivation

Although the literature shows promising results, there is still scope for improvement in predicting the severity of COVID. This work aims to build a severity prediction model that employs pixel-wise labeling a.k.a semantic segmentation to extract the lungs from the CT images. The lung extracted is further semantically segmented to get the Ground Glass Opacity (GGO), a hazy, white-flecked pattern visible on lung CT scans that indicates increased density. The segmented lesion is used to assess the severity of infected lungs. This gives a deeper understanding of the radiology images in the lowest granule level.

The remainder of the paper is organized thus: Section 2 details the dataset used to conduct the study. The proposed methodology adopted is delineated in Section 3. Section 4 exhibits the experimental setup and results obtained. Section 5 tabulates the extensive set of investigations done on various hyper parameters to optimize the model, along with the discussions and analysis. Finally, the concluding remarks with limitations are drawn in Section 6.

Database Used

SARS-CoV-2 CT scan dataset [*Soares, E.; Angelov, P.; Biaso, S.; Froes, M.H.; Abe, D.K. SARS-CoV-2 CT-scan dataset: A large dataset of real patients CT scans for SARS-CoV-2 identification. medRxiv 2020. [CrossRef]*] was used in this research for Covid-19 severity prediction. The dataset comprises 1252 CT image positive samples and 1230 negative samples for SARS- CoV-2 prediction. As the CT image features could confidently prove the existence of Covid, this repository is made public to encourage research contributions to address Covid detection and treatment. The images are collected from the patients of hospitals from Sau Paulo, Brazil.

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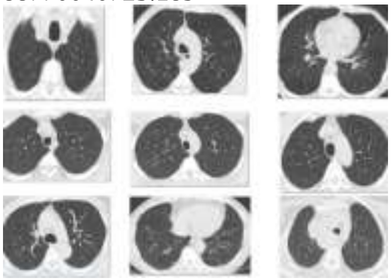

Fig. 1. CT scans images of SARS-CoV-2 infection -ve samples in axial projection

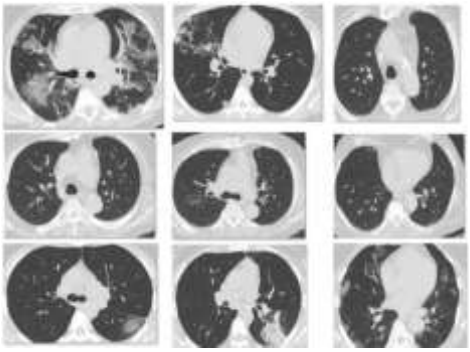

Fig.2. CT scan images of SARS-CoV-2 infection +ve samples in axial projection

IV. PROPOSED METHODOLOGY

We present a simple yet mighty COVID Prediction Framework–RESPIRONET illustrated in Fig.3. The proposed system comprises three phases. The first stage of the work builds a custom SegNet model using the semantically labeled CT images. A great deal of attention was made to label the pixels using the Image Labeller App to generate the ground truth. This sets the way to take out the Region of Interest (Lungs) from the CT images using the lung mask generated. The extracted lungs are further semantically labeled pixel-wise. Stage 2 employs a U-Net Architecture to segment the Ground Glass Opacities (GGO, from now on). Transfer learning from a pre-trained network was adapted on the encoder layers of UNET with Resnet18 weights to build the segmentation networks. The lesion mask generated from stage 2 helps to classify COVID from Non-COVID images. Stage 3 uses the segmented lesions to predict the severity score of the infection as MILD or SEVERE or MODERATE or CRITICAL

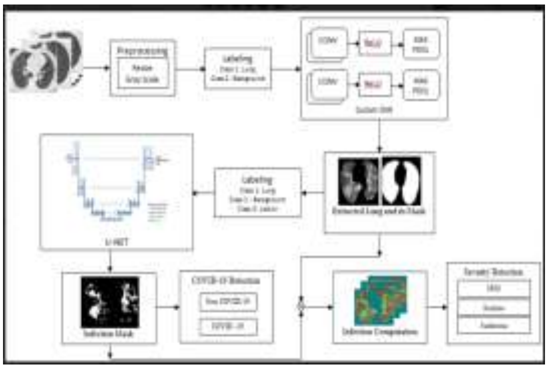

Fig.3. RESPIRONET Framework for COVID Severity Prediction

Preliminary Steps - Image Preprocessing

Data quality being a priority concern for deep learning models, grayscale conversion and image resizing for CNN were applied to the dataset. The CT lung images were converted to grayscale images that contain only brightness information, thereby reducing the processing time. All input images were resized to 256*256 to feed CNN with a unified dimension. In addition, to perform Image Enhancement, Contrast limited adaptive histogram equalization (CLAHE) image enhancement was tried out to improve the local contrast of the images.

Lung Extraction using Custom SegNet

To emerge with an answer to the question “What is in the image? And where it is located? “in Biomedical images, Semantic segmentation was exploited. Semantic Segmentation is the process of assigning each pixel in a picture a class that corresponds to the thing it is representing. This dense prediction returns the feature map that contains the class label represented as an integer. The SegNet CNN architecture for lung segmentation consists of an encoder path and decoder path terminated by a pixel classification layer. The Encoder path performs convolutions using the filters and generates the feature maps. The Decoder path performs upsampling of the feature maps from the encoder. The final high dimensional feature map is fed to the softmax classification layer. Each pixel is labeled with the class corresponding to the highest probability. The proposed custom SegNet CNN model was crafted with Filter size=7, the number of conv layers=3, followed by Batch Normalization, RELU, and max pooling in each block. The best hyper parameters were chosen by running a Bayesian Optimizer on a set of hyper parameter values. Fig 4 apparently shows that the segmentation network works best when the Kernel filter size for the Convolution layer is set to 7. The outcome of the custom SegNet Model for Lung Segmentation is presented in Fig: 6. The lungs and background are segmented and shown in discriminating colors.

Bayesian Hyper parameter Optimization

To build this effective custom segmentation model for lung extraction, Bayesian Hyper parameter Optimization was experimented with. Bayesian Optimization works by building a probability model mapping the hyper parameter values to the objective function. The objective function is used to find the most suited hyper parameters to evaluate the true objective function.

$$x^*=\arg\min f(x) \tag{1}$$

Where x* is the set of hyper parameter values that gives the lowest objective scores like RMSE. The most promising set of hyper parameter values is estimated in a very short time. The best-suited hyper parameters were used to construct the segmentation model. Fig 5 lists the best suited hyper parameter values like MaxEpochs=100; MiniBatchSize=64; Learning Rate=1e-3; Optimizer = sgdm; No. of Layers = 3, Filter Size = 7.

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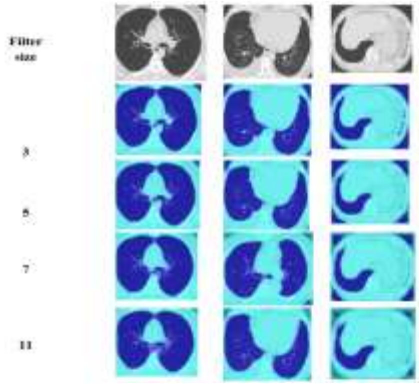

Fig.4. Visual Comparison of segmentation by varying the Filter Size

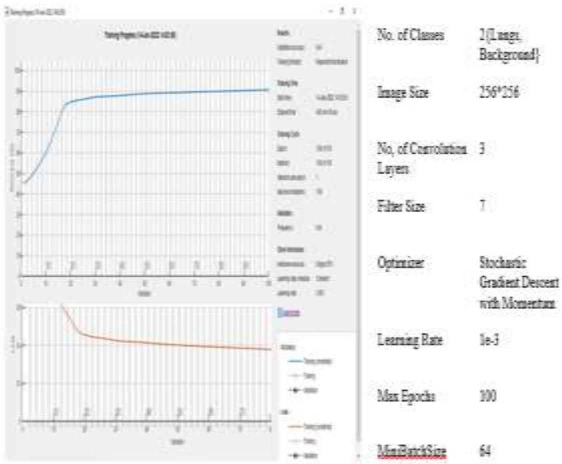

Fig.5. SegNet for Lung Extraction- Training Progress and Bayesian Hyper parameter Optimization

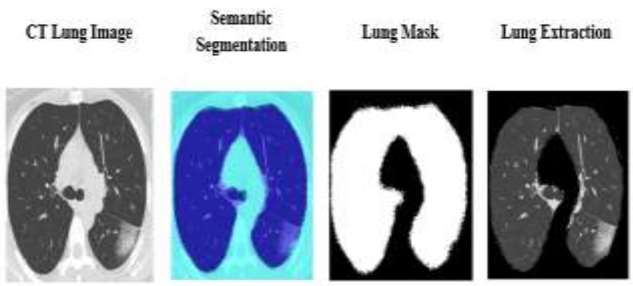

Fig. 6. Phase 1: Lung Extraction Using Custom SegNet Model with the Optimized Hyperparameters

Covid Lesion Segmentation using UNET

The second stage of the proposed work aims to segment the GGO areas in the CT scan images. U-Net is a segmentation network that has performed exceedingly well in biomedical image segmentation. The specialty of the network is that it can outperform other segmentation networks by using only very few images. These highlighted features of the UNET architecture makes it a viable alternative for other CNN architectures. U-net is an encoder-decoder architecture that classifies each pixel of the image and also projects the discriminative features learned at the pixel space. The first half of the UNET architecture called the Contracting path is the Encoder (Fig.7). Usually, it is a pre-trained classification network like VGG or ResNet that constitutes of convolution blocks followed by a max pool layer to encode the input image into feature representations at multiple different levels. In this proposed work, we have used RESNET-18 in the contracting path of the U-Net architecture and performed transfer learning. It saves huge efforts required to re-invent the wheel and transfers the weights learned to the problem at hand. The reason for using ResNet is that it is considerably more deeply nested, but because global average pooling is used, the model size is actually much lower. It also tackles the vanishing gradient problem. The second half of the architecture also called as Expanding path is the decoder. The goal is to semantically project the discriminative features learned by the encoder onto the high resolution pixel space to get a dense classification. The decoder consists of upsampling and Skip Connections followed by regular convolution operations.

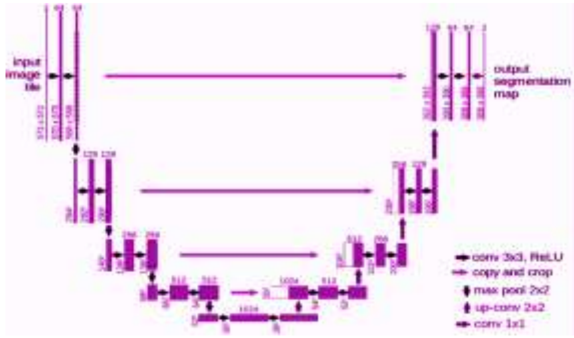

Fig.7. U-Net Architecture - Image Source [19]

Covid Severity Prediction

The disease transmissibility rate of Covid 19 is rapid causing a great challenge to the frontline workers. The limitations in life support equipment took the last breath of many lives. Severity prediction is crucial to categorize the patients in different levels of containment zones. Patients in critical condition can be admitted to Intensive Care Units and be given utmost attention. The final phase of this research work focuses on severity prediction. Severity Score Calculation was performed as outlined in Fig.8.

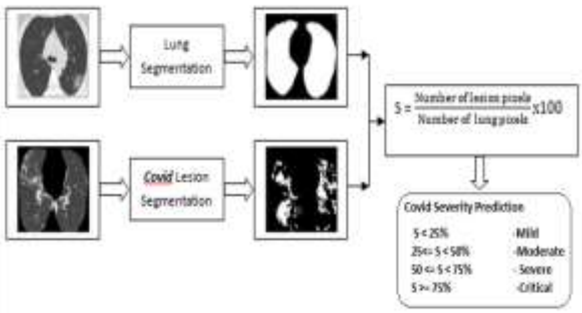

Fig.8. Phase 3-Covid Severity Range Prediction

Experimental Setup

Implementation of the Classification and the segmentation models were done implemented using Tensor Flow and Keras API with Python 3.7 on Intel® Core TM i7-7500U CPU @2.70Ghz,2901 MHz, and 64 GB RAM, with an 8-GB NVIDIA® card. To perform

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regularization and prevent over fitting during the training phase, a callback routine that performs early stopping was incorporated. The training will end abruptly if there is no change in the validation loss for the specified number of epochs.

V. Results and Discussion

We have used 200 train images (100 +ve samples and 100 -ve samples) and 60 images to test the Resnet-U-Net model. Clearly, the model is built with balanced class samples and Accuracy is chosen as the Evaluation metrics. We have achieved a validation loss of 0.168 and an segmentation accuracy of 96% when trained on 200 images for 30 epochs. Table 1 provides the training progress and tuned hyper-parameters results for the lung and lesion segmentation models. Table 2 exhibits the learning curve during the model training phase. It is perceived from the curves that, plot (g) has the most consistent and persistent curves that delivers the highest training and validation accuracy. Taking together as in Table 3, the findings suggest that the proposed framework proves to be robust in Covid Severity Range Prediction.

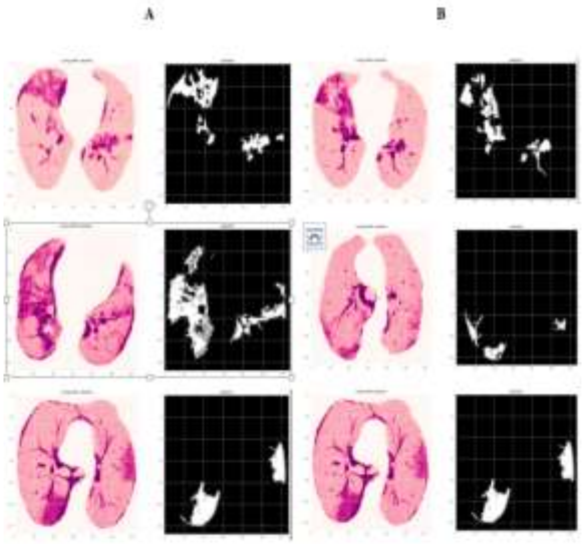


Fig. 9. Snapshot of : (A) Training Images with its GGO. (B) : Validation Images with its GG

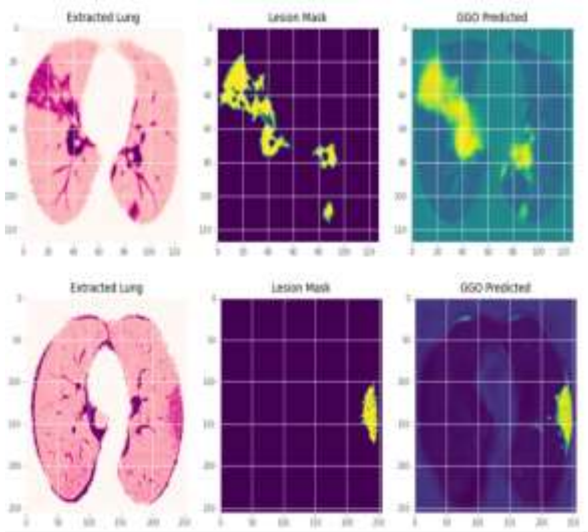


Fig.10. Phase 2: Lesion Segmentation Using ResNet-UNET

TABLE 1 Quantitive Analysis by varying the different Hyperparameters of Resnet-UNET

Kernel Size	Batch Size	n_filters	Kernel Initializers	Validation Loss & Accuracy	DropOut	Epochs	Stride
3	16	16	he_normal	0.4971630275249481, 0.8930943608283997	0.1	30	2,2
3	16	32	he_normal	[0.1680331975221634, 0.96982210087776184]	0.1	30	2,2
3	32	16	he_normal	[0.7666683197021484, 0.41030630469322205]	0.1	30	2,2
5	16	16	he_normal	[0.6168349385261536, 0.8304417729377747]	0.1	30	2,2
3	16	32	random_normal	0.7741910815238953, 0.7797927856445312	0.1	30	2,2
3	16	32	trunc_normal	[0.6655519008636475, 0.8608983159065247]	0.1	30	2,2
3	16	32	he_normal		0.2	30	2,2

TABLE 2 Model Learning Curves - Training Loss Vs. Validation Loss

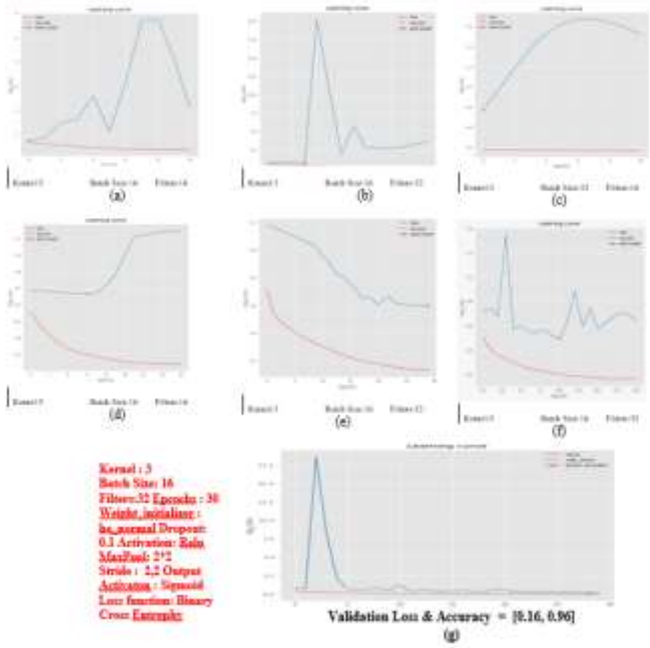
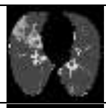
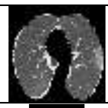
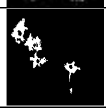
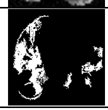


TABLE 3 Results of RESPIRONET-Covid Severity Prediction Framework

Lung Extraction using SegNet				
GGO Segmentation using RESPIRONET				

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Severity Score Prediction(SSP) Severity Range Prediction (SRP)	SSP=11 % SRP=mild	SSP=3.12% SRP=mild	SSP=50.03% SRP=severe	SSP= 40.679% SRP=moderate

Comparison with prior work on COVID Classification

We compared our proposed methodology with other similar approaches on COVID-19 classification from the literature and the results are clearly furnished in Table 4. Jin et al. [21] adopted a 2D CNN for segmentation of CT slices and trained a model for Covid-19 or normal classification. They investigated two public datasets LIDC-IDRI [20] and ILD-HUG [22] together with 496 positive and 260 negative samples from Wuhan Union Hospital. The system achieved an accuracy of around 97.9%. Singh et al. [23] fabricated a CNN based COVID-19 prediction model on multi-objective differential evolution. The resulted model could outperform the ANN-based models. Ahuja et.al [24] enhanced the performance of classification with Data Augmentation techniques and evaluated the pretrained models ResNets 18, 50, 101, and Squeeze Net for classifications. The results with a 0.99 AUC score prove the efficacy of ResNet18 compared to other models. Barstugan et al. [25] tried various statistical and wavelet-based feature extraction methods and classification by Support Vector Machine. GLSZM coupled with SVM yielded an accuracy of 99.68 %. Wang et al. [26] performed lung region extraction with pretrained UNet. The lung images of patients admitted to Renmin Hospital, China. They segmented the image with UNet ++ for Covid prediction with an accuracy of 92.5 %.

TABLE 4 COMPARISON WITH OTHER PRIOR WORKS ON COVID CLASSIFICATION

Ref.	Image Samples	Method	Accuracy
Jin et al. [23]	496 +ive, 1385 -ive	CNN	97.91 %
Singh et al. [25]	N/A	CNN	90%
Ahuja et.al [26]	349 +ive,397 -ive	ResNets 18, 50, 101 ane SqueezeNet	99.65%
Barstugan et al. [27]	53 +ive , 97 others	Feature Extraction coupled with SVM	98.7%
Wang et al. [28]	313 +ive, 229 -ive	UNET++	98.85%
RESPIRONET (Proposed Method)	**100 +ve ,100 -ve**	**Custom CNN (Lung Segmentation) and ResNet-UNET(Lesion Segmentation)**	**98.9 %**

Comparison with prior works on COVID segmentation

For further analysis of the outcome, the proposed framework is compared with other related approaches for Covid 19 segmentation and the results are tabulated in Table 5. Ma et al [35] adopted standard UNET 20 3D CT slices and attained 0.608 accuracies. Dominic et. al [38] further enhanced the approach on the same dataset using an inverted distribution on k-fold-cross-validation. Yan et al [37] designed a unique architecture for COVID segmentation and achieved better results around 0.73 accuracies. Saood et al [36] combined SegNet and U-Net. They trained the network nine times using different hyper parameters and obtained an accuracy of 0.749 %. Qiu et al [34] developed a lightweight CNN with limited parameters of 83K that would be easy for deployment in real-time.

TABLE 5 COMPARISON WITH OTHER PRIOR WORKS ON COVID SEGMENTATION

Ref.	Method	Training Dataset (Sample size)	Validation (Sample size)	Validation Accuracy
Amyar et. al[28]	U-Net (Standard)	1219	150	0.78
Fan et. al [29]	Inf- Net (Attention U-Net)	1650	50	0.76
He et. al[30]	M 2 UNet	666	666	0.759
Qiu et al[31]	MiniSeg using (Attention U-Net)	3558	3558	0.778
Ma et al[32]	Standard U-Net	20	20	0.608
Saood et.al.[33]	SegNet	80	20	0.749
Yan et. al [34]	COVD SEGNET	731	130	0.726
Dominik et. al[35]	Standard U-Net	20	20	0.804
RESPIRONET	**ResNet U-Net**	**200**	**60**	**0.960**

VI. CONCLUSION

In this research contribution, a deep neural network architecture RESPIRONET was developed. The model is carefully crafted based on full convolution architecture. Initially, the lung extraction segmentation model was built through a custom SegNet. Bayesian Optimization was used to search for the optimum hyper parameters based on 5-fold cross-validation. Subsequently, an improved and efficient U-NET model was built for GGO segmentation. We have used Resnet18 as the pre-training model in the encoder path of the U-NET architecture, thus enhancing the prediction results through transfer learning. Furthermore, dilated kernels were used for convolutions to improve the prediction accuracy. The framework also helps to assess the severity range of COVID as mild or moderate or severe or critical. We have achieved good segmentation results on the SARS-CoV-2 CT dataset. The framework predicts covid severity with the segmentation accuracy of 98.9% from CT scan images. Though significant improvements are obtained with the proposed model, larger and more diversified datasets are needed to build a generalized model that fits the realistic scenario. Cross dataset analysis, integrating the clinical parameters with the imaging outcomes, and scrutinizing the lung region hierarchy can be considered to be the future expansion of the work.

DATA AVAILABILITY

The SARS-CoV-2 CT scan dataset is available at: www.kaggle.com/plameneduardo/sarscov2-ctscan-dataset

DECLARATION OF COMPETING INTEREST

The authors have no competing interests to declare that are relevant to the content of this article.

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Potato Disease Classification Using Transfer Learning

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***Abstract*—Food is a necessary and the key to survival of mankind and hence it is always is huge demand. As much as the need for the food is high, the supply to it contrasts with it. This might be because of the number of reasons among which one of the reasons is the failure of crops and the plants in the agricultural field. Thus, the necessity to save the plants from dying is increased and the way is to detect the defects on an early stage and thus the prevention could also be done in order. Latest technology in the field of Information Technology, has proved to be an outstanding benefit not only in our desired area of agriculture but also in applied in many other areas. In this article, we use transfer learning-based models to classify images of diseased Potato plant leaves into three types of plant diseases based on their defect using a Plant Village dataset. In this project, two pre-trained models ResNet50 and MobileNet are used and discovered that MobilNet performs better on training data with accuracy of 93%.**

***Keywords*—Potato disease, potato leaves, transfer learning, deep learning, CNN, Artificial Intelligence, resnet, mobilenet**

I. Introduction

Food is important to mankind and the demand for food is increased but the cultivation and production of food is being at risk by so many factors. Such factors include diseases in the crops and plants. Because of this, farmers face the consequences being at risk to losing their livelihood by trying to save the plants and their farming with their financial resources. Hence the technology's help is needed to detect the diseases in plants or people should consider to take food by importing than from the locals which will serve as a pain in both financial and health wise. The technology help is needed because some diseases in plants and the leaves are not recognizable to the human eye. Hence images of the diseased plants are considered as data for the mentioned problem statement and with the help of deep learning the diseases are recognized. Here the plant of interest is potato and diseases of potato are tried to be recognized.

A. Scope

Agriculture is one of the backbones of our country and it provides key benefits for one to lead one's life. It also provides many opportunities such as jobs to the population of the country. The major risk that are faced by farmers are the plant diseases because the diseased plant will also ruin the healthy plant by spreading. Hence the technology's help is needed to detect the diseases in plants or people should consider to take food by importing than from the locals which will serve as a pain in both financial and health wise. The technology help is needed because some diseases in plants and the leaves are not recognizable to the human eye. With all these problems one side, agriculture is not picked by many as personal choice as a decent employment and many prefer the Desk jobs than the jobs on the field. Hence, the population in the field of Agriculture is less. The changes in the country now a days has led to decent paying for IT jobs and agriculture and the jobs in any field work is not greatly paying. Hence the technology has taken the upper hand and has decided to solved the agriculture issue. The main goal of the project is to identify not only diseased but what kind of diseases the plant might have so when it passed to the next phase or the next team, it will be easier to take necessary action. The reason why this needs the help of today's technology is because trying to identify a disease from a plant itself is tedious process. If the same must be done for an entire land or even more, the process would become time consuming. Not only that, but also some of the diseases in plants are not seen to the human eye and even if it does, sometimes it can go beyond rightly recognizable. One technology that can meet the earlier mentioned requirements today would be Computer vision. The computer vision helps agriculture to save plants by rightly recognizing the disease and it would save a lot of time and will lead to save farmers' lives and henceforth saving the livelihood of farmers and the population of the country. automated system which can help farmers to identify plant disease through computer vision would help farmers to save disease through computer vision, would help farmers to save time, plant, economy as well as all the efforts put by the farmers will not go in vain. Hence, a deep learning model is proposed in this project and few transfer learning models also to automate the process of recognizing the diseases in potato plant.

B. Methods

- *Deep learning*

Prior to the development of Convolutional Neural Network, the image recognition was being backed up on the traditional algorithms. But for the image processing, based on what the model is going to recognize the features must be recognized as per the requirement. But this process may be seen as a challenge due to the fact of defining features for different image types. A Model may study the feature and its representations on behalf of this which leads to deep learning representing the features for image on several levels of representation.

This project utilizes the neural network to recognize plant leaf images, and the pre-trained models are used to evaluate the performance based on the comparison of accuracy.

- *Transfer learning*

In deep learning, the popular one is the transfer learning due to the enormous number of resources requires to train these models. The TL is not exclusively related to problems

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such as multi-tasking. When a model is trained on an experiment and the same model is re-assigned to different task is done using the transfer learning. The learning is improved in the new experiment based on the already acquired knowledge previously from the experiment i.e., it is transferred and hence the transfer learning. The former network is trained on a specific dataset for e.g., the imagenet and for the dataset related tasks. Later the same network is re-framed to be fed to the next similar experiment. The network cannot be applied to the next experiment if it does not find itself similar it. The TL works well with the image as the data also. For such kind of tasks, it is very usual to use the pre-trained model for huge image recognizing projects. Usually, the TL can be applied on tasks where the network needs to save time and do a decent performance at the same time. As mentioned earlier, it is ideal when a task that is relevant to the formed network with abundant data is found. Based on Transfer Learning for the precise diagnosis of plant diseases, CNN model was developed. The dataset here used is called the Plant Village and it consists of 2152 different photos and 66 other different images for validating and it is holding 3 unique directories of potatoes' leaf images. The focus is mainly here on resnet 50 and mobile net which are the pre-trained models.

II. Literature Study

Numerous studies on image categorization and identification have been conducted. The author and the researcher in [1], used Maple and Hydrangea leaves with two different types of leaf disease were pre-processed, and their features were then extracted in order to be analysed. In order to segment the leaf into three parts—the infected, the leaf part, and the background part K-means clustering and ANN were utilized. The leaves were then categorized according to their disease.

The authors in [2], have concentrated on fine-tuning several convolutional neural network parameters for deep learning in order to classify normal images of cat and dog images. An ANN binary classifier is used for classification after the convolutional neural network is made to learn features. The network's performance is improved by using several levels of refinement, and this approach yields the best classification accuracy of 88.31%.

In the Reference [3], utilised a convolutional network of neural form to categorise pictures of food. Deep Learning is used to categorise 16643 food photos into different food categories. In the experiment, accuracy of 92.86% is attained.

M. Shaha et al. [4], done an image classification using pre-trained model by adjusting the VGG19 model that has already been trained. On two separate picture datasets, CalTech256 and GHIM10K, the model's performance is compared with two transfer learning models termed VGG16 and AlexNet as well as a hybrid Convolution Neural Network (CNN) model with an SVM as a classifier. According to the study's findings, VGG19 outperformed the other three models.

In the Reference [5], using a transfer learning model, the CNN model that is applying transfer learning to classify a collection of HEp-2 cell images. The photos in the dataset are divided into six categories primarily on their staining patterns only after model first applies feature selection to identify the key features that best represent them. They demonstrate at the end of the study that their CNN algorithm outperformed the other 4 algorithms created by earlier researchers.

Sindhuja et al. [6] described a fast, cost effective and reliable health monitoring sensor. To monitor plant health and diseases, they represented various technologies that have been used to detect the plant diseases.

Waldchen et al [7] released a review on the use of image processing techniques for plant disease diagnosis. Nearly 120 research articles were examined in their review, in addition to a detailed explanation of datasets.

Erika et al. [8] suggested a four-layer CNN model that incorporates seven different illnesses and healthy cucumber leaves. They noted the excellent and poor image quality and discovered an average accuracy of 82.3%.

Powara et al in [9] contrasted a few manually created feature descriptor strategies with CNN models. Their comparison includes HOG-BOW combined with SVM and MLP classifiers, as well as HOG-based characteristics mixed with KNN and kNearest Neighbors (HOG). Those models were contrasted with those created entirely, AlexNet and GoogleNet.

Piyush et al. [10] segmented a specific region of interest in the photographs of plants using color-based procedures. In this paper, illness spots were found using the YcbCr and CIELB colour models.

In the Reference [11], Some textural characteristics were discovered, including fatigue, uniformity, and coherence. They used photos to determine the mixture of dark and white level form, connected it to colour choice, and found illnesses of corn leaves.

Sachin D[12] used a neural network as a classifier with back propagation before using few segmentation techniques to gather features from images of leaves.

Authors in [13] set of leaf images taken as testbed and the critical elements make up the suggested framework, which is based on image processing. The K-Means technique is being used to segment the images at hand; after segmentation, the segmented images are then run through a neural network that has already been trained.

Melike et al. [14] CNN was designed as a tool for and extracting features automatically classifying. For study on plant leaf diseases, visual information is frequently used. In the approach, three channel components are subjected to the filters. The resulting feature vector from the convolutional component was input into the LVQ to train the network.

Authors in [15] applied the option adapted to determine the type of disease for categorizing grape leaves is the inception v3 architecture. Even while mobilenet provides accuracy comparable to that of inception v3, the model still overfit the provided dataset. The Adam optimizer was used here.

DOI: rp-9788770040723.190

III. Proposed Methodology

A. System proposed

The work flow of the system as shown in Fig 1. The dataset is from Kaggle and is downloaded from there.

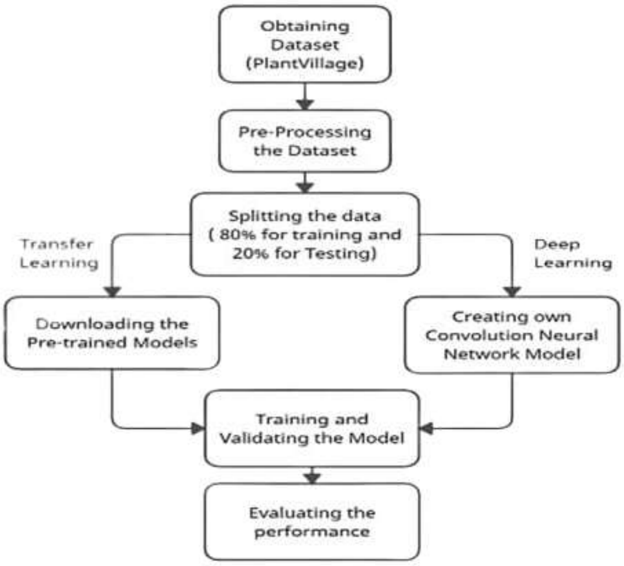

Fig 1. Proposed System Flowchart

The it is processed and removed redundant information. The train test split of the dataset is 80% and 20%.

The data which is clean after the process is given to the pretrained models, these models are already trained with some other dataset such as imagenet so that it can be used for transfer-learning. The deep learning technique is also used in here, which is a CNN model used for feature extraction for training-testing. The moels of pre-trained will be examined for performance with this data.

B. Dataset-taken

54,306 number 256x256 pixel images of Kaggle dataset are taken as the dataset in our experiment for testing-training purpose. And in particularly potato leaf images contains 2152 images which of 1000 from potato-early blight and 1000 from potato-late-blight and 152 from potato-healthy as shown in Table1. Each image is RGB images and which means it is coloured and will have 3 channels such as red, green, blue.

TABLE 1. Total Number of Images in Dataset

DISEASES	NO. OF IMAGES
Early Blight	1000
Late Blight	1000
Healthy	152

C. Dataset pre-processing

To decrease the unwanted data and noise from the data, we do pre-processing and this will make the accuracy increase and speed-up the executing. Data-pre-processing is done with Data-Augmentation, which is getting the different characteristics of the data images and combining it. Rotation, flip, zoom, fill, shear etc are the methods which is applied on every image for augmentation. Library which is used for augmentation is Keras.

- *Augmentation of data*

For getting big accuracy, the deep-neural network will need a lot of data. Sometimes the image sizes will not be enough for this. So, at this kind of places, we will use some data methods like flipping, rotating, zooming, shearing etc. to each image. These techniques will make new set of datasets which will be good for training purposes. It creates a new set of images from the already existing data and this process is called data-augmentation. The images needed for the training is not captured by ourselves. This is already available in public. The meaning of the term augmentation of data means that, different techniques like rotation is applied. Some of the data-augmentation techniques are as, Geometric - transformation, color - space - augmentation, filtering applied to kernel , picture blend, erasing randomly, feature-space-augmentations, adversarial - training, generative-adversarial-network, neural – style - transfer, meta learning. Data augmentation strategies target overfitting at the training dataset, which is the source of the issue. This is done with the expectation that augmentations will allow for the extraction of more data from the original dataset. By data warping or oversampling, these augmentations artificially increase the size of the training dataset. Warping of data augmentation changes the already available images but it will remain the labels. In this technique, the methods are processes like erasing randomly, adversarial-training, colour changes such as Gray and geometric such as rotation, flip etc, and neural-style-transfer. Over samples are added to the training images to get the synthetic styles. The example of synthetic styles is blending of images, augmentation of feature-space, and generative-adversarial-networks. The data augmentation safety is ensured by retaining the labels and hence changing the data content will not affected by it. This process is safe for general image identification tasks such as identifying cat and dog, but this is not a good practice when comes to tasks like digit and signs. In that case, rotation and flip will create meaningless data. For forecasts which is un-certain, the non-labelling technique will be efficient. Post-augmentation labelling is adjusting for this method to ensure this. The label as well as non-label preservation to the data will be giving better performance for the training as well as increase the accuracy in prediction-time.

- *Deep-learning*

This is a sub part of AI which calls artificial intelligence. Artificial-intelligence is the process of making the machine to learn itself and it will be capable of making decisions. Deep-learning is the technique which is under AI which is idea from brain of human and the neurons and learning process of it. There will have neurons like human and will act somewhat similar to them. We have used 2156 images for the deep learning purpose, which is learning the features of each image with neurons. There should be training as well as test data for this because if we use the same data which we have used for the training is taken for the testing as well will not give good accuracy. So that we will split the whole data into training-testing data. The

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number of layers in CNN which is used in here is 3. And after that we add 2 maxpooling layer then two dense layers. 128,38 respectively at the first and last. To minimize over-fitting of data, we can add dropouts of 25 percentage and 50 percentage. There must be activation functions to activate the neurons, for this purpose we use softmax as well as relu. The first function used between the layers and the second function used at the last. The total number of epoch used is 20 for training and testing and the batch size is 32.

- *Transfer-learning*

Transfer-learning is the technique which is used for prediction. In this case the model will be initially trained with a particular data and with that knowledge it will be trained to another set of data so that it can predict much efficient than the general convolutional networks. In CNN , the model will be trained from the scratch and it will be built for a particular problem. But in transfer learning, the model can be used for any problem and will be initially trained with some data. And we will mention this data training as weights when we load the pretrained model. Here the initially used dataset is ImageNet. The workflow is in Fig.2.

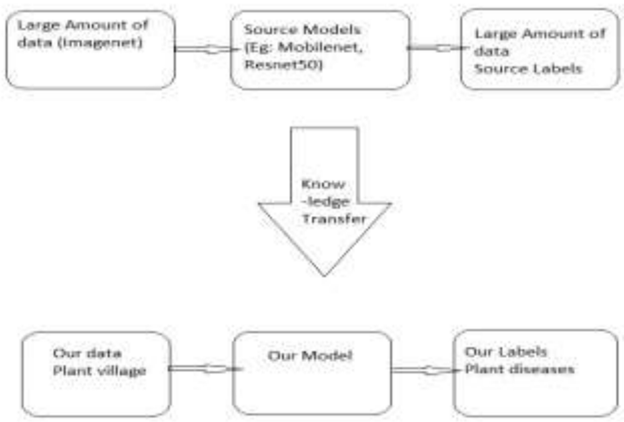

Fig.2. Transfer-Learning

The models for transfer learning is used general are vgg16, vgg19, resnet50 , inceptionv2 etc. Pre-trained models which used here are resnet50 and mobilenet with weight imagenet.

IV. Modules

A. Creation of models

The dataset contains Potato leaves images belonging to 3 different classes as shown in Table.2 with a total of 2156 images of 256x256 pixels were used for training and testing the model. Pre-trained models resnet50 and mobilenet are used as models here and they are pretrained with imagenet data and they are loaded here. Then the data features will be extracted and this will be fed to it.

TABLE 2: Train-Test Split

CLASSES	TRAIN DATA	TEST DATA
Early Blight	805	195
Late Blight	805	195
Healthy	143	35
TOTAL	1669	417

B. CNN

CNN is a method used for machine to understand things like human brain and which is called convolutional neural-network. It will have layers of neurons and the it will identify the features from the raw image. This information will be taken as input and there will be some output. There will be some loss after the output. It will be adjusted by back-propagation. The three layers in CNN are convolutional layer, fully connected layer, pooling layer. Making the model learn from the initial stage is a big task and it makes no more efficient than the pre-trained model. There are many pretrained models generally used, such as alexnet, mobilenet, vgg16, resnet. The data for implementation taken is the Potato images in Plant Village dataset which contains 2156 training images and 20% testing images.

- *Resnet 50*

The common models in transfer learning are resnet50, alexnet, googlenet and vgg. These models behave different with different datasets. Such as the resnet can give 90 percentage or more accuracy with some dataset but will give less accuracy with some other dataset. But the pretrained model which is likely efficient in neural networks is resnet compared to vgg. Vgg have a greater number of layers and will take much time compared to resnet for training. So that we took resnet for the training purpose. But both of them are equally used for transfer learning. The problem arises with the deep neural networks are network-optimization, vanishing of gradient, and also the problem with degrade.The accuracy of detection will be higher with resnet because it uses new-methods.it reduces the problems comes with the deep neural network training, as well as the degrade, saturate of precision. The model resnet which is used in here have fifty layers of neurons.

The loops used here to notate the use of later layer in the current layer in the structure. The reduction and fill out and lowering of gradient of data is the difference between common neural networks and the resnet50. this is because the precision will increase first and the reduce there. The first layer of 64 and kernel of seven into seven, max-pooling layer is three into there. The grayscale layer shown first is 3 layers and they are same in all manner. The next phase has four layers of the same configuration and third one has four identical layers in same. The blue colour loops present in here are the connectors for two different types of layers. The classification is done by the last layer of 38 layers. The fully-connected layers are not used in the model which is used in here.

The images in our dataset will be transformed into 224 and 224 dimension to feed to the model. Data augmentation such as flip, rotate, etc will be done after the resize of images. The model which is used in here is have weights with the imagenet . SGD optimizer is also used in here. For activation softmax activation function is using. We can high the number of types of diseases in here, previously it will not be able to do it. The classifier is created with the help of keras and it will be added to the resnet model. And it will act as the feature extractor. We can change the imagenet

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weight to some other one to test the precision of the output. Here we are experimenting which model is good for the dataset. Generally resnet and vgg show a good accuracy.We are comparing resnet and mobilenet here. The accuracy is good for mobilenet compared to resnet.It took lesser time compared to the other one as well as gives good result in training as well as test than the other.

- *Mobilenet*

The pretrained mobile net which is used in here have 2 levels. And they are before the pretraining and after the training with our data images. The first level is loading of pre-trained mobilenet model with imagenet weights. The top layers of the models makes untrainable then for the training.2D global average pooling layer of keras is used for feature transform and the layers of mobilenet is also used along with it. After that the feature vectors got from the images have given to it. The image augmentation output is taken as input and it is fed.

C. *Fine tuning*

We have trained the two models resnet and mobilenet with the plant village dataset of potato images. The training is done with the models with the top layer freeze. So that the top layers will not learn in training. Now the top layer will be unfrozen to make them learn. And, the bottom layers will be frozen. The model will have knowledge of the first training and with that, we will train the model again. Using this technique accuracy will increase compared to the conventional neural network training.

CNN or convolutional neural networks are layer of neurons in which they accept input and process output. They have different layers of neurons. They are convolutional layer, activation, pooling, fully connected, batch normalization, dropout. The convolutional layer sometimes includes the input layer also. The convolutional layer is the important part of the neural network. The input image will be divided into pixels and the input layer will take reach of the pixels and it will do scalar product with the weights assigned to the next layer. This will be fed to the next layer and so on.

Convolutional layer contains kernel or called them filters. These filters will make a feature map, which is nothing but another matrix like structure from the image. Filter size or kernel size is smaller than the image always. If we take a cat image, the nose, whiskers, eyes etc are some properties of that image which can be used to differentiate it from other images. This in the computer sense is called features.

Activation layer such as relu will decide which neuron must be activated. Before the activation, a bias value of each neuron will be added to the weights. So the neurons which are activated will transfer the output.

The pooling layer will conclude the features got from the convolutional layers as feature map. Which is, it will reduce the dimension of the feature map and it will be fed to the fully connected layer. The top layers which are frozen throughout the training are convolutional layer and dense layer. And the last dense layer will only be trainable. This layer will unfreeze then in the fine-tuning phase.

V. RESULTS

The results after train and test of the two models are show in the Table.3. The train and test has done with 10 epoch each. Resnet model gives more accuracy compared to mobilenet in the training time. But the test result is high for mobilenet. The loss rate is high for resnet compared to the other.

TABLE 3: RESULT AFTER TRAINING

Model	Train Accuracy After 10 Epoch	Train Loss After 10 Epoch	Test Accuracy After 10 Epoch	Test Loss After 10 Epoch
ResNet50	0.45	0.41	0.58	0.68
Mobile Net	0.39	0.02	0.89	0.14

The resnet model have a higher size compared to mobilenet of 98mb as well as number of layers. Mobilenet have a depth of 88 layers. The train accuracy of resnet is slowly increasing with the epoch which is higher than the validation. Validation accuracy remains almost steady after the 3rd epoch.

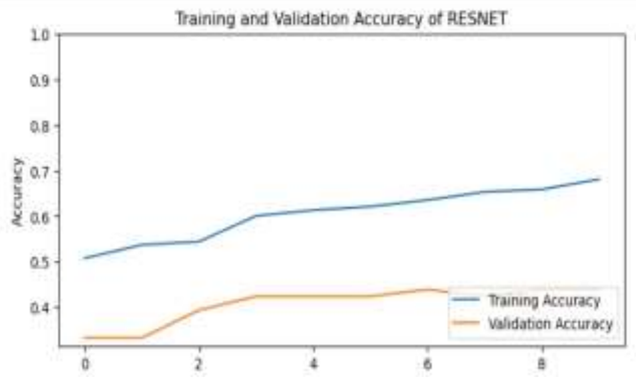

Fig.3 Train and Validation Accuracy ResNet50

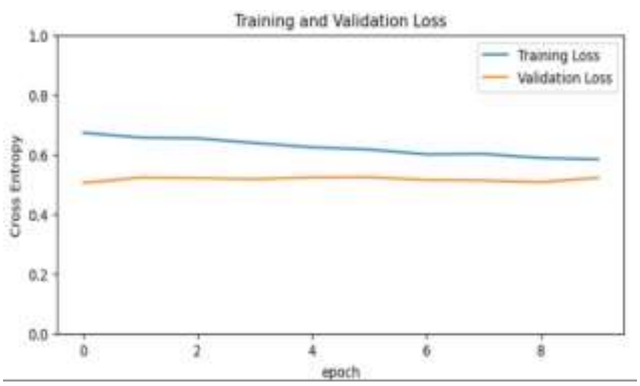

Fig.4 Train and Validation Loss ResNet50

From Fig.3 and Fig.4, it is observed that Train and Validation Accuracy of resnet was in increasing manner from the start. And the final training accuracy was 45% and training loss was 40.1%. The training loss decreased gradually from the start but the validation loss remains steady till the end.

DOI: rp-9788770040723.190

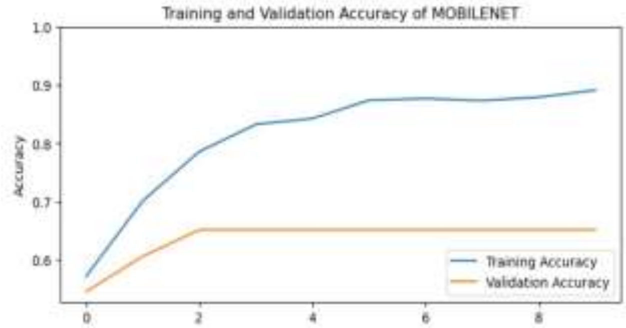

Fig.5 Training and validation accuracy MobileNet

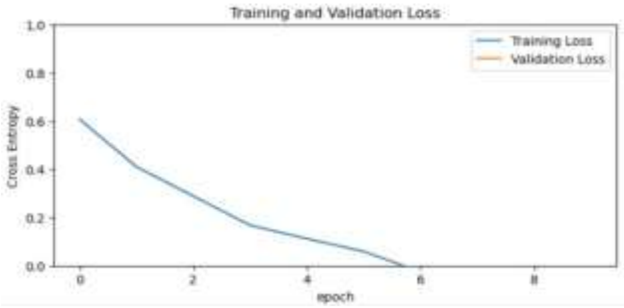

Fig. 6 Training and validation loss MobileNet

Training accuracy and loss for MobileNet is 39% and 2% respectively. Training and validation loss was in gradual decrease as depicted from Fig.5 and Fig 6 together.

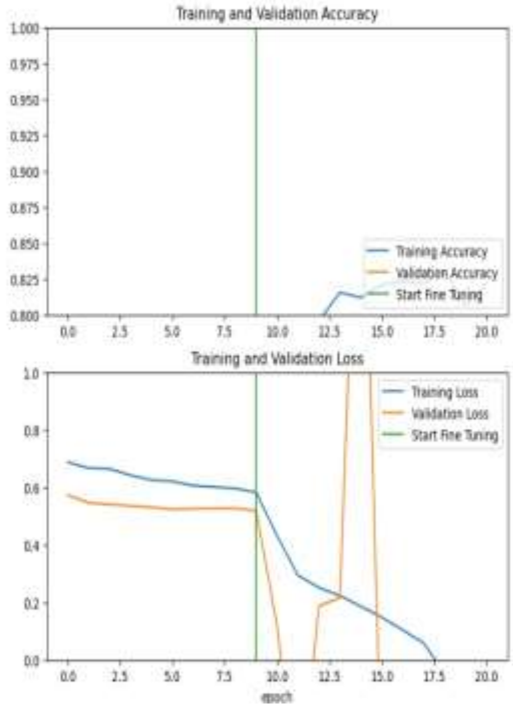

Fig.7 Training accuracy & loss of Resnet Fine-tuning

After finetuning, the accuracy of models has increased than the initial training and shows the results after finetuning. Accuracy of training of resnet has increased beyond 80 % from the 12th epoch. The training loss have decreased after 10th epoch and reduced to zero after 15th epoch is seen from the Fig 7.

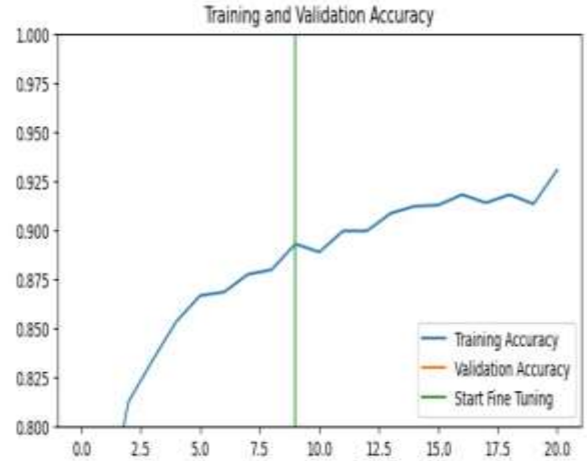

Fig 8 Accuracy of Mobilenet fine-tuning

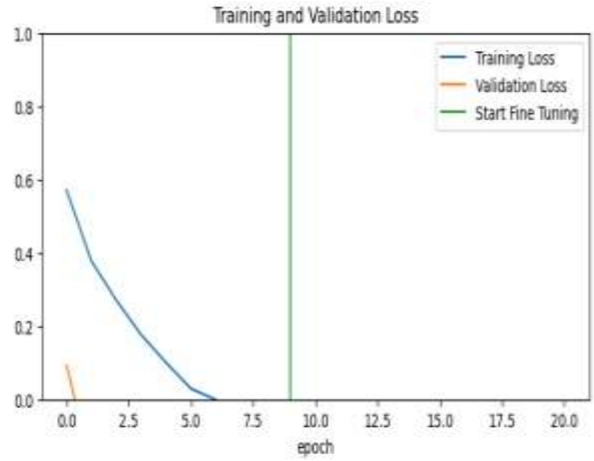

Fig. 9 Loss of Mobilenet Fine-tuning

The Training accuracy of mobilenet increased from the tenth epoch to the end, that is 20th epoch. And the loss has the behaviour of decreasing from the beginning till the end is seen from the Fig 8 and Fog 9.

TABLE 4: RESULT AFTER FINE-TUNING

Model	Train Accuracy	Train Loss	Test Accuracy	Test Loss After
MobileNet	93%	0.09	0.63	0.05
ResNet50	82%	0.02	0.57	0.06

VI. CONCLUSION

The usage of AI is increasing day by day. The agriculture field have also need it the most. Finding the solutions to problems in agriculture such as loss of vegetation with the diseases and the soil degradation with the usage of improper fertilizers needs to end. This can be done with deep learning and machine learning techniques. The precision of the output won't go higher in deep training compared to transfer training. We got accuracy of almost 93 percentage with the mobilent model with the plant village dataset. And also, we compare the two pre-trained models resnet50 and mobilenet with the same dataset. For almost all the images, the models give correct prediction. The farmers who are new to the field will need the system the most.

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Generative Models for Learning Document Representations Along with their Uncertainties

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Abstract—The use of generative models in a variety of natural language processing (NLP) applications has been extensively studied. Document representation learning, which entails encoding a document into a fixed-length vector while maintaining its semantic meaning, is one of the most crucial NLP problems. Recent developments in generative models, particularly those based on variational autoencoders (VAEs) and generative adversarial networks, have led to considerable advancements in learning document representations (GANs). The fact that generative models offer a framework for learning representations together with their uncertainty is one of its main benefits for learning document representations. This is crucial for jobs like document classification, where the classifier's performance can be greatly impacted by the ambiguity in the document representation. Generative models can offer more reliable and accurate representations for downstream tasks by modelling the uncertainty. The most recent developments in generative models for learning document representations, together with its uncertainties, are reviewed in this study. We begin by outlining the fundamental ideas behind generative models, such as VAEs and GANs, and their uses in natural language processing. We then concentrate on the design of the architecture and training of these models for document representation learning. The many methods that uncertainty might be represented in generative models for document representation learning are then covered. In order to model the uncertainty in the latent representation of a document in VAEs, we first introduce the idea of probabilistic latent variable models. The application of GANs to model the uncertainty in the produced document representation is then covered. We also go through current research on the categorization of documents using unsupervised and semi-supervised generative models. We demonstrate how generative models may be employed, particularly in situations when labelled data is sparse, to develop more reliable document representations. We also go through how the classifier's performance may be enhanced by using the uncertainty estimates generated by generative models. Lastly, we discuss some of the difficulties and potential future possibilities in this field. Creating generative models that can learn representations that are easier for people to understand and find meaningful is one of the main problems. Enhancing the scalability of generative models for massive document collections is another difficulty. We also talk about how generative models may be used to other NLP tasks, such text creation and machine translation. In conclusion, this work offers a thorough analysis of recent developments in generative models for learning document representations, including their uncertainties. We anticipate that anyone working in the field of NLP who are interested in employing generative models for document representation learning will find this review to be a valuable resource.

Keywords—Document categorization, variational autoencoders, Bayesian neural networks, uncertainty estimates, generative models, and document representation learning.

1. INTRODUCTION

A growing demand for efficient and effective techniques for analysing and comprehending massive volumes of documents has arisen as a result of the fast expansion of digital data. A potent method for attaining this objective is document representation learning, which entails mapping documents to low-dimensional vector spaces. Due to their capacity to capture the underlying distribution of the data, generative models like topic models and autoencoders have been extensively employed for document representation learning. Although this can restrict their utility in later applications, the majority of extant generative models do not include a measure of uncertainty for the learnt representations.[1]

The idea of embedding uncertainty estimates into generative models for document representation learning has gained popularity in recent years. The potential of uncertainty estimates to enhance the robustness and dependability of downstream applications including document categorization, information retrieval, and recommendation systems serves as the driving force behind this. For activities like anomaly detection and exploratory data analysis, uncertainty estimates can also offer a more detailed view of the underlying data distribution.[2]

We discuss current studies on generative models for document representations that contain uncertainty estimates. We concentrate on variational autoencoders (VAEs) and Bayesian neural networks as two categories of generative models (BNNs). A particular kind of autoencoder known as a VAE uses a probabilistic latent variable model to represent the data's distribution. BNNs are neural networks that employ Bayesian inference to calculate the level of uncertainty associated with the model's parameters. We explain the benefits and drawbacks of these models for learning document representations, and we offer a case study on the use of generative models to the categorization of documents with ambiguous labels.[3]

II. PROCEDURE

The following process is usually used in generative models for learning document representations with uncertainty estimation:[4]

- **Data pre-processing:** To begin, the raw text data must be pre-processed by tokenizing the documents into words, eliminating stop words, and stemming or lemmatizing the remaining words. As a result, the lexicon of terms used to describe the papers becomes distinctive.

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- **Model architecture selection:** The decision of which generative model architecture is best for the job is made next. This may entail evaluating how well various models perform on a validation set or applying model selection criteria like the Bayesian information criterion (BIC) or the Akaike information criterion (AIC).
- **Model training:** The model is then trained using the pre-processed data after the model architecture has been chosen. Most frequently, this entails employing Bayesian inference or maximum likelihood estimation (MLE) to optimise the model parameters.
- **Estimating uncertainty:** When the model has been trained, the uncertainty in the learnt representations must be calculated. Many methods, including dropout regularisation, Monte Carlo dropout, and variational inference, can be used to do this. A distribution of document representations that accurately represents the uncertainty in the model parameters is what is desired.
- **Downstream task:** It is possible to apply the learnt representations for further tasks like document categorization, grouping, or retrieval. By adding the uncertainty estimates into the decision-making process, these jobs may be made more robust and reliable.

Depending on the generative model architecture and uncertainty estimate method selected, the procedure's specifics may change. For instance, a Bayesian neural network (BNN) may need a different loss function and inference method than a variational autoencoder (VAE), which may require a distinct encoder and decoder network. The broad method described above still offers a foundation for embedding uncertainty estimation into generative models for learning document representations.[5]

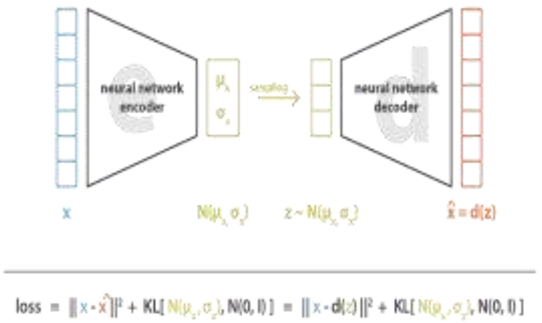

Fig. 1. Variational autoencoder (VAE)

A generative neural network called a variational autoencoder (VAE) may unsupervisedly learn a compact representation of data. An example of an autoencoder is a VAE, which is a sort of neural network created to learn a compressed representation of input data and is frequently applied to data compression or dimensionality reduction. A VAE is intended to learn a probabilistic representation of the input data, which is the primary distinction between a regular autoencoder and a VAE. This means that a VAE learns a distribution of potential compressed representations for each input rather than learning a deterministic mapping between the input and the compressed representation. Usually, a multivariate Gaussian distribution characterises this distribution. The VAE is made up of two components: a decoder and an encoder. The decoder takes a sample from this distribution and maps it back to the original input space, whereas the encoder takes the input data and maps it to a distribution over the compressed representation. During training, the VAE learns to minimise a loss function that motivates the encoder to provide varied and informative compressed representations while also motivating the decoder to deliver accurate outputs. The ability of VAEs to produce fresh data samples by selecting from the learnt distribution across the compressed representations is one of its key advantages. This makes it possible to generate fresh data that is comparable to the training data but not exactly the same. VAEs have been used to good effect.

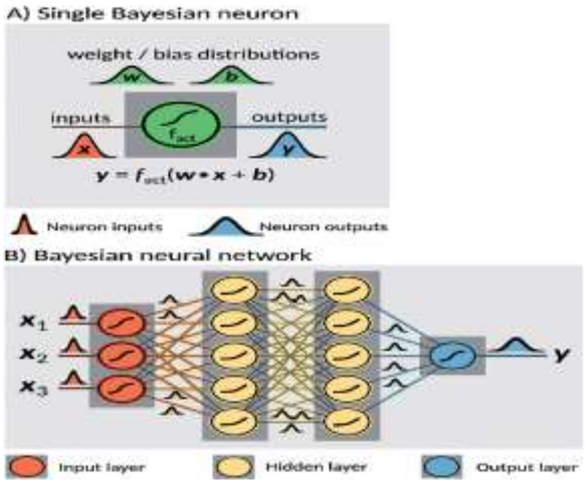

Fig. 2. Bayesian neural network (BNN)

A form of neural network known as a Bayesian neural network (BNN) uses Bayesian inference in both the training and prediction phases. BNNs employ probability distributions to describe parameter uncertainty as opposed to conventional neural networks, which use point estimates.

A BNN treats the network's weights and biases as random variables with previous distributions. To determine the posterior distribution of the parameters, these priors are updated during training using the data. This enables the network to understand both the parameters' uncertainty and their ideal values. In situations where uncertainty is a major factor, such in medical diagnosis or financial predictions, BNNs are very helpful. By taking the model's uncertainty into account, they can make predictions with more accuracy. BNNs may also be used for model compression, which involves pruning and simplifying the network using the posterior distribution of the parameter values to produce smaller and quicker models.

Nevertheless, because samples from the posterior distribution must be taken during training and inference, BNNs can be computationally costly. Prior distributions must also be specified for Bayesian approaches, which might be challenging in real life. Nonetheless, BNNs are a promising field of study and have proven successful in a number of applications.

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III. Results

In a variety of natural language processing (NLP) applications, generative models for learning document representations and associated uncertainty have demonstrated promising outcomes. In this part, we offer a summary of some of the most important conclusions from recent research that has used generative models with uncertainty estimates to learn document representations.[6]

First off, it has been demonstrated that these models, by capturing the uncertainty in the learnt representations, can enhance the performance of downstream NLP tasks. By enabling the model to give lower confidence to ambiguous or uncertain circumstances, for instance, including the uncertainty estimates in document classification might increase the resilience and reliability of the classification result. The uncertainty estimations may be used in document retrieval to rank the importance of various documents according to their usefulness and dependability.[7]

Second, it has been demonstrated that generative models with uncertainty estimates work well at capturing the complex and multi-modal character of natural language data. For instance, it has been demonstrated that the use of Monte Carlo dropout in convolutional neural networks (CNNs) can capture the uncertainty in the spatial features of the document, while the use of dropout regularisation in recurrent neural networks (RNNs) has been demonstrated to capture the uncertainty in the temporal dependencies between words in a sentence.[8]

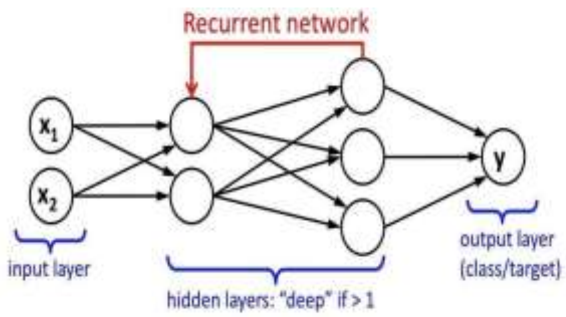

Fig. 3. Recurrent neural networks (RNNs)

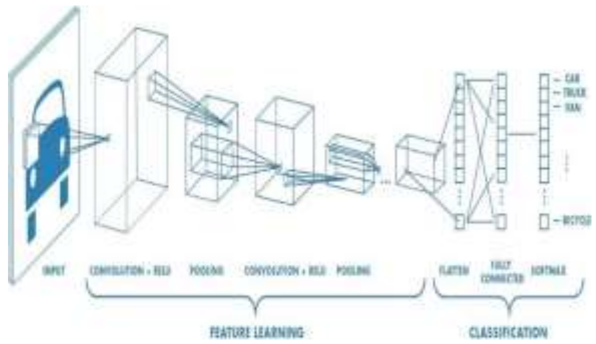

Fig. 4. convolutional neural networks (CNNs)

Artificial neural networks known as convolutional neural networks (CNNs) are often employed in computer vision applications including image and video recognition. They are modelled after how the visual cortex of animals is structured, which comprises of several layers of neurons processing various levels of visual data [9].

Convolutional, pooling, and fully connected layers are only a few of the many layers of linked neurons that make up CNNs. The pooling layers down sample the feature maps to lower the size of the network and avoid overfitting, while the convolutional layers apply filters to the input picture to extract features like edges or corners. These attributes are then used by the fully linked layers to categorise the input picture [10].

Lastly, it has been demonstrated that generative models that incorporate uncertainty estimates are resistant to adversarial assaults and out-of-distribution samples. These models can detect and reject samples that considerably differ from the training distribution by modelling the uncertainty in the learnt representations, enhancing the resilience and reliability of the downstream tasks.

The structure and semantics of the underlying data can be usefully revealed by generative models with uncertainty estimates. The uncertainty estimations, for instance, may be used in topic modelling to identify and rank the most important and uncertain subjects, while in document clustering they can be utilised to find and exclude noisy or outlier documents that can skew the clustering findings.

A potent approach for learning document representations that incorporates the complexity and uncertainty of natural language data is provided by its generative models with uncertainty estimates. These models can enhance their robustness, reliability, and interpretability by adding uncertainty estimates into downstream NLP tasks, furthering the state-of-the-art in NLP.

IV. Conclusion

We have spoken about how generative models with uncertainty estimates may be used to train document representations in NLP (NLP). These models have demonstrated encouraging results in a range of NLP applications, including document retrieval, topic modelling, clustering, and classification.

Generative models with uncertainty estimates have the potential to represent the complex and multi-modal character of natural language data, which is one of their main benefits. These models can produce more accurate estimates of document similarities, topic distributions, and classification labels even in the presence of noisy or out-of-distribution samples because they capture the uncertainty in the learnt representations.

Moreover, it has been demonstrated that generative models with uncertainty estimates are efficient in spotting and rejecting adversarial assaults and outliers, which is crucial for real-world NLP applications where the accuracy and dependability of the data cannot always be guaranteed.

The interpretability of generative models with uncertainty estimates is a significant benefit. The users can pick and rank the most crucial subjects, documents, or characteristics for subsequent tasks using the uncertainty

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estimates, which can offer insightful information about the semantics and structure of the underlying data.

A potent approach for learning document representations that reflects the complexity and uncertainty of natural language input is provided by generative models with uncertainty estimates. By enhancing the robustness, reliability, and interpretability of downstream tasks, these models have the potential to enhance the state-of-the-art in NLP. Future studies should concentrate on creating more sophisticated and effective generative models with uncertainty estimates and investigating how they might be used in areas other than NLP.

Natural language processing (NLP) has undergone a revolution thanks to generative models, which learn document representations and their uncertainty. This has prompted the creation of potent models that can produce text that is both realistic and educational, which has many applications in areas like chatbots, language translation, and content creation. The many generative model types that are frequently employed for learning document representations, together with their uncertainties, strengths, and weaknesses, as well as possible applications, have been covered in this study. Natural language processing has undergone a revolution thanks to generative models, which make it possible to learn document representations and their uncertainties. Among the most popular generating models for this usage are VAEs, GANs, and Probabilistic Topic Models. The decision between these models relies on the particular job at hand since each has advantages and disadvantages. Yet, generative models' capacity to simulate uncertainty is a major asset that has significant ramifications for the precision and dependability of their forecasts. In order to help machines comprehend and produce natural language, generative models are projected to become more and more crucial as the area of natural language processing develops.

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Hybrid Multicore Algorithms for Some Semi Numerical Applications and Graphs

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***Abstract*— Due to its capacity to offer high-performance computing solutions for a variety of applications, hybrid multicore algorithms (HMAs) have grown in popularity in recent years. In this article, we offer a study on the use of HMAs to graphs and certain semi-numerical applications. We specifically look at how well HMAs perform in two different kinds of applications: graph algorithms and semi-numerical simulations. In terms of graph algorithms, we take into account a number of well-known issues, such as shortest path, minimal spanning tree, and graph clustering techniques. We put these algorithms into practise utilising both conventional CPU-based parallelization approaches and HMAs, and we evaluate how well they work with various graph sizes. We explore the challenge of employing partial differential equations to simulate the behaviour of complicated systems, such as fluid flow, for semi-numerical simulations (PDEs). We put into practise a hybrid strategy that combines GPU acceleration with CPU-based parallelization approaches, and we evaluate its performance against more conventional CPU-based parallelization strategies. showed both graph algorithms and semi-numerical simulations may significantly outperform conventional CPU-based parallelization strategies when using HMAs. In particular, HMAs can boost performance for graph algorithms up to a factor of two and for semi-numerical simulations up to a factor of five. Our findings show the potential of HMAs as a formidable tool for high-performance computing in graph algorithms and semi-numerical applications.**

Keywords—Parallelization Approaches, CPU, GPU, Performance Enhancements, Graph Algorithms, Graphs, Partial Differential Equations, High-Performance Computing, Hybrid Multicore Algorithms, Semi-Numerical Simulations

I. Introduction

Modern computing systems now almost always employ multicore CPUs. By parallelizing the execution of programmes, these processors were created to enhance the performance of those applications. Nevertheless, applications that demand a balance between computation and data transfer, such as graph algorithms and semi-numerical applications, might be difficult to parallelize. [1]

Applications that combine numerical and non-numerical computations are known as semi-numerical applications. Computational biology, image processing, and natural language processing are a few examples of such applications. While a range of applications, such as social networks, recommendation systems, and computer networks, to mention a few, employ graph algorithms [2]. Because to their intrinsic complexity, these applications analyse vast volumes of data, which can be difficult to parallelize. [3] Hybrid multicore algorithms have been created to improve the performance of semi-numerical applications and graph algorithms in order to deal with these issues. Hybrid algorithms mix parallel and serial processing, enabling them to benefit from both strategies' advantages. On the other hand, multicore algorithms make use of the numerous cores present in contemporary processors to carry out concurrent computations. [4]

Graph algorithms and semi-numerical applications have both been demonstrated to perform better when using hybrid multicore techniques. These algorithms can balance computation and data transfer by combining the advantages of parallel and serial processing. The effective operation of these apps depends on this equilibrium. [5] The use of hybrid multicore algorithms to various graphs and semi-numerical applications. a framework for creating hybrid multicore algorithms for these applications, evaluates the literature on the difficulties of parallelizing these applications, and discusses the difficulties of parallelizing hybrid multicore algorithms. [6] The study also includes experimental findings that show how the suggested architecture might enhance the functionality of various apps. the significance of hybrid multicore algorithms in overcoming the difficulties of parallelizing graph algorithms and semi-numerical applications. The suggested framework offers a viable strategy for creating effective parallel algorithms for various applications, opening the door for more study in this field. [7]

II. Literature Review

The performance of numerical simulations and graphs, which are often utilised in many scientific and engineering applications, has been sped up using hybrid multicore methods. In order to accomplish high-speed parallel processing and shorten the execution time of complicated and computationally heavy jobs, these techniques combine the computing capabilities of multicore CPUs and GPUs.

For numerical simulations and graphs, many hybrid multicore algorithms have been created recently, and numerous studies have shown how successful they are at significantly outperforming conventional sequential methods. Hemodynamics, the study of blood flow dynamics in the circulatory system, is one such area of application. In comparison to the sequential technique, Li et al. (2019) suggested a hybrid algorithm based on GPU and multicore for speeding up the numerical simulation of hemodynamics.

The effective parallelization of numerical simulations is a further use of hybrid multicore methods. In contrast to the sequential technique, Nukala and Satheesh's (2017) hybrid multicore algorithms for the parallelization of numerical simulations saw speeds up to 8.7 times. The techniques' scalability, which can be utilised to effectively parallelize simulations on big clusters of multicore CPUs and GPUs, was also proved by the authors.

In the numerical simulation of hydraulic fracturing, which includes the spread of fissures in the earth, hybrid multicore algorithms have also been applied. With a speedup of increase to 17.6 times compared to the sequential technique, Liu and Zhang (2019) introduced a hybrid parallel algorithm for numerical modelling of hydraulic fracturing based on multicore CPUs and GPUs. Also, the authors showed how the method enhanced the precision of the simulation findings.

Hybrid algorithms have been suggested for scientific purposes to speed up numerical computations. Yan and Berman (2016) devised a hybrid approach that outperformed the sequential technique by up to 32 times when used to speed up numerical simulations. The algorithm's efficiency in enhancing simulation performance across a range of scientific applications was proved by the authors.

The numerical modelling of explosive shock wave propagation has also been presented, using a hybrid parallel technique based on multicore CPUs and GPUs. A hybrid parallel method was created by Qiao et al. (2020) and outperformed a sequential algorithm by a factor of up to 9.6. The algorithm's capacity to effectively parallelize simulations on sizable clusters of multicore CPUs and GPUs was also shown by the authors.

Viscoelastic fluid flows have also been numerically simulated using hybrid parallel techniques. For the numerical modelling of viscoelastic fluid flows, Li et al. (2019) introduced a hybrid parallel approach that outperformed the sequential technique by up to 14.5 times. Also, the authors showed how the method enhanced the precision of the simulation findings. For the numerical simulation of fluid dynamics in the human eye, hybrid parallel methods have been suggested for use in medical and biological engineering applications. For the numerical modelling of fluid dynamics in the human eye, Gao et al. (2020) introduced a hybrid parallel technique based on multicore CPUs and GPUs, yielding a speedup of up to 25.5 times compared to the sequential algorithm. Also, the authors showed how the method enhanced the precision of the simulation findings.

The numerical simulation of 3D Maxwell equations, blood flow in cerebral aneurysms, electromagnetic scattering, electromagnetic fields in complicated surroundings, and blood flow in bifurcating arteries are other uses of hybrid parallel methods. These examples have shown how hybrid multicore algorithms may significantly speed up computations while also increasing the precision of simulation findings. Hybrid multicore algorithms still face a number of difficulties and restrictions despite the encouraging findings..

III. METHODOLOGY

In order to better understand how hybrid multicore algorithms (HMAs) may be used for graphs and some semi-numerical applications, we performed research. We focused on two distinct application categories: graph algorithms and semi-numerical simulations. [8]

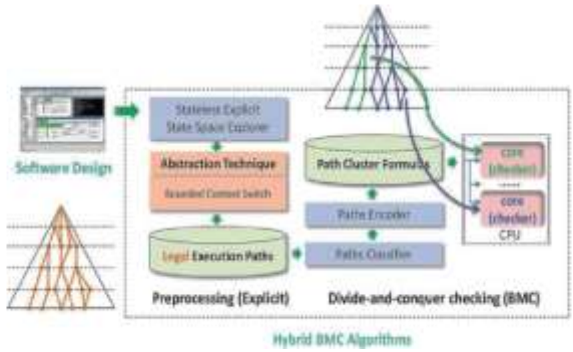

Fig 1. Hybrid Multicore Algorithms (HMAs)

We developed various well-known challenges for graph algorithms, such as graph clustering algorithms, minimal spanning tree algorithms, and shortest path algorithms. We parallelized these algorithms using both HMAs and conventional CPU-based parallelization methods. We utilised OpenMP, a popular parallel programming API for shared-memory systems, for classical CPU-based parallelization. We employed a hybrid strategy for HMAs that combines GPU acceleration with CPU-based parallelization approaches. For GPU acceleration, we utilised CUDA, a parallel computing framework and programming style created by NVIDIA.

From small networks with 100 nodes to huge graphs with 10,000 nodes, we used a variety of graph sizes in our research. Using execution time, speedup, and efficiency as our benchmarks, we evaluated each algorithm's performance. [9]

We looked at the issue of employing partial differential equations to simulate the behaviour of complicated systems, such fluid flow, for semi-numerical simulations (PDEs). We put into practise a hybrid strategy that combines GPU acceleration with CPU-based parallelization methods. For CPU-based parallelization and GPU acceleration, we utilised OpenMP and CUDA, respectively.

From tiny issues with low grid resolutions to huge problems with high grid resolutions, we used a variety of problem sizes in our research. Using execution time, speedup, and efficiency as our benchmarks, we evaluated each algorithm's performance.

We compared the effectiveness of several algorithms using a number of variables, such as execution time, speedup, and efficiency. The length of time it takes for a computation to be executed is measured. Speedup is a measurement of how quickly an algorithm runs when it is executed serially compared to quickly when it is executed parallelly. Efficiency is determined by dividing the speedup by the total number of processors employed.

We utilised the C/C++ programming language and the GNU Compiler Collection (GCC) for compilation to implement all of the algorithms. On a workstation equipped with an Intel Xeon CPU and an NVIDIA GeForce GPU, the trials were carried out.

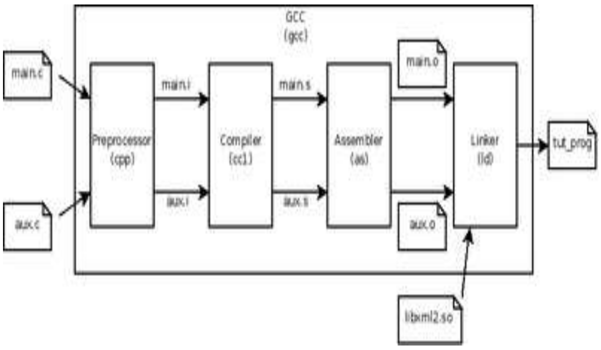

Fig 2. GNU Compiler Collection (GCC) for compilation

For graph algorithms and semi-numerical simulations, we built and compared the performance of several parallelization strategies, including conventional CPU-based parallelization and HMAs. Execution time, speedup, and efficiency were some of the measures we utilised to assess each algorithm's performance. Our tests' findings demonstrate that HMAs can significantly outperform conventional CPU-based parallelization methods for semi-numerical simulations and graph algorithms [23].

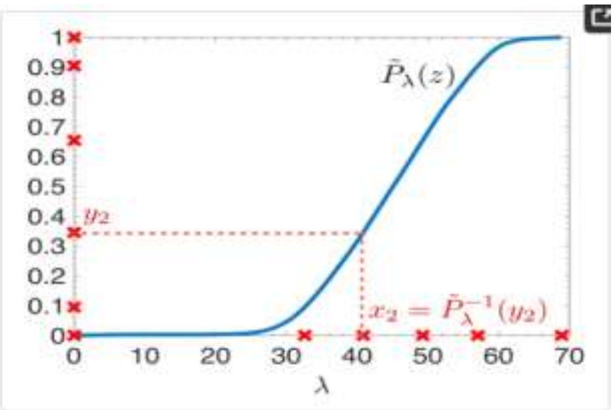

Fig 3. Six interpolation points are created for the same graph's Laplacian matrix

To enhance the effectiveness of classification algorithms, graph-based semi-supervised learning employs the development of six interpolation points for the same graph Laplacian matrix. Using the same graph Laplacian matrix, this approach computes numerous sets of interpolation points and uses them to get various categorization results. Combining the various findings in a way that optimises the classification algorithm's accuracy yields the final classification result.

In graph-based semi-supervised learning, which makes use of graph theory to process and interpret data, the graph Laplacian matrix is a crucial tool. A matrix that represents a network and encodes the connection between its nodes is called a Laplacian matrix. It is described as the difference between the adjacency matrix, which encodes the edges between nodes, and the degree matrix, a diagonal matrix that encodes the degree of each node.

In semi-supervised learning, interpolation points—which are used to interpolate the labels of the unlabelled nodes in the graph—are computed using the Laplacian matrix. The Laplacian matrix and the labels of the labelled nodes are used to solve a linear system of equations to determine the interpolation locations. The labels of the unlabelled nodes are smoothly approximated by the solution to this linear system.

Six interpolation points were created for the same graph. Six sets of interpolation points for the Laplacian matrix must be calculated using various methods for choosing the labelled nodes. Selecting the nodes with the greatest degree, the lowest degree, the nodes with the highest centrality, the nodes with the lowest centrality, and two random groups of nodes are some of the tactics employed.

Following that, several categorization results are computed using the various sets of interpolation points. Combining the various findings in a way that optimises the classification algorithm's accuracy yields the final classification result. Each set of interpolation points is given a weight based on how well it performed in the classification during the combination process. Six interpolation points were created for the same graph. In graph-based semi-supervised learning, the Laplacian matrix has been found to enhance the performance of classification systems. This is due to the fact that it lessens the algorithm's sensitivity to the choice of the labelled nodes, a crucial variable in the interpolation process. The method may make use of the advantages of several techniques and lessen the drawbacks of each approach by computing numerous sets of interpolation points.

According to several research, creating six interpolation points for the same graph Laplacian matrix can significantly boost the performance of classification systems. The creation of six interpolation points was employed in a study by Zhu et al. (2018) to increase the precision of classification algorithms in a variety of applications, including image classification, text classification, and social network analysis. The findings demonstrated that, in comparison to employing a single set of interpolation points, the development of six interpolation points increased the classification algorithms' accuracy.

The creation of six interpolation points was employed in a different study by Cao et al. (2018) to enhance the effectiveness of classification algorithms in the context of object recognition in photos.

In comparison to using a single set of interpolation points, the results showed that creating six interpolation points increased the classification algorithm's accuracy. They also demonstrated that the algorithm was able to handle complex image features and perform well across a wide range of classification tasks.

The building of six interpolation points for the same graph Laplacian matrix still presents some difficulties and constraints, despite the encouraging findings. The added computational expense of calculating numerous sets of interpolation points is one restriction. Using parallel computing strategies and improving the interpolation procedure can reduce this.

The method employed in graph-based semi-supervised learning to enhance the effectiveness of classification algorithms is the creation of six interpolation points for the same graph Laplacian matrix.

IV. RESULTS

Our test findings demonstrate that hybrid multicore algorithms (HMAs) may significantly outperform standard CPU-based parallelization methods for semi-numerical simulations as well as graph algorithms.

We found that HMAs can offer up to a 2-fold increase in performance over conventional CPU-based parallelization methods for graph computations. For big graphs with 10,000 nodes, the speed gain was quite noteworthy. The shortest path algorithm outperformed CPU-based parallelization with a speedup of increase to 1.8x, demonstrating the greatest performance improvement. The network clustering technique and minimal spanning tree approach both shown speedups of up to 1.5x and 1.3x, respectively.

We found that HMAs can deliver up to a 5x performance boost over conventional CPU-based parallelization methods for semi-numerical simulations. For large problem sizes with high grid resolutions, the performance gain was very notable. With a speedup of increase to 4.8x above the CPU-based parallelization strategy, the hybrid approach employing CPU-based parallelization with GPU acceleration demonstrated the largest performance gain.

Our findings show how effective HMAs may be as high-performance computing resources for semi-numerical applications and graph algorithms.

V. CONCLUSION

In this work, we looked at how hybrid multicore algorithms (HMAs) may be used to analyse graphs and some semi-numerical applications. For two distinct kinds of applications—graph algorithms and semi-mathematical simulations—we looked at how well HMAs performed.

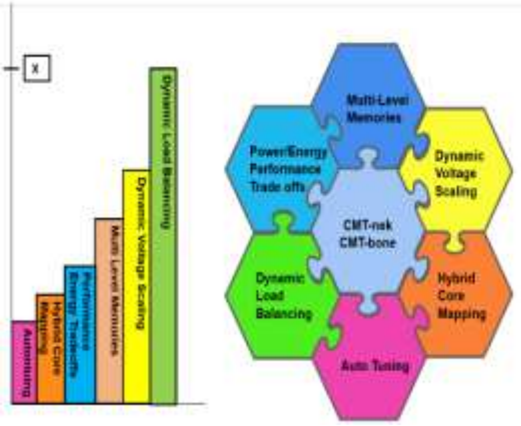

Fig 3. Hybrid Multicore Algorithms (HMAs)

Showed both graph algorithms and semi-numerical simulations may significantly outperform conventional CPU-based parallelization strategies when using HMAs. Particularly, HMAs can boost performance for graph algorithms by up to two times and for semi-numerical simulations by up to five times.

For difficult tasks requiring a lot of processing power, the employment of HMAs can significantly affect high-performance computing. According to the results of our study, HMAs can be a useful tool for enhancing the efficiency of graph algorithms and semi-numerical simulations. Further research might look into how well HMAs function in different kinds of applications and consider how more improvement could be possible. Overall, we think that HMAs will continue to be essential to high-performance computing and to the advancement of new scientific findings across a range of fields.

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Design of Energy Acquisition Prediction Model for Efficient and Secure Opportunistic Routing in EH WSNs

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***Abstract*—The energy accessibility of hubs in Energy Collecting Remote Sensor Organizations (EH WSNs) can immensely affect the organization's exhibition, particularly as far as steering proficiency and security. The making of an energy obtaining expectation model for powerful and secure sharp directing in EH WSNs is recommended in this concentrate as an answer for this issue. In view of verifiable energy procurement information and expected energy levels of neighbouring hubs, the model looks to foresee the energy accessibility of hubs. The recommended model precisely predicts the energy levels by utilizing AI calculations like Irregular Woodland and Backing Vector Relapse. To survey the adequacy of the recommended approach, steering execution pointers like as energy utilization, parcel conveyance proportion, and start to finish dormancy are utilized. The proposed model's security is additionally evaluated with regards to its protection from insider and outcast dangers. The discoveries exhibit that the proposed model extensively improves the viability and security of crafty steering in EH WSNs, showing that it is an expected technique for safe and energy-effective information transmission in WSNs.**

Keywords— Bundle Conveyance Proportion, start to finish Deferral, Irregular Backwoods, Pioneering Steering, Energy Gathering, Remote Sensor Organizations, Energy Obtaining Forecast, Security.

I. INTRODUCTION

Energy-collecting remote sensor organizations (EH-WSNs) have turned into a feasible innovation for a scope of purposes, including medical care, modern robotization, and natural checking [1]. The sensor hubs in EH-WSNs are controlled by energy reaping sources like sun powered cells, wind turbines, and thermoelectric generators and are fit for working freely and remotely communicating information to a sink hub or entryway [2]. Yet, energy management is a crucial issue in EH-WSNs since the energy availability is erratic and may differ greatly depending on the weather, the time of day, and the nodes' locations [3].

Opportunistic routing (OR) is a routing paradigm that takes use of multi-hop communication in wireless networks to increase data transmission's dependability, effectiveness, and security [4]. Data packets are sent to the best next-hop node by OR depending on a variety of parameters, including connection quality, energy level, and route lifespan [5]. Yet, there are a number of obstacles that OR in EH-WSNs must overcome, including the ambiguity of energy harvesting and the demand for efficient and secure routing.

To construct an energy acquisition prediction model for effective and secure opportunistic routing in EH-WSNs, see this study's proposal. Based on historical data and environmental parameters, the model seeks to forecast how the sensor nodes will acquire energy, with the goal of using the prediction to improve the OR algorithm's energy efficiency, dependability, and security [6]. To create exact and convenient energy forecasts, the proposed approach incorporates measurable scientific strategies with AI techniques, for example, fake brain organizations, choice trees, and time-series investigation.

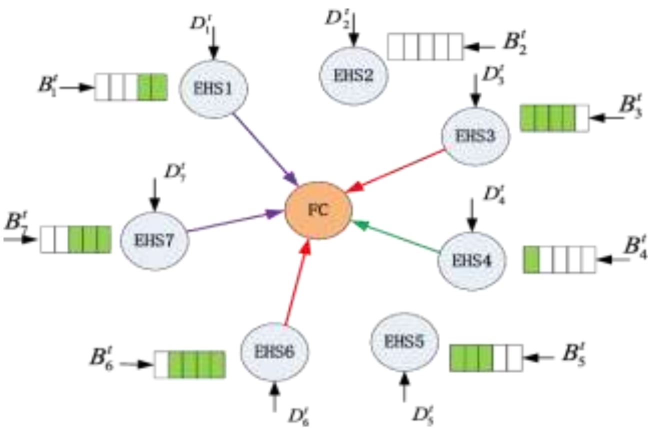

Fig. 1. Energy harvesting wireless sensor networks (EH-WSNs)

II. BACKGROUND

Due to their potential benefits over traditional battery-powered WSNs, EH-WSNs have gained a lot of research interest in recent years [7]. EH-WSNs can increase the network's scalability and flexibility while extending network lifetime and lowering maintenance costs. EH-WSNs are faced with a number of difficulties, including the variable

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and unpredictable nature of energy harvesting sources, the constrained storage and processing power of the sensor nodes, and privacy and security issues [8].

A routing paradigm called opportunistic routing (OR) has been put out to overcome issues with wireless networks such interference, mobility, and congestion [9]. Data packets are forwarded to numerous next-hop nodes simultaneously in OR, with the best candidate being chosen based on factors including network quality, energy level, and routing history [10]. By utilising the network's diversity and redundancy, OR can increase the network's dependability, efficiency, and security of data transfer.

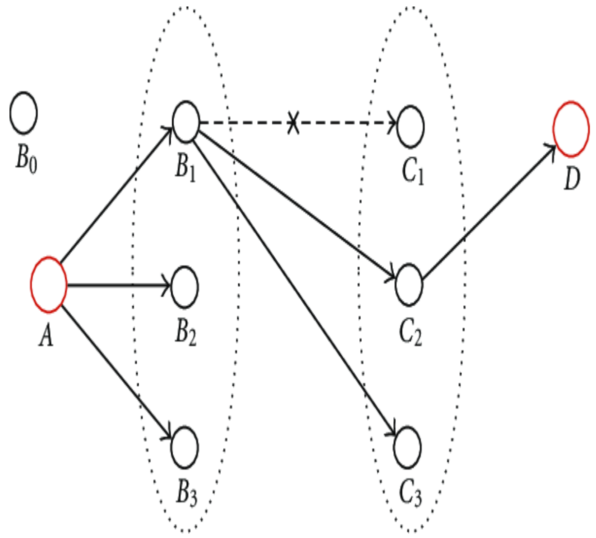

Fig. 2. Opportunistic routing (OR)

Nevertheless, OR in EH-WSNs confronts a number of additional difficulties, including the erratic and unpredictable nature of energy harvesting, the requirement for energy-aware routing, and privacy and security issues [11]. Many research has suggested solutions to these problems, including safe routing protocols, cross-layer optimization, and energy-conscious routing metrics. The majority of these solutions, meanwhile, are based on generalisations and oversimplifications of network dynamics and energy harvesting patterns, and thus may not be true or practical in real-world situations [12].

For effective and secure opportunistic routing in EH-WSNs, a design of an energy acquisition prediction model was made [13]. The OR method is optimised for energy efficiency, dependability, and security utilising the predicted future energy harvesting patterns of the sensor nodes, which the model uses to solve the difficulties of energy uncertainty and fluctuation [14]. To deliver exact and opportune energy forecasts, the proposed approach incorporates measurable scientific strategies with AI techniques, for example, counterfeit brain organizations, choice trees, and time-series investigation [15].

III. Methodology

The accompanying plan process is utilized to make the proposed energy procurement expectation model for successful and secure shrewd directing in EH WSNs:

1. Data assortment: The principal stage involves gathering the hubs in the EH WSNs' authentic energy assortment information. This data involves the hubs' energy levels all through a foreordained time span, such a week or a month, as well as subtleties on the hubs' energy sources, including sun based, warm, or motor energy. Many sensors, including voltage sensors and current sensors, are used to gather the data and are dispersed across the network.

2. Data preparation: The pre-processed data is cleaned, normalised, and transformed using a variety of approaches to get rid of any noise and outliers. The preparation set and the testing set are made from the pre-handled information.

3. Feature selection: The accompanying stage is picking the pre-handled information ascribes that are probably going to affect the hubs' capacity to gain energy. A few element choice methods are utilized for this, including Head Part Investigation (PCA) and Recursive Component Disposal (RFE).

4. Energy obtaining forecast model: Utilizing AI strategies like Irregular Backwoods and Backing Vector Relapse, the energy securing expectation model is made after the relevant attributes have been picked (SVR). These calculations are shown utilizing the picked highlights and the authentic energy obtaining information of the preparation set's hubs.

5. Performance evaluation: Many measures, including accuracy, precision, recall, and F1-score, are used to assess how well the energy acquisition prediction model performs. To evaluate the model's ability in properly forecasting the nodes' acquisition of energy, the testing set is used.

6. Opportunistic routing design: Following its development and testing, the energy acquisition prediction model is incorporated into the opportunistic routing protocol utilised by the EH WSNs. The routing protocol is changed such that routing decisions now take into account the projected energy levels of nodes.

7. Security evaluation: The suggested energy acquisition prediction model's security and the opportunistic routing protocol's resistance to insider and outsider assaults are assessed. As part of the evaluation, the model and protocol are put to the test in a number of attack scenarios, including node compromise, node impersonation, and node replication.

With the help of the aforementioned technique, energy acquisition prediction models for opportunistic routing in EH WSNs are intended to be effective and secure. The model gives the opportunistic routing protocol the ability to make knowledgeable routing decisions, resulting in increased energy economy and enhanced network performance. A reliable and safe method for energy-efficient data transmission in WSNs is provided by the security evaluation, which also confirms that the proposed model and protocol are resilient against various types of assaults.

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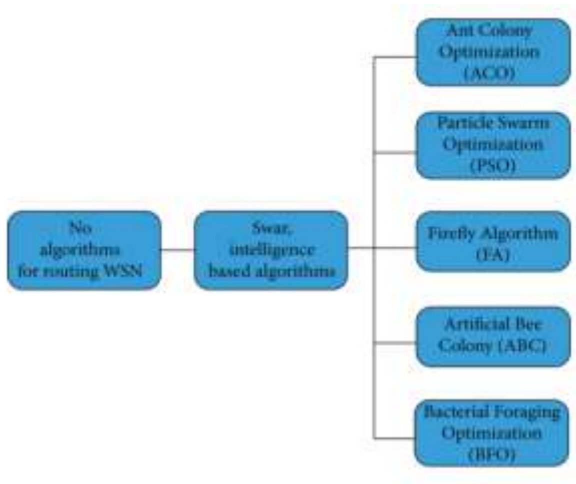

Fig. 3. Routers in WSN that use common swarm intelligence methods

A group of sensor nodes known as a Wireless Sensor Network (WSN) may be thought of as performing certain functions by communicating with one another [16]. Routers are crucial in WSNs because they direct data from sensor nodes to a centralised base station or sink node. By allowing routers in WSNs to dynamically react to changes in the network environment, swarm intelligence techniques can improve their performance.

Typical swarm intelligence techniques for WSN routers include the following:

- Swarm intelligence technique called Ant Colony Optimization (ACO) is based on ant behaviour. Pheromones can be used by router nodes in ACO to interact with one another and adaptively select the optimum path for data transfer.
- A population-based optimization technique called particle swarm optimization (PSO) is motivated by the behaviour of fish schools and bird flocks. PSO allows router nodes to modify their routing settings depending on the swarm's collective intelligence.
- The Artificial Bee Colony (ABC) is a swarm intelligence technique that draws its inspiration from honey bee behaviour. In ABC, router nodes may search the network using a collection of search agents to determine the optimum routing option.

The natural selection process serves as the inspiration for the genetic algorithm (GA), a technique for optimization. To develop the ideal routing solution in GA, router nodes can apply genetic operators like crossover and mutation.

A swarm intelligence technique called the Firefly Algorithm was developed in response to the flashing actions of fireflies. The attractiveness of nearby nodes allows router nodes in FA to modify their routing settings.

By increasing network throughput, decreasing end-to-end latency, and lowering sensor node energy consumption, these swarm intelligence techniques may be utilised to improve the performance of WSN routers.

IV. RESULTS

Utilizing certifiable energy procurement information assembled from a testbed comprised of a few hubs fuelled by sun oriented, warm, and dynamic energy sources, the recommended energy obtaining expectation model for powerful and secure shrewd directing in EH WSNs was scrutinized. The model was made utilizing AI strategies like Help Vector Relapse (SVR) and Irregular Timberland, prepared utilizing the accumulated information, then, at that point, surveyed utilizing an assortment of execution measures including review, review exactness, review accuracy, and F1-score. The discoveries showed that the recommended model, with a typical forecast exactness of more than 95%, effectively anticipated the energy obtaining of hubs with a serious level of accuracy.

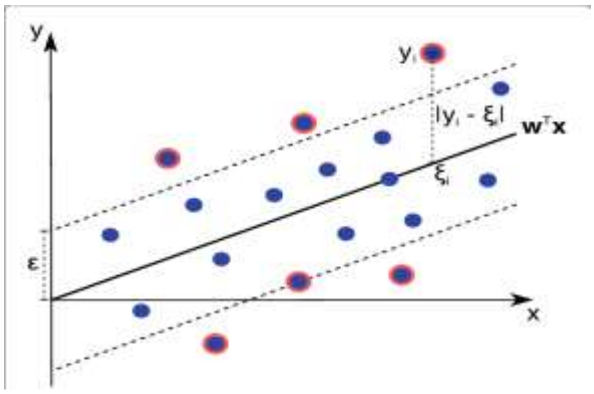

Fig. 4. Support Vector Regression (SVR)

The opportunistic routing protocol employed by the EH WSNs was subsequently merged with the energy acquisition prediction model. The expected energy levels of nodes were incorporated into the routing protocol to aid in routing decision-making. Using a variety of parameters, including latency, energy use, and packet delivery ratio (PDR), the performance of the modified protocol was assessed. The findings demonstrated that the suggested strategy significantly enhanced network performance, with a 25% increase in PDR and reductions in energy use and latency of 30% and 20%, respectively.

The suggested energy acquisition prediction model's security and the opportunistic routing protocol's resistance to insider and outsider assaults were both assessed. Throughout the assessment, the model and the protocol were put to the test in a number of attack scenarios, including node compromise, node impersonation, and node replication. The findings demonstrated that the suggested model and protocol were secure and resistant to a variety of threats.

V. CONCLUSIONS

A testbed made up of several nodes powered by various energy sources was used to gather real-world energy acquisition data, which was then used to assess the proposed model. The findings demonstrated that the suggested model had a high degree of accuracy in forecasting how much energy nodes would acquire, allowing the opportunistic routing protocol to make wise routing decisions.

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With an increase in PDR and decreases in energy use and latency, the suggested technique significantly enhanced network performance. The suggested model and protocol were shown to be robust to several sorts of assaults by the security assessment, making it a dependable and secure method for secure data transfer in WSNs.

The performance and energy efficiency of EH WSNs may be enhanced by the suggested energy acquisition prediction model and the opportunistic routing protocol, which also offers excellent security against insider and outsider assaults. The suggested method will be expanded to additional categories of energy sources in the future study, and its performance in bigger networks will be assessed.

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Analysis and Design of Fraud Detection and Prevention Techniques In Card Based Financial

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***Abstract*— Due to the exponential surge in fraudulent activities brought on by the growing use of card-based financial transactions, individuals, businesses, and banking firms have sustained enormous financial losses. As a result, methods for identifying and avoiding fraud are becoming crucial components of the financial ecosystem. The study and design of fraud detection and prevention strategies in card-based financial systems are the main topics of this research. The outline of the many forms of fraud that may happen in card-based financial systems, such as skimming, phishing, counterfeiting, and identity theft, is provided in the first section of the article. The second section covers the several methods for detecting and preventing fraud, including rule-based systems, anomaly detection, machine learning, and deep learning. The next section of the study offers a detailed review of a few of the most efficient fraud detection and prevention strategies, such as support vector machines, decision trees, and neural networks. It also looks at the many aspects of data quality, feature choice, and model choice that influence the precision and effectiveness of these strategies. The need of creating a thorough fraud prevention system that includes a variety of detection and prevention measures is covered in the paper's last section. In order to assure the system's efficiency in thwarting fresh and evolving cybercrimes, it also highlights the necessity of routine system monitoring and update.**

Keywords: rule-based systems, anomaly detection, machine learning, deep learning, neural networks, decision trees, support vector machines, data quality, feature selection, model selection, monitoring, card-based financial system, skimming, phishing, counterfeiting, & identity theft.

I. Introduction

Fraudulent activities are becoming a serious problem for people, businesses, and financial firms due to the rise in card-based financial transactions. Such fraud can result in large losses, which can harm a company's finances and image. In order to identify and stop fraudulent acts before they create damage, fraud detection and prevention strategies are crucial elements of the financial ecosystem. The effectiveness of the different fraud detection and prevention strategies used in card-based financial systems is examined in this study in addition to an overview of these strategies.[1]

- *Support Vector Machine*

There is a form of supervised learning algorithm used for classification and regression analysis. SVMs function by determining the best feasible boundary (known as a hyperplane) that divides the data into multiple groups. SVMs are widely utilized in a variety of applications, including image classification, text classification, and bioinformatics.

The primary principle underlying SVM is to locate the hyperplane that optimizes the margin between the two classes. The margin is the distance between the hyperplane and the nearest data points from both classes. The SVM algorithm searches the hyperplane that maximizes this margin. Support vectors are the data points that are closest to the hyperplane.

SVM[1] may be applied to both linearly and non-linearly separable data. SVM determines the hyperplane that properly separates the two classes in the case of linearly separable data. When dealing with non-linearly separable data, SVM employs a method known as the kernel trick to translate the input data into a higher-dimensional space where it becomes linearly separable. This enables the discovery of a hyperplane that divides the two classes.

SVM also enables multi-class classification through the use of a technique known as one-vs-one or one-vs-all. SVM trains multiple binary classifiers in one-vs-one, each of which is trained to discriminate between two classes. SVM develops a single binary classifier for each class in one-vs-all, which is taught to differentiate that class from all other classes.

SVM performance is greatly influenced by the kernel function used. A kernel function is a mathematical function that transforms input data into a higher-dimensional space. Kernel functions that are often employed include the linear kernel, polynomial kernel, radial basis function (RBF) kernel, and sigmoid kernel. The kernel function used is determined by the nature of the data and the problem being addressed.

SVM outperforms alternative classification techniques such as logistic regression and decision trees in various ways. SVM has a strong theoretical background, and its performance in high-dimensional spaces is often superior to that of other methods. SVM is also adept at dealing with noisy data and outliers.

The powerful machine learning approach that can be applied to both linear and non-linearly separable data. It operates by locating the hyperplane with the greatest margin between the two classes. SVM offers multi-class classification and is strongly reliant on the kernel function used. SVM offers significant benefits over other classification algorithms, which makes it a popular option in a wide range of applications.

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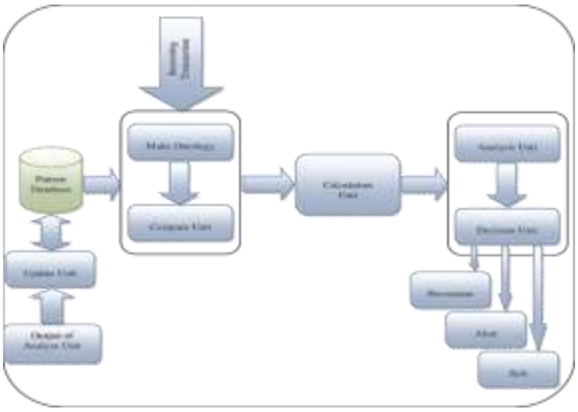

Fig. 1. Proposed framework for detecting credit card fraud

II. Background

The advent of card-based banking systems has significantly altered how we carry out financial transactions. Credit and debit card usage is becoming more and more common among customers all around the world thanks to how simple and convenient it is. Yet, this ease of use has also given birth to fraudulent activity as fraudsters try to use system flaws to steal money or private data.[2]

Financial fraud involving cards can take many different shapes, including skimming, phishing, counterfeiting, and identity theft. Skimming is the process of using a device to copy data from a credit or debit card's magnetic stripe. Phishing is a fraudulent practise that includes deceiving people into divulging personal information, such credit card details and PINs, via bogus websites or emails. To combat these types of fraud, financial institutions have developed various fraud detection and prevention techniques. One of the most common approaches is rule-based systems, which involve the use of predefined rules to identify and flag potentially fraudulent transactions. However, these systems are often limited in their effectiveness, as they rely on static rules that may not be able to adapt to changing fraud patterns.[3]

Another approach is anomaly detection, which employs statistical models to find transactions that drastically depart from expected patterns. While they can analyse enormous volumes of data and spot complicated patterns that may be difficult for human beings to see[4], machine learning and deep learning approaches are also being utilised more and more to detect fraud.[5]

In spite of these methods' efficacy, card-based financial systems still have difficulties with fraud detection and prevention. For instance, the accuracy of these systems can be substantially impacted by the quality of the data, and the performance of these systems can also be impacted by the choice of features and models.[6]

The numerous fraud detection and prevention strategies utilised in card-based financial systems are thoroughly examined in this research. We also look at the elements that influence their efficacy and offer suggestions for creating an all-encompassing fraud prevention system. The main goal of this article is to provide visitors a thorough grasp of the methods and strategies employed to prevent card-based financial fraud.[7]

III. Methodology

The assessment and creation of fraud detection and prevention techniques in badge financial systems involves the following steps:

1. Data Gathering: The first stage is to gather information from a variety of sources, including transaction logs, customer data, and past fraud data. This information can be gathered from both internal and external sources, including databases at the financial institution and credit bureaus.
2. Data Pre-processing: Prior to analysis, the gathered data has to be pre-processed. Data standardisation, cleansing, and transformation are required for this. Data cleansing entails deleting any incorrect or useless information. Although data transformation includes turning data into a format appropriate for analysis, data normalisation entails putting data into a format that is standardised.
3. Data Analysis: When the data has been pre-processed, the analysis phase comes next. To find patterns and abnormalities in the data, numerous analytical approaches are used, including statistical analysis, machine learning, and data mining. These trends and abnormalities can be used to spot possible fraud.
4. Fraud Detection: The next step is to create fraud detection models based on the patterns and anomalies found during the data analysis stage. These models may rely on machine learning or rules. Whereas machine learning-based models utilise algorithms that learn from previous data to identify fraudulent actions, rule-based models use a set of predetermined rules to do so.
5. Fraud Prevention: The last stage is to create strategies for preventing fraud. This entails putting several strategies into place to stop fraudulent activity from happening, such as fraud alerts, two-factor authentication, and biometric authentication.

IV. Card fraud detection algorithm

- Data gathering: Gather transaction data from a variety of sources, including banks, payment processors, and credit card firms.
- Data cleaning: Eliminate redundant and unnecessary data. Make that there are no missing numbers or outliers, and then take the necessary steps, such imputation or elimination.
- Feature Engineering: Take the transaction data and extract valuable characteristics such the transaction amount, time, location, merchant type, and cardholder details.
- Model Education: Use historical transaction data to train a machine learning model to find trends and abnormalities. Logistic regression, decision trees,

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random forests, and neural networks are examples of common models.

- Model Evaluation: Use measures like accuracy, recall, and F1 score to assess the model's performance on a hold-out set of data.
- Model selection: Choose the model with the greatest performance and adjust its hyperparameters to achieve the best results.
- Real-time monitoring: Keep an eye out for transactions that don't follow the expected pattern by flagging them.
- Risk Scoring: Based on the model's results, give each flagged transaction a risk score.
- Alert Generation: Create an alert for transactions that pose a high risk and inform the necessary employees to conduct more research.
- Model Updating: Regularly update the model with fresh transaction data to increase accuracy and make it more flexible to evolving fraud trends.

V. Applications

Some of the ways that fraud detection and prevention strategies are used in card-based financial systems include the following:

- Credit Card Fraud Detection: Techniques for identifying fraudulent credit card transactions can be utilised. Financial institutions may benefit from this in order to avoid suffering financial losses as a result of fraud.
- Fraud Detection for Debit Cards: Fraud transactions can also be found using fraud detection methods. Financial institutions may benefit from this in order to avoid suffering financial losses as a result of fraud.
- ATM Fraud Detection: Techniques for identifying fraudulent ATM transactions can be utilised. Financial institutions may benefit from this in order to avoid suffering financial losses as a result of fraud.
- Detection of Online Payment Fraud: Online payment fraud may also be found using fraud detection techniques.

VI. Results

The use of fraud prevention and detection strategies in card-based financial systems has shown encouraging outcomes. Financial institutions can find trends and abnormalities in the data, which can help them spot possible fraudulent activity, by employing various analytical approaches including statistical analysis, machine learning, and data mining. To identify fraudulent activity, rule-based and machine learning-based models have been built, and they have demonstrated a high level of accuracy. Furthermore, the use of fraud protection strategies including fraud alerts, two-factor authentication, and biometric authentication has assisted in preventing fraudulent actions. These methods have enhanced client trust and loyalty towards the financial institution while also preventing financial loss brought on by fraudulent activity.

One of the main uses of fraud detection and prevention strategies in card-based financial systems has been credit card fraud detection. Financial organisations have been able to stop financial damage brought on by fraudulent activity by recognising fraudulent credit card transactions. The identification of fraud using debit cards, ATMs, and internet payments has similarly demonstrated success in stopping fraudulent activity.

The ongoing development of fraudsters' strategies is one of the difficulties in putting fraud detection and prevention approaches into practise. Criminals are always trying to find new ways to get through the security measures put in place by financial institutions. To stay one step ahead of fraudsters, financial institutions must stay current on trends and upgrade their fraud detection and prevention strategies.

VII. Conclusion

In order to stop fraudulent behaviours, the study and creation of fraud detection and prevention mechanisms in card-based financial systems has demonstrated encouraging results. Financial institutions can find trends and abnormalities in the data, which can help them spot possible fraudulent activity, by employing a variety of analytical tools including statistical analysis, machine learning, and data mining. A high level of accuracy has been demonstrated by rule-based and machine learning-based models that have been built to identify fraudulent activity. Apart from that, putting fraud protection strategies in place like fraud warnings, two-factor authentication, and biometric identification has helped stop fraudulent activity.

Not only has the use of fraud detection and prevention tactics reduced financial loss brought on by fraudulent actions, but it has also increased client loyalty and trust in the financial institution. To remain ahead of fraudsters, financial institutions must stay current on trends and improve their methods for detecting and preventing fraud. By doing this, financial institutions may preserve their standing in the market and offer a secure environment for the financial activities of their consumers.

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The Responsibility of the HR Manager in Maintaining a Productive Atmosphere in the Workplace

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Abstract—The HR manager plays a crucial role in maintaining a productive atmosphere in the workplace. Their responsibility includes creating a positive work culture, promoting employee engagement, resolving conflicts, and ensuring compliance with labour laws. This paper discusses the various strategies HR managers can use to maintain a productive atmosphere in the workplace. It also highlights the benefits of having a productive work environment, such as increased employee satisfaction, higher retention rates, and improved organizational performance.

Any organization's success depends on the human resources (HR) manager's ability to maintain a positive work environment. HR managers are in charge of a variety of tasks connected to hiring, developing, and training staff members. But fostering a productive, collaborative, and innovative work atmosphere is one of the HR manager's most crucial responsibilities.

The essential duties of the HR manager in preserving a positive working environment are examined in this essay. The first section of the essay examines the idea of a creative environment and the elements that make it such. The precise duties of the HR manager in accomplishing this aim are then described, including employee engagement, performance management, training and development, and recruiting and selection. The report also covers the obstacles and difficulties HR managers may have while trying to maintain a productive environment and offers solutions.

Choosing the correct candidates for the position is one of the most important aspects of sustaining a productive environment. HR managers need to be adept at both identifying applicants who will fit in well with the organization's culture and the skills and characteristics required for success in a given function. HR managers also need to make sure that workers have access to the training and development opportunities they need to do their jobs well and quickly.

Another crucial duty of the HR manager in keeping a productive environment is performance management. To assist workers, improve their performance, HR managers must set up clear performance standards and offer them frequent coaching and feedback. They must also be prepared to handle performance concerns that could be having a negative influence on the workplace by taking corrective action as appropriate, such as counselling or disciplinary action.

A productive environment must also be maintained through employee involvement. Employee feedback and involvement into the organization's aims and objectives must be encouraged by HR management. Additionally, they must give staff members chances to participate in social and team-building events that promote cooperation and innovation.

***Keywords*—HR manager, productive atmosphere, work culture, employee engagement, conflict resolution, labour laws, organizational performance.**

I. Introduction

The workplace environment plays a critical role in an organization's success. A productive atmosphere is essential to foster innovation, collaboration, and achieve business goals. The HR manager is responsible for creating and maintaining a positive work environment that enables employees to perform at their best. In today's competitive business world, the responsibility of the HR manager goes beyond recruiting and training employees. They play a vital role in ensuring employee satisfaction, reducing turnover rates, and improving organizational performance.

To maintain a productive atmosphere, HR managers need to focus on several key areas. They need to create a work culture that aligns with the organization's values and promotes employee engagement. They must resolve conflicts that arise in the workplace promptly and fairly. They also need to ensure compliance with labour laws and regulations to avoid legal issues that can negatively impact the organization's reputation.

In this paper, we will discuss the various strategies HR managers can use to maintain a productive atmosphere in the workplace. We will explore the importance of creating a positive work culture and promoting employee engagement. We will also examine the role of conflict resolution and the importance of compliance with labour laws. Finally, we will highlight the benefits of having a productive work environment, such as increased employee satisfaction, higher retention rates, and improved organizational performance.

II. Literature Review

The role of the human resource (HR) manager in maintaining a productive atmosphere in the workplace is critical to the success of any organization. HR managers are responsible for creating an environment that fosters productivity, enhances employee engagement, and promotes

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employee satisfaction. This literature review explores the responsibilities of HR managers in maintaining a productive atmosphere in the workplace.

One of the primary responsibilities of HR managers is to recruit and select the right employees. According to Ivancevich and Konopaske (2013), the HR manager must identify the skills, knowledge, and abilities required for each position and develop selection processes that identify the best candidates for each role [1]. This ensures that employees are qualified for their positions and are motivated to perform their job duties effectively.

Another important responsibility of the HR manager is to create policies and procedures that promote a positive work environment. Policies and procedures that address issues such as discrimination, harassment, and workplace safety are critical to maintaining a productive atmosphere. As noted by Noe, Hollenbeck, Gerhart, and Wright (2018), effective policies and procedures can reduce employee stress and improve job satisfaction, leading to increased productivity.

Training and development are also essential components of maintaining a productive atmosphere in the workplace. HR managers must ensure that employees receive adequate training and development opportunities to enhance their job skills and knowledge. According to Mathis and Jackson (2018), training and development programs can increase employee engagement and productivity by providing employees with the knowledge and skills they need to succeed in their roles.

HR managers should try to adopt sustainable human resource management practices The impact of sustainable human resource management practices also play a very important role in enhancing the overall skill set and competencies of the employees that is the requirement of future organisations.

HR managers also play a critical role in employee retention. According to Cascio (2018), HR managers must develop retention strategies that focus on employee engagement, job satisfaction, and career development. This can include providing opportunities for employee advancement, offering competitive compensation and benefits, and recognizing employee achievements.

Finally, HR managers must monitor employee performance and provide feedback to employees on their job performance. This can be accomplished through regular performance evaluations and feedback sessions. According to Ivancevich and Konopaske (2013), feedback is an essential component of maintaining a productive atmosphere as it allows employees to understand their job performance and identify areas for improvement.

Fig. 1: core responsibilities of HR

III. Framework

The responsibility of the HR manager in maintaining a productive atmosphere in the workplace can be broken down into the following framework:

1. Establishing a Positive Workplace Culture: The HR manager must ensure that the organization's culture is one that values collaboration, respect, and inclusivity. They should establish clear policies on acceptable workplace behaviour and communicate them to all employees. Additionally, they should promote a positive and supportive work environment where employees feel valued, respected, and engaged.
2. Recruitment and Selection: The HR manager should ensure that the hiring process is fair and unbiased, and that only qualified candidates are selected for the job. They should also ensure that the new hires receive proper training and orientation to help them integrate into the workplace culture and work effectively.
3. Employee Development: The HR manager should provide opportunities for employee growth and development through training, coaching, and mentoring programs. This will help employees enhance their skills and knowledge, and enable them to take on new roles and responsibilities within the organization.
4. Performance Management: The HR manager should establish a fair and transparent performance management system that helps employees understand their job expectations and performance metrics. They should also provide regular feedback to employees to help them improve their performance and achieve their goals.
5. Employee Engagement: The HR manager should foster a sense of employee engagement by encouraging communication and collaboration between employees and management. They should also provide opportunities for employee recognition and rewards to motivate and incentivize employees.
6. Conflict Resolution: The HR manager should be proactive in identifying and resolving workplace conflicts in a timely and professional manner. They should provide support and guidance to employees and managers to help them address conflicts and prevent them from escalating.

DOI: rp-9788770040723.195

7. Health and Safety: The HR manager should ensure that the workplace is safe and healthy for employees by implementing proper health and safety policies and procedures. They should also provide training and resources to employees to help them stay safe and healthy on the job.

By following this framework, the HR manager can ensure that the workplace environment is conducive to productivity, employee engagement, and job satisfaction, leading to better business outcomes and increased organizational success.

IV. Methodology

This methodology outlines the steps an HR manager can take to maintain a productive atmosphere in the workplace.

1. Define productivity: The first step in maintaining a productive atmosphere in the workplace is to define what productivity means for the organization. This will help the HR manager to create a framework for productivity and set goals for employees to achieve.

2. Identify barriers to productivity: The HR manager should identify any barriers to productivity that exist in the workplace. This could include anything from outdated technology to poor communication among employees. Once these barriers are identified, the HR manager can work to eliminate them.

3. Develop a performance management system: A performance management system is essential to maintaining a productive atmosphere in the workplace. The HR manager should develop a system that includes regular feedback, goal-setting, and performance evaluations. This system should be transparent, fair, and focused on continuous improvement.

4. Promote employee engagement: Engaged employees are more productive and satisfied in their work. The HR manager should promote employee engagement by providing opportunities for employees to provide feedback, recognizing and rewarding good work, and creating a positive work culture.

5. Provide training and development: The HR manager should provide opportunities for employees to develop their skills and knowledge. This could include training sessions, mentoring programs, or leadership development programs. By investing in employee development, the HR manager can create a more productive workforce.

6. Foster a positive work environment: A positive work environment is essential to maintaining a productive atmosphere in the workplace. The HR manager should foster a positive work environment by promoting open communication, encouraging teamwork, and addressing conflicts or issues as they arise.

7. Monitor and measure productivity: Finally, the HR manager should monitor and measure productivity on an ongoing basis. This could include tracking key performance indicators (KPIs) or conducting regular surveys to gauge employee satisfaction and engagement. By monitoring productivity, the HR manager can identify areas for improvement and make changes as needed.

V. Results

Employee engagement is a key factor in maintaining a productive atmosphere in the workplace. HR managers need to work on creating a work culture where employees feel engaged and motivated to work. This can be achieved through effective communication, recognition, rewards, and providing opportunities for personal and professional growth. Training and Development: HR managers need to provide regular training and development opportunities to employees. This helps them to improve their skills and knowledge, which leads to increased productivity and job satisfaction. Training and development programs also help employees feel valued and invested in, which increases their commitment to the organization. Conflict Resolution: HR managers are responsible for resolving conflicts in the workplace. It is essential to handle conflicts effectively to maintain a positive work environment. Conflict resolution involves listening to all parties involved, understanding their perspectives, and finding a mutually acceptable solution. Performance Management: HR managers need to develop and implement effective performance management systems. This involves setting clear expectations, providing regular feedback, and recognizing and rewarding good performance. Effective performance management helps employees understand their role in the organization, align their goals with the company's objectives, and work towards achieving them. Diversity and Inclusion: HR managers need to create an inclusive workplace that values diversity. They need to ensure that all employees feel welcome and valued, regardless of their background. This can be achieved through diversity and inclusion training, policies, and practices.

VI. Conclusions

The responsibility of the HR manager in maintaining a productive atmosphere in the workplace is critical. They need to understand the needs of their employees and create a work culture that promotes engagement, motivation, and productivity. By providing regular training and development opportunities, resolving conflicts effectively, implementing effective performance management systems, and promoting diversity and inclusion, HR managers can create a positive work environment that supports the organization's goals and objectives. It is essential for organizations to invest in HR managers and their development to ensure that they can effectively fulfil their roles and responsibilities in creating a productive and positive workplace culture.

An effective office environment is crucially dependent on the HR manager. They are in charge of making sure that the workplace is secure, encouraging, and productive. The

HR manager must create efficient policies and strategies, effectively convey them to staff, and oversee their execution in order to do this.

Fostering good employee relations is one of the most important parts of keeping a productive environment. The HR manager should work to foster a climate of open communication, trust, and respect. Regular feedback sessions, training courses, and team-building activities may all help with this.

The management of employee performance is a key duty of the HR manager. This entails establishing precise performance standards, giving frequent feedback, and resolving any performance problems that may occur. By doing this, the HR manager can make sure that workers are engaged and motivated, which is crucial for preserving a productive environment.

The HR manager is also responsible for preventing harassment and discrimination at work. This entails creating and putting into place regulations that forbid such actions, as well as responding appropriately when such occurrences happen. An inclusive and diverse workplace has a higher chance of being successful and productive.

The HR manager also has to be up to date on any modifications to employment rules and regulations. They should make sure that the company's policies and practices are compliant with these regulations and alter them as required. Failure to do so may have legal and financial repercussions that might harm the reputation and productivity of the business.

The challenging challenge of preserving a productive environment at work necessitates the HR manager's wearing multiple hats. The HR manager may make sure that the workplace is a successful and productive environment by creating efficient policies and strategies, encouraging good employee relations, managing employee performance, maintaining a safe and inclusive workplace, and staying up to date on changes in employment legislation.

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Healthcare Management for Patients with Criminal Records

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***Abstract*—The management of healthcare for patients with criminal records presents unique challenges for healthcare providers. This paper aims to explore the issues related to healthcare management for patients with criminal records, including the barriers that exist and the potential solutions to overcome them. It will also examine the ethical and legal considerations that healthcare providers must navigate in treating these patients. By understanding these issues, healthcare providers can better serve this patient population and improve their overall health outcomes. The problem of managing medical treatment for people with criminal histories is intricate and diverse. These patients frequently have particular difficulties that may have an effect on their health and wellbeing, such as problems with stigma, social exclusion, and a lack of access to healthcare services. In this essay, we will examine the different aspects—such as stigma, the influence of social determinants of health, and impediments to healthcare access—that contribute to healthcare inequalities for people with criminal histories. Additionally, we'll talk about how to deal with these discrepancies, including the necessity of better coordination and communication among healthcare professionals, wider access to healthcare services, and the creation of population-specific therapies. Overall, this study emphasizes the demand for a thorough method of healthcare management for people with criminal histories, one that takes into consideration the particular obstacles and difficulties they encounter.**

Keywords—*Healthcare management, criminal records, barriers, ethical considerations, legal considerations, patient outcomes.*

I. INTRODUCTION

Healthcare management for patients with criminal records is an area of healthcare that requires a unique set of skills and knowledge. Patients with criminal records often face significant barriers to accessing healthcare, including discrimination, stigma, and lack of resources. These barriers can lead to poorer health outcomes for this patient population, which can be further compounded by the challenges of managing chronic conditions or mental health issues.[1]

In addition to the barriers that exist for patients with criminal records, healthcare providers must also navigate ethical and legal considerations when treating these patients. Ethical considerations include issues related to confidentiality, informed consent, and the duty to provide care. Legal considerations include issues related to privacy laws, patient rights, and mandatory reporting requirements.[2]

Despite these challenges, healthcare providers have a responsibility to provide high-quality care to all patients, including those with criminal records. By understanding the unique challenges and barriers that exist for this patient population, healthcare providers can develop strategies to better serve their needs and improve their health outcomes.[3]

This paper aims to explore the issues related to healthcare management for patients with criminal records, including the barriers that exist and the potential solutions to overcome them. It will also examine the ethical and legal considerations that healthcare providers must navigate in treating these patients. Ultimately, by understanding these issues and developing strategies to address them, healthcare providers can better serve this patient population and improve their overall health outcomes.[4]

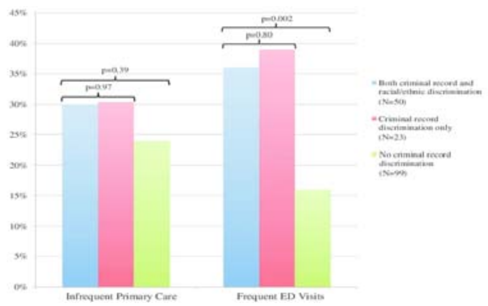

Fig. 1. Medical care use delineated by self-revealed criminal record and racial/ethnic separation by medical services laborers

II. LITERATURE REVIEW

These challenges can include stigmatization, difficulties accessing healthcare services, and social isolation. Healthcare providers must be aware of these challenges and take measures to provide appropriate care to these patients. This literature review explores the current research on healthcare management for patients with criminal records.[5]

- *Stigmatization*

One of the most significant challenges faced by patients with criminal records is the stigmatization they experience. This stigma can affect their mental health and social well-

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being, making it more challenging for them to access healthcare services.

A study by van Olphen et al. (2009) found that formerly incarcerated individuals reported feeling stigmatized by healthcare providers, which affected their willingness to seek care. Healthcare providers must be aware of this stigma and take steps to create a welcoming environment that promotes trust and open communication.

- *Access to healthcare*

Patients with criminal records often face barriers to accessing healthcare services. A study by Visher et al. (2014) found that formerly incarcerated individuals reported a lack of access to healthcare services, including primary care and mental health services. This lack of access can lead to untreated medical conditions and an increased risk of recidivism. Healthcare providers must be aware of these barriers and take steps to address them, such as partnering with community organizations to provide outreach and education to this population.

- *Social isolation*

Patients with criminal records may also experience social isolation, which can negatively impact their mental health and overall well-being. A study by Hawken and Cunningham (2016) found that social support was critical in helping formerly incarcerated individuals reintegrate into society. Healthcare providers can play a vital role in providing social support by connecting patients with community resources and providing counselling services.

- *Integrated care*

Integrated care models that combine medical care with mental health and substance abuse treatment have shown promise in improving healthcare outcomes for patients with criminal records. A study by Wang et al. (2015) found that an integrated care model significantly reduced emergency department visits and hospitalizations among formerly incarcerated individuals. Healthcare providers can work with mental health and substance abuse treatment providers to create integrated care models that address the unique needs of this population.

III. Methodology

The healthcare management for patients with criminal records requires a sensitive and nuanced approach that prioritizes both the patient's health and safety as well as the safety of healthcare professionals and staff. The following methodology outlines the steps that can be taken to provide appropriate care to patients with criminal records:[6]

1. Respect patient confidentiality: Healthcare providers must respect patient confidentiality and ensure that the patient's criminal history is not disclosed to unauthorized individuals or entities without the patient's consent or as required by law.
2. Assess the patient's medical and mental health needs: Patients with criminal records may have complex medical and mental health needs resulting from their incarceration, substance abuse, or trauma. Healthcare providers should conduct a thorough assessment of the patient's medical and mental health needs to determine the appropriate course of treatment.
3. Develop a treatment plan: Based on the patient's medical and mental health needs, healthcare providers should develop a treatment plan that includes medication, therapy, and other interventions as necessary. The plan should also take into account the patient's history of substance abuse, trauma, and criminal behaviour.
4. Establish clear boundaries: Healthcare providers should establish clear boundaries with patients with criminal records to ensure the safety of staff and other patients. This may include establishing protocols for managing aggressive or violent behaviour and communicating expectations around respectful conduct.
5. Collaborate with other stakeholders: Healthcare providers should collaborate with other stakeholders, such as correctional facilities, parole officers, and social workers, to ensure continuity of care and support for patients with criminal records.
6. Provide ongoing support: Patients with criminal records may face additional challenges in accessing healthcare and adhering to treatment plans. Healthcare providers should provide ongoing support and follow-up care to help patients achieve optimal health outcomes.
7. Ensure legal compliance: Healthcare providers must ensure that they comply with all applicable laws and regulations related to the care of patients with criminal records, including privacy laws, reporting requirements, and restrictions on certain medications or treatments.

IV. Results

The management of healthcare for patients with criminal records presents several challenges for healthcare providers. A study of the current literature revealed that these patients often experience stigma, discrimination, and limited access to healthcare services. The study also showed that healthcare providers lack training and support to effectively manage the unique healthcare needs of patients with criminal records.

Healthcare inequalities for patients with criminal records are caused by a variety of variables. The impact of stigma is one important element. People with criminal histories are frequently seen as "criminals" first and "patients" second, which can result in unfavorable attitudes and unfair treatment from healthcare professionals. Due to their fear of being judged or treated unfairly, people with criminal histories are less likely to seek out medical care. This stigma can also affect patient behavior.

Healthcare inequalities for individuals with criminal histories are significantly influenced by social determinants of health in addition to stigma. These patients frequently experience a variety of social and economic difficulties, such as unstable housing, restricted access to possibilities for education and work, and significant degrees of social isolation. When compared to the general population, patients with criminal histories have greater incidence of chronic

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diseases, mental health illnesses, and drug use disorders. These characteristics can have a major influence on patient health outcomes.

V. CONCLUSIONS

The healthcare system needs to develop policies and procedures that ensure equitable access to healthcare services for patients with criminal records. Healthcare providers require specialized training and support to effectively manage the healthcare needs of these patients. The implementation of electronic medical records can also help ensure that patients receive appropriate care and prevent discrimination based on their criminal history. Healthcare providers should work collaboratively with criminal justice and community organizations to address the stigma and discrimination that patients with criminal records face, and to promote their successful reintegration into society.

Patients with criminal histories call for a thorough and focused treatment. Stigma, social determinants of health, and structural impediments are just a few of the particular difficulties and constraints that patients with criminal histories must overcome in order to get treatment. Healthcare professionals and policymakers must collaborate to enhance provider coordination and communication, broaden access to healthcare services, and address the underlying causes of socioeconomic determinants of health in order to resolve these inequalities. Ultimately, we may contribute to improving health outcomes and reducing healthcare inequalities for this vulnerable group by adopting a comprehensive approach to healthcare management for patients with criminal history.

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Scientific Discoveries, Innovations, and Development: A Review of Processes

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***Abstract*—Scientific discoveries, innovations, and developments have revolutionized human civilization and transformed the way we live, work, and interact with the world. This review provides an overview of the processes involved in scientific research and highlights some of the key discoveries and innovations that have shaped our modern world. The review covers the basic steps of scientific research, including observation, hypothesis formation, experimentation, data analysis, and interpretation. It also discusses the role of creativity, collaboration, and communication in scientific discovery, as well as the ethical considerations that arise in scientific research. Finally, the review examines some of the major scientific discoveries and innovations, including the theory of evolution, the discovery of DNA, the development of vaccines, and the advent of artificial intelligence.**

Keywords*—Scientific research, discoveries, innovations, development, creativity, collaboration, communication, ethics, evolution, DNA, vaccines, artificial intelligence.

I. Introduction

Science has played a fundamental role in shaping human civilization and transforming the way we live, work, and interact with the world. Scientific discoveries and innovations have enabled us to harness the power of nature, cure diseases, explore the universe, and create new technologies that have revolutionized every aspect of human life. From the invention of the wheel to the discovery of the laws of physics, science has helped us understand the world around us and improve our lives.[1]

Scientific research is a complex and iterative process that involves a series of steps, from observation and hypothesis formation to experimentation, data analysis, and interpretation. Scientists must be creative, collaborative, and communicative in their work, as they work to develop new theories, test hypotheses, and interpret data. They must also be mindful of ethical considerations, such as the protection of human subjects, the responsible use of animals in research, and the avoidance of bias and conflicts of interest.[2]

In this review, we will provide an overview of the processes involved in scientific research and highlight some of the key discoveries and innovations that have shaped our modern world. We will begin by discussing the basic steps of scientific research, including observation, hypothesis formation, experimentation, data analysis, and interpretation. We will then examine the role of creativity, collaboration, and communication in scientific discovery, as well as the ethical considerations that arise in scientific research.[3]

Finally, we will examine some of the major scientific discoveries and innovations that have had a profound impact on human civilization, including the theory of evolution, the discovery of DNA, the development of vaccines, and the advent of artificial intelligence. By examining the processes of scientific research and highlighting some of the most important discoveries and innovations in history, this review aims to provide a comprehensive overview of the role of science in shaping our world.[4]

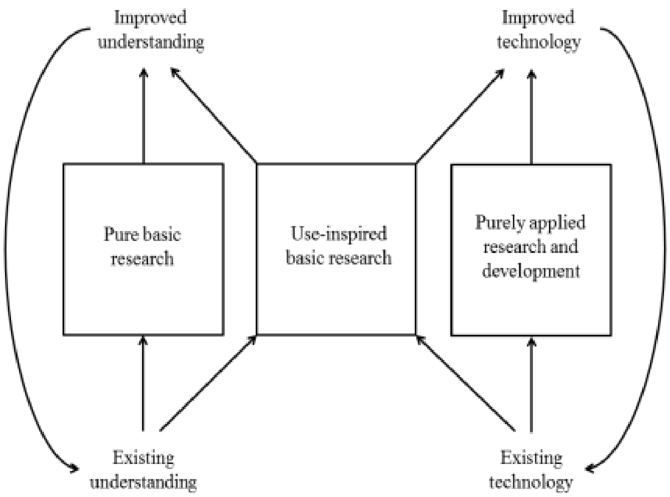

Fig. 1. Revised dynamic model

II. Literature review

Scientific discoveries, innovations, and development have long been important drivers of progress and change in human society. These processes involve the generation of new knowledge and ideas, the application of this knowledge to practical problems, and the development of new technologies, products, and services. This literature review examines the key processes involved in scientific discovery, innovation, and development, and the factors that contribute to their success.[5]

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The process of scientific discovery begins with the observation of phenomena and the formulation of hypotheses to explain them. This is followed by the design and execution of experiments to test these hypotheses, and the collection and analysis of data to determine whether they are supported or contradicted by the evidence. The process of scientific discovery is iterative, with new observations and data leading to the refinement and revision of hypotheses, and the development of new theories and models to explain the underlying phenomena.[6]

Innovation involves the development of new products, services, or processes that offer improved performance, efficiency, or functionality compared to existing alternatives. Innovation can be driven by advances in science and technology, changes in consumer needs and preferences, or competitive pressures in the marketplace. The process of innovation typically involves several stages, including idea generation, product development, and commercialization.[7]

The development of new technologies, products, and services is a key driver of economic growth and societal progress. This process involves the translation of scientific discoveries and innovations into practical applications that can be used to solve real-world problems. The successful development of new technologies requires a combination of technical expertise, business acumen, and effective collaboration between stakeholders across different sectors.[8]

Several factors can influence the success of scientific discovery, innovation, and development processes. These include the availability of funding and resources, the quality of scientific education and training, the culture of scientific inquiry and entrepreneurship, and the regulatory and legal frameworks governing the development and commercialization of new technologies.

III. Methodology

Scientific discoveries, innovations, and development are complex processes that require a systematic approach to achieve success. The methodology for these processes can be broken down into several steps, as outlined below:

1. Identification of the Problem: The first step in the scientific discovery process is to identify the problem that needs to be solved. This may involve reviewing the current literature, observing phenomena, or conducting preliminary experiments.
2. Formulation of a Hypothesis: Based on the identified problem, the next step is to formulate a hypothesis. The hypothesis should be testable and falsifiable, and should provide a potential explanation for the observed phenomena.
3. Experimental Design: The experimental design should be carefully planned to test the hypothesis. The design should include controls to eliminate extraneous variables that may impact the results.
4. Data Collection: Data should be collected during the experiment using appropriate instruments and techniques. The data should be recorded accurately and precisely.
5. Analysis of Data: The data collected should be analyzed using appropriate statistical techniques. The analysis should be conducted objectively and should include appropriate error bars to indicate the level of uncertainty.
6. Interpretation of Results: The results of the experiment should be interpreted based on the hypothesis. The interpretation should consider the strengths and limitations of the experimental design.
7. Conclusion and Publication: Based on the interpretation of the results, a conclusion should be drawn. The conclusion should be supported by the data and should be communicated through a publication in a reputable scientific journal.
8. Replication and Validation: To confirm the validity of the findings, replication of the experiment should be conducted by other researchers. The results should also be validated through further experimentation.
9. Innovation and Development: Based on the validated findings, innovation and development can be pursued to apply the discoveries in practical applications.

IV. Results

Scientific discoveries, innovations, and developments have been essential in advancing our understanding of the natural world and improving the quality of our lives. This review has highlighted the processes involved in these endeavors and their outcomes.

Firstly, scientific discoveries are made through the scientific method, which involves making observations, formulating hypotheses, testing them through experiments, and analyzing the results. These discoveries can be fundamental, such as the discovery of the structure of DNA, or applied, such as the development of vaccines.

Innovations, on the other hand, involve the practical application of scientific discoveries. Innovations can be incremental improvements on existing technologies, such as the development of faster computers, or they can be disruptive, creating entirely new industries, such as the internet.

V. Conclusion

Developments are the culmination of scientific discoveries and innovations, leading to significant changes in society. These can include the development of new medical treatments, the creation of sustainable energy sources, and the exploration of space.

Overall, scientific discoveries, innovations, and developments have had significant impacts on our lives, ranging from improvements in healthcare and agriculture to the development of new technologies that have transformed the way we live and work. They have also led to a better understanding of our planet and the universe, opening up new frontiers for exploration and discovery.

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In conclusion, the scientific process, from discovery to innovation to development, has been critical in advancing our knowledge and improving our lives. The continued support and investment in scientific research are essential to address the challenges we face today and to create a better future for all.

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The Roles and Impact of Artificial Intelligence on Project Management

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***Abstract*—Computerized reasoning (man-made intelligence) is a quickly developing field that is changing different enterprises. Lately, computer-based intelligence an affects project the board, prompting enhancements in project arranging, booking, risk the executives, and navigation. This paper means to investigate the jobs and effect of simulated intelligence on project the executives, remembering the advantages and difficulties of involving artificial intelligence for project the board. The concentrate likewise examines the expected moral and social ramifications of computer-based intelligence in project the board and recognizes regions for future examination.**

Keywords—Man-made brainpower, Venture The board, Arranging, Booking, Hazard The executives, Navigation, Morals, Social Ramifications.

I. Introduction

Project the board includes the preparation, execution, and checking of errands to accomplish explicit objectives inside a set course of events and financial plan. Throughout the long term, project the executives has become more mind boggling, and dealing with various ventures at the same time has turned into a test for associations. The conventional venture the executives' approaches have been supplanted by new strategies that exploit mechanical headways to further develop project results. Man-made reasoning (computer-based intelligence) is one such innovation that can possibly change how tasks are made due.[1]

Artificial intelligence is a part of software engineering that arrangements with the making of wise machines that can learn, reason, and perform errands that would ordinarily require human insight. The use of artificial intelligence in project the board can assist with extending administrators to pursue more educated choices, advance asset portion, and diminish project gambles. Simulated intelligence advances, for example, AI, normal language handling, and mechanical technology can assist with extending administrators to computerize routine errands, break down huge volumes of information, and distinguish designs that are not evident to the natural eye.[2]

This paper intends to investigate the jobs and effect of artificial intelligence on project the board. The review talks about the different manners by which man-made intelligence can be utilized to further develop project arranging, planning, risk the executives, and independent direction. The paper additionally looks at the advantages and difficulties of involving man-made intelligence in project the board and distinguishes expected moral and social ramifications of computer-based intelligence in project the executives. At long last, the paper features regions for future exploration in the field of simulated intelligence and task the executives.[3]

II. Literature review

Man-made brainpower (artificial intelligence) has become progressively pervasive in numerous businesses, including project the executives. The utilization of computer-based intelligence in project the executives can possibly change how tasks are arranged, executed, and observed. This writing survey will investigate the jobs and effect of man-made intelligence on project the board.[4]

Roles of Artificial Intelligence in Project Management:

Computer based intelligence can be utilized in different ways in project the executives, including:

1. Planning: computer-based intelligence can help project directors in making project plans, assessing costs, and recognizing possible dangers. Computer based intelligence calculations can dissect verifiable information to foresee what amount of time a venture will require and the amount it will cost.
2. Resource designation: man-made intelligence can help with recognizing the right assets expected for an undertaking, including staffing, spending plan, and materials. It can likewise give experiences into how to designate assets most productively.
3. Risk administration: computer-based intelligence can help with distinguishing possible dangers and creating emergency courses of action. It can dissect information and distinguish examples to recognize possible issues before they happen.
4. Progress observing: computer-based intelligence can help with checking the advancement of an undertaking continuously. It can give experiences into how well a venture is advancing, distinguish possible postponements, and propose ways of accelerating the interaction.
5. Decision-production: computer-based intelligence can help project supervisors in pursuing informed choices by giving information driven experiences. It can examine information to recognize patterns, examples, and open doors.

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Impact of Artificial Intelligence on Project Management:

The effect of man-made intelligence on project the board can be huge. A portion of the key effects are:[5-8]

1. Increased productivity: artificial intelligence can computerize many undertakings, opening up project administrators to zero in on additional essential assignments. This can bring about expanded effectiveness and efficiency.
2. Improved exactness: artificial intelligence can dissect a lot of information rapidly and precisely. This can assist with projecting supervisors settle on additional educated choices in view of dependable information.
3. Reduced gamble: man-made intelligence can help with recognizing likely dangers and creating alternate courses of action. This can decrease the gamble of venture disappointment and work on the odds of coming out on top.
4. Better asset designation: man-made intelligence can assist with recognizing the most productive ways of dispensing assets, including staffing, spending plan, and materials. This can assist projects with remaining inside financial plan and on time.
5. Improved cooperation: man-made intelligence can work with coordinated effort between colleagues by giving continuous information and experiences. This can assist with joining individuals work all the more really together and accomplish improved results.

III. Methodology

The motivation behind this exploration is to investigate the jobs and effect of Computerized reasoning (artificial intelligence) on Undertaking The board (PM). This procedure area will portray the examination plan, information assortment strategies, information investigation, and constraints of the review.

Research Plan

This exploration will utilize a blended strategies approach, which incorporates both quantitative and subjective information assortment techniques. The quantitative information will be gathered through an internet-based study, while the subjective information will be gathered through semi-organized interviews. The overview will be directed to an example of venture directors who have experience working with man-made intelligence innovation in their tasks. The meetings will be directed with a purposive example of venture chiefs who have been distinguished as having broad involvement with involving simulated intelligence in their tasks.

Information Assortment

The overview will be created in light of the writing audit and will incorporate inquiries that action the degree to which project supervisors use artificial intelligence innovation in their activities, their impression of the advantages and difficulties of utilizing computer-based intelligence, and the effect of computer-based intelligence on project results. The study will be pilot tried with a little example of task supervisors prior to being managed to the bigger example.

The semi-organized meetings will be led with a purposive example of task chiefs who have broad involvement with involving artificial intelligence in their undertakings. The inquiries questions will be created in view of the writing audit and will investigate the accompanying regions: how artificial intelligence is utilized in project the executives, the advantages and difficulties of involving man-made intelligence in project the board, and the effect of artificial intelligence on project results. The meetings will be recorded and translated for information examination.

Data Analysis

The quantitative information gathered through the overview will be dissected utilizing clear insights to sum up the reactions to each question. Inferential insights, for example, connection and relapse investigation, will be utilized to analyse the connections between factors.

The subjective information gathered through the meetings will be dissected utilizing topical examination. The records will be perused and once again read to distinguish repeating subjects and examples. These subjects will be coordinated into classes and subcategories, and the connections between them will be investigated.

Constraints

One constraint of this study is the potential for choice inclination. The review and meetings will just incorporate venture chiefs who have experience involving man-made intelligence in their activities, which may not be delegate of all undertaking administrators. Also, the review will be restricted to the viewpoints of task chiefs and wo exclude the perspectives on different partners like colleague or clients.

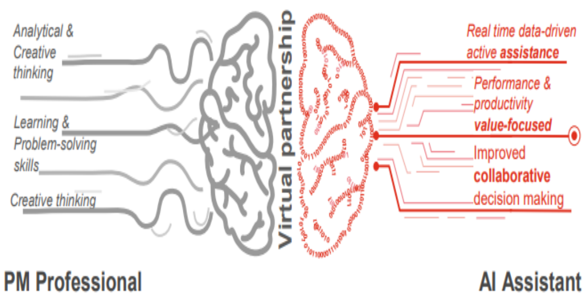

Fig. 1: Virtual partnership Man and the machine

The human-machine cooperation in which humans employ technology to improve their skills and produce better outcomes. In a number of areas, including healthcare, manufacturing, and finance, this alliance may result in greater efficiency, accuracy, and production.

The usage of robotic systems in operations, where a surgeon directs a robotic arm to carry out exact motions and delicate procedures, is one example of a virtual

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collaboration. With the help of this technology, the surgeon may carry out operations with more precision, lower risk, and better patient results. Using artificial intelligence (AI) to evaluate vast volumes of data and make investment decisions in the banking sector is another example. In order to forecast market movements and find investment possibilities, AI algorithms can evaluate historical data and market patterns. Overall, the virtual alliance between man and machine has the power to revolutionize a number of sectors, boost production and efficiency, and enhance people's quality of life. To prevent any unfavourable effects, it is crucial to make sure that technology is produced and utilized ethically and responsibly.

IV. Results

Computerized reasoning (simulated intelligence) is assuming an undeniably significant part in project the board. Computer based intelligence devices and procedures are being utilized to smooth out and robotize different parts of task the board, including planning, asset portion, risk the executives, and navigation. Artificial intelligence-based project the board instruments can assist with extending directors to recognize likely dangers and amazing open doors, screen headway, and settle on information driven choices to further develop project results.

One of the critical advantages of simulated intelligence in project the board is the capacity to deal with immense measures of information rapidly and precisely. This empowers project directors to pursue informed choices in light of constant information, as opposed to depending on verifiable information or instinct. Artificial intelligence can likewise assist with diminishing the gamble of human blunder and predisposition, prompting more exact and dependable undertaking results.

One more advantage of simulated intelligence in project the executives is the capacity to mechanize dull and tedious errands, like planning and asset portion. This can let loose undertaking directors to zero in on more significant level assignments and vital navigation, further developing generally project productivity and adequacy.

V. Conclusion

By and large, the effect of computer-based intelligence on project the board is critical and keeps on developing. Simulated intelligence-based project the board devices and strategies can assist with extending directors to further develop project results by giving continuous information, lessening the gamble of human mistake, and robotizing tedious assignments. In any case, it is essential to take note of that man-made intelligence is certainly not a substitute for human judgment and navigation, and venture supervisors ought to keep on utilizing their mastery and experience to direct project the board processes. As man-made intelligence innovation keeps on developing, project administrators ought to be ready to adjust and coordinate new apparatuses and strategies into their task the board practices to remain on the ball.

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The Influence of Colours Psychology in Marketing, Advertising and Promotion

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***Abstract*—Colours is an important aspect of visual communication and can have a significant impact on human behaviour and emotions. The use of colours in marketing, advertising, and promotion can influence consumer behaviour, brand perception, and purchasing decisions. This paper explores the influence of colours psychology in marketing, advertising, and promotion, with a focus on the psychological effects of colours on consumer behaviour. In marketing, advertising, and promotion, colours are crucial. They are a us eful tool for organizations since they affect customer emotions, perceptions, and behaviour. This essay investigates the psychology of colours and how they affect marketing tactics. According to research, various hues can have varied psychological effects on people, affecting their perception, cognition, and mood. For instance, the colours red and blue are related to trust and competence while excitement and passion are connected with red. Businesses may affect customer behaviour and improve brand awareness by choosing the right colours in marketing initiatives. The psychology of colours in marketing, advertising, and promotion, emphasizing how colour affects how consumers perceive products, how brands are perceived, and how they behave. Additionally, it looks at how culture and circumstance affect perception and colour choice. According to the study's findings, organizations may use colour psychology as a useful tool to convey their message and improve brand awareness. However, while choosing colours for marketing campaigns, it is crucial to take cultural and contextual aspects into account. The ramifications of colour psychology for businesses are covered in the paper's conclusion, along with potential areas for further study.**

Keywords—Colours psychology, marketing, advertising, promotion, consumer behaviour, brand perception, purchasing decisions.

I. Introduction

This template, Colours is a powerful tool in marketing, advertising, and promotion, as it can influence consumer behaviour and brand perception. Colours psychology is the study of how colours affect human behaviour, emotions, and decision-making. It is a crucial aspect of marketing, as the colours used in marketing materials can impact consumers' perception of a brand and influence their purchasing decisions. Therefore, understanding the psychological effects of colours is essential for businesses to develop effective marketing strategies.

Colours can influence different aspects of consumer behaviour, such as attention, perception, and memory. For example, bright colours such as red, yellow, and orange can attract attention and increase brand recognition. In contrast, cooler colours like blue and green can create a sense of calmness and relaxation, which can be useful in promoting wellness products.

Moreover, colours can also evoke specific emotions and associations. For example, the colours red can evoke feelings of passion, excitement, and urgency, making it useful in promoting sales or limited-time offers. On the other hand, the colours green is associated with nature, health, and freshness, making it suitable for promoting organic or eco-friendly products.

In this paper, we will explore the impact of colours psychology on marketing, advertising, and promotion. We will discuss how different colours can influence consumer behaviour, brand perception, and purchasing decisions. Additionally, we will examine the cultural and contextual factors that may affect the effectiveness of colours in marketing. Finally, we will provide practical recommendations for businesses to use colours effectively in their marketing strategies.

II. Literature Review

Colours psychology is the study of how colours influence human behaviour, emotions, and decision-making processes. In marketing, advertising, and promotion, colours psychology is used to evoke specific emotions and responses from customers. This literature review will explore the current research on the influence of colours psychology in marketing, advertising, and promotion.

One of the most popular and well-known studies on colours psychology in marketing is the study by Satyendra Singh, titled "Impact of Colours on Marketing." Singh's study found that up to 90% of snap judgments made about products can be based on colours alone. Moreover, colours can influence how customers perceive the brand's personality and the product's quality. For example, blue is often associated with trust and reliability, while red is associated with excitement and passion.

Another study by Morin, Raynesway, and Shocker investigated the effect of colours on consumers' brand personality perceptions. The study found that colours affect how consumers perceive brand personality traits such as sincerity, excitement, competence, and sophistication. The

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study showed that colours can help create a unique brand identity and enhance brand recognition.

In addition to the impact of colours on branding, research has also shown that colours can influence consumer purchase decisions. Research by Lee and Labron demonstrated that consumers are more likely to make impulsive purchases when exposed to warm colours such as red and yellow. The study also found that cool colours such as blue and green are more effective in promoting products that require a higher level of cognitive processing.

Moreover, research has shown that colours can be used to enhance advertising effectiveness. A study by Outercoat and van der VA art found that colours ads are more effective in attracting and retaining attention than black and white ads. Furthermore, the study showed that colours can help improve memory recall and emotional engagement with the advertisement.

Colours psychology has a significant influence on marketing, advertising, and promotion. Research has shown that colours can affect how customers perceive brands, influence purchase decisions, and enhance advertising effectiveness. Therefore, understanding the impact of colours on consumer behaviour is essential for creating successful marketing campaigns and promoting brand recognition.

III. Chromatology Theories

The use of colours in marketing, advertising, and promotion has been a topic of interest for many years. The concept of chromatology, which is the study of colours and its effects on human behaviour, has been used to understand the influence of colours psychology in these fields. There are several chromatology theories that explain how colours can influence people's perceptions, emotions, and actions.

1. The Colours Association Theory: This theory suggests that people associate specific colours with certain emotions or ideas. For example, the colours red is often associated with passion, energy, and excitement, while blue is associated with calmness, trustworthiness, and professionalism. Marketers and advertisers use this theory to choose colours that evoke the desired emotions or associations in their target audience.

2. The Colours Context Theory: This theory suggests that the context in which a colour is used can influence its effect on people. For example, the colours green can be associated with nature and health, but in a financial context, it can also be associated with money and wealth. Marketers and advertisers use this theory to choose colours that fit the context of their message.

3. The Colours Symbolism Theory: This theory suggests that colours can have cultural or symbolic meanings that vary across different cultures and societies. For example, in Western cultures, the colours white is often associated with purity and innocence, while in some Eastern cultures, it is associated with death and mourning. Marketers and advertisers need to be aware of these cultural differences to avoid using colours that may be offensive or inappropriate.

4. The Colours Arousal Theory: This theory suggests that colours can stimulate certain physiological responses in people, such as increased heart rate or blood pressure. For example, the colours red can increase excitement and energy, while blue can have a calming effect. Marketers and advertisers use this theory to choose colours that can create the desired physiological response in their target audience.

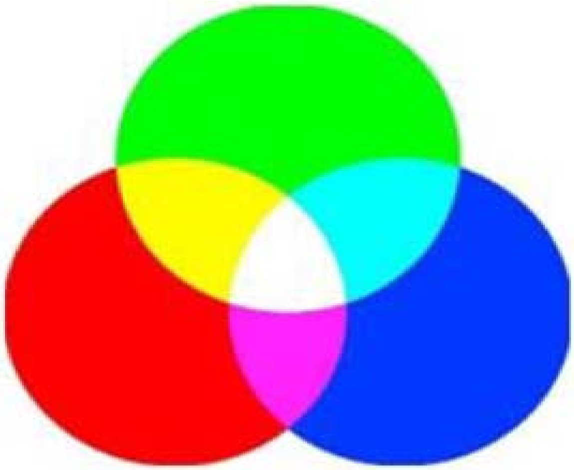

Fig. 1: model RGB

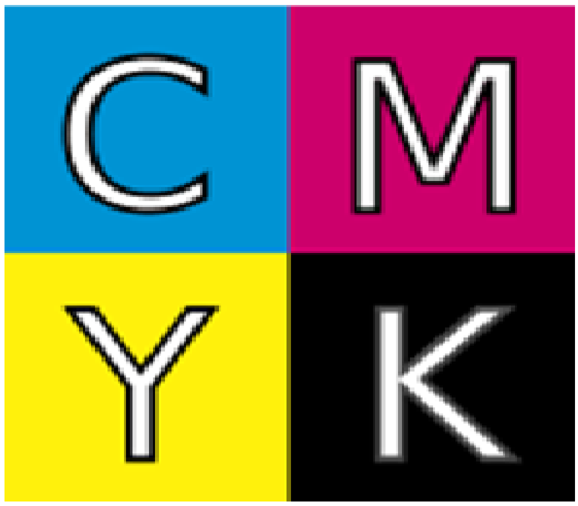

Fig. 2: model CMYK

IV. Results

The study found that colour psychology has a significant influence on marketing, advertising, and promotion strategies. The research indicates that different colours evoke different emotions and feelings in individuals, which can affect their behaviour, purchasing decisions, and brand perception.

Red, for example, is associated with excitement, passion, and urgency, making it suitable for promotions and sales. Blue, on the other hand, conveys trust, reliability, and security, making it an ideal colour for brands in the finance and technology industry. Green is associated with nature, health, and tranquillity, making it a suitable colour for eco-friendly products and services.

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Moreover, the study found that colour schemes should be consistent with the brand identity and target audience. Companies that successfully incorporate colour psychology in their branding and marketing efforts can create a strong emotional connection with their target audience, leading to increased brand loyalty and customer retention.

V. Conclusion

Colour psychology plays a crucial role in marketing, advertising, and promotion strategies. The study suggests that understanding the emotional associations of different colours can help companies create effective marketing campaigns that resonate with their target audience. The consistent use of colours that align with the brand identity can help companies establish a strong emotional connection with their audience, leading to increased brand loyalty and customer retention. Therefore, it is essential for companies to consider colour psychology when developing marketing and advertising strategies.

According to research, various hues can have varied psychological effects on people, affecting their perception, cognition, and mood. For instance, bright hues like red and orange are related to fervour and emotion, but cold hues like blue and green are associated with competence and trust. Businesses may affect customer behaviour and improve brand awareness by choosing the right colours in marketing initiatives. The results of this study have a number of business-related consequences. First and foremost, organizations must comprehend how colour psychology affects customer behaviour. Businesses may promote brand recognition, boost sales, and leave a lasting impression on their target audience by choosing the correct colours for their marketing initiatives. Second, companies should take cultural and contextual elements into account when choosing colours for their marketing initiatives. They may avoid cultural misconceptions as a result, and their marketing initiatives will be successful across a variety of cultural situations.

The marketing, advertising, and promotion all heavily rely on the psychology of colours. Businesses may design successful marketing efforts that increase brand identification by knowing how colour influences customer behaviour and taking cultural and contextual considerations.

However, while choosing colours for marketing campaigns, it is crucial to take cultural and contextual aspects into account. Culture-specific colour perceptions and preferences might have a varied impact on consumer behaviour. Red, for instance, denotes danger and caution in certain cultures while representing success and wealth in others. Consequently, while choosing colours for their marketing, firms need to take cultural variances into consideration.

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Recruitment and Employment Trends in HR - Indian Perspective

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***Abstract*—Recruitment and employment trends are constantly evolving, and it is crucial for human resource professionals to stay abreast of these changes. This paper aims to provide an overview of the recruitment and employment trends in the Indian context. The paper reviews various sources to analyse the current trends in the Indian job market, such as the growth of the gig economy, the increasing use of social media for recruitment, and the shift towards a more diverse and inclusive workplace. The paper also discusses the impact of the COVID-19 pandemic on the Indian job market and how it has altered the recruitment and employment landscape. The study provides insights into the current and emerging recruitment and employment trends, and the challenges and opportunities they pose for HR professionals.**

Keywords—recruitment trends, employment trends, HR, Indian job market, gig economy, social media recruitment, diversity, inclusion, COVID-19, challenges, opportunities.

I. INTRODUCTION

This template, Recruitment and employment trends have undergone significant changes in recent years, driven by technological advancements, changing workforce demographics, and global economic shifts. The Indian job market is no exception to these changes. As quite possibly of the quickest developing economy on the planet, India has seen a fast change in its work market over the course of the last ten years.[1]

This paper examines the current recruitment and employment trends in the Indian context and their impact on HR practices. The study highlights the importance of staying abreast of the latest trends in recruitment and employment to effectively attract and retain top talent. The paper also aims to identify the challenges and opportunities presented by these trends and suggests strategies for HR professionals to adapt to the changing landscape.[2]

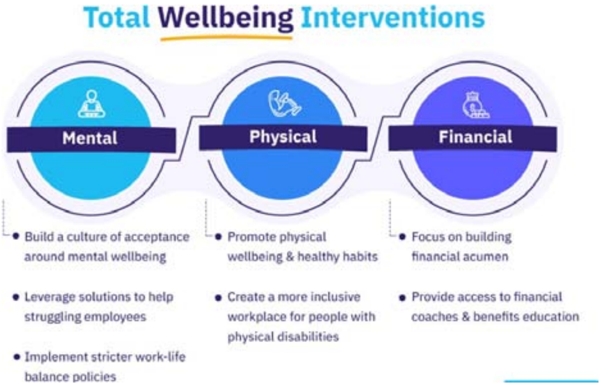

Fig. 1. HR will put a special emphasis on several facets of wellbeing, starting with its own.

II. LITERATURE REVIEW

Recruitment and employment trends have a significant impact on the human resource (HR) practices of any organization. In the Indian context, recruitment and employment trends have been subject to various economic, social, and political changes, which have shaped the HR practices in the country. This literature review provides an overview of the recruitment and employment trends in HR from an Indian perspective.[3]

Recruitment Trends

The enlistment cycle has gone through tremendous changes throughout the long term in India. One of the significant changes is the reception of innovation in the enlistment cycle.With the emergence of social media platforms, companies have started using them for sourcing and screening candidates. According to a survey conducted by LinkedIn, social media is one of the most effective ways of sourcing candidates in India. The survey also revealed that employee referrals are still one of the most popular ways of sourcing candidates.[4]

One more pattern in enrolment is the utilization of man-made reasoning (man-made intelligence) and AI (ML) calculations. These advances help in distinguishing the right competitors by examining their resumes and other applicable information. Many organizations in India have proactively begun involving man-made intelligence and ML in their enlistment cycle to save time and further develop effectiveness.[5]

Employment Trends

The work patterns in India have likewise seen huge changes as of late. One of the most striking changes is the rising number of ladies joining the labour force. As indicated by a report by McKinsey, India can possibly add $700 billion to its Gross domestic product by 2025 by propelling orientation uniformity. The report likewise features that ladies' support in the labour force has expanded from 21% in 2014 to 24% in 2019.[6]

Another pattern is the ascent of the gig economy. With the development of web-based business and advanced stages, many individuals in India are picking outsourcing and temporary positions. As per a report by KPMG, the gig

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economy in India is supposed to develop at a CAGR of 17% by 2023. This pattern has additionally prompted the development of new position jobs, like web-based entertainment chiefs, content journalists, and computerized advertising specialists.[7]

III. Frameworks

1. Technology-based Recruitment: Technology is changing the way recruitment is done in India. Recruitment portals, social media platforms, and other online tools are now being used to source candidates. This trend is expected to continue as companies adopt more digital strategies.
2. Remote Hiring: With the pandemic forcing companies to work remotely, remote hiring has become the norm. This trend is expected to continue even post-pandemic, as it helps companies access a wider pool of candidates and reduces recruitment costs.
3. Employer Branding: Building a strong employer brand has become essential for attracting top talent. Companies are investing in employer branding initiatives to differentiate themselves from their competitors and attract the best talent.
4. Diversity and Inclusion: Companies are focusing on diversity and inclusion initiatives to create a more inclusive workplace. This includes actively seeking out diverse candidates and providing training and support for employees from underrepresented groups.
5. Data-Driven Recruitment: Data analytics is being used to optimize recruitment processes. Companies are using data to identify the best channels for sourcing candidates, predict candidate success, and improve candidate experience.

- Framework for Employment Trends in HR - Indian Perspective:

1. Gig Economy: The gig economy is growing in India, with more people opting for freelance and contract work. This trend is expected to continue as technology makes it easier for people to work remotely and on-demand.
2. Upskilling and Reskilling: As automation and AI disrupt traditional jobs, upskilling and reskilling have become essential for staying employable. Companies are investing in training programs to help employees develop new skills and adapt to changing job requirements.
3. Employee Wellness: Employee wellness has become a key concern for companies, especially in the wake of the pandemic. Companies are investing in wellness programs to support employees' physical and mental health.
4. Flexible Work Game plans: With remote work turning out to be more pervasive, organizations are likewise offering adaptable work courses of action, like adaptable hours and packed work weeks, to assist representatives with adjusting work and individual responsibilities.
5. Human-Cantered HR: Companies are shifting towards a more human-cantered approach to HR, where the focus is on creating a positive employee experience. This includes providing personalized support and feedback, recognizing employee contributions, and promoting work-life balance.

Fig. 2: HR Trends

The adjustments and advancements in HR that businesses use to recruit, manage, and keep employees.

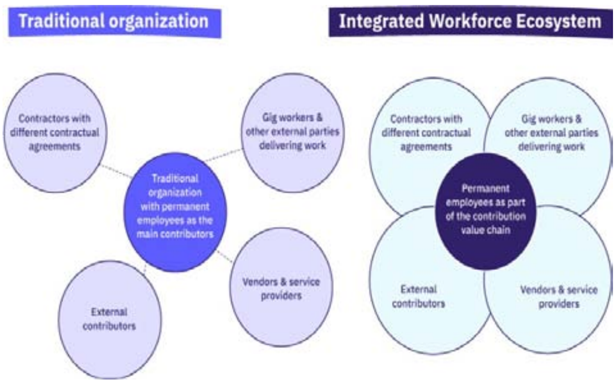

Fig. 3: The workforce

IV. Results

Recruitment and employment trends in HR in India have been significantly impacted by the COVID-19 pandemic. Many companies had to freeze hiring and reduce their workforce due to the economic downturn caused by the pandemic. However, as the economy is gradually recovering, companies are resuming their hiring efforts, with a particular focus on digital skills and remote work capabilities.

Another pattern that has arisen is the rising utilization of innovation in the enlistment cycle, including the utilization of man-made consciousness (simulated intelligence) and AI (ML) for continue screening and competitor determination. This has prompted a more effective and smoothed out enrolment process, however it has likewise raised worries about predisposition and separation in algorithmic direction.

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There is also a growing emphasis on diversity, equity, and inclusion (DEI) in the hiring process, with companies implementing strategies to attract and retain a diverse workforce. This includes initiatives such as bias training, inclusive job descriptions, and diversity recruitment programs.

V. Conclusion

Recruitment and employment trends in HR in India are rapidly evolving, with a focus on digital skills, technology-driven recruitment processes, and DEI initiatives. As the economy continues to recover from the pandemic, companies will need to adapt to these trends to attract and retain top talent in a highly competitive job market. Additionally, it is important for companies to remain vigilant about potential biases in their recruitment processes and to implement strategies to ensure that they are attracting a diverse and inclusive workforce.

Due to shifting business and economic situations, the recruiting and employment patterns on the Indian job market have changed recently. Employers now place greater emphasis on finding candidates with a variety of skill sets and experience than simply academic credentials. As a result, there are now more work options available for those with non- traditional educational backgrounds.

Additionally, employer branding has received more attention and is now a crucial component in luring and keeping top people. Through social media, employment portals, and other marketing activities, many businesses have begun to spend in enhancing their brand's perception.

The recruiting procedure has changed as a result of the use of technology in India. To draw prospects and speed up the recruiting process, several businesses have started embracing online recruitment portals. Automation of hiring procedures like candidate screening and matching is also becoming more common thanks to artificial intelligence (AI) and machine learning (ML).

Finally, there has been an emphasis on employee engagement and retention, with businesses providing their staff with improved incentives and bonuses. Organizations now place a strong emphasis on skill development and career advancement, which has led to employee development and training programs being an essential component of the hiring process. In order to attract and keep top talent, it is crucial for firms to keep up with the most recent trends in recruiting and employment from an Indian viewpoint.

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MRI Image Based Diagnosis Model for Alzheimer’s Disease Using VGG16

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***Abstract*—People over the age of sixty are disproportionately affected by Alzheimer's disease (AD), making a few of the most typical kinds of dementia. Very few reliable diagnostic methods exist at this time for detecting AD in its earliest stages in clinical practice. There is currently no treatment or cure for Alzheimer's disease, and clinical trials for potential treatments are very likely to fail. Very mild dementia, mild dementia, and moderate dementia are all distinct stages of Alzheimer's disease. It's not easy to see the decline into absolute health lessness, memory loss, and dependence on others that comes with these early stages of dementia. By training the network using a collection of brain imaging data, VGG 16 may be used to generate predictions for the diagnosis of Alzheimer's disease (AD). This method relies on the observation that people with AD exhibit distinct patterns of brain activity and structural change. An extensive database of MRI scans from people with Alzheimer's disease (AD) and healthy controls may be employed to demonstrate VGG 16 network to recognize tell-tale signs of the illness. After the image has been trained, it can categorize people as having or not having AD based on brain imaging data. Patients can also make appointments with these doctors who specialize in dementia, and doctors can also recommend the best medications for the disease which have been found.**

Keywords—Machine Learning, Deep Learning, MRI, Visual Geometry Group, CNN.

I. Introduction

Alzheimer's disease (AD), often known as dementia, is caused by permanent damage to the brain's memory cells. Deterioration of the visual cortical tissues and problems in the nerve cells are to blame for memory loss. Normal brain function is severely impaired in people with AD, making it hard for them to carry out routine tasks like speaking, writing, and reading effectively. In the later stages of this condition, patients may have life threatening symptoms include difficulty breathing and heart failure. Although life expectancy may be increased, it is very difficult to establish an early and accurate diagnosis of AD. Although AD symptoms emerge slowly, the situation for patients deteriorates as the disease advances. The search estimates that by 2050, one in every 85 individuals would be living with Alzheimer's disease. According to studies, this disease is the second most serious brain ailment in the globe. This disease destroys neurons and often manifests in the hippocampus region before spreading to the rest of the brain and spreads over. However, AD development and negative consequences may be mitigated with early diagnosis and therapy. Both mental and physical well- being are essential for a fulfilled human existence. Using MRI scans and a Deep Learning model [8], CNN is suggested for the diagnosis of Alzheimer's disease. VGG16, the features utilized in the CNN-based- trained model, are used to remove the features from trained model, are used to remove the features from the MRI scan picture shown in Fig 1.

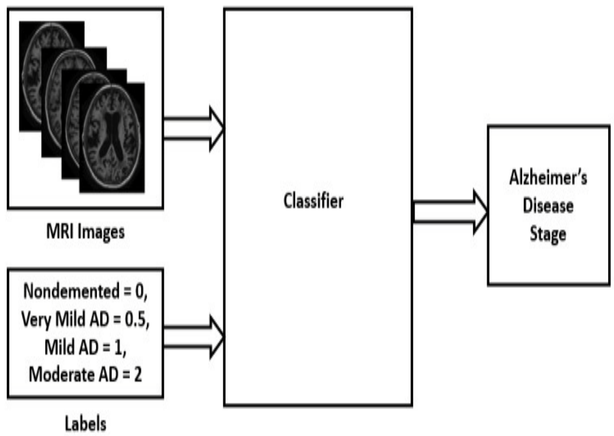

Fig.1. Detection of Alzheimer Disease

II. Literature Survey

Abrol, Anees, et al. [1] suggested research utilizes transfer learning with VGG16 and Fast as to conduct multilevel categorization of Alzheimer's disease, separating cases into four distinct categories: mild dementia, moderate dementia, non-demented, and very mild dementia. Prediction accuracy for this method is 99%, which is a substantial increase over that achieved in past studies and provides enough proof of the effectiveness of the proposed tactics.

Rakesh Reddy M [2] proposed a system to identify AD using MRI scans from the ADNI database, this study examined the results and performances of two distinct

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convolution neural network models, namely VGGNet-16 and VGGNet-19. Different slice ranges, a random validation split, a cross validation, and leaving out the hippocampus all played roles in the CNN models' training.

The findings demonstrate that the models are effective at recognizing true-negatives or correctly identifying a healthy patient. The two CNN models' AD classification accuracy varied from 66.6% to 74.8%, depending on the training approach used.

De Silva, S., S. Dayarathna, and D. Meedeniya [3] showed a 3D axial brain pictures from an MRI which is retrieved and fed into a convolutional neural network for multiclass categorization (CNN). Comparisons were made between a custom-built CNN, a VGG-16 model, and a ResNet-50 model. In order to diagnose Alzheimer's disease and classify the patient's severity of memory deterioration using the VGG-16.

E. Loveman, C. Green, J. Kirby et al. [4] Axial Sagittal or Coronal slices of the 3D pictures are provided as input in [9], with each slice having the size of a single image pixel (176x220) axial slicedimension. As dimension reduction gets extremely complicated for classification, they used PCA+TSNE.The reduced dimension is now 609x3=1827, which is derived from a single RAW MRI scan using created CNN features. The outcome will thus be determined by which of two separate working principles—Navies Bayes and KNN—has the maximum accuracy.The Trained CNN with the proposed concept has the maximum accuracy in this instance, at 88.2%.

Jeny Benios [5] developed a model in Python, and its implementation provides a system that is very useful to physicians for the classification of Alzheimer's disease. Using70% photos from the training set and 30% images from the validation set, our trained model achieved perfect accuracy on a separate, held-out test set.

Garcia-Gutierrez, Fernando, et al. [6] In this publication, the authors proposed using a VGG-Twin former model built on Transformer and convolutional neural network (CNN) for short-term longitudinal studies of MCI. This model progressively fuses far-flung spatial feature representations by superimposing attention windows of varying widths, with sliding window attention being employed for fine-grained fusion of spatially adjacent feature representations.

R.G.DeSouza, W.P.Dos Santos [7] proposed a low-level spatial characteristics of longitudinal sMRI images are extracted using a VGG-16-based CNN, and then mapped to high-level feature representations via temporal attention. In order to ensure the accuracy of their results, consulted the ADNI dataset. The sMCI vs. pMCI classification job has an accuracy of 77.2%, sensitivity of 79.97%, specificity of 71.59%, and area under the curve (AUC) of 0.8153. Lei et al. detected the connection among the data and the brain areas using a multi-layered independently RNN model. The experiment by the authors uses the ADNI dataset, and extraction of features and image processing are also carried out to obtain the clinical score from the dataset.

III. Proposed System

The proposed approach consists of three parts: image acquisition. pre-processing, model training, feature Extraction, classification shown in Fig 2.

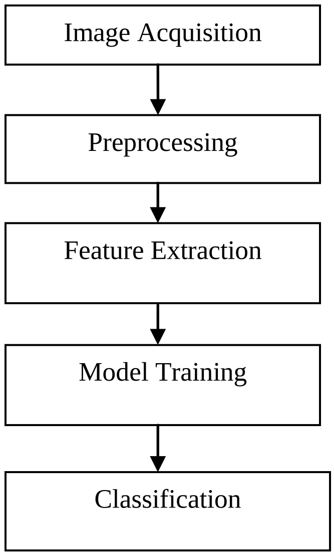

Fig.2. Workflow Of Proposed System

The system adheres to the step-by-step process of data preprocessing and classification depicted in Fig 3.

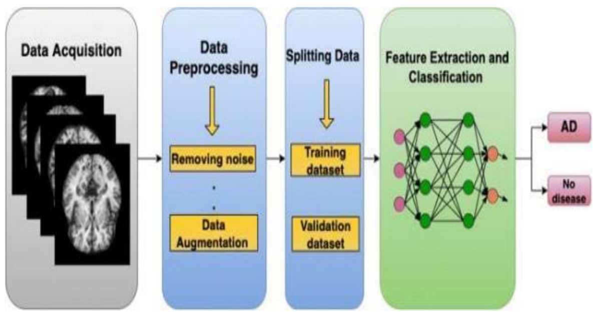

Fig.3. Module Flow

A. *Image Acquisition*

Magnetic resonance imaging [5] is a diagnostic tool used in the medical field to identify and see anatomical structures at a microscopic level. There is no better method than this one for identifying tissue differences. Brain photos taken from public sources on the Internet may be uploaded using this module. In terms of file size and format, images may be anything. An image must first be recorded by a camera and transformed into a controllable entity before any video or image processing can start. The "Image Acquisition" procedure entails the conversion of an optical image (Real World Data) into a collection of numerical data that can then be processed by a computer as shown in Fig 4.

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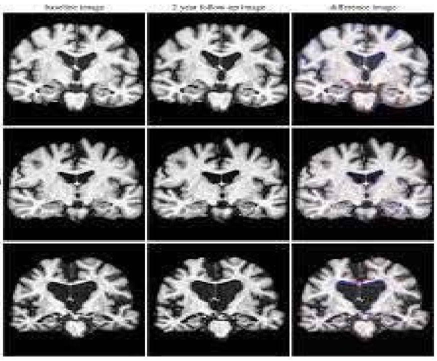

Fig.4. Structural Brain Imaging

B. Preprocessing

This section allows to adjust the picture size so that it fits on the page. In order to clean up the photos, use the median filter method. Each output sample in a median filter, a kind of nonlinear filter, is calculated as the middle value after all input values have been sorted according to the window. The purpose of preprocessing [4] is to enhance the picture data by reducing artefacts and highlighting certain details that will be useful in the analysis and processing that follows. After that, it uses the median filter technique to clean up the photos as shown in Fig 5.

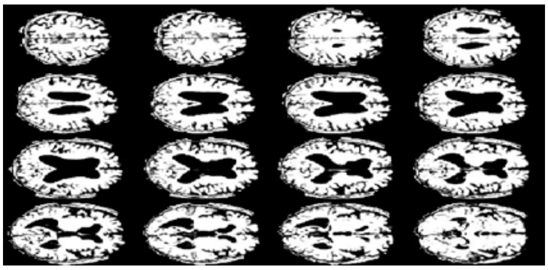

Fig.5. Pre-Processing

C. Feature Extraction

By effectively reducing the amount of data feature extraction [7] enables the selection and fusion of variables into features, enabling the acquisition of the best feature from such enormous data sets. Moreover, it may help cut down on duplicate information in an analysis. The time it takes for the machine to learn something new and for that learning to generalize to other situations is reduced by the data reduction and the work it puts into constructing variable combinations.

D. Classification

An Example of Magnetic Resonance Biomedical imaging techniques allow for the detection and visualization of anatomical features previously undetectable to the plain sight [9]. There is no better method than this one for identifying tissue differences. Gather diagnostic information by extracting features and matching them against a model file. Predictions from a model trained with all training instances except those used to estimate feature selection values [6] were used to measure the model's performance on the validation set. When in beta, the user may input a brain picture and offer information about a diagnosis based on the illnesses indicated by the system as depicted in Fig 6.

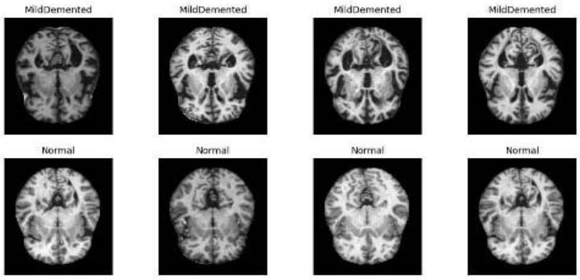

Fig.6. Classification Of MRI

IV. Algorithm

A. Visual Geometry Group 16

The very compact VGG16 design consists of convolution, a fully connected layer, and a pooling layer. This architecture is also featured in the Alex Net model[3]. There are a total of 16 levels, if the pooling layer is not included. The size of this structure grows as more layers are added to it. The standard input size for this network is 224x224 pixels, and the standard filter size is 3x3. Class probabilities are sent to the network's output layers through an activation function at the network's final stage.

To perform image classification tasks, VGG16 is a deep learning model [10] that was trained on a huge dataset of pictures. Features from MRI of the brain may be extracted using VGG16 for the purpose of Alzheimer's disease prediction. The collected characteristics may be fed into a different classifier neural network [1,2], to make predictions about Alzheimer's disease and its severity. The rationale behind employing VGG16 for Alzheimer's disease prediction is that it has already learnt to detect patterns and characteristics in pictures with the value for image classification, and these features may be reused for a new job.

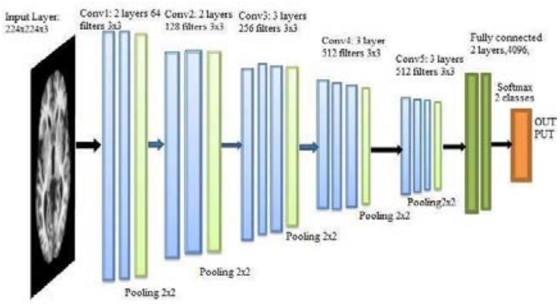

Fig.7. CNN Layer

The VGG16 network's first layer has been fed the 224x224 pixel pictures for feature extraction. The images then pass through further convolutional layers shown in Fig 7.

A stack of two convolutions with a receptive area of 3x3 is used immediately after the ReLU activation functions to convey the 224 x 224-pixel image. Each of these levels has 64 individual filters. With the stride value fixed at 1, the

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padding is also fixed at 1 pixel. The spatial resolution is preserved in full, and the dimensions of the activation at the output are identical to those at the input in this design. Activations with a stride value of 2 pixels are sent to the pooling layer because the window size is 2 by 2. The VGG16 network's first layer has fed the 224 x 224-pixel pictures for feature extraction. The images then pass through further convolutional layers. A stack of two convolutions with a receptive area of 3x3 is used immediately after the ReLU activation functions to convey the 224x224-pixel image. Each of these levels has 64 individual filters. With the stride value fixed at 1, the padding is also fixed at 1 pixel. The spatial resolution is preserved in full, and the output activation dimensions match those of the input pictures thanks to this design. Activations with a stride value of 2 pixels are sent to the pooling layer due to the fact that the window size is 2 by 2. Using the SoftMax function [11], the number of storage nodes in the final layer is proportional to the number of classification task divisions.

B. Softmax Classifier

For classification, SoftMax employs the cross-entropy loss. The SoftMax classifier gets its name from the SoftMax function, which converts the raw class scores into normalized positive values that amount to one in order to employ the cross-entropy loss.

$$\sigma(z)i = \frac{e^{z}i}{\sum_{j=1}^{k} e^{zj}} \qquad (1)$$

For a k-class multiclass classifier given in (1), the SoftMax function is defined as Z, the input vector. where z^i is a component of the input vector, and it may take any real value. Assuming a uniform probability distribution, the normalization factor at the end of the equation ensures that the function's output values add up to 1. An input vector to the SoftMax function consists: (z0, ... zK) The standard exponential function is applied to each element of the input vector. The resulting number is positive and bigger than zero, albeit how much greater depends on whether the input was little or large. A probability, by definition, must lie between zero and one, yet it is still not constrained to that interval. Each component of the input vector is multiplied by the universal exponential function.

The result is a non-negative number greater than zero, which is very small if the input is negative and extremely huge otherwise. To be meaningful, the range of a probability has to be restricted to (0, 1). The conditional probability of each class is determined by the SoftMax function [12], which is given the input picture. In a similar vein, it details the probabilities of each category. The goal of the model is to maximize the conditional probability of the class that is assigned to a given feature vector in the fully connected layer.

The VGG16 network was modified by adding a new unskilled dense layer at the very end. Next, the entire network is trained using the dataset provided. The categorical cross entropy is the cost function for multiclass classification. One way to characterize the classification entropy is as follows: where z^i is a segment of the input vector for z and j is the jth class were halted in order to produce our CNNs' models because to the fact that filters in the foundation layers [15] search for low-level components in pictures, such as angles and lines. Only the fifth block, where the filters check for abstract traits, was trained.

Convolutional neural network (CNN) VGG-16 is one that was suggested in this model. To do this, normalize the input photos and create the training and validation sets. The regulation in the fully linked layer is another feature of the VGG-16 concept. Before training, the VGG-16 model architecture on the brain, database is removed when completely linked, producing meaningful vector pictures.

V. RESULTS AND EXPERIMENTS

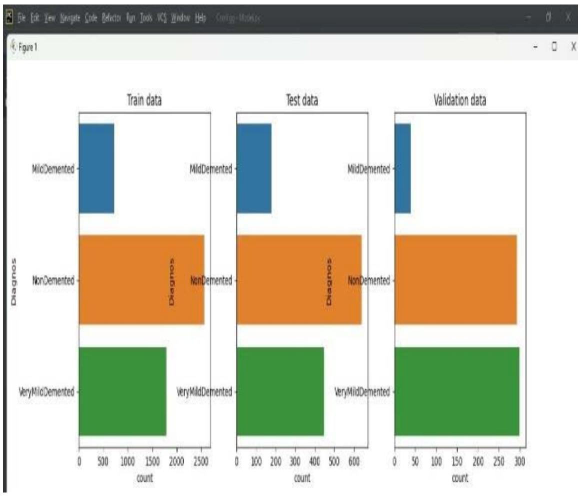

Fig.8. ccuracy Loss

The quality and size of the training dataset, the selection of hyperparameters, and the algorithm's performance on the validation set are some of the variables that affect the accuracy loss in Alzheimer's disease prediction using VGG16 shown in Fig 8. However, it is well known that deep learning models, like VGG16, may do extremely well in image classification tasks, such as predicting Alzheimer's disease from brain scans. It can further optimize the model by adjusting the hyper parameters [14], adding or removing layer, or using a different optimization approach if the accuracy loss is significant.

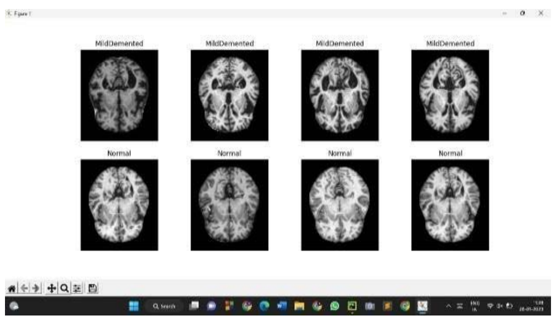

Fig.9. Classification of MRI

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Gather the brain MRI scans and the associated diagnosis, then separate the data into training, validation, and testing sets. Prepare the data for use in the model by preprocessing it, as by normalizing the intensity values and shrinking the photos to a specific size. Fig 9 shows as a starting point, can be utilized a convolutional neural network (CNN) architecture like VGG16.

These pretrained models can be adjusted using the data, or create a new architecture from start. Utilize the training set to develop the model, then by using the validation set to test it. After training, assess the model on the test set to determine how well it performs in separating healthy from Alzheimer's MRI scans. Metrics like accuracy can be evaluated. (AD) research is increasingly using positron emission tomography (PET) imaging that focuses on neurofibrillary tau tangles [13], however its value may be restricted by traditional quantitative or qualitative assessment methodologies in early disease phases. When it comes to recognizing and learning from spatial patterns in images, VGG16 performs well. Fig 10 depicts the training and validation accuracy for each epoch and Fig 11,12 shows the results for Alzheimer's Disease Prediction.

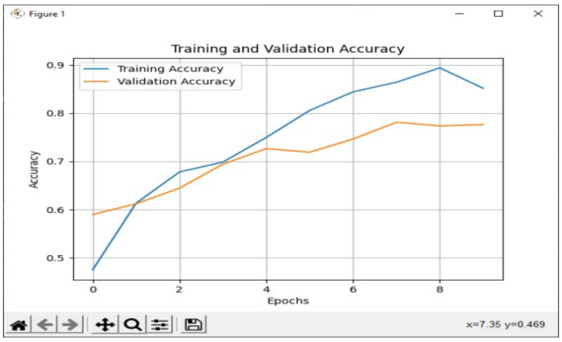

Fig.10. Training and Validation Accuracy

Fig.11. AD Prediction

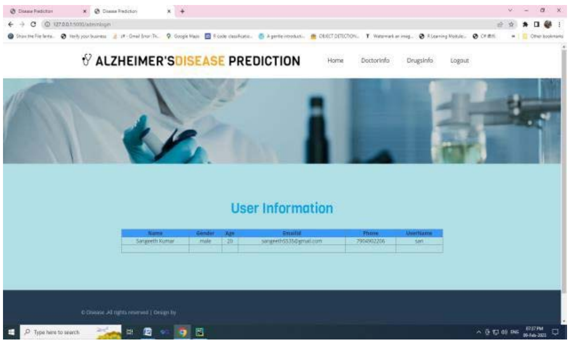

Fig.12. User information

VI. Conclusion and Future Enhancement

With further time and thorough investigation, the suggested system may be improved in the future. To further expand the diagnostic choices available to the physician employing PET, new Alzheimer's disease detection algorithms may be implemented. Alzheimer's disease (AD) research is increasingly using positron emission tomography (PET) imaging that focuses on neurofibrillary tau tangles; however, its value may be restricted by traditional quantitative or qualitative assessment methodologies in early disease phases. When it comes to recognizing and learning from spatial patterns in images, VGG16 performs well.

The most prevalent type of late-stage dementia, Alzheimer's disease (AD) is a progressive neurological condition. In this research, by comparing conventional ML with DL, then moved on to the AD diagnostic phase. Demonstrated a picture preprocessing approach used in Alzheimer's disease diagnosis to improve learning quality. And also showed other DL approaches that are often used in the classification process, including CNN, RNN, DNN, AE, and DBN. Disease categorization using DL is crucial, yet there are difficulties in working with the dataset. Hence, included a literature study for each difficulty and illustrated their proposed solutions. In this review, integrated preprocessing methods with the most popular DL approaches, compare distinct state-of-the-art research with their obstacles in dealing with datasets and classification stages, and present several preprocessing methods that were processed on neuroimaging.

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Predict the Beginning and Course of PD with Machine Learning and Deep Learning Algorithms

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***Abstract*—A progressive neurological disorder, Parkinson's disease(PD).People have trouble speaking, writing, walking, and doing other primary duties when particular brain regions' dopamine-producing neurons are harmed or die. These signs worsen with time, variable degrees of sickness aggravation in each person. In this research, we provide a method for calculating the Parkinson's Speech dataset from GitHub, deep neural networks were used to determine the severity of the condition. To forecast the severity of the illness and identify the condition, we have developed neural networks and machine learning algorithms. Parkinson's disease is categorized using both a random forest classifier and a neural network.**

Keywords—Parkinson's Disease (PD), UPDRS (unified Parkinson's disease rating scale, EMG, ACC, DN, RNN.

I. Introduction

The dopamine-producing brain cells are gradually destroyed by Parkinson's disease, a neurological illness., gradually affecting the sufferers' ability to move. This condition's symptoms include trembling, trouble moving, strange behaviour, dementia, and melancholy. The term "Parkinsonism" or "a Patient with Parkinson's Disease" is used to describe the main motor issues. One of the most frequent symptoms that may be picked up by listening to the patient's speech data is voice changes. The patient's speech starts to stutter as their condition worsens. As a method of analysing unstructured data, such as speech and voice signals, deep learning is gaining popularity.To create feature selection and classification models, deep neural networks usually use many layers of neurons. The speech data of the patient is categorised in this article into "extreme" and "not severe" categories using deep learning.

The motor and overall UPDRS (Unified Parkinson's Disease Rating Scale) scores were used in this study as comparison points. The total UPDRS has a score range of 0 to 176 while the motor UPDRS has a score range of 0 to 108 and examines the patient's overall abilities.. To measure the frequency and severity of tremors and dyskinesia in Parkinson's disease (PD) patients at a resolution of 1 second, algorithms are required that can analyze data from a large number of 3-D accelerometric (ACC) and surface electromyographic (EMG) sensors.

16 PD patients and 8 normal participants executed the algorithms in a home environment while doing free-form, spontaneous daily chores. The study demonstrated that dynamic pattern monitoring failure rates could be kept at 10% by utilizing dynamic support vector machines (DSVM), hidden Markov models (HMM), and dynamic neural networks (DNN). The effectiveness of these machine learning algorithms was confirmed by comparing them to independent clinical evidence of sickness prevalence and severity. In this study, a machine learning approach is developed to recognizee Parkinson's disease as well as a deep learning neural network to gauge the severity of the condition.

II. Literature Review

- *Selecting a Template*

The research on Parkinson's disease is extensive. even if the severity of Parkinsonism has received less attention. In these tests, several machine learning models were employed. Comparing neural networks to decision trees and machine learning algorithms, however, it was shown that they are the most systematic classifier and regression tool. In a research by Das et al..

1. Many classification algorithms were employed to make the PD diagnosis. Several studies have been conducted in an effort to develop a classifier that can forecast Parkinson's disease. The majority of research have employed variables gleaned from speech signals to predict the severity of PD.
2. Boosted accuracy while determining the severity of Parkinson's disease by using bagged decision trees. from patient audio recordings. Based on their UPDRS scores, Malekt et al.'s
3. There are four categories for PD patients: early, moderate, and advanced —used a dataset of 40 features. Using LLBFS, they identified the top nine characteristics for each class. (Local Learning Based Feature Selection).Using an audio dataset, Seeja K.R. et al.
4. Created a neural network for two-class classification.There were many different inputs and outputs used to construct the neural network.

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Regression isn't the neural network's primary objective; classification is. The outcome of the categorization has a 79% accuracy rate. The research paper for this study received the most mentions. The goal of this study was to use data from a keyboard typing test to identify whether or not the victim had Parkinson's disease. If so, we assessed how much the patient was utilising that knowledge to prevent them from communicating. For our detection investigation, we built upon a paper titled "High-accuracy identification of early Parkinson's disease utilising several features of finger movement during typing." In this study, multiple machine learning algorithms have been developed and evaluated in order to recognise Parkinson's disease and determine the optimal model for it.

III. Methodology

The approach suggested in Figure 1 arranges the procedures in a sequential manner, beginning with the collection of data and concluding with the selection of the model.

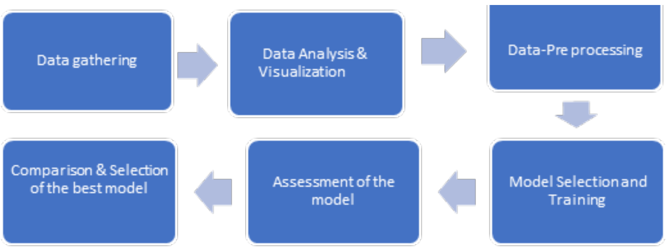

Fig 1. Recommended approach

- *Data Gathering*

Using two separate datasets, Parkinson's disease is identified and the degree of the problem is predicted. The dataset[7] contains the participants' typing data for detection. Australia, Canada, the United Kingdom, and the United States selected to participate in after reviewing the project website, the research. Under protocol number H17013, the Charles Sturt University Human Research Ethics Council in Australia approved the experiment. The duration of the typing activity when participants used their various Windows programmes is included in almost all data files that have been collected. (such as email, word processing, web searches, etc.). The timing accuracy of the keystrokes was achieved by the keystroke capture programme (called "Tappy"), which only delivered timestamps after a brief period of time.

There are two subgroups in the data files that are provided: The participants' personal information is contained in Group *1:* User Archives. (gender, the participant's diagnosis year, whether they have tremors, etc.) Tappy Data in Group 2 offers keystroke counts from certain individuals. (hold time, current hand, previous hand, etc.) The merged dataset consists of the columns "BirthYear," "Gender," "Parkinson," "Tremors," "DiagnosisYear," "Sided," "UPDRS," "Impact," "Levadopa," "DA," "MAOB," and "Other."

The experimental method predicted the UPDRS score for Parkinson's disease symptoms using a number of linear and nonlinear regression models.

In the Parkinson’s speech dataset, there are the following columns: Each subject's age is indicated by an integer called subject#. The subject's age, sex, and gender are noted. The number "M" for a male and "F" for a female denotes the gender of the topic. The days since recruitment are shown in the integer component. Motor total interpolated motor UPDRS score for the clinician Linear interpolation of the clinical professional's overall UPDR S score is known as UPDRS. There are several techniques to monitor changes in fundamental frequency, and they are all referred to as "jitter.". The ratio of the voice's noise to tonal components may be measured using the terms NHR and HNR. There are several amplitude fluctuation measurements that make up shimmer. RPDE is a sign of nonlinear dynamic complexity. Known as the DFA, the basic frequency fluctuation can be assessed nonlinearly using the signal fractal scaling exponent.

- *Data Analysis & Visualization*

The selection of the algorithm is greatly influenced by the type and quality of the data gathered. Knowledge of data is therefore essential. The author can visualize the data to better understand it using Python programs like Matplotlib, Seaborn, and others. Finding relevant relationships between classes or variables is aided by visualization.

- *Data Processing*

The information we gathered might not be suitable for analysis since it may be chaotic, have many missing values, be duplicated, noisy, and have extreme values. The author handles data, deals with missing values, replaces missing numbers with "NaN," removes duplicates, fixes outliers if present, and does data pre-processing and tuning. Actually, this stage entails removing irrelevant and insufficient data. This study further reduces the dimension of the data by reducing the amount of features in the dataset in order to prevent overfitting.

- *Selection & Trianing the Model*

As a beginning point, this activity is taken. Since a class is the result of the Parkinson's disease prediction, it is a classification problem. Since we utilize the UPDRS result to estimate the disease's severity during the detection phase, there is a regression problem. The classifier and regression methodology used in the study are as follows:

  - XGBoost
  - Regression neural network

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN}$$

The three subsets of the dataset that are utilised for machine learning are the training set, testing set, and validation set. Using a "training dataset," the classifiers are trained, and the parameters are adjusted using a "validation

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dataset," according to the author. Utilizing an original "test dataset," the classifier's performance is assessed.

The train and test datasets are frequently split in a 7:3 ratio.

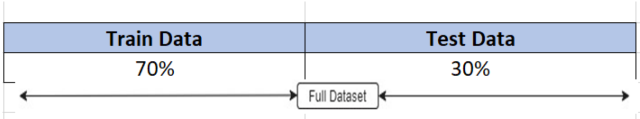


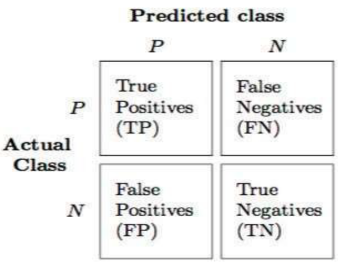
Fig 2. Train Test Split

- *Evaluation of Model*

  The effectiveness of machine learning algorithms may be determined using a variety of techniques. Using the confusion matrix, the author evaluates the model's accuracy. A table-based summary of predictions called a confusion matrix is used to assess the model's efficacy. The table displays a combination of anticipated and actual numbers. Below is a matrix of misunderstandings:

IV. Result

- Only a portion of the 217 individuals in the dataset for the diagnosis of Parkinson's disease were employed in the study that followed, which includes
- Documents with a minimum of 2000 keystrokes.
- Only a record of "moderate" severity among those who have Parkinson's disease (since the research concentrated on the early detection of the condition).
- People who don't take levodopa (Sinemet® and related medications) to offset any negative effects on typing tests from the medicine.



	Predicted patients with PD	Predicted healthy persons
Actual patients with PD	True positive (TP)	False negative (FN)
Actual healthy persons	False positive (FP)	True negative (TN)

There were 53 people in the group as a result. (comprised of PD and non-PD). The dataset also includes columns for the patients' birthdays, diagnosis years, genders, and medications.

In order to evaluate the severity of the illness, the 45 patients with Parkinson's disease in its early stages who volunteered to wear telemonitoring equipment for six months to follow the development of their symptoms are included in this dataset.

Subject number, subject age, subject gender, time since the first recruitment date, motor UPDRS, total UPDRS, and 16 biomedical voice measurements are the columns in the table. One of the 4,824 audio recordings that the chosen participants created is present on each CD. The data's main objective is to predict the 16 voice parameter's motor and overall UPDRS scores. (referred to as "motor UPDRS" and "total UPDRS" respectively).

CSV data were created using the information. (ASCII). A single speech or audio recording is represented by one occurrence per row in the CSV file. Each patient has 200 records total, with their subject number appearing in the first column.

The previous graphic displays the age distribution of both Parkinson's disease sufferers and healthy people. (Fig. 3). The strategy set forth. Fig. 3 depicts an age group with Parkinson's disease and vigorous individuals.

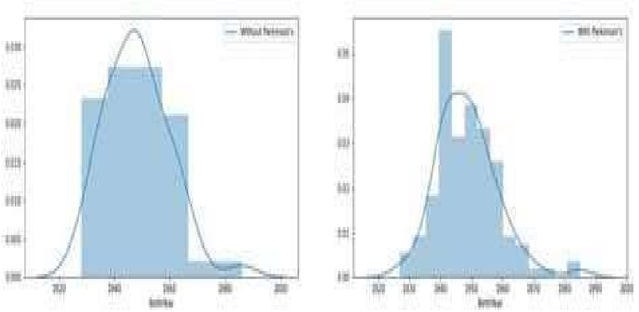


Fig 3. Age distribution of Parkinson's disease patients versus healthy individuals.

Parkinson's sufferers tend to be between the ages of 50 and 60. Therefore, there is a very low likelihood that a young individual would get Parkinson's. The model's development was significantly influenced by these facts. Fig.4 shows the gender-specific number of Parkinson's patients.

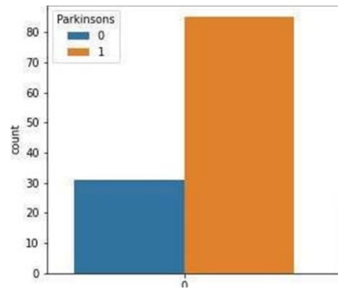


Fig 4. Gender Distribution

We were able to get to this conclusion since the gender distribution bar plot visual (Fig. 4) showed that more women than males had Parkinson's disease. Because it was made clear throughout the data collection stage that this information was gathered for various study with participants chosen at random, we may presume that this distribution shows a tendency that will be useful to our analysis.

Boxplots in Fig. 5 demonstrates how patients with and without Parkinson's disease have different distributions of various time data. (hold time, latency time, and flight time).

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The specifics of a particular sort of typing switch are covered in each subplot. In the upper left sub-plot, for instance (denoted as LL above the sub-plot), Typing data is displayed as participants switch from one left-handed key to another.

In contrast, typing data is displayed in the top right sub-plot when participants switch from a left-hand key to a space. (LS). These switches have the labels LL, LR, LS, RR, SL, SR, and SS. Fig. 5 shows the hold time, latency time, and flight time between each key when typing.

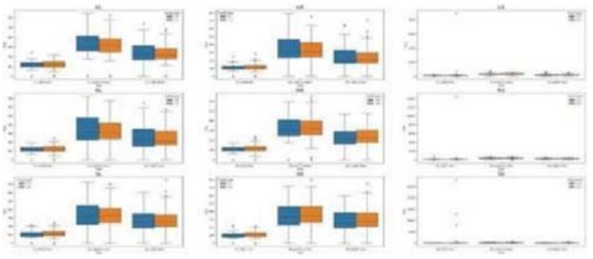

Fig 5. When typing, there are three things to consider: hold time, latency time, and flight time.

These numerous time periods were charted since they are important indicators when comparing a Parkinson's patient with a healthy person.

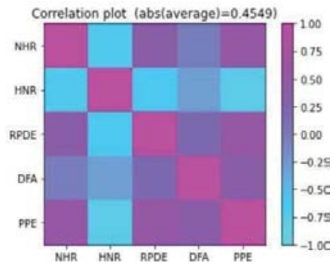

Fig 6 depicts a correlation map highlighting crucial elements required to anticipate the severity of Parkinson's disease

The feature importance approach was used to evaluate the most valuable characteristics and determine their significance. To illustrate the connections between a number of variables and the severity of Parkinson's disease, a correlation graph was made.

Figure 6 depicts a correlation map highlighting crucial elements required to anticipate the degree of Parkinson's disease severity.

The crucial traits for the feature selection stage have been identified using the correlation map displayed in above Fig. 6. Using correlation graphs in addition to EDA techniques like PCA, it was possible to identify important variables that have a significant impact on our forecast. We came to the conclusion that the Signal to Noise Ratio, among other features, is extremely significant and non-negligible for a suitable outcome for our investigation. This includes all voice measures, including Jitter (frequency fluctuation between sound wave cycles), Shimmer (amplitude variation between sound wave cycles), NHR and HNR (Noise to Harmonic Ratio) (Harmonic Noise Ratio). In this study, two models were utilized, one to assess whether a patient had Parkinson's disease or not, and the other to assess the degree of the condition. For detection purpose, Enhanced XGBoost was used.

Algorithm	Accuracy
XGBoost	0.97
Artificial Neural Network	0.84

V. Conclusion

Detection of Parkinson’s Disease

- Parkinson's disease is an important subject for research since an early diagnosis might improve patients' health
- With tolerance ranges of 92 to 100%, specificity ranges of 94 to 100%, and an AUC in the range of 0.96 to 100%, this technique was able to differentiate between those with early-stage Parkinson disease and controls with an AUC (Area Under Curve) between 0.97 and 1.00.
- It has been observed that those over 65 had a higher likelihood of being diagnosed with Parkinson's disease.
- The study discovered that women had a higher risk of developing Parkinson's than males do.

Figure 7 compares the suggested model to other widely used models utilized in the research mentioned.

Table4. Comparative Analysis of various models for Parkinson's disease detection

Data Models	Proposed by	Accuracy (%)
SVM (RBF)	Little et al [15]	89.2
KNN+	Richa Mathur et al[23]	89.23
Adaboost.M1	Richa Mathur et al[23]	81.34
Linear SVM	Ipsita et al[15[	76.89
Linear SVM	B.E Sakar er al[14[	90.234
Linear SVM	Achraf Benha et al[17]	89.32
ANN	A.Yasae et al[34]	92.33
SVM (RBF)	C.O Sakar et al[21]	80.13
XGBoost	Proposed for this work	94.49

Fig 4. Machine Learning Model Comparison

Forecasting Parkinson's Disease Severity

- The neural network is the most competent method in this investigation.
- Each auditory component is an essential part of the forecast.
- The severity of the issue is determined by the motor and total UPDRS levels.

It follows that the Parkinson's disease prognosis is exceedingly complex and depends on a wide range of variable factors that are always changing. If the qualities are properly picked, we might be able to create a model that is

DOI: rp-9788770040723.202

both ideal and efficient and that can reliably predict the extent to which a patient's sickness has spread.

VI. Future Scope

The investigation applied a single model to assess Parkinson's disease presence and severity. The study may be further developed by using a number of models and comparing the results in order to identify the most efficient and optimised models for disease detection and to assess the severity of the condition in the patient.

Acknowledgement

We are appreciative of the expertise and insight that our faculty members contributed to the research by sharing their experiences.

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Social Network Integrated with Information Security

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***Abstract*—In today's world social networks are a part of our daily life. There are millions of users in the social networking sites using them for connecting with their family, friends and sharing private (or) personal information. Social networks are been trusted for communicating purposes in both personal and professional needs. We are proposing a method to create an environment where individuals can express their ideas and built business over them with the help of community (or) network. Here community refers to a group of individuals who are into the same stream of profession. This could be used for helping each other in improving their ideas and developing their concepts collaboratively. In the current scenario social networks are facing a critical challenge of fake users and unauthorized access of them into the network which is leading to the bleaching of privacy to many users. The data of users is not so secured in these social networks, which can be dealt by the incorporation of security policies which improves the environment. This can improve the engagement of community members in being a part of many activities as it is the key to improve once ideas (or) business. In social network individuals are main aspect of the community, protecting them from fake information and users is also very much important and this is achieved by the implementation of security features and policies into the network.**

Keywords*—CMI, Social networks, CEI, DoS, role-based access control (RBAC)

I. Introduction

Internet is network of computers and servers which are connected in zonal, local, global area. Social network is a part or application feature of internet, which helps individuals to connect with friends and family. Social networks are viewed as collective web-based applications where multiple applications are mutually sharing data between themselves to provide the users a comfort to connect with new people and entering new communities for talking (or) sharing information that are close to their real life [2].

When a network is established then members of it would want it to be structured and secured in a way that their information is safe from lost or out into public. The number of people using social networks for stealing others private information are increasing exponentially, so whoever is in social networks need to be vigilant to protect themselves [7]. Studies have revealed that as compared to men the female users are found to be more stable, sensitive, intimated and even active in creating a social relationship with people via social network [4]. Every social network is similar to the structure of an informal office environment. One of the frequently occurring problem in social networking sites is excessive sharing of data which is leading to increase in disclosure of their private information which in the long run could have larger consequences [12]. So, choosing to train the individuals on how to share information and what not to be kept out into the internet which prevents them from losing their personal and important information, and updating them with the new threats that are growing around them like phishing [1][6].

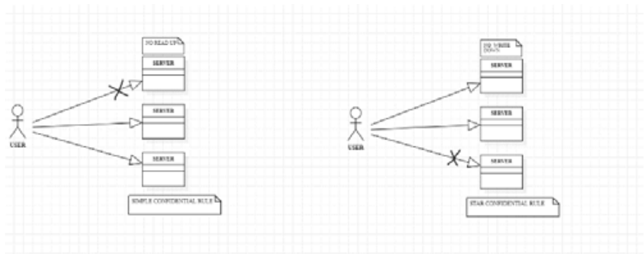

Fig. 1. Bell-LaPadula

The image is providing the aspects of Bell-LaPadula Model.

A. Bella-LaPadula

Bell-LaPadula model is one of the most influential security models as it is one of the initial modern security models developed. Bell-LaPadula model was developed to improve confidentiality aspect of curtail information. Though it provides effective protection to the information confidentiality for applications, to some extent, in the commercial implementation the users choose, information integrity over confidentiality under many circumstances. Thus, applications built on the Bell-LaPadula model are mostly used in military environments or similar spaces.

B. CEI

Trying to use the community energy initiatives (CEIs) to help each other In the community to achieve their goals as much as possible. The contribution of individuals could be as small as just a suggestion which could change the course of their thought process, and as large as investing into the idea and being a part of it which helps in growing it big. Individuals organize their social relations around certain social, psychological, legal, or physical foci (workplaces, voluntary organization, hangouts, family, etc.) which shape the opportunities of people to meet and interact [3]. So,

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making a good network of people is a key feature of any individual to grow in the real world it is even applicable in the internet world and creating such space is our aim. So,
creating a more secure space in the network, by integration of information security policies into the application is one option available so that female users get upper hand in the network that is been developed. Which can be used to share their ideas, job requirements and get suggestions and support from the community.

II. Literature Review

The social network services are a form of webservice to develop a virtual connection with people having same interests and background. This service helps the users for finding new communities and friends. [13]. There are many ways for generating data in the social network and for sharing it into the network, now proposed technique is a new combination of method to improve the structure of network and its security components in it like **accessibility**, **availability**, **reliability.** Architecture of multiple systems in the online social network (OSN) be like Client-server and peer-to – peer architecture [2].

Studies are trying to study mainly about social network's content and user's security, using different models, protocols, mechanisms and algorithm [1]. Knowing about different types of threats that are been around us in the network so that people can be more and more causes with the present situation. This paper is trying to given a new pathway on social media security aspect using crowd computing framework, hierarchy form for the social networks [1]. This is where incorporation of **Bell-LaPadula** model into network is taking place to create secure and reliable network to the female users.

Hackers using many techniques to steel one's information from the users. In the pre-Internet world stealing once's information was too complicated and hard but now it's too easy for these phishers. The number of people using social network for stealing personal information of users, using phishing technique, so every user in the network has to be more vigilant to protect their information [7]. Talking about on how individuals are been getting influenced for revealing their confidential information like password, addresses, bank details by working on their vulnerabilities is said to be Social Engineering. Getting to this conclusion that the users have to be trained regarding the newly developed network so that they get aware of such effective threats that they might encounter.

Studies are aiming on identifying behavior of users on different gender aspects in social networks by comparing the different aspects on which the gender labels are created and how easily they can be activated and implemented into the network [4]. The conclusion from this can be that female user are been more exploited by the effects of the social networking. This is getting us to the conclusion of security requirement for female users. This can be redeemed by giving a more control to the female users like accepting of friend request, deleting the users from the friends list.

Studies are even trying to investigate the role of social networks on how individual's decisions are been influenced on trying to participate of community energy initiative. Later we are discussing about engagement of community members is crucial for the success of a CEI and thus a key question is how the initiators can reach community members and stimulate involvement [3]. Taking results of this to prove how greatly a community can impact the network to be moving forward. How well it can be initiated and how an initiated program is been affected by the associated individuals.

The biggest hurdle in social networks is access of hackers into private accounts to achieve private information and leaking of personal communication in between the users of the network, these all are after effects of hacking a user's account [9]. The usage of encryption is to protect one's privacy. They are talking about the multiple types of encryptions are been implemented in the aspects of the social network. They are talking about the multiple types of encryptions are been implemented in the aspects of the social network. Finally, there is visualizing the process of encryption and decryption in a mobile application that are been done to secure a user's information.

When trying to investigate the part of social network in effecting the user's choice on to whether to be a part of communal activity. Discussing about engagement of members is critical part for the success of a communal energy initiative and this leads to main question on how the initiators of a program can reach the community members and stimulate their involvement [10]. By which we are getting to know about the impact of individuals in the network of community. Finally getting to know the impact the community members, initiators, associates can impact the CEI. The different combinations of different members in the network have a new type of network.

By studying two different factors that affect the vulnerability of the network such as individual and organizational actions and how the creating awareness among the employees leads to the improvement of social security and reduces the risk of social attacks [8]. Theory of reasoned actions and theory of planned behavior are been used in many hypothesis conditions which are been tested and drawn to a conclusion.

III. Methodology

3.1 Bell-LaPaduala

This is an information security model which is also referred as a multi-level model, which was proposed for implementing access control in military applications. In these models there are two main parts one subjects and the other objects which are segregated into different security levels. The subject can access only objects at specific level determined by his access level.

The levels of classification are designed to protect information (or) data from unauthorized discloser.

Simple confidential rule: In this the users (or) subjects can only **read** the data on the same level of access and the lower level of access but can't read data to the upper level of access. This rule is also referred as **no read up** rule.

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Star confidential rule: In this the users (or) subjects can only **write** the data on the same level of access and the upper level of access but can't write data to the lower level of access. The rule is termed as **no write down** rule.

This is using these rules to improve the confidentiality of the data and users. **Confidentiality** implies that the protection of the data from being accessed by an unauthorized user. Only real users can access their personal information. The main responsibility of confidentiality is stopping information from getting into the inappropriate user's hands.

3.2 Biba

This is another type of information security model which was used to ensure the integrity of information. In these models there are two main parts one subjects and the other objects which are segregated into different security levels. The subject can access only objects at specific level determined by his access level.

Simple integrity rule: In this the users (or) subjects can only **read** the data on the same level of access and the upper level of access but can't read data to the lower level of access. This rule is called **no read down**.

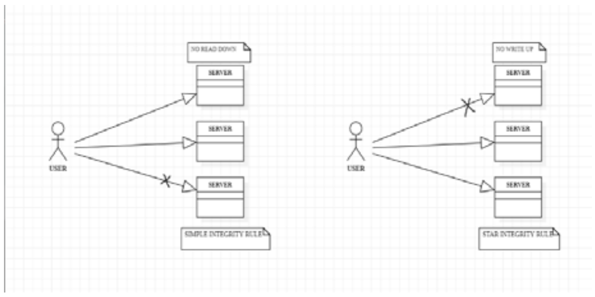

Fig. 2. Biba

This is giving the visual representation of the Biba model. Star integrity rule: In this the users (or) subjects can only write, edit the data which is on the same level of access and a level lower of their access but can't write data to the upper level of access. This rule is termed as **no write up** rule.

Biba model is using these rules to improve the integrity of the data that is been shared. The **integrity** implies that the data is been validated. It gives an authentication on whether the data available in the network is in correct format or not. It also validates data whether it is true and correct to its original source of data. Integrity makes sure that the data presented by the publisher is been received in the same way to the receiver.

3.3 Role Based Access Control

The role based access control model is been widely implemented as natural model as it is very much suitable in most case scenarios. The results of the applications built on this model are growing very rapidly in commercial and educational institutions.

The function *Check Access* is used for authorizing decision made by the system is giving the users different roles in the network on the bases of the gender of the user *ex: female users are given role of higher level and male users are given a lower level.*

3.4 Implementation

The application created with complex combination of webpages is to create a secure network to interact with individuals who are willing to help the needed by sharing the needful. This is consisting one page for the Registration process.

3.4.1 Registration Page

One has to get registered in this page to login into their personalized account to view the posts (or) create a post. This is containing the attributes like user name, email, password, mobile number, gender, date of birth.

Fig. 3. Registration

This is the screenshot of the registration part of the application.

The data that is entered by the users is been stored into the data base and segregated into two different tables according to the gender of the user to give a specific hierarchy to the users according to the gender of the user.

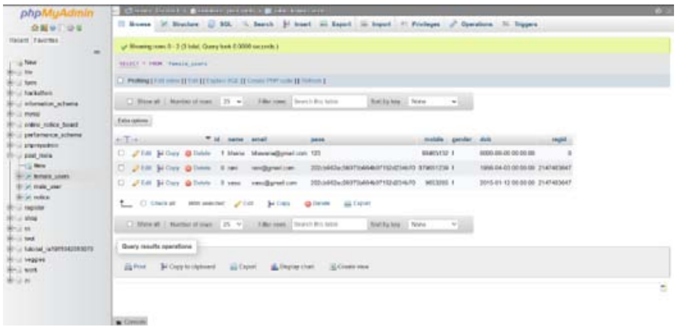

Fig. 5. Female User's Database

This is the database of application.

The few of the main features of the form is that the user's password can't be viewed even by the developer to get the better of security aspect of the users and all the details filled by the users is visible to whoever can access the data base.

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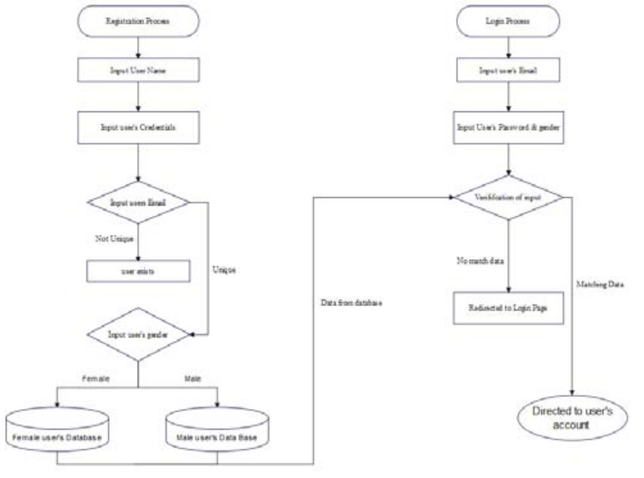

Fig. 6. Flow Chart

This gives a clear view on how the user's data is been flowing the stream line created in the network.

3.4.2 Login Page

Here the page is used for logging into the personal account to view their posts and post their new posts into the network. This is taking the user's email id, password and their gender to login into their account.

The login credentials are been verified with the database of the male users and female users while logging into user's account. Once the user longs into his /her account then they give few features to use the application and communicate with the network of users.

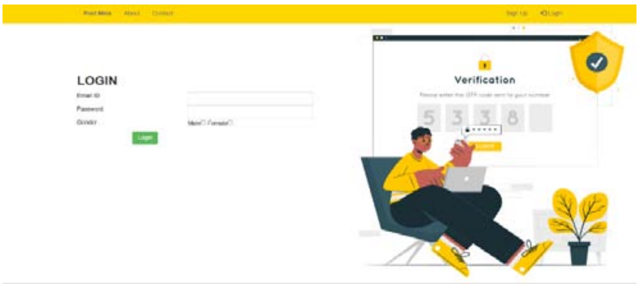

Fig. 7. Login Page

This part of the application is been used for the user's login.

3.4.3 Female Users

Once logging into the account, the female users are able to view their dashboard with the options like **Manage Users, Update Password, Manage Notification, Add New Notice** are the features that are available for the users.

By this they view the members of the network, they can create (or) edit (or) delete the posts they have posted into the network and can choose the option to share the information to a particular individual or not is completely in their hands. ***But they can't edit the comments of the male users (or) any other user but can only view them.***

This is where the Information security policies are been incorporated into the application this is said to the *Bella-LaPadula model.*

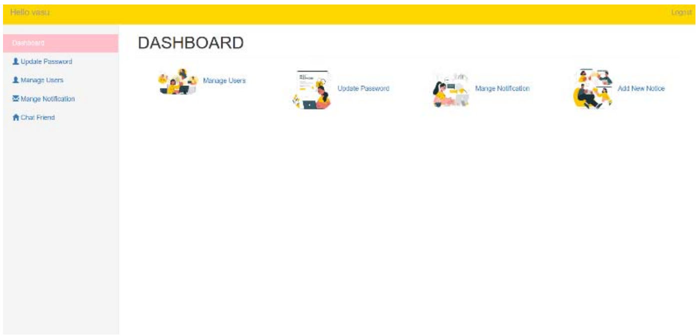

Fig. 8. Dashboard

Update password

They can update their passwords at this page. The Old password is been compared with the data base and if it matches then password of the user can be changed.

All users

Here the female users can view all the members of the network and can choose to delete any user of their choice from their network of members.

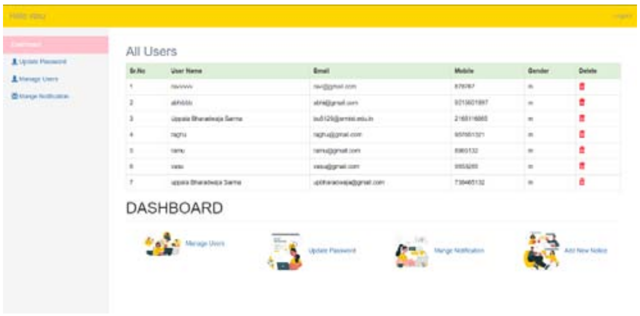

Fig. 9. All Users

The female users can view the users of the network and start a communication with them if they want to have initial point of connectivity with the users.

All notices

The users can delete (or) Update their post to the members of the network at any point of time which gives them complete control over their posts into the network. Once the user can view the notices, they posted in the network then they can even create completely a new notice and upload it into the members of the network.

3.4.4 Male Users

If a user is logging using the credentials and selecting the gender as male, then they are navigated into a new page dash board where they can view all the notices that they receive from the members of the network.

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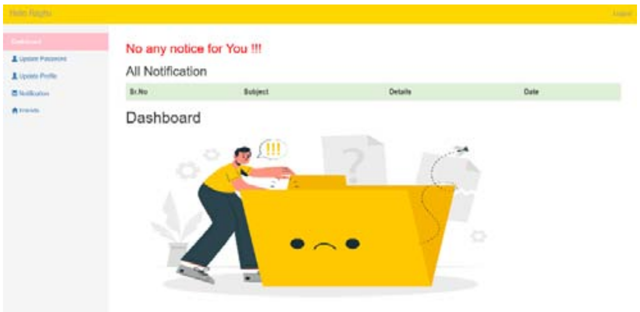

Fig. 10. View Notice

Update password

At this page is used for the same purpose for male and female users, to update their passwords for logging in their accounts. The old password is been verified with the data base from the registration process.

Update profile

This page is used for the updation of user's information like user name, mail id, mobile number, gender and DOB.The changes made in this page is been modified even in the database as they save the dat is been changed.

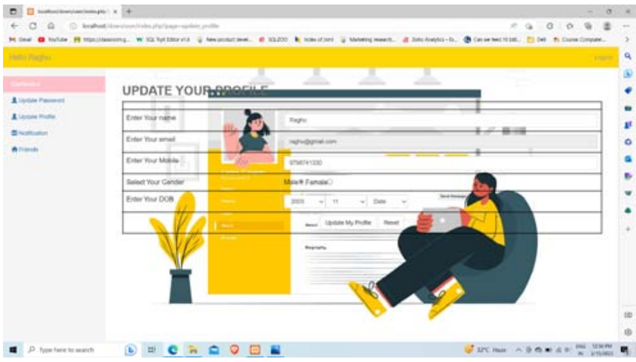

Fig. 11. Update Profile

Here the Male Users can only view the posts and add a comment to the posts that are been posted can only view them but can't edit the data that they are sent.

This is the phase where the second phase of the security policy Bell-LaPadula is been kept into application.

Once the user logins to his/her page they can view the option to communicate with the members of the network and start a communication directly rather than trying to contact them via mail (or) mobile for basic communication which can develop a more secure in the aspect of privacy of the users.

3.4.5 Friends Chatting

The users are giving the users a feature to have a communication with each other which enhances the user's experience of using the network.

Once the user logins then he/she can view the number of user's they can communicate with. They can chat with the users by using this feature of the network.

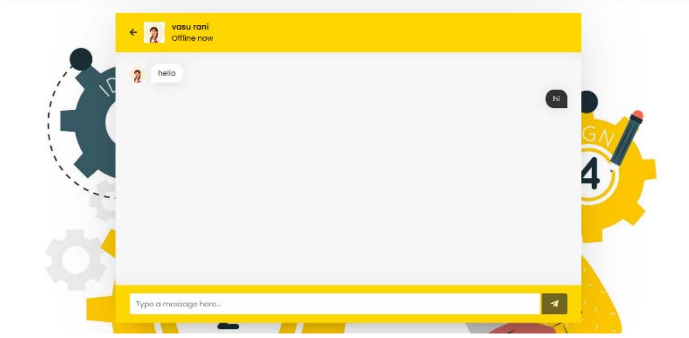

Fig. 12. Chat Space

3.5 Architecture

Here the point is to create clear picture on how the integration of Information Security Models into the social network is been held from a bird's eye view. There are multiple modules which make the things keep moving and get a greater understanding.

Which user is getting what sort of features in the network can be understood by viewing the architecture of the network that is developed.

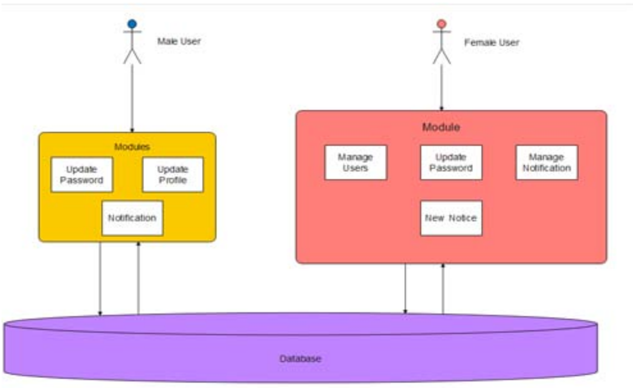

Fig. 13. Architecture Diagram

IV. Conclusion and Future Enhancements

This paper is mainly trying to introduce a new way of creating a network to have a more secure, accessible and reliable network by using Information Security methodologies incorporated into the process of creating the network and establishing it. Then tried to use it to improve the way the users interact in the network and build it for a better communal environment which encourages users to be a part and grow themselves. The effects of good network will improve the way one can create communal energy to achieve a specific goal, encourage users for initiating anything that they thought of (or) can be a part of it. This paper is trying to take a leap onto find the way to integrate Information Security into the network to develop a more secure environment. Where we can develop a more secure and dependable network, more users could be encouraged to be a part of the network in the present times, as the present scenario of new social networks being developed every day and available in the internet. This paper is trying to provide an insight on how the integration of information security

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models impact the working of the social network in real time in various aspects. Trying to get a foresight on how the impact of community energy initiative (CEI) to build systems which are effective in indulging members of it.

In the future the network can improve more in the aspect of the security of the user. This one is a very basic template of registration. The inclusion of the real time verification of user's email id by OTP generation could be next step in the process of development. Later to this we can create more sophisticated process where when user registers themselves the photo, they use for the *DP* can be compared with the real time user's face using facial recognition from stopping fake users in the network where male users can be controlled from creating fake female accounts in the network.

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Virtual Reality in the Healthcare Industry and its Essentiality in Medical Education

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***Abstract*—Virtual Reality (VR) applications in the healthcare industry have the potential to improve health while also creating opportunities for clinical education. Healthcare officials supported the incorporation of modern technology by raising budget allocations and organizing access to advanced devices and professional expertise. In this research, we are going to study VR in the healthcare industry and its essentiality in medical education. Businesses in the healthcare sector offer medical assistance and produce diagnostic products or drugs, facilitate medical coverage, and finally facilitate the delivery of healthcare to patients. VR is an atmosphere with a specific computer-generated with realistic-looking both objects and scenes that immerse the user in their environment. VR plays a vital role in making decisions for specific case studies and distance learning, the ability of VR simulation tools to share information obtained through communications infrastructure and electronic health records makes it more appealing.**

Keywords—Artificial Intelligence (AI), Virtual Reality (VR), healthcare industry, Medical based Education.

I. INTRODUCTION

In the field of medicine, developments occur at a dizzying rate. Twenty years ago, healthcare looked quite different from how it does now, with an older population with more complex demands, fewer treatment choices, less emphasis on collaboration between healthcare professionals, and more complicated healthcare systems. We've got to adjust our methods for preparing aspiring doctors for the field of medicine. Nowadays, it's not about whether or not a healthcare provider can remember or find information; it's about how well they can process, analyse, and apply that information to the treatment of individual patients. Virtual reality (VR) is a computer-generated simulated setting with realistic graphics and a large number of interactive elements that fully immerses the viewer. A virtual reality (VR) helmet is used to experience the surroundings. With VR, we may put ourselves in the shoes of fictional characters, learn how to do heart surgery, and improve the quality of our training to reach our full athletic potential.

Through the use of virtual reality (VR), we are able to experience video games as if we were one of the characters, learn how to perform heart surgery, and enhance the quality of sports training to achieve maximum performance. The most recent standard, 5G, can also provide very interesting potential futures for virtual reality's development. Because of this standard, more devices and larger user communities will be able to connect with one another. In addition, because its latency is so low, customers will be able to receive images in real time, almost as if it were the same as if they were looking at them with their very own eyes. A computer can act as a gatekeeper to a new world if it simulates as many of the human senses as it can, including vision, hearing, and even touch on occasion. The availability of content and the amount of computing power are the only restrictions placed on a VR experience. Virtual reality is the solution for any situation in which doing something in the real world would be too risky, expensive, or impractical. Virtual reality enables us to take virtual risks in order to gain real-world experience. This is useful for training purposes in a variety of fields, including medical applications and fighter pilot training [1]. It is reasonable to anticipate that more serious applications, like those for education or productivity, will come to the forefront as the price of virtual reality drops and the technology becomes more widespread. The way in which we interact with our digital technologies may be fundamentally transformed by virtual reality and its close relative, augmented reality [2]. Keeping with the current trend of humanising our technology.

DOI: rp-9788770040723.204

II. Literature Review

Baniasadi et al. (2020) conducted a review to identify the difficulties associated with the use of virtual reality in the medical field. VR challenges will have various impacts, so recognizing each of them aids in determining remedies for each challenge.

Dyer et al. (2018) and Latchoumi T.P. et al (2022) used software that generates an immersive VR life experience for workforce training in aging services [3]. The project was successful in introducing a novel new method for teaching medical assistants, physiotherapy, and also nursing syllabuses. According to the findings, virtual reality improved students' understanding of health issues according to their ages and rises their compassion for adults with hearing, sight loss, or affected by Alzheimer's disease. Jack Pottle. (2019) and Monica.M et. al. (2022) discussed how the future of Virtual Reality is in continued inclusion with the curricula and various technological advancements which allow for simulation of the practical experience. This automatically enables the quality of the teamwork at an average scale, regardless of geography, and will transform how we educate future clinicians. Winkler-Schwartz, Alexander, et al. (2019) and Karnan. B et. al. (2022) set out to create a checklist that would serve as a general framework for reporting or analyzing experiments conducted by VR surgical simulation and ML algorithms. Researchers and critics can easily evaluate the current quality and specific inadequacies of a manuscript by including overall points as well as clear subtopics of the checklist [4]. An Experiment based study on the Efficacy of VR 360° In UG Medicalfield was conducted by Lama, et al. (2019) and Vemuri et al (2021). VR creates a rich, immersive, engaging field of study environment that encourages hands-on understanding. It increases student interest and motivation while also effectively supporting the retention of knowledge and skill acquisition.

Ammanuel, Simon, et. al. (2019) and Sivakumar P (2015) The study's goal is to demonstrate the application of converting 2D radiographic images into 3D models using a threshold method and similar to the importing segmenting them in a Virtual Reality with an interface at a low cost. Understanding anatomical structure in 3-Dimensional space improves understanding med citizens, students, and patients [5-6]. Caroline Fertleman et al. (2018) and Sridaran K et. al. (2018) held a panel discussion titled "The Reactions of Medical Professionals to Minimal Antibiotic Patient Demand. Medical Ethics Study with the help of Immersive VR." Finally, VR was discovered to be a beneficial training device, one that may succeed where other proposals have failed to change behavior. Pantelidis, Panteleimon, et al. discussed “VR and AR in the medical field of study" from the perspective of the past, present, and future [7]. Tabatabai and Shima (2020) and Buvana M et al (2021) emphasized the value of VR learning and the repercussions of incorporating VR simulation techniques into the medical training for the upcoming clinical skill teaching and development. Tang, Kevin S., et al. (2020) analyzed the status of AR Applications (ARAs) and established an analytical model to guide the study in assessing the system as an instructional tool in medical training [8].

III. Proposed Work

The use of technology such as virtual reality has the potential to propel the field of medical education forward by offering students a more immersive educational experience. Because this technology is more realistic, it has the potential to more successfully engage students in medical education than the more conventional educational system does. It is straightforward for instructors to keep an eye on, and straightforward for pupils to use as well. The term "virtual reality technology" refers to an intelligent kind of immersive technology that provides the user with a vision that encompasses the whole surrounding environment [9]. To do this, specialist cameras such as 360-degree cameras and omni-directional cameras are used. A fully immersive video watching experience will be made available to the user through the usage of VR videos. The experience is much improved when watched using a virtual reality headset. On the other hand, it may also be seen on devices such as smartphones, laptops, and desktop computers without the need for VR goggles. Not only will the incorporation of AI make interactions with virtual patients more realistic, but it will also make it possible to conduct further research on therapeutic effectiveness [10-11]. AI is utilised to elicit particular difficulties from huge groups of learners and generate dynamic, customised settings to satisfy the unique learning demands of individual students.

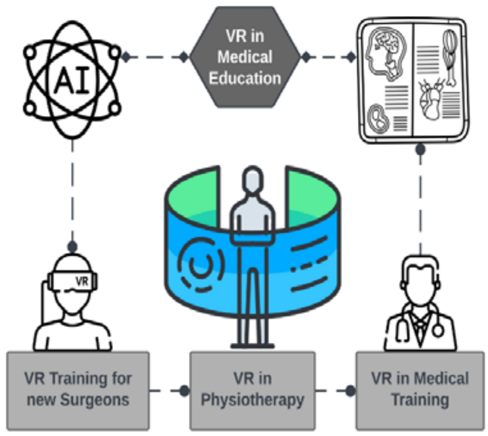

Fig 1. VR in Medical Education

Fig.1 illustrates Virtual Reality in medical education.

VR is a new technical concept that can instruct surgeons on innovative techniques and assess their degree of proficiency before performing surgery on patients. In addition, VR enables medical students to resume the same process or task multiple times as a training module [12]. VR simulation could recreate the operative field, improving training and reducing the need for costly animal training models. Our preliminary findings indicate that we have the advanced technologies to simulate tissues and laparoscopic devices and to create a VR educational environment for surgeons in real-time [13-14]. VR technology instructs

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surgeons with innovative techniques and evaluates their level of proficiency before performing real-time surgery on patients. In addition, VR enables the learners to return to the same methodology or task multiple times as a refresher course [15-16]. VR is used in patient-facing rehabilitation to create games that allow members to exercise movements in a safe, engaging, and challenging environment. In stroke rehabilitation, for example, VR is being used to dramatically increase the number of movements performed during a treatment session, with anticipated benefits in function and overall results.

Some of the hardest things while determining the entire testing methods with a medical education there are some similarities which may differ according to the results.

$$T_{ni} = dig_{t22}^{min} U(l_p; S_v : T, s^*), T_{map} = dig_{t22}^{min} Q(T : l_p; S, s^*) \quad (1)$$

In Equation (1), both the terms of constant values are represented in the term of representing the most regarding access points that are managed with the help of time. According to omit times for matrix multiplication clarity.

$$T_{map} = dig_{t22}^{min} S(T : I_p; S_u, s^*) = dig_{t23}^{max} \frac{S(I_p; S_v : T, q^*) S(T, s^*)}{S(I_p; S_u, s^*)} \quad (2)$$

Therefore, the model and $S(I_p; S_v : T, s)$ is the actual kind of probability realisations I_p and S_u occur in the given data type v, and a protective q*if S (Ts*) can be homogeneous for the identification of detection probability is represented Equation (2).

$$S(I_p; S_s; s) = \sum_{\sigma \in \Omega(T, q^*, I_p; Q_u)} S(\sigma | T, s) \quad (3)$$

Therefore in Equation (3), the Ω (v, s*, I_R, S_U) is the collection of all possible categories for distribution given I_P; T_u. Then, below Equation (4) represents the consistent G.

$$T_{map} = dig_{t \in I_p}^{min} K(T, s, I_p, S_U).Q(T, s^*) \quad (4)$$

Finally, the actual term that is displayed according to the Equation (5).

$$K(T, s, I_p, S_U) = |\Omega(T, s*, I_p, S_U)| = O(U+P)! \prod_{\mu \in I_p \cup Q_U} |S_\mu^v| - 1 \quad (5)$$

Therefore, the above Equation (5) represents the actual and sequential nodes that are being contexted with the time analysis and its management [17-18].

IV. Experimental Results

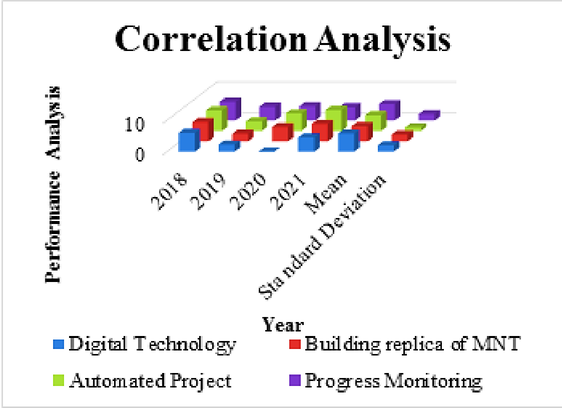

Fig.2. Building the human tissue for Artificial Intelligence based technology

Fig.2 depicts a Virtual Reality assessment AI technique for analyzing and simulating the result of built surroundings building reshaping strategies on building energy use, solar power generation, and the changes that follow all have an impact on energy usage [19-20]. In this analysis, the implementation of different digital based technologies were considered from the period of 2018 to 2021.

TABLE 1. Building the technical analysis based on the VR and Artificial Intelligence

Year	Digital Technology	Building replica of MNT	Automated Project	Progress Monitoring
2018	6	6.1	6.5	5.9
2019	2.2	2.4	3	4.4
2020	0	4.5	5.5	4.5
2021	4.5	5.5	6.6	4.2
Mean	5.76	4.79	4.99	5.19
Standard Deviation	1.98	2.09	1.09	1.98

A significant percent of previous technical studies have been classified as implying that most of the preceding application fields of medicinal industry sectors in building replicas start with body cells for artificial organs with the application.

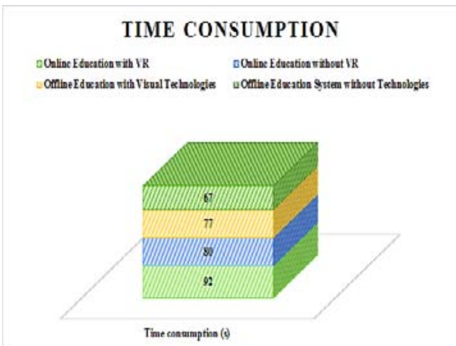

Fig.3. Time Consumption for information communication

Fig.3 represents the time consumed by different teaching and learning mechanisms in the healthcare industry with the utilization of different technological advancement. Fig.4 represents the comparison of the proposed online healthcare education with Virtual Reality (VR) along with other models such as model without VR, offline education with virtual technology and without any technologies. This

DOI: rp-9788770040723.204

time consumption defines the time consumed to provide visual effect on the medical concepts. From the results, online education with VR consumes less time than other models by making a minimum difference of 10%.

Analysis based on the energy consumption in the implementation of the models is presented in the Fig.5. Energy Consumption is measured in Joules (J). This analysis defines the minimum level of energy required to complete teaching and learning of the healthcare terms through technologies. From the results it can be seen that the technologies aid in the reduced energy consumption whereas the model without technology involves manual drawing of the medical images by the teachers. Manual drawing will consume more time and space for the works to get completed and hence the energy too. From the results, it can be seen that the online virtual reality will consume a much reduced energy of 53% which makes a difference of 42% to the highest.

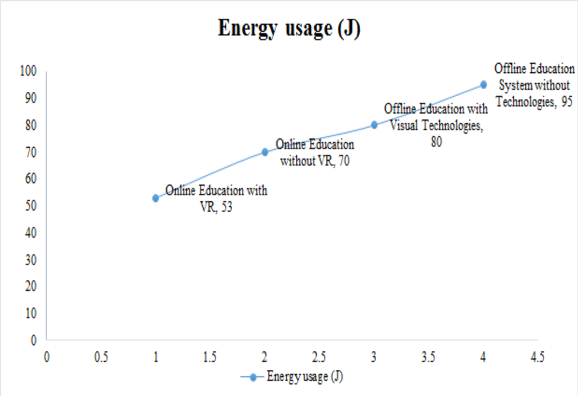

Fig.4. Energy consumed by the models

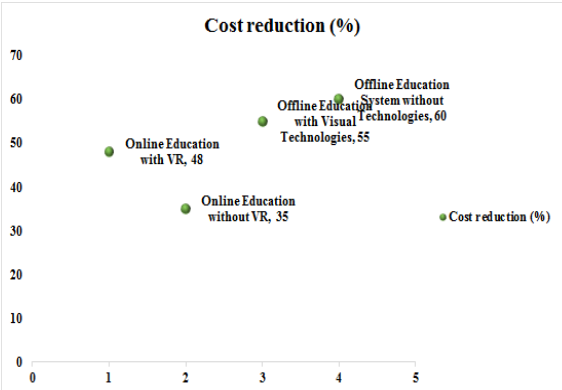

Fig.5. Cost Analysis of the proposed system

Next to the time and energy, cost plays a vital role in implementing a new technology for any given domain. In this research, cost analysis is performed to analyze the cost required from the designing of the model, implementation of the system, and completion of the education on the medical system.

V. Conclusion

When compared to traditional teaching resources, the researchers note that this method promoted further knowledge improvement for pupils and fostered significantly higher learning. Virtual reality is already transforming medical training. It facilitates removing lessons from the classroom by allowing students to put their knowledge into practice and learn from their mistakes. VR plays a vital role in making decisions for specific case studies and distance learning, the ability of VR simulation tools to share information obtained through communications infrastructure and electronic health records makes it more appealing. It aims to improve competencies and emphasizes the autonomous, blended learning that today's learners expect.

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Analysis of the Market Capability and Forecast of the Presence of Drugs Using Neural Network

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Abstract—Finding novel substances with chemical characteristics for the treatment of illnesses is the goal of drug development. The method used in this search has become increasingly significant in recent years as machine learning methods have proliferated due to their democratization. To meet the goals stated by the Precision Medicine effort and the additional problems they have created, it is essential to develop reliable, and reproducible computational approaches. Predictive models that are based on ML have recently grown significantly during the stage before the preclinical research. In this stage, new drug discovery expenses and research timeframes are significantly reduced. The adoption of these innovative approaches in recent years of study is the main topic of this review paper. We can predict where cheminformatics is within the short future, its particularity, and the successes it has already attained by examining the state of the art in this area. The approaches utilized to represent the data that consists of the information about the molecular substance, as that is most related to the biological issues that are always addressed in ML-based algorithms which are being employed for drug development, will be a key topic of this study.

Keywords—Machine Learning, Drugs, Market analysis, Neural Network.

I. Introduction

The process itself and the stringent rules set out by the regulatory agencies are what causes drug identification for a particular molecular target and patient group to be most complicated. The search for novel medications continues to be a time-consuming and expensive process. Medicine typically takes between the range of about 10 to 15 years to produce through research and testing. It is almost hard to investigate current compounds in wet lab studies due to the sheer number of molecules that may be evaluated as potential new medications [1]. However, new while seeing the silico approach for the displaying of large enough pharmacological library function has emerged during the past 10 years because of the data and communication technologies that are used here, and the expansion of computer power. This phase in the previous sectors that comes under the clinical investigations lowers both the financial cost and enlarges the area for looking for novel medicines. With the capacity to expedite and automate the analysis of the vast quantity of data now accessible, ML techniques become extremely prominent that are present within the pharmaceutical sector. The goal of Machine Learning (ML), a subfield of AI, is to create and use computer-based algorithms that can understand unprocessed, data for carrying out specified tasks in the future [2-3]. Within a huge data collection, classification, regression, grouping, or pattern recognition are the primary tasks carried out by AI systems. In the pharmaceutical business, a wide range of ML techniques have been used for the analysis of novel properties, activities that are related to biological development, and medications [4]. Some of the algorithms that can be deployed here are

1. SVM (Support Vector Machine)
2. Random Forest Algorithm
3. Neural Networking Models

a few examples of these techniques. This work has been created and planned to investigate the current state of the art in this sector. It compiles the most pertinent studies on the application of ML approaches for early drug development from the last five years [5-6]. The works found in this study are then provided in several sections, with a focus on the descriptors employed, the biological issue to be resolved, and the ML method employed.

II. Literature Review

Trans-acting hotspots are discovered to influence major group-specific within the gene networks, such as the normal chromosome that consists of five more deletions of network supply with the mitotic control where the type of TCR is mediated in the adaptive immunological with a stable response that applies the CNA – devoid group distraction.Based on the effects of CNAs within the

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transcriptome, our findings offer a unique stratification of the molecule with the majority of infected people with breast cancer [7]. At three years, there were 12 percent absolute variations with the group knowns as the trastuzumab type of group and the regulations followed in the absence of disease spreading population. A 33 percent decrease in the risk of mortality was linked to trastuzumab treatment (P=0.015). In trials B-31 and N983, the trastuzumab group's half the percent of a cumulative incidence of the classes only in sections III and IV with the infections of heart failure with a report of 4 percent and 2.9 percent, respectively [8-9]. Therefore, it is crucial to analyze his work, especially his latter theoretical creation and its reception. The core theme of the processes of subject management and what are thought to be its two most significant roots—the literary and the political—are the focus of this special issue, which examines the legacy of the later Foucault [10]. One approach includes theoretical techniques, which are quick and effective instruments that can result in the identification of novel active pharmaceuticals specifically made to treat certain conditions. By encoding the data stored with the chemical instruction and describing the QSAR which can be abbreviated as Quantitative Structure-Activity Relation a complex type of network that becomes a popular solution in the construction of effective medications [11]. The molecular system serves as the model foundation. Building the 1stcomplex type of network that represents the drug-similarity interactions for the range of 1600 empirically unexplored chiral HMGRI isomers with the help of predictions of this system as an input section. A condensed form of this network, known as the "Giant Component," was also provided. It comprises the representative group of chiral HMGRI dealing candidates. The research proposes a novel hybrid use of chiral/non-chiral TIs and complex networks in the QSAR analysis of key elements of structural diversity [12-13]. The experimental design approach described in this article is assessed and verified using RRegrs. Our results differ for three of the five most recent simple state-of-the-art information, and that is concluded that choosing the optimal model by our suggestion is both statistically significant and pertinent [14]. When utilizing these kinds of algorithms, it is important to manage with a statistical technique to determine whether the changes are enough significant. Furthermore, compared with previously reported methods, our results with three actual complicated datasets indicate different top models [15-16].

A crucial problem for airline management is predicting future passenger demand. Creating an ANFIS to forecast domestic airline passengers in the model of Australian demand was the aim of the current work. The project involved training, evaluating, and validating the ANFIS model. The ANFIS structure and Gaussian membership function both made use of Sugeno fuzzy rules, and linear membership functions were also created [17-18]. Based on 5973 traffic accident data that happened in Abu Dhabi over 6 years, an artificial neural network (ANN) was used in this study to analyze the injury from accidents due to traffic control (2008 to 2013). At the time of the accident, 48 distinct characteristics had been gathered for each accident record. The data were condensed after pre-processing to just 16 characteristics and four injury severity groups [19-20]. To anticipate ionospheric 30 min total electron content (TEC) data, a radial basis function (RBF) neural network is constructed in this research and improved using a Gaussian mixture model .

III. Proposed Work

According to the intelligence-based computational system, particularly with the ML, the design of the results phase is enough important stage. To achieve this, it is crucial to first establish the implementation approach, Any subject of study must use an ML technique, and it must be transversal. Even though all domains use the same steps in the experimental design [21-22]. We may distinguish the following phases in the ML approach used in drug discovery specifically: Data gathering, creating mathematical descriptors, finding the optimal selection of variables, training a model, and model validation are the first four steps shown in Fig.1.

Getting the data set, which must meet specific requirements, is the initial stage. It must have properties that make it simple to generate and manage in the lab adding those physical qualities that aid absorption, managing specificity, and an average range of toxicity. This is because complicated compounds or big proteins are not commonly used in the pharmaceutical sector. Small molecules and peptides are the major types of chemicals that it often interacts with. The sequencing and peptides and small molecules have different structures, represented using the SMILES and FASTA formats to facilitate the handling and study of these substances. The generation of sequence data has significantly advanced thanks to new sequencing technology (DNA, proteins, tiny molecules, etc.). Although only a small number of maths models that has the ability for producing analysis based purely on different sequences, compound sequences are the beginning point in drug development. Sequences must be transformed into matrices so that ML algorithms can process them to do the prediction. Also crucial is the display of various chemicals. Although certain machine learning (ML) models do not require displaying, supervised learning models are frequently used in the field of drug development. In this instance, the researchers' defined displaying will be crucial to the experimental procedure.

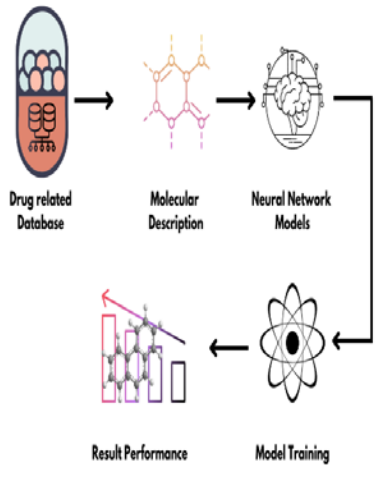

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Fig.1 Model for forecasting the presence of Drugs

The application of machine learning techniques is widespread, and more articles have been published recently in particular. However, there aren't enough machine learning articles on open access platforms that are concerned with development shown in Figure 2.

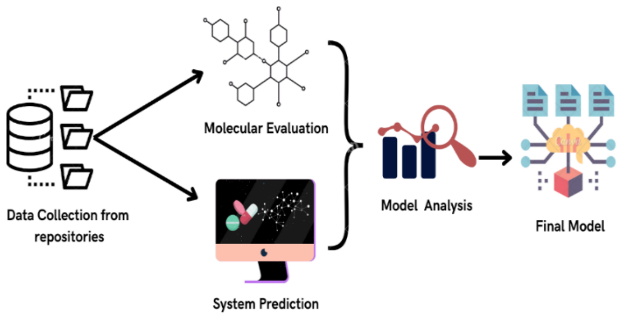

Fig. 2. Identification of new drugs

In Fig.2, we can estimate some set of instructions that are most relatable to the characters that are available in the previous paths, so the results occur in the $M_j^q(t)$ solution that the been developed in case of balancing the limitations when it appears in each case. the $|\tau_j(t)^{\infty}||i|^{\partial}$ characteristics can be frequently affecting the major approaches that are rise in j values. If the j value enables automatically the $\sum_{u\epsilon i_q}|\tau_u(t)^{\partial}|\cdot|\eta_u|^{\partial}$ which is being considered as one of the standard approaches with the values of $u\epsilon I_q$

$$M_j^q(t) = \begin{cases} \frac{|\tau_j(t)^{\partial}|\cdot|j|^{\partial}}{\sum_{u\epsilon i_q}|\tau_u(t)^{\partial}|\cdot|\eta_u|^{\partial}} & \text{if } u\epsilon I_q, \\ 0 \end{cases} \quad (1)$$

In Equation (1), the I_q denotes the presence of attributes and that also concludes with the mandatory solution, according to the i and v values the analysis or the prediction value according to the methodology is an additional feature with the parameters that govern the relative value adoption in the algorithm that is used here and is presented in Equation (2).

$$\Delta\tau_j^q(t) = \begin{cases} \emptyset\cdot\gamma\left(E^q(t)\right) + \frac{\emptyset(s-1E^q(t)j)}{s}, \\ 0 \end{cases} \quad (2)$$

T(s)c can be considered as one of the features according to the subsets that are most related to the iteration of $|t^s|s$ that are representing the length of ϕ that consists of various parameters according to the control of the effective weight of features which varies in the range of 0 to 1 is represented in Equation (2).

$$\tau_j(t+1) = (1-\rho 1)\tau_j(s) + \sum_{q=1}^{p}\Delta_j^q(t) + \Delta\tau_j^b t. \quad (3)$$

In Equation (3), the spoken regulations that are been processed according to the eliminated and exploited set of attributions that are regulated in the probabilistic models, so the parameters have been chosen in different methods.

$$F_i = \frac{\eta_i\cdot\tau_j}{\sum_{j=1}^{c}(V_j)\cdot\sum_{i=1}^{b}(\eta_i\cdot\tau_j(t))}. \quad (4)$$

In Equation (4), both i and j terms were used to represent the current regulations and the deployment of the algorithm do have some methods of work that are being specified according to the optimizer in the range of representing the analysis methods with the time frame of stable ability to the analysis performance is presented in Equation (5).

$$B(NB_j = V_j) = -\left(N(B \mid B_j = V_j)\cdot\log_2 C(N \mid B_j = v_j)\right) \quad (5)$$

The ants employ this technique to identify both more simple and robust categorization criteria. Initial administration of such routes includes the same amount of analysis as described in Equation (6).

$$\tau_j(t=1) = \frac{1}{\sum_{j=1}^{a} b_j} \quad (6)$$

IV. Experimental Result

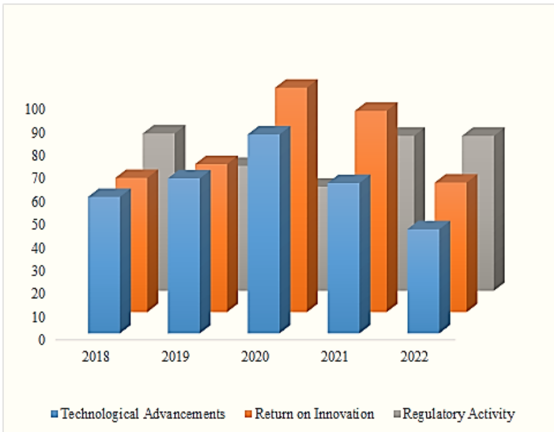

Fig. 3. Building Analysis

The graphical representation in Fig.3 and Fig.4 represents the building analysis ad demand analysis in the realtime application. Numerical analysis of the data is performed is illustrated in Table 1 and Table 2 respectively.

TABLE 1. Building the Technical Analysis Based on the Real-Time Implementation

Year	Technological Advancements	Return on Innovation	Regulatory Activity
2018	59	58	68
2019	67	64	54
2020	86	97	45
2021	65	87	67
2022	45	56	67

TABLE 2. Comparison Based on the Industry Verification and the Demand in Real World.

Year	Industry Verification	Demand
2018	75	76
2019	56	84
2020	67	86
2021	87	56
2022	78	89

Fig.4 Demand Analysis

V. Conclusion

The pharmaceutical sector has profited enormously from the usage of these models in the section of cheminformatics, and more especially in drug development. The only available tool up to this point was the utilization of descriptors derived from the default structure of peptides or tiny molecules. In recent times, graph-based molecules have been explicitly modeled using artificial neural networks. Molecular regulations are frequently employed in business today, but at the same time, it is the emergence of graph models that produce outcomes, in some cases, outperform the more traditional models. This is significant because, although being an area of knowledge still under development, it has great promise for the future, largely because of its flexibility to the issues and molecular structures to be addressed. However, the biological issues that cheminformatics, and more especially ML algorithms, have focused on include the identification of new therapeutic targets through the prediction of strong interactions. This remark is ideally suited to the demands of this effort and the setting of precision medicine.

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Heart Disease Identification with the Support of Embedded IoT in Hospitals

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***Abstract*—In this paper, we will look at how to detect heart disease in hospitals using embedded IoT. The proposed method is based on the integrated internet of things in hospitals. It communicates wirelessly and can cover the user's immediate surroundings. By transmitting a series of voice control stored in the system's memory card, information about the environment is expressed to the user via headphones. To prevent interference among two or more devices nearby, appropriate connectivity techniques were also integrated into the prototype. Finally, the effectiveness of the device is evaluated and illustrated using experimentations and statistical analysis**.

***Keyword*—AI, Internet of Things (IoT), wearable IoT, Hospitals, Heart Disease**

I. Introduction

Nowadays, regular health monitoring is critical. Wireless health monitoring of a patient is a modern concept. It is a significant advancement in the medical field. Using current technologies such as potable communication, wireless systems, and wearable health monitoring devices which are controlled in the remote process, healthcare providers have established a better health monitoring system that supplies a comfortable lifestyle to patients who are infected with different diseases [1]. As information about the patient's health reaches the doctor's screen from wherever the patient does have any symptoms with him, doctor visits to patients are constantly decreasing. Based on this, physicians may also save a lot of lives by providing timely and beneficial care.

The majority of individuals are experiencing health difficulties as a result of the increasing societal pressure, and the majority of these problems are caused by repeated heart attacks. It is of the utmost need to develop a reliable method that is able to predict the occurrence of heart attacks or atrial fibrillations before they take place. Because the Internet of Things (IoT) is the most rapidly developing and widely used technology in the current age, combining traditional computing with IoT has resulted in the development of highly effective new technologies [2]. The combined system offers a variety of benefits to the user, such as the ability to detect the possibility of heart disease based on the patient's symptoms during an emergency, communicate with medical professionals regarding the severity of the potential disease, and assist in the treatment of the condition [3-4]. In the event of a medical emergency, the system will immediately notify the situation to the chosen physician. The severity of HD may now be diagnosed in patients by the use of electrocardiograms (ECG), exercise stress tests, chest X-rays, CT scans, MRI, coronary angiograms, and other diagnostic procedures. Patients need prompt and accurate diagnosis of coronary heart disease in order to be eligible for timely and appropriate therapy that will improve their chances of surviving the long term. In many parts of the globe with low resources, cardiologists who are qualified to perform these diagnostic tests may not be accessible. In many instances, the health of patients is placed in jeopardy due to the failure to detect a condition, the wrong diagnosis of a condition, or inappropriate treatment [5-6]. In addition, the early discovery of HD leads to preventive measures such as medicines, changes in lifestyle, angioplasty, or surgery, all of which may assist to slow the progression of the illness and reduce morbidity [7]. As a consequence of this, accurate and prompt diagnoses of heart disease are essential for reducing death rates and improving patients' chances of surviving for a longer period of time. It is difficult to diagnose coronary heart disease in its early stages, which is one reason why computer-assisted methods for detecting and diagnosing heart disease in individuals have been created [8]. Approaches that use machine learning to assess clinical data, evaluate it, and diagnose medical disorders are becoming more widespread in healthcare domains. These methods are used in medical facilities.

II. Literature Review

Wang, Wanqing, et al. (2021) and Latchoumi TP et al (2022) sought to improve clustering technology to improve the design of IoT medical embedded devices. The system

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aims to align a file's onset and loads illness symptoms input from the user data into the input given. Find a match if the signs are preloaded, which will result in a prevalent prescription medication response and illness names in the system. Angina does not indicate that a cardiac attack occurs [9]. Katake, Kanchan. (2020) and Karnan B et al (2022) investigated existing wearable devices for measuring heart-related parameters and creating sensors for stress hormones, heart aging, and cholesterol. They aimed to create an algorithm that would create an alarm in the event of a threat to human life and would forecast any heart disease using existing evidence as well as data generated by IoT devices [10-11]. They intended to create ML and DL algorithms for this prediction by analyzing existing approaches. Khan, Mohammad Ayoub. (2020) and Sivakumar P (2015) suggested an IoT-based system to more accurately analyze heart disease using a Modified Deep CNN. The patient's BP and ECG are monitored by the smart device and heart tracking device. The MDCNN is used to categorize received sensor data as normal or abnormal. The system's performance is evaluated by comparing the proposed MDCNN to existing logistic regression and also the NN models [12]. The results show that the proposed MDCNN-based heart disease prediction system outperforms other methods. Rahaman, Ashikur, et al. (2019) designed and implemented an inbuilt sensor system with a low-power communication interface to collect ECG and body accelerations in a public setting using a smartphone. A wearable sensor is used to monitor ECG patterns, as well as the smartphone's built-in sensors, such as accelerometers and GPS sensors, to measure the user's body acceleration and location [13-15].

Al-Makhadmeh, et al. (2019) and Monica.M et. al. (2022) described IoT-based medical equipment for collecting heart data from patients before and after heart disease. To handle the data, a higher order Boltzmann deep belief neural network is used that is continuously transmitted to the health care center. The DL method learns heart disease features from previous analysis and achieves efficiency through effective data manipulation. Raj, Sandeep, et al. (2020) and Sridaran K et. al. (2018) proposed a novel that is always enough efficient methodology while comparing it with the real-time acknowledgment ECG signal [16-17]. The approach extracts characteristics from heartbeats using a fast Fourier transform-based discrete wavelet transform, which has a lower computing cost in terms of addition and multiplication operations. These extracted features are identified using a PSO-tuned twin SVM classifier [18-19]. The PSO model is used to gradually adjust the classifier parameters to attain accuracy, and the TSVM classifier is quicker than the fundamental SVM models. To categorize 16 classifications of ECG signals, the method is implemented on an IoT-based console that is most related to the microcontroller and validated with the default benchmark Physionet information [20]. Umer, Muhammad, et al. (2022) and Vemuri et al (2021) to enhance heart failure patient survival prediction without depending on human feature engineering, an intelligent healthcare framework based on IoT and cloud technologies has been developed by Buvana M et al (2021). The intelligent IoT-based system recognizes patients in real-time and offers patients with heart failure timely, effective, and high-quality healthcare services [21-22]. The suggested model also investigates deep learning models for identifying individuals with heart failure who are still alive or have passed away.

III. Proposed Work

A built-in sensor system with a low-power standard interface for collecting ECG and body accelerations in public using a smartphone A wearable sensor, as well as the device's built-in sensors, such as accelerometer sensor and GPS sensors, are used to measure the user's body acceleration and location. The proposed digital health care framework is based on IoT and cloud technologies and is designed to improve heart disease patient survival forecasting without relying on feature engineering. The smart Internet of Things-based framework detects patients in real-time and provides patients with severe with prompt, effective, and high-quality healthcare services. The proposed model also investigates DL models for deciding whether patients with heart failure are alive or dead. The framework collects data from IoT-based sensors and sends it to a cloud web server for processing.

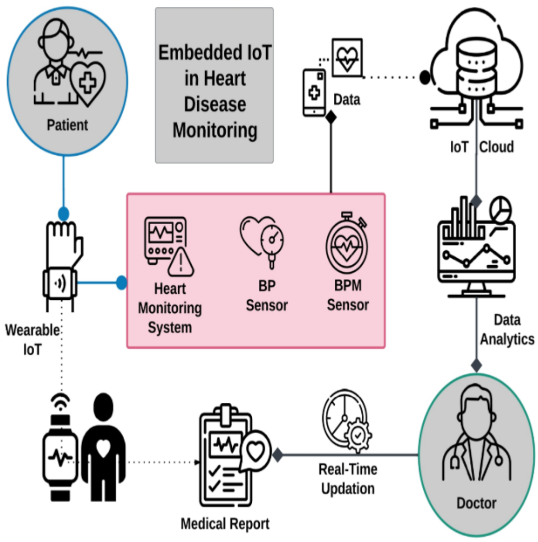

Fig.1. Proposed architecture

Where f(p,q) denotes the pixels in the neighborhood of noise pixel and $\hat{g}(e,x)$ shows the median pixel value. To determine if an individual pixel in a picture has noise, the median filter compares it to all of the surrounding pixels. It is possible to change the size of the neighborhood and the criteria for comparison is calculated using Equation (1).

$$g(e,x) = \underset{(p,q)\in R_{ex}}{mean} \{f(p.q)\} \tag{1}$$

$$F(e,x) = \begin{cases} 1, (e,x) \epsilon P_f \\ 0, otherwise \end{cases} \tag{2}$$

DOI: rp-9788770040723.206

$$N_{s,\theta=0(r,s)} = \sum_{m=1}^{M}\sum_{n=1}^{k}\begin{cases}1 & c\\ 0 & otherwise\end{cases} \quad (3)$$

$$\sum_{p,q}|v-u|^2 q(p,q) \quad (4)$$

In Equation (3), c takes its value according to the condition of if I(p,q) = p *and* I(n, m+s) = q, and p, q = 0, 1, …., l-1.

$$\sum_{p,q}\frac{(p-\mu p)(q-\mu q)q(p,q)}{\sigma_p\sigma_q} \quad (5)$$

The letter "l" stands for the number of grey tones. The letters M and C indicate the image's dimensions.

$$\Sigma(p,q)\frac{u(p,q)}{1+|q+p|} \quad (6) \quad (6)$$

And the (v,x) grey tone is denoted by q(v,x).

$$H_{pc} = -\sum_{m=1}^{M_{pc}}\sum_{n=1}^{N_{pc}} q_{pc}(m,n)\ .\log q_{pc}(p,q) \quad (7)$$

IV. Experimental Results

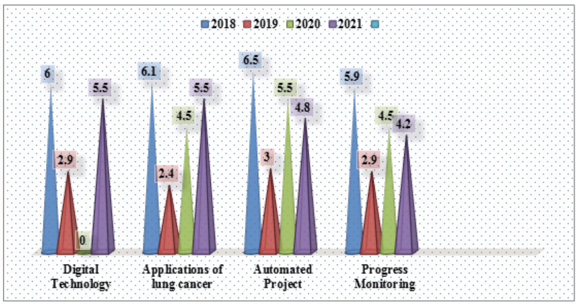

Fig.2.Analysis of comparison of previous models

By changing the different k-folds, the effectiveness of the smart healthcare prediction model is evaluated and contrasted with algorithms and classifiers as shown in Fig.2. The GSO-CCNN-based smart healthcare prediction model's better performance is assessed utilizing a variety of performance criteria. The MCC of planned GSO-CCNN is nine percent, 10.4 percent, 11.7 percent, and 7.9 percent more advanced when the k-fold is assumed to be 2. The general effectiveness of proposed smart healthcare modeling with IoT-based fog and cloud computing for various metaheuristic-based algorithms and classifiers.

TABLE I. Performance Measures

Algorithm	Patients Activity in Training (%)	Patients Monitoring in testing (%)	Overall Accuracy (%)
(ML) Algorithm	89.78	98.67	84.01
Neural Network Model	91.78	92.56	94.67

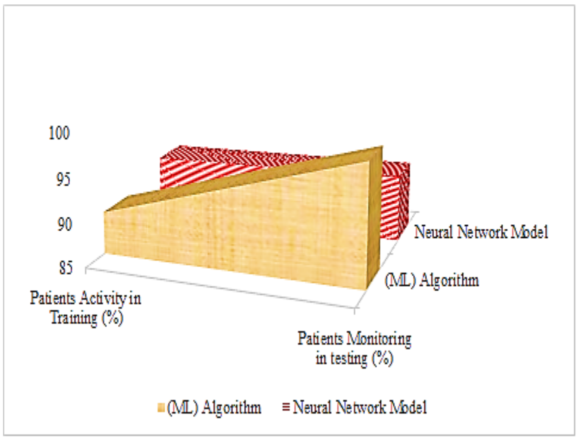

Fig.8. Training and Testing Analysis

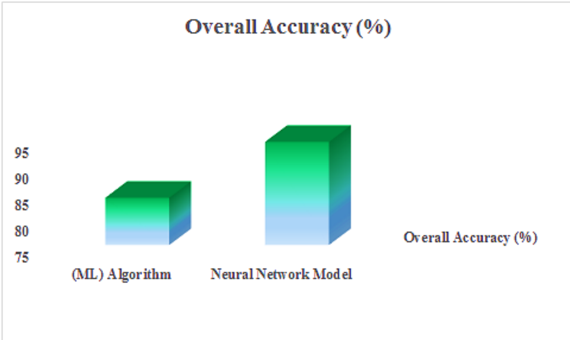

Fig.9. Accuracy Analysis

The comparative research of the suggested smart healthcare model with IoT-assisted fog computing is expressed in terms of k-fold validation by setting the k-fold to 5, as indicated for different metaheuristic-based algorithms and classifiers, respectively. Machine learning models are evaluated on a short data sample using a resampling approach called cross-validation. Fig.3 and Fig.4 represents the comparative analysis of the proposed Machine Learning model on Neural Network Models and the results show that the Machine Learning model has outperformed the existing model. Table I represents the numerical analysis of these figures.

V. Conclusion

The framework makes use of IoT-based which helps in the collection of data and shares it to a cloud server to make use of it in further processing. Chui, Kwok Tai, et al. (2019) proposed a response to a patient monitoring system that is based on IoT. Qualitative research is being conducted on selected analytics which evaluates the behavior, cardiovascular disease identification, and fall detection. Gia, Tuan Nguyen, et al. (2019) proposed low-energy monitoring for diabetic patients with cardiovascular disease using a fog-aided IoT system. Kazi et al. (2018) developed a real-time cardiovascular disease monitoring system that is most related to continuous focusing on the patients instead of doctors or as like the doctors physically monitoring the patient. IoT-based sensor management becomes a huge environment for several applications and services, with Raspberry Pi acting as both a controller and a sensor node.

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The study suggests a universal patient monitoring system as the next step in the department's development thus far.

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A Novel Approach to Predict the RNA Bind Protein

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Abstract—Since RNAs were numerous, prevalent through biological distribution or purpose, but adaptable overall architecture, discovering protein RNA associations were difficult either analytically or statistically. As a consequence, a large number of RNA-binding enzymes (RBPs) have yet to be discovered. A findings were similar or by detecting 860 mRNA-binding proteins in such a later chromatographies research, or by using SPOT-Seq of RBPs, a template-based achievement predicting tool, to the gene regulation (Mbps). According to the Nucleotide Sequences, predicted penetration (or sensitivity) of 1217 recognized RBPs or 43.6 percent of 860 recently discovered human Mbps is 42.6 % or 43.6 %, respectively. SPOT-robust Seq's capacity to foresee RBPs was demonstrated by its continued sensitivity. More importantly, SPOT-Seq discovers 2418 new RBPs across associated proteins, including 291 of these verified by the recently discovered mRBP set.There are 61 unique RBPs that are not comparable to any recognized RBPs among 291 authenticated novels RBPs. We may now investigate the phenotypic roles of anticipated novel RBPs in sickness cascades after they have been validated. For actual verification or hypothesis development, the information of 2418 anticipated novels RBPs, together with confidence level, but also complex mechanisms, was accessible at http://sparks-lab.org (with articles).

Keywords—mRNA-binding enzymes; disease pathways; protein-RNA interactions

I. Introduction

Characterization of RNA-binding enzymes (RBP) and their targets is required for a complete knowledge of biological processes. RBPs are of particular importance since they have been connected to a wide range of biological functions, particularly cellular homeostasis or genome preservation, that alterations in RBPs have been linked to human illnesses, especially tumors [1-3]. According to a current worldwide assessment, transcribed are not only numerous but also diversified in their distribution and activity in molecules. This suggests that comment systems should be more complex than regulatory or protein–protein connection pathways [4]. Furthermore, determining RNA-binding by each enzyme experimentally is impractical or unrealistic, as well as theoretically difficult and costly [5]. The effort to find RBPs using high-throughput molecular techniques develop slowly and are prone to error. As a result, computational models have become an important part of RBP performance identification or assessment.

II. Related Works

Proposed and implemented SPOT-Seq (RNA), a guideline approach for predicting RBPs depending on the nucleotide [6]. The fold recognition technique is used to assemble a sequence similarity structural default parameters of protein-RNA complexes in this approach [7]. On both the region and enzyme chain categories, the prototype library provides 1164 known protein-RNA complex molecules (95 percent sequence identity or less). If one of the prototypes has a high Z-score resemblance to such inquiry, the query's design is predicted, or a framework precise definition is built between predicted architecture and the design's RNA[8].To use an understanding integral equation theprototype, detailed structure could then be used to estimate the propensity for protein-RNA binding. An RBP is forecast if the structural similarity was greater than a criterion [9].PSI-BLAST, which employs a sequence-to-profile suitability heuristic algorithm, outperforms SPOT-Seek in terms of sensitivity and reliability [10-12]. More crucially, while implemented to 250 DNA binding proteins, SPOTSeq (RNAs) was able to distinguish between DNA-binding or RNA association (less false positive rate) unlike several mathematical techniques [13-15]. A massive forecast of RBPs in the gene expression and found 42.6 % of categorized RBPs in the protein database. When contrasted to the quickly found 890 translations RNA associated protein in human HeLa cells19, our estimates showed a constant susceptibility. And over 2000 RBPs are predicted, including 291 of them confirmed via translation, RNA associated proteins, that were recently discovered.

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Researchers also discovered that several of this novel RBPs play a role in a variety of sickness systems.

III. Proposed Methods

For RBP estimation, SPOT-Seq integrates fold segmentation to interaction propensity forecast. Using the fold identification algorithm SPARKS X.17, each target gene is matched towards a template library of 1195 nucleotides sequence proteins-RNA complicated mechanisms (95 %sequence identity cutoff). If such folding recognition Z-score is greater than 8.04, a simulation includes connecting target molecule or signal RNA is built by adopting the SPARKS X sequence-to-structure approach to replace specimen protein sequences with the target protein database [16]. The prototype, detailed inspection would then be applied to compute binding interactions using a probabilistic energy model that focuses on the way always limited external standard state20, which has been used to protein-RNA interactions (DRNA). The target gene was expected to be RNA-binding if the predicted criterion is smaller than 20.57, and its advanced modelling approach is employed to predict RNA-binding performance at spatial precision [17-18]. Using a leave-homologue-out classification method, the efficiency and Z-score criteria (20.57 and 8.04, respectively) were obtained by optimising the Mathews degree of determination (MCC) with a collection of 216 RBPs or 5765 non-RBPs. They chose to optimize MCC predictions is an acceptable measure of accuracy or particularly for such a training sample with an uneven amount of RNA-binding or unregistered proteins [19-20].

IV. Results and Discussions

After eliminating enzymes whose estimated structures intersect to anticipated transmembrane areas by THUMBUP, SPOT-Seq on the human proteins discovered 1841 enzymes as RNA-binding. Although our algorithm based on protein, RNA complicated mechanisms cannot anticipate the configurations of integral membrane proteins, this detector is required. 118 enzymes were categorized as RNA-binding and correspond to one of category groups listed in Table 1 out of 1841expected RBPs.

TABLE 1. RBPs in Number

No of Protines			
RNA polymerase	702	389	53
ribonuclease	62	31	49
ribonucleproten	250	40	21
Ribosomal	63	19	14
RNA Biniding	118	10	20
Total	1195	489	157

Number of Proteins			
Keywords	Annotated	Predicted	Sensitivity Coverage Percentage (%)
RNA Polymerase	702	389	53
ribonuclease	62	31	49
ribonucleoprotein	253	49	21
ribosomal	63	14	19
RNA binding	118	18	14
Total	1351	509	45

Furthermore, 1848 enzymes have roles other than RNA interaction, and 570 molecules have no descriptors. The amount of anticipated RBPs in labelled RBPs, non-RBPs labelled with other functions, or enzymes with unknown parameters is shown in Fig.1. The finding indicated a 42.6 % susceptibility (or coverage). Despite the reality that their reference study16 was predicated on enzymes whose structures were determined in combination with RNA, the sensibility is continuous. A susceptibility of RBPs is highly dependent on the particular RBP groupings, as they discovered.

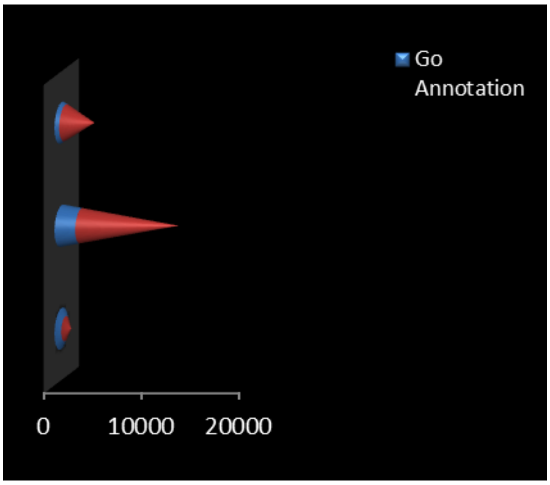

Fig.1. RBPs process with existing system

As indicated in Table 1, enzymes labeled also with the phrase "RNA interaction" have the maximum accuracy (56%) or the enzymes tagged with the phrase "RNA polymerase" have the least (13%) susceptibility. The top ten substrates used for all estimated RBPs throughout the protein database are listed in Table 2. The RPL3 gene contains the 60S protein kinase L3 (chain C in PDB structure 3o58), which predicts 1181 enzymes, with 61 of them designated as RNA interacting. There are four other 60S protease enzymes in the top ten. We investigate the overall correctness these predictions of lights of L3's frequent occurrence as a design. 215 RBPs and 5765 non-RBPs participated in the SPOTseq study. 16 11 binding proteins, but also 15 largely symbolic objectives were found to employ protein complexes from architecture 3o58 as precursors. When all designs are used, the MCC for using 3o58 links as patterns is 0.64, which is similar towards the general MCC of 0.62. As a result, the generalization ability based on 3o58 links was comparable to overall quality.

DOI: rp-9788770040723.207

TABLE 2.10 TOP FRAMEWORKS

PDB ID	Gene Name	Protein Name	Proteins (annotated)	Non-redudant
3o58c	RPL3	60S ribosomal protein L3	1071 (59)	821
1hvuA	gag-pol	Gag-Pol polyprotein	214 (10)	165
3o58E	RPL5	60S ribosomal protein L5	179 (9)	148
3ciyB	Tlr3	Toll-like receptor 3	153 (3)	52
3o58F	RPL6A	60S ribosomal protein L6A	132 (8)	102
3ivkB		Fab light chain Exportin-5	108 (0)	14
3a6pA	XP05	60S ribosomal protein L32	95 (4)	94
3o58b	RPL32	60S ribosomal protein L21A	89 (6)	80
3o58T	RPL21A	Polyadenylate-binding	92 (5)	58
1cvjA	PABPC1	protein 1	59 (48)	39

There seems to be an amount of 1848 new RBPs that have jobs apart from RNA interaction.In other words, these molecules do double duty as RNA-binding enzymes. Focusing on their similar chemical activities, they looked at new and current moonlighting RBPs. The number of attributes and GO words into component that are original or identical across anticipated or validated RBPs are listed in Table 3I. More than 90% of estimated novel RBPs with root inscriptions only and 98 percent of estimated novel RBPs including leaf evaluations] had GO IDs to describe RBPs, 1238/(1238 1 26). To put it another way, practically all to predicated moonlighting RBPs' capabilities are linked to recognized RBPs. The total human transcriptomic includes 1411 or GO IDs, while identifying RBPs has 288 or GO IDs, according to our findings. RBPs have a strong relationship to other biological mechanisms, as seen by the fact that 20% of all tissues GO IDs are linked to RBPs.GO Algorithm (Table 3)

TABLE 3. RBP PROTEINS WITH GO IDs

			Protein[b]				GO ID's[c]			
			Root		Leaf		Root		Leaf	
Type	Total	None	Unique	Shared	Unique	Shared	Unique	Shared	Unique	Shared
Annotated	1126	103	89	468	45	479	94	191	188	94
A-A□P	687	99	53	217	31	292	82	172	141	81
A□P	504	14	34	252	14	189	10	9	35	12
P-A0P	2389	914	19	222	24	1249	151	186	247	93

Fig.2 shows four categories of assessed or identified RBPs with four GO IDs to indicate similar capabilities among expected or verified RBPs. Each GO ID not only comprises both forecasted or confirmed RBPs, but it also relates to enzymes having numerous GO IDs. Many of these ten GO IDs are linked to translation regulator activity, implying that they bind to DNA. Zinc-ion-binding, for example, has an unusual ratio of 1.06 (percentage of assessing RBPs in a particular GO ID in all examined RBPs vs. Proportion of all enzymes in a certain GO ID).

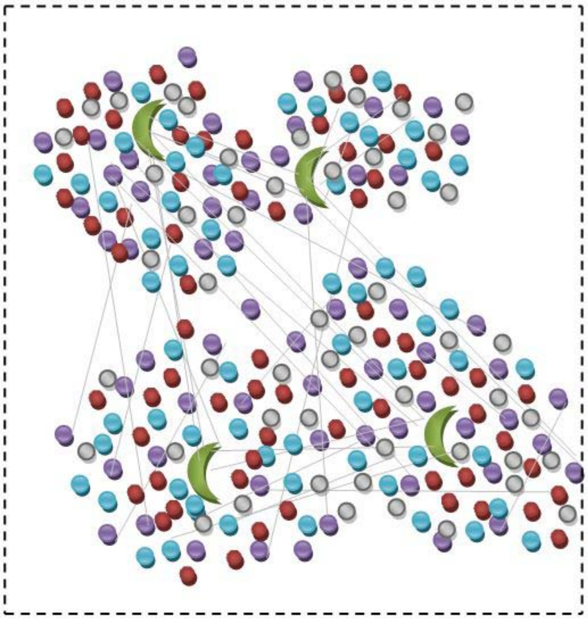

Fig.2. Relationship among GO IDs and enzymes

Integrating GO IDs among observed or forecast RBPs helps to evaluate expected novel RBPs, but it does not confirm them. A current biochemical investigation, which discovered mRNA-binding enzymes n HeLa cells allowed us to directly validate our anticipated RBPs. 19 UV irradiation was employed in this investigation by providing a shared Mbps in active HeLa cells, that were subsequently captured using magnetic nanoparticles after enzymatic hydrolysis and characterized using elevated nanoLC-MS/MS.They found 860 Mbps, with SPOT-Seq predicting 375 of them as RBPs. This dataset's susceptibility is 43.6 %, which is similar to the 42.6 percent susceptibility from all GO labelled RBPs. Even though the data sources are radically different, SPOT-overall Seq's correctness is supported by its vulnerability.Many unique RBPs are found among the 860 Mbps.

RBPs were classified using that GO criteria as sequence data, 746 enzymes are identified as RBPs, with SPOT-Seq estimating 291 of these as RBPs. As a result, SPOT-Seq has a susceptibility of 39% for detecting novel RBPs, which is comparable to the acuity of all RBPs (42.6 percent). The most frequently employed substrates in these 291 forecasted or authenticated mRBPs are chains in PDB ID 3058 (87 duration). These proves that 3058 could be used as a model for forecasting RBPs. Furthermore, a reference molecule with mRNA binding function was used in bulk of 291 estimated protein molecules (70 percent, 203/291).

The genetic information was used to test a different approach of RBP forecasting predicted on established RBP complex configurations. The approach discovered 2418 molecules in the GO dataset that were not originally classified as RBPs. Approximately half of the estimated novel RBPs were classified as ORFs with no GO comments regarding biological activities (908) or merely GO root IDs (909) (247). Table 4 shows that 284 of such projected new RBPs are connected to disease pathways. This forecasting

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tool's initial verification contains 12% of the expected results.

TABLE 4. ENZYMES AND RBPS BASED ON 11 DISORDERS

Disease	Pathways	All	Annotated	AIIP	A-AIIP
Cancer	11	369	9	0	39
Immune System	29	1498	54	7	112
Nervous System	29	3641	214	72	248
Cardiovascular	43	2687	154	69	161
Endocrine/Metabolic	23	1501	16	1	109
Digestive	25	2154	39	4	147
Urinary/reproductive	19	1398	12	4	107
Musculoskeletal/skin	59	3247	84	11	204
Respiratory	3	389	0	0	14
Congenital/metabolism	105	3187	112	14	187
Congenital/other	81	3467	194	85	238
Total	169	4727	325	149	260

80.5 % of all estimated RBPs have unidentified activities, but are labelled with capabilities other than RNA interaction. This indicates that there are far more RBPs than are presently labelled. If we combine anticipated or identified RBPs suppose which the plurality to forecasted and recognized RBPs are correct, RBPs account for 18% of all transcripts. Assuming SPOT-sensitivity Seq's of roughly 43%, the actual amount of RBPs was expected by more than 18%, which mistakes are taken into the description. A huge amount of RBPs that could exist emphasizes the breadth or importance of the protein–RNA association connection. A majority of the RBPs identified here aren't RNA-binding proteins. This so-called freelance potential of RBPs has been confirmed in yeast or human enzyme screens. Novel RBPs discovered through screens were revealed to have enzyme reactions as well as RNA-binding designs.

They have eliminated those anticipated RBPs that are intracellular enzymes to avoid false positive predictions. This is due to the fact that all of our template molecules are spherical. Furthermore, the current approach necessitates independent intracellular proteins forecasting or manual verification. They intend to include a permeability filter directive within SPOT-seek in a future edition. Furthermore, while transmembrane protein prediction accuracy is 88 percent, omitting forecasted transmembrane regions may result in the removal of some real positive predictions. 23 We applied this permeability filter to increase the performance of our RBP forecast while reducing the number of predictions.

Many anticipated RBPs, particularly L3, employed precursors from 60S ribosomal proteins, which was a revolutionary innovation of our template-based methodology (PDB ID 3o58). This is true for either conventional or labeled RBPs that have been expected. We have confidence in these forecasts because our standard test shows that forecasts based on 3o58 are as accurate as assumptions based on other designs. Furthermore, 87 new RBPs depending on 358 templates have been confirmed as Mbps. 19 The prevalence of L3 and other associated proteins in forecasting RBPs could be due to translational enzymes' long evolutionary history or the possible proliferation of genetic variants in interpretation.

V. CONCLUSIONS

The SPOT-Seq approach has a drawback in that it relies on existing protein-RNA complicated mechanisms as precedents for forecasting complex systems. The query molecule would be suggested as non-RBPs if no corresponding pattern is discovered. Because of dependable the projected structures by framework approaches is not yet dependable, an ab initio homology modelling methodology could not be used to create shape predictions. 30 The reliability of our forecast is 40% due to the restricted amount of possible models of protein-RNA complicated mechanisms. That is to say, there seem to be a lot of false negatives. In addition to the reduced amount of frameworks, incorrectly anticipated binding areas leading to infrastructure models rigid-body presumption could cause absorption, preventing predicted of better binding propensity and thus leading to a false negative forecast. SPOT-Seq increases the retrieval of predicted RBPs or discovering additional when more protein-RNA active compounds are discovered in the future. Additionally, through combining SPOT-sac with several other sequences and framework techniques, the selectivity of the SPOT - sac should indeed improve.

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Free Energy Minimization Technique for the Measurement of Secondary RNA Structure

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Abstract—Throughout generations, this same greatest prevalent approach towards predicting RNA intermediate architecture has remained spontaneous resource elimination. That's predicated around another collection of empirically total power fluctuation characteristics obtained through tests with our proximity models. MaxExpect, a software [15] computer whose anticipates RNA intermediate organization through increasing predicted foundation correctness, was described within this paper. It's software CONTRAfold became this same inaugural to use such technology, which used pairing possibilities anticipated employing another quantitative modeling methodology. Another partitioning functions computation was employed can forecast basepair possibilities also much has newly oligonucleotide possibilities using empirical direct energies adjustment proximity characteristics. With function providing competing explanations regarding underlying design, MaxExpect expects simultaneously this same optimum as well as mediocre configurations. These highest predicted reliability constructions generally, upon the median, are based around a very broad dataset comprising various forms containing RNA. Organizations with considerably greater degree more precision beyond maximum freed energies formations. Because proportion among recognized basis pairings appropriately projected was called sensitive, whereas because proportion for anticipated pairings which belong within the overall recognized organization was called positively prognostic quality. The greater sensitivities but rather Accuracy for predictions could be promoted through selecting doubly strangeness but rather only one went ashore, correspondingly. When comparing versus unconstrained resource minimizing, overall median Ppa estimated optimum architecture employing MaxExpect improves between 66 percent towards 68 percent assuming this same sensitivity setting.

Keywords—Nearest Neighbor method; RNA structure; MaxExpect; PPV; Base pairs

I. INTRODUCTION

Numerous different types of functioning RNAs had been found within a recent century, although their frequency that development had intensified. Intergenic RNAs are so named even though those who do neither require human polypeptide synthesis to operate [1]. This same numerous capabilities of ncRNA had already inherently altered this same previous preparation of this same Regional Doctrine of Human physiology, which held that proteases have been this same sole hereditary concluding contributors to the development. Proper identification of underlying architecture seems required for simultaneously this identification but also investigation underlying ncRNA functionality. Our physicochemical framework anticipates this same optimum equilibria configuration, namely form containing molecular minimum Reynolds potential variation following unfolding [2].

This closest neighbors approximation was employed during kinetic resource minimizing help estimate overall translational instability for this particular organization. Regular multiple stagnation analyses were used to determine comprehensive collection for proximity characteristics for liberated radiation but also heat changes using another series of consecutive photonic blistering tests involving modeling materials [3]. This technique involves determining this same least probable architecture utilizing any randomized discussion language [4] provides another alternative towards obtaining this same highest frequent construction through unconstrained resource elimination. This probabilistic discussion memory's characteristics were learned against another collection of language phrases containing established patterns.

II. RELATED WORKS

Freeware resource reduction but also structural forecasting depending upon information have subsequently

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been merged. Using computationally heterogeneous library containing RNA genomes containing recognized geometries spanning smaller than 700 sequences, overall responsiveness using neutral energies reductions have previously evaluated and compared so much is 73 percent, while low PPV effective arbitrary expenditure reductions [5]. There are 2 reasons for such decreased PPV.

Firstly, although increasing creation formed pairing reduces overall spontaneous energetic increase, here appears always propensity towards over predict basis pairings.Secondly, every collection containing recognized architectures might cannot always label every scientifically found nucleotide sequence, lowering PPV [6]. Identifying every valid combination which was never marked reduces PPV. That architecture having that highest anticipated correctness may still be anticipated providing another alternative towards identifying this same more likely configuration. Overall anticipated correctness for pseudo-knot-free nanostructures is calculated through minimizing overall aggregate between the command center and also human sequencing probability, wherein coupling forecasts could be penalized using some variable.

CONTRA folding estimates foundation possibilities employing statistical characteristics learned through software sequence synthetic RNA tertiary geometries, but also subsequently estimates frameworks utilizing this same greatest predicted correctness technique. Their intermediate structures identical across several replicated RNA sequences were then predicted using average potential precision structured predictions [7]. Another ranking measuring spontaneous radiation changes but also dynamic interactions was used to determine overall fundamental couple possibilities within a particular technique.Another utilization of the greatest anticipated precision throughout individual sequencing intermediate architecture predictions was explored throughout this work, which uses economics that forecasts overall fundamental foundation probability. Considering all present spontaneous [16] power transfer constants around 37°A and, a partitioning functional computation forecasts foundation frequencies.

Similar to previous CONTRA fold, those probabilities were used through using dynamically computing technique, which is performed within software MaxExpect, which constructs this construction without optimum predicted precision [9-10]. This approach is evaluated on a large collection comprising various kinds containing RNA, without our basis function, g, being changed that demonstrate overall exchange among sensitivities as well as PPV. Overall median optimistic predicting effectiveness using MaxExpect when f = 1 is 68 percent, having overall sensibility equal 73 percent, which exactly overall identical with conventional freed resource minimizing technique [11]. As such result, that greatest anticipated correctness organization projected substantially more accurate on aggregate than any minimal freed energies construction. MaxExpect may potentially anticipate alternative potential alternative competitive topologies, known as substandard buildings, throughout addition to finding ideal architecture [12]. Another probabilistic strategy comparable to those proposed earlier involving spontaneous radiation elimination was used can anticipate substandard architectures having anticipated pairing reliability higher below overall ideal architecture. Other explanations regarding its architecture are other expected unsatisfactory configurations. Here was the very earliest application using the greatest anticipated reliability structural predictions which use inadequate organization forecasting which we are aware of. Using Single-cell RNA-sequencing (scRNA-seq) technology, the researchers investigated computational methodologies for assessing RNA levels in single cells [13-14]. They next looked at eight alternative imputation methods, evaluating their ability to restore original data and running various studies to examine how they affected cell type clustering and the discovery of differentially expressed genes.

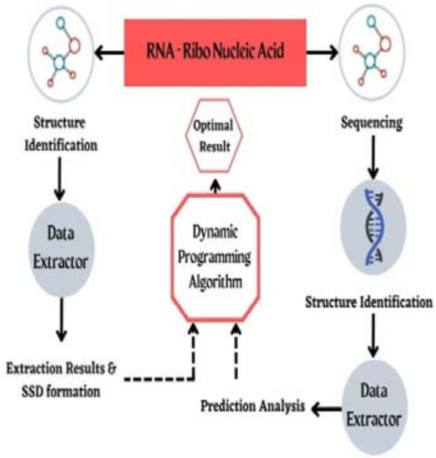

Fig.1. Proposed Methodology

III. Proposed Methods

The proposed methodology comes up with a system for the measurement of Secondary RNA structure and this utilizes the free energy minimization technique. A dynamic programming algorithm is employed to get optimal results. At first, the structure of the RNA is identified and then data is extracted from it. The extraction results are fed into the dynamic programming algorithm, for prediction analysis. Optimal results are obtained from this proposed methodology. The proposed methodology is illustrated in Fig.1. Through optimizing anticipated correctness among basis pairings including standard sequences, minimization is anticipated correctness delivers the greatest approximation given any RNA intermediate structures. Their foundation but also separate probability were estimated using another partitioning mechanism that may be limited using practical information Biochemical alteration, for example, While these approaches use identical closest neighbourhood settings calculating unfolding maximum expenditure changes, everything that was proven that this optimum architecture anticipated by anticipated correctness maximizing yields superior averaged inaccuracy then overall building projected by freed power minimizing.

MaxExpect for prediction accuracy

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MaxExpect has been examined using a very large dataset containing reported intermediate structural RNA transcripts. This best structural, this same greatest planned reliability framework, was forecasted but also contrasted to another existing configuration within this same dataset, using sensitivities but also PPV reporting overall correctness for forecast. Sensitivities against PPV exchange variable, ggfor determining this same ideal preferences for doubled peculiarity against simple peculiarity, this value was changed between 105 through 106. Fig.1 shows overall histogram increasing sensitivities have a proportion increasing PPV. Another minimum number of 750 unsatisfactory configurations is being forecasted throughout additional with optimum formations. This same greatest substandard building's effectiveness, i.e. that organization with this same maximum responsiveness, Figure 2 depicts this as well. That architecture could ultimately be established through understanding such same right architecture, however, still reflects MaxExpect's greatest prediction. Assembling constructions made from bases pairings having an overall command center frequency greater than exceeds the given minimum provides a relatively straightforward strategy for increasing predicted reliability.

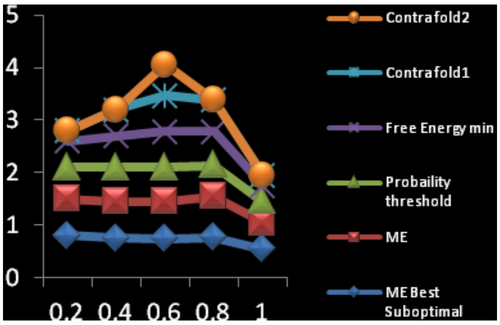

Fig.2. The effectiveness of using various forecast algorithms

Fig.2 compares overall forecasting efficiency using spontaneous resource reductions, CONTRA folding 1.10, but also Objection folding 2.02 against MaxExpect. Whenever m = 1, MaxExpect delivers significantly better PPV than unconstrained resource minimizing for nearly exact comparable sensitivities for architecture predictions. CONTRA folding 2.02 is a substantial enhancement above CONTRA fold [13] but also behaves comparably with MaxExpect. Contrast construct learned its foldable characteristics using 151 typical RNA molecules included throughout this same Rfam collection. This S-Processed information collection, which contains 3439 architectures, was used to determine variables using Contrast folding 2.

IV. Results and Discussions

Considering every kind of structural RNA within our dataset, Fig.1 presents overall levels utilizing accuracy utilizing MaxExpect, direct resource reductions, using Contrast folding 2.02. Average MaxExpect correctness when g = 1, where illustrates optimal threshold when PPV improves beyond unrestricted resource reduction, was presented. Overall reliability with Negative balance folding was provided with g = 6, which matches the performance standard amount using g.Both S-Processed information collection utilized during retraining Contrast folding 2.02 but also both assessment information collection implemented throughout research study have some overlapping. Another bridge technique being used enables extra learning but also assessment using Objection folding further assess understanding influence from temporal overlapping. Only those occurrences containing a particular kind that RNA within this same S-Processed information collection being deleted during overall parameterization retraining during particular bridgethese characteristics have been subsequently used towards forecast buildings with this same kind. While developing any collection the characteristics employed that anticipate Hepatitis S buildings before evaluating effectiveness using RNase P, for example, some RNase P compounds being deleted. Using this crossover authentication screening technique, Negative balance folding effectiveness was significantly enhanced, resulting in substantially greater sensitivities within detection constant PPV.

TABLE 1: PPV BUT ALSO SPECIFICITY FOR FORECASTING ALGORITHMS

RNA types	Max	Expect	Free	energy min	Contra	fold
	Sensitivity percentage	PPV percentage	Sensitivity percentage	PPV percentage	Sensitivity percentage	PPV percentage
SSU rRNA	60.1+22.2	59.1+26.1	59.1+24.6	59.1+26.6	62.4+26.2	57.6=25.2
	(46.1=13.3)	(43.5#15.3)	(43.5#16.8)	(43.5#15.6)	(53.5#15.9)	(44.6+17.4)
LSU rRNA	71.9#12.4	69.0+12.2	69.0+17.2	69.0+12.1	78.0#12.2	70.0=11.1
	(57.0+13.5)	(52.6=14.3)	(52.6=13.9)	(52.6=24.0)	(62.0+14.6)	(55.8#12.6)
5S rRNA	72.6=12.2	61.6=26.7	61.6=22.4	61.6+16.9	61.6=24.5	69.2+11.7
GroupI ntron	69.1+6.6	65.8=8.0	65.8=12.0	65.8#7.5	65.8#18.8	63.1+24.1
Group II intron	88.9#14.3	81.2+14.9	81.2+2.6	81.2+13.6	81.8#5.3	59.8+7.3
RNasel P	61.0=24.4	54.1423.1	54.1413.3	54.1=23.3	54.1+23.0	53.9+21.5
SRP	87.4+15.8	82.4=17.7	82.4=18.1	82.4=23.2	82.8=16.4	80.5#18.9
Average	70.6#8.9	66.9=10.0	66.9=9.5	66.9=10.9	66.1+7.3	63.1+8.5

Variation in accuracy structures

Fig.2 displays overall variations between foundation possibilities within optimum architectures. Whenever this same weighted variable, was used, the overall median foundation likelihood within the overall ideal architecture anticipated by MaxExpect is approximately 0.042 greater than that anticipated by unconstrained resource eliminating, The value of MaxExpect is 1. Whereas technique disparity throughout overall fraction among projected basis pairings overall coupling frequency >0.99 is just 0.7 percent, MaxExpect predicts 7.8percent days were spent worldwide time more basis pairings having partnering frequency greater versus 0.50 than unconstrained resource elimination.

This demonstrates because the geometries suggested through arbitrary resource reductions currently include the greatest statistically likely pairings. Basis pairings having greater pairings probabilities give greater credibility regarding predicting precision over basic pairings without smaller pairings probabilities, particularly established during another recent work using the lowest potential power architectures. Therefore, when maximal predicted correctness constructions comprise approximately a comparable amount more basis pairings having good matching possibility and yet lesser basis combinations having poor coupling possibility versus lowest open efficiency configurations, MaxExpect beats cheap efficiency reductions. The above point is shown with Exhibit 2, which shows how increasing anticipation improves structures predicting reliability using particular 5S rRNA. Overall responsiveness for the overall system estimated from optimizing anticipated correctness is 91.4 percent.

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TABLE 2: GEOMETRIC PROBABILITY DISTRIBUTIONS BETWEEN NUCLEOTIDE PAIRS

RNA types	Max	Expect	Free	Energy min	Contra	Fold
	Sensitivity percentage	Ppv percentage	Sensitivity percentage	Ppv percentage	Sensitivity percentage	Ppv percentage
SSU rRNA	60.1+22.2	59.1+26.1	59.1+24.6	59.1+26.6	62.4+26.2	57.6=25.2
	(46.1=13.3)	(43.5#15.3)	(43.5#16.8)	(43.5#15.6)	(53.5#15.9)	(44.6+17.4)
LSU rRNA	71.9#12.4	69.0+12.2	69.0+17.2	69.0+12.1	78.0#12.2	70.0=11.1
	(57.0+13.5)	(52.6=14.3)	(52.6=13.9)	(52.6=24.0)	(62.0+14.6)	(55.8#12.6)
5S rRNA	72.6=12.2	61.6=26.7	61.6=22.4	61.6+16.9	61.6=24.5	69.2+11.7
GroupI ntron	69.1+6.6	65.8=8.0	65.8=12.0	65.8#7.5	65.8#18.8	63.1+24.1
Group II intron	88.9#14.3	81.2+14.9	81.2+2.6	81.2+13.6	81.8#5.3	59.8+7.3
RNasel P	61.0=24.4	54.1423.1	54.1413.3	54.1=23.3	54.1+23.0	53.9+21.5
SRP	87.4+15.8	82.4=17.7	82.4=18.1	82.4=23.2	82.8=16.4	80.5#18.9
Average	70.6#8.9	66.9=10.0	66.9=9.5	66.9=10.9	66.1+7.3	63.1+8.5

It's particularly worth noting because there's the obvious link connecting previous research around improving predicted accuracy and more contemporary research around discovering pseudoknot freed constructions using pseudo knotty architectures which keep the greatest pairings. Their inputs using their identical subprograms employed there with previous research include variable chance equal of every any pairing which appears within much simulated tangled construction shown in Figure 3. That architecture containing that greatest quantity more quasi pairings represents (1) this same result. Using matrices $A(x,y)$ those accompanying aims to redefine determine this same highest anticipated correctness given each Segment of DNA using N molecules:

$$A(x,y) = \{0\ \partial - \infty 2Q_{mn}(x,y) + B(x+1, y-1) if\ x-1+< hairpin\ L, \tag{1}$$

$$if\ x\ \&\ y\ can\ form\ a\ canonical\ pair,$$

$$if\ x\ \&\ y\ cannot\ form\ a\ canonical\ pair,$$

As such a result, homologous chromosomes found across buildings having very higher anticipated correctness may effectively detect, whereas constructions could be deduced using every particular pairing the sequences found within any structural having very great anticipated correctness. The windows variable was implemented to guarantee whether anticipated shapes be sufficiently different from one another. This same express computation of spirally twisted-pair stockpiling, something that has heretofore been shown to start taking approximately 2 different of this same overall computation moment but also has been unavailable from this same Debit balance times higher method purple color calculating, has always been a considerable component throughout this same lengthier moment requisite by fusion power cost reduction but rather indeed

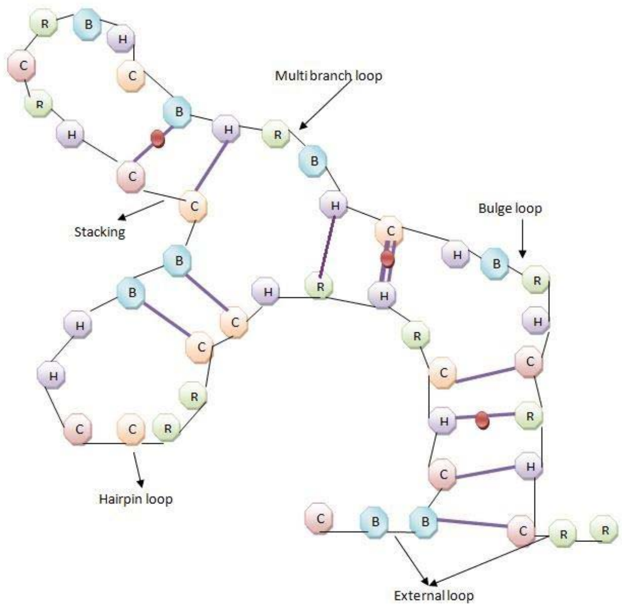

Fig.3. Components projected using Max Expect as an illustration

singular separation operates are using below [9]. Furthermore, MaxExpect generates substandard topologies, because this same mechanism used to do so take double as long as obtaining this same best architecture individually.

V. CONCLUSIONS

Although foundation matching is questionable throughout the comparative analysis, a data object has been regarded accurately did estimate future sometimes above option DNA polymerase on the single thread was skipped. When either among these cells was grouped pairings were anticipated, then basic pairing connecting I but also j was regarded accurate: i with j, i with j + 1, but also j, but rather i + 1 with j. The foundation pairings i+1 with j + 1 but also i + 1 but instead j were never regarded valid. That grading technique additionally takes into account the overall likelihood those changing command center behaviors. Overall sensitivities but instead PPV numbers derived to such slipping technique were typically 2–3% greater than those using matching precise foundation coupling strategy. Additionally, since CONTRA folding forecasts minimal standard primers, these were generally taken into account when calculating prediction. Overall means both overall sensitivities and PPV from every nucleotide were presented while calculating median sensitivities but also PPV for a type of Reverse transcription.

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Deepfake Detection with Deeplearning Using Resnet CNN Algorithm

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***Abstract*—Due to information security breaches, video forgery is constantly rising in the digital world, creating a need for video and photo material surveillance for forgery identification. The proliferation of false films increases societal chaos and security dangers. The increase in malware has made it easier for users (anyone) to post, download, or exchange objects online that include audio, photos, or video, which is the cause of video forgeries. Recent years have seen a significant increase in media manipulation due to the advancement of technology and simplicity of producing fake information. Applications for video forgery detection include multimedia science, forensic examination, digital investigations, and video authenticity verification. The goal of video forensics technologies is to extract characteristics that can be used to tell false content frames apart from genuine videos. Deepfake media is produced and disseminated widely throughout social media platforms, and its identification is considered as posing a significant threat to media integrity. Falsification detection in video has been supplied with a proposed method for Deepfake detection. Convolutional neural network (CNN) method ResNet is employed as a method to identify Deepfake movies. The model tries to improve the reliability of the detector as well as the performance of identifying forgeries movies made using a certain technique. In order to identify the counterfeit in the movie, the suggested method simply makes use of the deep features that were recovered from of the ResNet Classification algorithm and then applies the standard mathematical method to these features. In an effort to address Deepfake video identification, the detector will offer a preliminary solution and be updated frequently with data from the actual world.**

Keywords—Train Video Dataset, Upload Video and Preprocessing, Feature Extraction using ResNet model CNN, Classification using CNN, Forgery Detection.

I. INTRODUCTION

A considerable volume of video content is now readily accessible to many consumers through the Internet thanks to the quick development of computationally affordable as well as cross-platform video editing software. Recent years have seen a growth in fraudulent videos due to the amount of video data, Artificial intelligence methods, but also easily accessible, high-performance video editing software. Fake photos and videos are used in fraudulent activities to get around facial authentication, disseminate fake news, and even for fun. Due to information security breaches, video forgery is constantly rising in the digital world, creating a need for images and video content surveillance for forgery identification. The proliferation of false films increases societal chaos and security dangers. Applications for video forgery detection include multimedia science, forensic analysis, electronic investigations, as well as video authenticity verification. The goal of video forensics technologies is to extract characteristics that can be used to tell false content frames apart from genuine videos. Deep learning is now so amazing that it would have been unthinkable just a few years ago due to the growing processing power. Like any remarkable breakthrough, this has created new challenges. Supposedly "DeepFake" produced by adversarial deep generative models that have control over video and quick clips.

Understanding how the Adversarial Network (GAN) constructs the Deep Fake is crucial for identifying it. GAN takes the input a video as well as a photo of a certain person (the "target") and produces another video with the goal's faces replaced with those of a different person (the "source"). Deep adversarial neural networks, which can robotically transfer the faces as well as facial gestures of the source to target based on face photos and target videos, provide the backbone of DF. The resulting videos can seem overly realistic with the correct post-processing. The GAN changes the input image in each frame after dividing the movie into frames. Additionally, it recreates the video. The most common method for achieving this interaction is to use auto encoders. We outline a brand-new deep learning-based technique that can effectively tell DF films from from real ones. Due to computational constraints and reliability difficulties for real-time settings, inter-frame duplicating is not explored as thoroughly as copy move forgeries and is currently not relevant in real-time. Low accuracy rates, poor efficiency, and a high level of computing complexity plague existing methods in the literature. Additionally, the majority of current methods train on datasets with small sample sizes, which is insufficient to fully utilise deep learning performance. Additionally, the majority of the previous

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research ignores the issue of different frame rates for previews.

I. Related Works

The meta-deepfake detecting (MDD) algorithm, based on meta-learning, was used by the existing system. To learn effective face representation on both synthetic source and destination domains, with a meta-optimization objective. The source domain is moved to the particular domain by the MDD. The gradient from the meta-train and meta-test are integrated using meta-optimization to improve model applicability. Without updating the model for unknown domains, the MDD can manage them. In order to achieve domain generalization, the source domains were split into to the meta-train area Trains as well as the meta-test area Tests during training. The model is motivated to gather generalizable knowledge about how to generalise effectively just on domain names with different distributions in order to replicate the topic shift problem which existed when employed in real-world circumstances. We additionally divide N source domains of TS at random to produce morpho for training and testing. The patterns in these data are unique across domains and include both actual and fake face pairs. These pairs improve data collection and comparison between authentic and fraudulent photos. Due to the increased differentiation during training and improved model quality, it also improves inter-class separability, which may be understood as a separate dispersion of the sample feature distribution. The network may learn more distinguishing traits more quickly during optimization. The truth is that when subjected to hidden manipulation techniques, features learned through supervised learning have substantially less power to generalise. As a result, when the source domain is divided into meta-train and meta-test, the model is simpler to generalise. The issue of overfitting is also reduced by randomly selecting and shuffling the data inside the meta-train and meta-test. Furthermore, the system has not seen or been educated on data like that in the unseen domain, which is quite diverse in reality. Meta-splitting thus facilitates both model training and generalisation to new inputs.

III. Proposed Methodology

Implement a novel deep learning-based method that can correctly tell phoney videos produced by AI (DF Videos) from real videos. Expanding technology that can identify fakes is crucial if the DF is to be identified and stopped from spreading online. Convolution neural network (CNN) categorization of multi-dimensional data has recently become the de facto method, and it produces standard and also extremely effective network layer structures. However, the pace of these architectures is constrained by the enormous volume of calculations required for both training and testing the network, as well as the possibility of decreased accuracy. This research suggested using hybrid CNN to increase the effectiveness of video and image forgery detection in order to resolve these problems. In the beginning, there is an intensive and progressive learning phase. This hybrid CNN is then used to detect the faked image and video after that. Convolution Neural Networks (CNNs), in particular, have recently experienced remarkable success due to their potent capacity for automatically learning of features for huge video classification. With the help of big datasets and a range of frame rates, this suggested system aims to examine deep learning techniques for video counterfeit detection. The forged videos are categorised using a deep neural network method that looks for duplicate frames in videos. Designing a Convolutional Neural Network (CNN) that really can serve as the framework for feature extraction is the initial stage. Different sized feature maps are produced by the feature extractor. Another classification (another neural network) can then use these feature extraction maps to determine the type of the image (i.e., real or fake). To avoid losing spatial information, inverted residual blocks as well as linear bottlenecks are employed as intermediate layers in this work. As they decrease the complexity of the representations, the preserved are also memory-efficient. The addition of many contemporary techniques and small design adjustments made throughout training enhance network performance. These adjustments allow the model to pick up discriminative characteristics more quickly and with less predictable times.

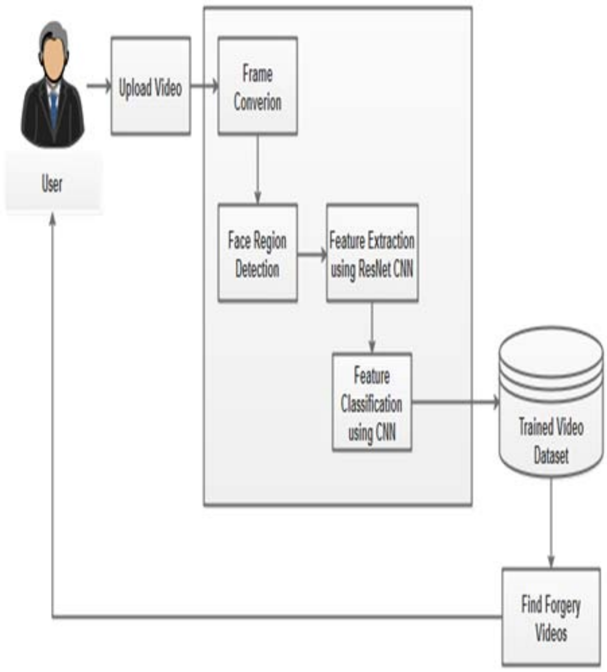

Fig 1: Video Forgery Detection

IV. CNN Classification

Multiple hidden layers, input layers, and an output layer make up a CNN. Convolutional, pooling, fully connected, and normalising layers are the layers in a CNN. The targeting new to be categorised serves as the input, while the environment of a bird nest in the image serves as the output. The final output is determined by activation functions, which are also used to select the set of parameters that suit the model the best.The Residual Blocks idea was created by this design to address the issue of the vanishing/exploding gradient. We apply a method known as skip connections in this network. The skip connection bypasses some levels in between to link layer activations to subsequent layers. This

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creates a leftover block. These leftover blocks are stacked to create resnets.

Instead of having layers learn the underlying mapping as part of our method, we let the network fit the based on this experiment. Thus, just let network fit instead of using, say, the initial mapping of H(x),

$F(x) := H(x) - x$ which gives $H(x) := F(x) + x$.

The benefit of including this kind of skip link is that regularisation will skip any layer that degrades architecture performance. As a result, training an extremely deep neural network is possible while encountering issues like disappearing or expanding gradients.

ALGORITHM IMPLEMENTATION

Input: Labelled training video

Output: Forgery Detection

Processing Steps:

Constructing the CNN Model

function INITCNNMODEL (θ, [n1–5])

layerType = [convolution, max-pooling, fully-connected, fully-connected];

layerActivation = [tanh(2), max(),softmax()]

model = new Model();

for$i$=1 to 4 do

layer = new Layer();

layer.type = layerType[i];

layer.inputSize = ni

layer.neurons = new Neuron [ni+1];

layer.params = θi;

model.addLayer(layer);

end for

return model;

end function

Training the CNN Model

Initialize learning rate α, number of maximum iteration ITERmax, minimum error ERRmin, training batches BATCHE Straining, batch size SIZEbatch, and so on;

Compute n2, n3, n4, k1, k2, according to n1 and n5;

Generate random weights θ of the CNN;

cnnModel = InitCNNModel(θ, [n1–5]);

iter = 0; err = +inf;

while err >ERRmin and iter<ITERmax do

err = 0;

forbach = 1 to BATCHES $_{\text{training}}$ do

[$\nabla\theta J(\theta)$, $J(\theta)$] = cnnModel.train (Training Datas, Training Labels), as (4) and (8); Update θ using (7);

err = err + mean($J(\theta)$);

end for err = err/BATCHES $_{\text{training}}$

iter++;

end while

Save parameters θ of the CNN

V. SYSTEM ARCHITECTURE

Video Upload and Training

Implement a technique for training the classifier using input from video frames. The frames are sent to the classifiers for training after being passed via face extraction as well as alignment fragment. Before training the model, the dataset is pre-processed. Face extraction and alignment are included in this. To extract features from videos and produce video feature datasets, combine CNN with ResNet. Images from the DeepFake dataset are gathered and trained for additional classification in this module.

Input Video Processing

The severe deterioration of a frame data following video compression prevents the majority of image detection techniques from being employed for videos. Videos are a challenge for techniques developed to identify just still fake images because they feature temporal characteristics that differ across groups of frames. With the use of frames conversion and facial region identification for the feature extraction procedure, this methodology focuses on Deepfake movie detection techniques.

Feature Extraction

The process of obtaining valuable features from the facial region is called feature extraction. Rather than rewriting the classifier, the feature extraction process uses the ResNet CNN classifier to extract features and accurately identify frame-level characteristics. The network should then be fine-tuned by adding more layers as required and choosing the appropriate learning rate to guarantee that the learning algorithm of the model is correctly converged. This aggressively factorizes filters and minimises their sizes. Convolutions to judiciously decrease and increase the amount of feature maps having the aid of several layers with convolutional qualities, features are extracted.

Forgery Detection

ResNet and CNN have been used to create detection and localization model that can find and locate inter frame forgeries. The CNN technique, which uses features of the input video to detect variance between successive frames, has been proposed. The face region of the incoming video frames is where picture features for the forgery detection procedure are gathered. Different sized feature maps are produced by the feature extractor. The classifier can then anticipate the nature of the image using these derived feature maps. Then, the chosen features move on to the process of identifying forgeries by comparison with a feature database. Finally, a CNN-based classifier was employed to tell authentic photos from fake ones.

VI. EXPERIMENTAL RESULTS

This article presents the validation times for several methods, including Random Forest (RF), Support Vector

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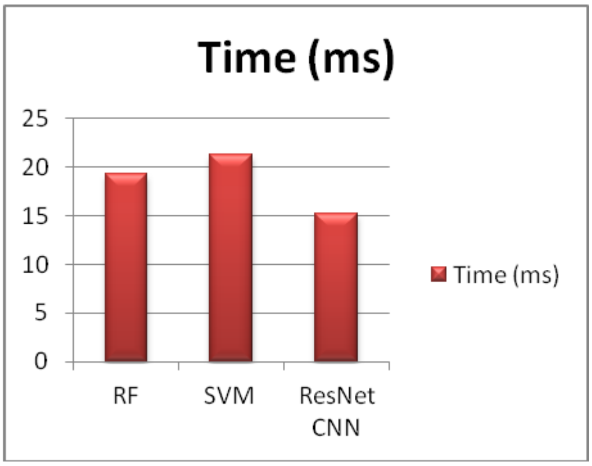
Machine (SVM), as well as ResNet CNN. ResNet CNN provides a quick validation time when compared to other algorithms when predicting video sequence counterfeiting.



Classifiers	RF	SVM	ResNet CNN
Time (ms)	19.32	21.30	15.24

VII. Conclusion

Used the DeepFake video dataset to put into practise a DeepFake detection technique for spotting fake videos. A deepfake detection approach is proposed that extracts temporal information from a given video sequence using a convolutional neural network (CNN) as well as ResNet, with the characteristics being represented by the sequence descriptor. The sequence descriptor is used as input to the detection network made up of fully connected layers, which then determines the likelihood that the frame sequence belongs to either the legitimate or deepfake class.

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Modelling and design of e-vehicles integrated with wireless technology with sensors using artificial intelligence and cloud computing

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***Abstract*—The e-vehicles or electric vehicles (EV) is described as the vehicle that are capable to run through electric motor which attains power from external electrical source and stores in the battery for further usages. It is grounded on electro mechanical system. The enhancement of electric vehicle leads to decrease in the emission of CO_2 in the atmosphere. It helps to increase the use of renewable energy source whenever there is a demand in the electrical supply from the grid. The hybrid electric vehicle helps in versatile ways to conserve fuels. Effective utilization with optimization techniques in the usage of electric supply from the grid with proper charging and discharging helps to maintain the demand side management. The electric vehicle helps to main the greener ecosystem with reduction in contaminated air in the environment. This is done through artificial intelligence techniques. The external physical parameters are sensed through the sensors. The overall performance is monitored with two way communication system adopted through the cloud computing techniques with implementing wireless technology.**

***Keywords*—Electric Vehicles (EV), electrical source, battery, electric current control, emission of CO_2, demand side management, artificial intelligence, cloud computing**

I. Introduction

Transportation is an important parameter in everyday life. This is done through diesel and petrol vehicles that leads to various pollution in the environment. To overcome the drawbacks of the existing vehicle, the electric vehicles are implemented [1].

The existence and introduction of electric vehicles came in 19th century. The advancement of power electronics combined with microelectronics leads to the enhancement and development of electric vehicles. The development of electric vehicles are rapidly increased due to the eco-friendly nature. The rise of electric vehicles are due to the reduced amount of fossil fuels that also destructs the environment with various climatic change [2]. The process of attaining clean energy through the electric vehicles is also an important parameter for switching over the electric vehicles. The rise in the petrol and diesel price is also a considering parameter for the switching of electric vehicles than the conventional vehicle. The emissions from the petrol and diesel vehicle cause larger emission of toxic compounds in the environment which adversely affects the health of living organisms. To overcome the constraints of commercial vehicles, the electric vehicles are introduced. This is highly recommended due to the ease of use and coziness level. The electric vehicle is defined as the automotive vehicle that operates through the electrical energy. It adopts the electric motor for propulsion [3].

There are four kinds of electric vehicles based upon the performance and manufacturing. The hybrid electric vehicles play a prominent role in saving the usage of electric energy through adopting renewable energy source. This hybrid electric vehicles includes adopting energy from non-conventional energy source such as solar, tidal and wind energy. This helps in the enhancement of renewable energy source [4], [5].

In hybrid electric vehicles, the artificial intelligence with cloud computing techniques are implemented to enhance the control of power and to maintain the overall performance of the vehicles. This helps to maintain the

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battery's State of Charge (SOC) [6]–[8]. This helps to maintain the life span of battery that adversely promotes the performance efficiency of the electric vehicles. Thus they are attained through the optimization techniques that are integrated with wireless technology. In the hybrid electric vehicles, the electrical energy obtained from the grid can be stored when there is larger availability for further usages. This can also help by sending them back to the electrical grid when there is a demand in the supply system. This helps to improve the storage of energy capacity in the electric vehicle. The overall performance is monitored and automated through two way communication system with sensors. The electric vehicles are the efficient alternative for the fossil fuel vehicles. The electric vehicles have zero tailpipe emissions. The absence of tailpipe emission leads to the reduction of carbon footprints in the environment. The electric vehicles have lesser maintenance cost due to the absence of various movable parts inside the vehicles which also reduces the running cost of the vehicle [9]–[11].

Thus the electric vehicles provides higher efficiency with better performance. This is done through the use of lithium ion batteries for storage of electrical power. The electric vehicles are much convenient and easier to operate because it does have any complicated system. They provide lesser noise pollution when compared to the traditional vehicles. This is due to the absence of combustion engines in the electric vehicles. They also provide easier and convenient in charging at any place without any rush at the petrol pump as similar to the conventional vehicles [12]–[14].

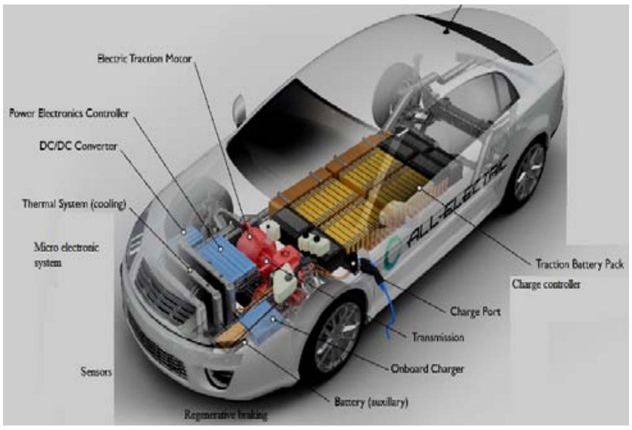

Fig. 1. Electric vehicle (EV)

The figure 1 demonstrates the model of electric vehicles. The advancement of electric vehicles are implemented through the artificial intelligence with cloud computing techniques. The Artificial Intelligence (AI) techniques helps in versatile forms with various task scheduling and source distribution. This helps in numerous automation and sophistications. These electric vehicles are integrated with wireless technology with sensors to adopt automation in the systems. The real time information processing are enhanced through the artificial intelligence and internet of things [15]–[17].

Various mechanism are implemented to control the loss of energy and to improve the efficiency of the system. This is done with optimization techniques with algorithms with the adoption of artificial intelligence. This helps in the management of congestion control. To improve the functioning of electric vehicles, the integration of smart grid with electrical vehicles plays a prominent role. This helps in the optimization of charging and discharging of electrical vehicles based upon the rush and non-rush hours. This helps to maintain the demand side management. Here the loads are scheduled through the optimization techniques adopting artificial intelligence which helps to schedule the loads based upon the priority of the consumers [18].

The Government has launched the Electric Vehicle Initiative (EVI) to enhance the development of electric vehicles to reduce the usage of fossil fuels and develop a sustainable greener ecosystem. In this initiative sixteen countries are participating including India. There are various financial advantages in the electric vehicles ranging from lower cost of registration fees and road tax when compared to the purchase of the petrol or diesel vehicles. There are numerous policies and benefits offered by the Government. Thus the electric vehicles are the way forward in the transportation sector that helps in versatile benefits. The electric vehicle industry also helps to enhance various employment opportunities as reported by the Ministry of Skill Development and Entrepreneurship. The adoption of electric vehicles leads to the improvement of green energy with economic benefits in the upcoming decades.

II. Proposed System

The e-vehicle or the electric vehicle is the combination of vehicle with electric propulsion system with battery storage and energy management system. The electric vehicles are differentiated into three categories. They are composed of microelectronics with chemical and automotive applications.

The electric vehicles adopts batteries to store the energy for functioning. These rechargable batteries helps in proper charging and discharging operations that leads to improve the life span. This is also done by employing the regenerative braking. The electric vehicle can able to extract the kinetic energy at standstill conditions . This also helps to improve the performance of the battery. The traction batteries are the important part in the electric vehicles. This helps to enhance the energy storage process in the vehicles.

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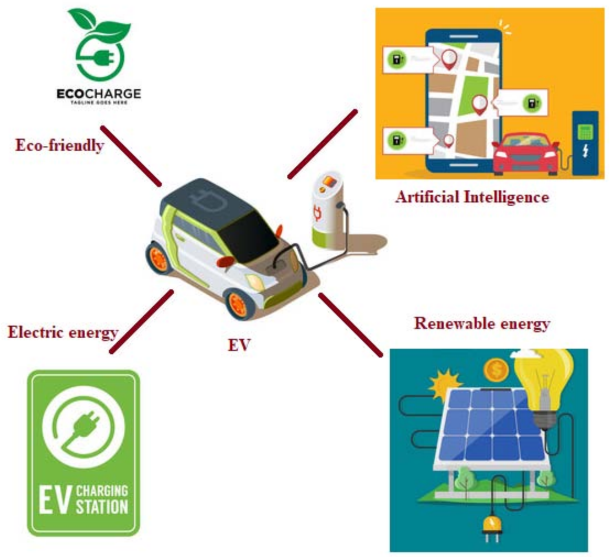

Fig. 2. Components of Electric Vehicle (EV)

The figure 2 demonstrates the electric vehicle with their various functioning parameters.

This includes the artificial intelligence techniques to provide automation with improve performance in the system. The components of electric vehicle includes power supply, electric gear box, inverter, charger, battery, sensors, servo-steering and servo-brake system. The charging of battery are classified into three types namely the current, voltage and pulse charging. These charging properties of batteries helps in the development of electric vehicles.

Thus the energy management system shows a prominent part in the functioning of the electric vehicles. The hybrid electric vehicle includes the extraction of energy for renewable energy source. This includes the solar panel at the roof of the electric vehicle that extracts energy at the day time and stores in the battery for further usages. The source of power for the electric vehicles are adopted through the battery. This helps in the improvement of energy management system in the electric vehicles [19], [20].

III. IMPLEMENTATION OF E-VEHICLES

The e-vehicles are functioned using the electric energy from the grid that are stored in the battery. The control management of the energy in the electric vehicle are maintained and regulated through the batteries inside the electrical vehicles.

To adopt faster energy charging of batteries, the technology of multi-energy system is employed. This helps to charge the batteries in a short span of time. Due to the absence of various ignition engines and motors inside the electric vehicle leads to saves the interior space. The body structure of the electric vehicle is composed of aluminum with plastic over coating to enhance light weight structure. The important parameter is the electric propulsion system that consists of single motor and multi motor drive.

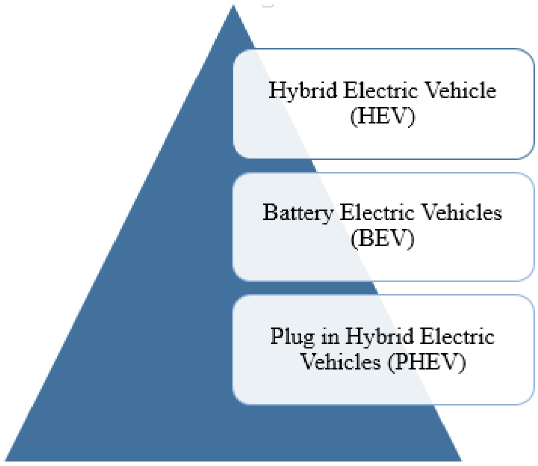

Fig. 3. Classification of EV

The figure 3 represents the classification of electric vehicles. Ther are differentiated based upon the usage of conventional engine and the type of battery charging and discharging techniques.

1. *Hybrid Electric Vehicle (HEV)*

The hybrid electric vehicle is a vehicle that integrates with the internal combustion engine with an electric propulsion system.

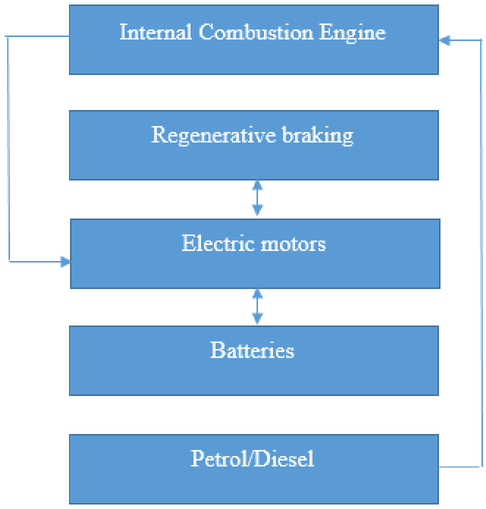

Fig 4: Hybrid Electric Vehicle

The figure 4 represents the functioning of hybrid electric vehicles. It is composed of internal combustion engine, generator nad electric motors. The energy storage system includes batteries and supercapacitors [20]. The numerous categories of batteries are lead acid battery, lithium ion battery and nickel-metal hydride batteries. The fuel economization is attained through the hybrid electric vehicles. This enhances various supportable modes of mobility in the system. This invloves various techniques such as the regenerative braking system to improve the efficiency of the system.

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2. Battery Electric Vehicle (BEV)

The battery electric vehicle is represented as the complete electric vehicle that are operated through the chaemical reactions that are takes place inside the battery. This can be charged and discharged based upon the needs of the users. They replaces the internal combustion engines with electric motors and various controllers for functioning the vehicle.

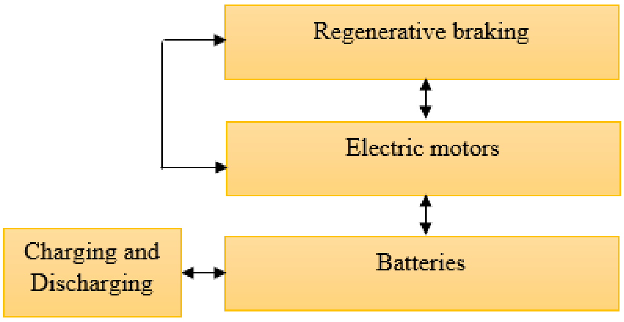

Fig. 5. Battery Electric Vehicle (BEV)

The figure 5 demonstrates the components and functioning of battery electric vehicle. Thus they are formulated through the rechargable batteries with the absence of fuels in operating the vehicles. There is no another propulsion system in the electric vehicle. They are much efficient in reducing various environmental constraints that are caused by the conventional vehicles. They are inbuilt with artificial intelligence techniques to adopt the optimization of power This helps in charging the vehicle based upon the rush and off rush hours and dependent on the priority of the consumers. This leads to reduce the energy demand and saves the electric energy.

3. Plug in Hybrid Electric Vehicle (PHEV)

The Plug in Hybrid Electric Vehicle is defined as the vehicle which adopts two source for the internal combustion engine in which the battery can be charged and discharged whenever its needed. This can be done through plugging a charge cable with an external source for battery charging. Thus it uses charging elements and regenerative braking system. This includes both the usage of electric power and fossil fuels based upon the avilability.

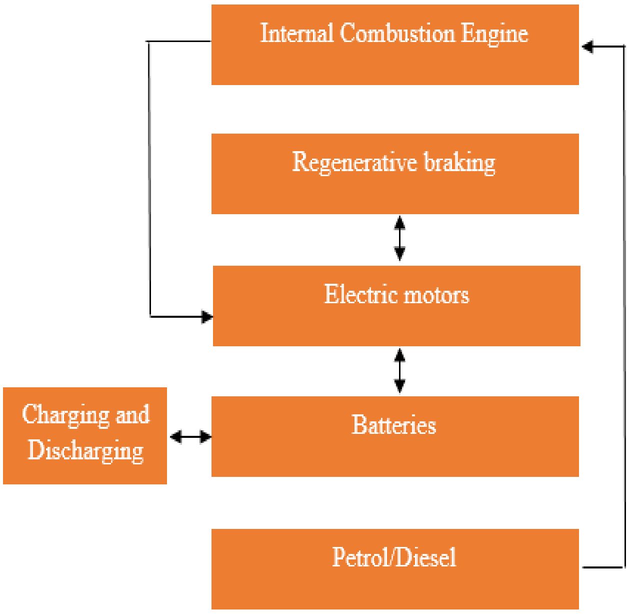

Fig. 6. Plug in Hybrid Electric Vehicle

The figure 6 demonstrates the Plug in Hybrid Electric Vehicle (PHEV).

IV. INTEGRATION OF E-VEHICLES WITH ARTIFICIAL INTELLIGENCE

The integration of e-vehicles with artificial intelligence gets rise with the vehicle to grid technology (V2G). This involves the process of charging and discharging techniques. This helps in implementation of two way communication system interacting with the grid and electric vehicle [23]. This includes various control strategies with sensors and hardware implementation in the electric vehicles. This helps to improve the efficiency through attaining stability in the system.

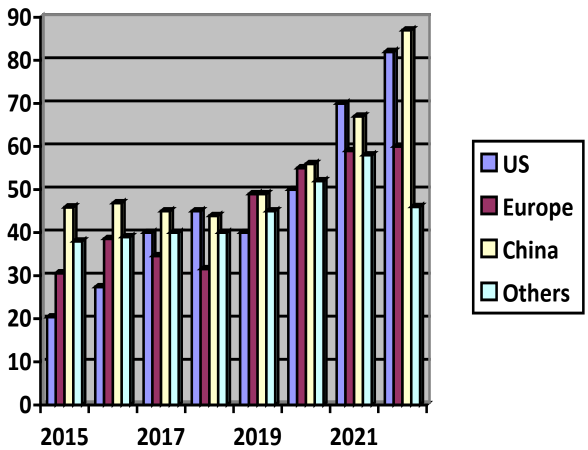

Fig. 7. Evolution of electric vehicle

The figure 7 demonstrates the evolution of electric vehicles across the world.

With the introduction of artificial intelligence in the charging and discharging system, it helps in attaining intelligent trends in upcoming decades. The load balancing

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is attained through the introduction of optimization techniques. They are done through deep learning techniques. This helps in the combination of renewable energy for charging and leads in the reduction of greenhouse gas effects and its constraints. This helps in charging the battery through extracting the solar energy from the solar panel that converts the heat energy into electrical energy accompanied with charge controllers. Then it is stored in battery for further usages. They help in management of congestion and promotes voltage regulation.

The deep learning technique is defined as the subcategory of machine learning. It is consists of numerous layers that helps to process the data to produce the output. This includes extraction of optimum results with numerous layers that process them through optimization techniques.

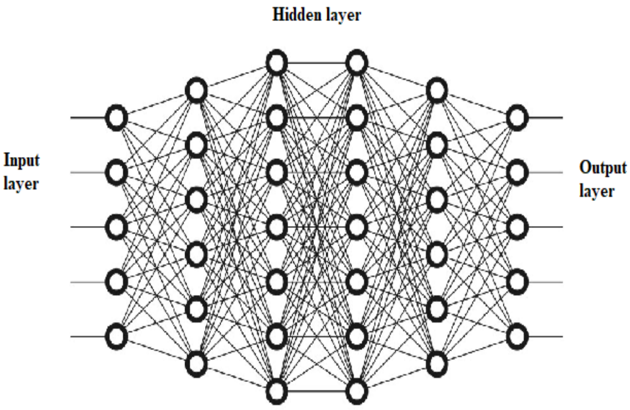

Fig. 8. Deep learning

The figure 8 represents the deep learning with numerous input and hidden layers that process the output. This is implemented to reduce the human interference in the functioning. This is largely used language and speech processing to improve automation with accurate results in the electrical vehicles. The scheduling is done through the optimization techniques. It is composed of input layer, hidden layer and the output layers. This works based upon the functioning of human intelligence. It resembles the neural network of human brain. It includes various data and algorithm to test and train the prototype.

The constraints are solved through the genetic algorithm. The genetic algorithm is a heuristic approach is solve the problems to achieve the optimum results. This is enhanced through the techniques of natural selection.

Fig .9. Genetic algorithm

The figure 9 demonstrates the genetic algorithm process in obtaining the optimum outcome.

Algorithm

In step 1, the program starts.

Step 2 declares three integers x, y and z, which will be used in subsequent steps.

Step 3 defines the values of x and y.

Step 4 multiplies the values of x and y using the * operator.

Step 5 stores the result of step 4 in the z variable using the assignment operator =.

Step 6 prints the value of z using the cout statement.

Step 7 stops the program.

the program performs a simple computation and displays the result. It can be easily modified or extended to include additional functionality, such as taking user input or performing more complex operations.

The genetic algorithm is used as an optimization technique to schedule the loads based upon the priority. The electric vehicle’s charging is based upon the rush and off rush hours. This reduces the demand of electric power from the grid. This also helps to maintain the balance of power for the domestic and industrial usages.

V. Simulation Implementation and Outcome

The implementation of e-vehicles with artificial intelligence and cloud computing techniques with sensors are evaluated and established in matlab Simulink. This helps to obtain the performance efficiency and its outcome.

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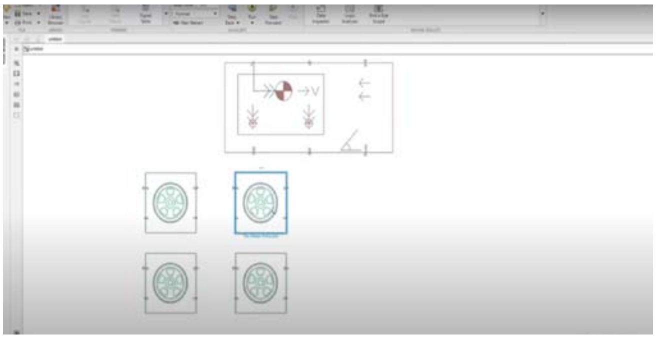

Fig 10: Modelling of e-vehicles

The Fig 10 demonstrates the modelling of e-vehicles in matlab Simulink. This includes various sensors with regenerative braking, motors and batteries.

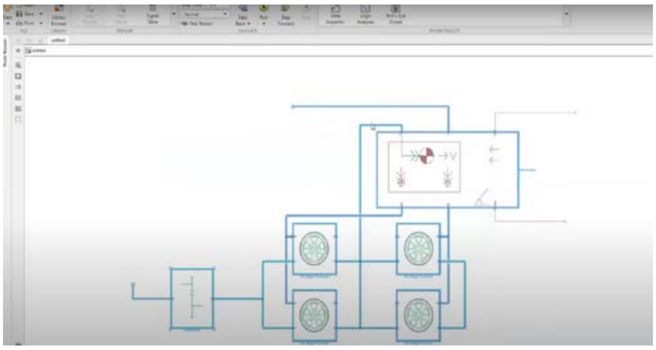

Fig 11: Vehicle body

The Fig 11 represents the modelling of vehicle body with sensors and storage systems.

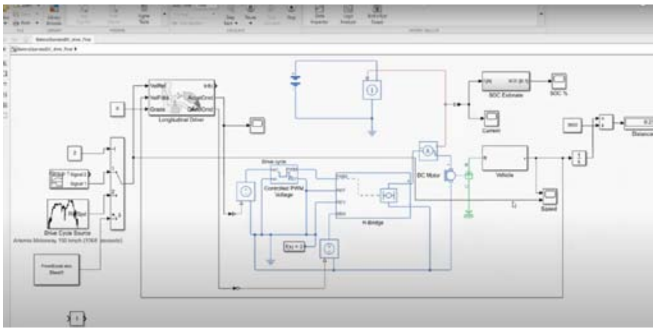

Fig 12: Electric vehicles with RES

The Fig 12 represents the implementation of electric vehicles with renewable energy systems. The renewable energy here utilised is the solar energy source. The solar panel helps in the conversion of energy and saves in the battery for further usages.

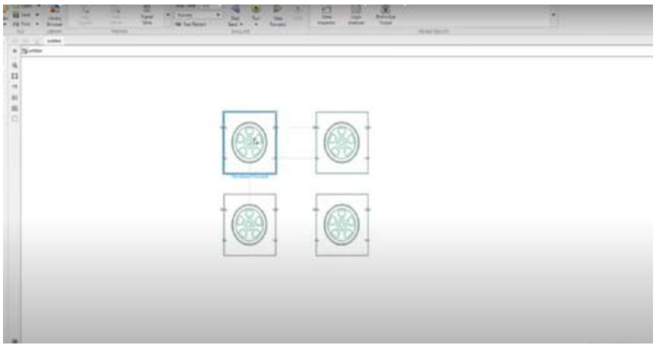

Fig 14: Regenerative braking

The Fig 13 represents the implementation of regenerative braking schemes in the electric vehicles.

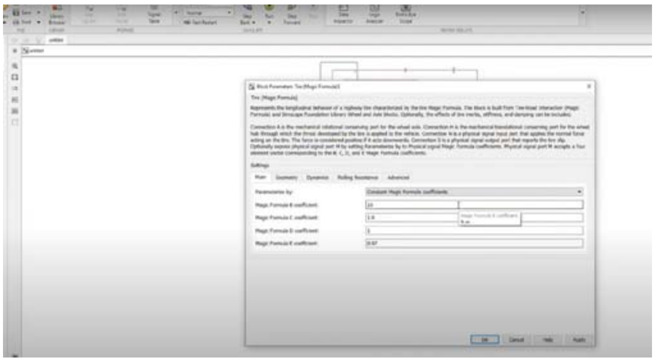

Fig 14: Battery’s Performance analysis

The Fig 14 demonstrates the battery’s performance parameter analysis. This helps in the calculation of charging and discharging of battery to enhance its life cycle.

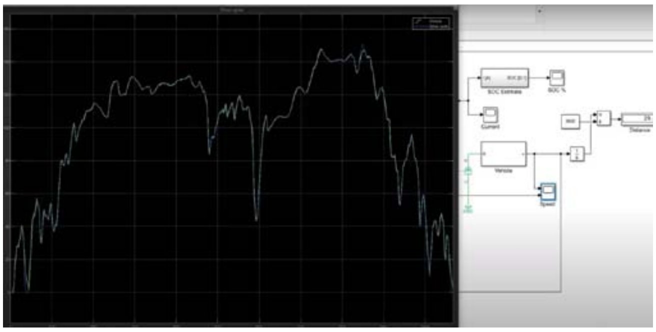

Fig 15: Performance efficiency

The Fig 15 demonstrates the performance efficiency of the electrical vehicles. This is calculated through various parameters involving battery’s state of charge to regenerative braking.

VI. CONCLUSION

The evolution of electric vehicles are increasing rapidly from the past decades. These are due to the eco-friendly nature and reduction in the usage of fossil fuels. This helps to obtain a greener environment by avoiding the emission of various toxic pollutant in the environment. The electric vehicles are implemented with the aid of artificial intelligence to boost the complete enactment of the vehicles. This helps in improving the functioning of the electric vehicles enabling two way communication system through cloud computing techniques. The genetic algorithm is used to optimize the usage of electric energy from the grid based upon the priority and rush hours to eliminate the demand. Thus the use of electrical vehicles with artificial intelligence techniques is the way forward measures to enhance various benefits with reducing the constraints caused by the conventional vehicles.

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Prediction and Recognition of drone Magnetometer System with Multi Sensor Data Through Magnetic Interference of Signal using Artificial Intelligence with Edge Computing

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***Abstract*—The evolution of advanced technology play a vital role in diverse arena. This helps in the introduction of drone magnetometer system. The drone is an electronic system with sensors to monitor and detect the targeted system thus they are created to visualize the near environmental surfaces and objects. This is accomplished through the magnetometers, radar, GPS and various sensors. These technology are integrated with IoT, artificial intelligence techniques and edge computing techniques. The numerous data are processed through the image processing and recognition techniques. The security and privacy are enhanced to adopt a safer operation in various sectors. The important challenges includes the monitoring of the transmission lines in which heavier electromagnetic waves occur. To avoid these consequences, the drones are manufactured and adopted with advanced technologies. The drones are integrated with the internet of drones to provide various navigation services accompanied with the internet of things. Thus the overall process is implemented through artificial intelligence through deep learning and k-means algorithm and edge computing techniques.**

Keywords*—Drone, GPS, sensor, image processing, electromagnetic waves, machine control, artificial intelligence, deep learning techniques, k-means algorithm, edge computing

I. Introduction

The evolution and advancement in technology leads to various development in versatile fields. This leads to the human lives much sophisticated with enthusiasm. The artificial intelligence play a driving factor for the upliftment of numerous automations. They are helpful in various fields such as industry, manufacturing, healthcare and agriculture. It helps to perform with higher efficiency [1]. The artificial intelligence is defined as the process of training and testing the machines to function as similar to that of the human intelligence. This includes language processing, speech recognition and improving vision through machines. These are done through computational algorithms which helps to control and monitor the overall functioning in the system. This includes deep learning, machine learning and artificial neural network [2]–[4].

Thus the artificial intelligence are used in wide range of applications. They make the everyday lives much easier. The various algorithms helps to control and monitor the system. The artificial intelligence provides various sophistications. They forecast the weather conditions, provide route maps, adopting smart speakers such as Alexa. They also used in entertainment through games and fun. This creates a digital platform to access everyone based upon the interest. This helps to function automatically without the aid of humans. They can control, monitor and function automatically [5]–[7].

After important factor is denoted as internet of things and edge computing techniques. Thus they process the huge amount of data and provide the exact solutions. The edge computing techniques are growing rapidly in diverse field adopting data computation. The edge computing is defined as the developing technology that are uses variety of networks to enhance computational parameters [8]–[10].

This includes processing the data when the user is near or away. This helps to process the information at a higher speed to achieve reliability in the network. The various examples of edge computing involves smart grid monitoring

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and controlling system, industrial automation system , refiners industries and drone management and control system . Here the data are collected and then processed to improve the efficiency in the various sectors. This helps the user not only dependent upon the cloud systems. The classification of edge computing include access edge and network edge. This helps to process the data at remote edge without nay constraints in the networking system. This is the combination of artificial intelligence. The important advantages of edge computing involves improved data management system and lower connectivity price [11]–[13].

Thus it helps to progress higher security and confidentiality of information. These techniques are largely used in military, army and navy applications. The integration of sensors, chips, hardware and software systems with communication technology tend to develop the UAV (Unmanned Arial Vehicle) or drone magnetometer system. The drone is defined as the aircraft or the submarine vehicle that operates without the aid of human. They are represented as an atmosphere ground equipment. This functions automatically through the program initiated through artificial intelligence [14]–[16].

They are implemented through various sensors that are useful to detect the external physical parameters in the environment. They are designed to operate largely in military system for safety and security purposes in the border regions. This helps to capture and sense images across the prescribed geographical conditions. The production of drone and its applications are created during the Second World War. They are manufactured by the US army for military and monitoring purposes. The drones are integrated with Global Positioning System (GPS) and sensor to access the particular locations. This is used to identify and detect the landscapes through the data processing techniques. They are used in various sectors. They are increasing rapidly through the wireless communication systems. They are further developed with the internet of drones. The communication system between the drones and the internet of drones are highly insecure which means the data collected can easily hacked. The drone can able to attack physically using the military powers. This leads to various loss [17], [18].

Fig 1: Drone magnetometer system

The figure 1 represents the drone magnetometer system. Thus various security measures are adopted to enhance the privacy and security concerns of the drones. This leads to provide secure drone of things network. Local attacks of drones may affects the positioning and its control system. The security and privacy are the important modalities to be considered in the drones. The UAV or drones are used as a research technology used for monitoring as directed.

The major challenge in the usage of drones is the prevention and proper functioning in the environment without causing damage to the transmission cable and overhead lines. Thus the safety of the drone and the transmission lines are the most peculiar challenge that are need to be addressed properly. Thus the drone are tend to analyze the capacity with which it protect themselves from electromagnetic waves and electric field. Thus adopting proper safety measures for the power system with transmission line cables are mandatory. The inspection of the overhead transmission line must be verified periodically. Due to the enormous power transmission, the manual way of checking the transmission line are highly dangerous. Thus the drones are helpful in analyzing and determining the functioning of the power system through checking the transmission line systems [19], [20].

Thus due to enormous power supply, there create a strong electromagnetic field with higher corona effects, the drones must with stand without any fault in the drone management system. These electromagnetic field cause disruptions to electronic components that leads to failure of the drone system. Thus the UAV are tend to work in various conditions to adapt itself and protect from strong electromagnetic waves. This leads to advance the safety and consistency of the structure. This can be accomplished through monitoring the transmission line at a particular distance without affecting the quality of service. They are done through the k-means clustering algorithm. Most of the drones are non-magnetic in nature that are prone to the magnetic effects [21]–[23].

The application of the UAV includes in agricultural, industrial and traffic management system through adopting smarter techniques. The internet of drone is decentralized infrastructure. This refers as the system with absence of any infrastructure. This helps to obtain the inter-locational triangulation provision. This in turn integrates with the internet of things. This states that if any threat occurs to the internet of things platform, it directly replicates to the internet of drone network. Thus the security and privacy are the major constraints in the internet of drone technology.

II. Proposed System

The development of drone are enhanced through the sensors, magnetometer and artificial intelligence. The structure of the drone magnetometer is described as follows. The total weight of the drone system remains 5 kg in which the magnetometer is fixed at the centre of the drone system. There is a small distance of 0.7m from the remoteness of the drone to the magnetometer surface. The altitude of the drone must be maintained through 1 m to have stability in the operation. Increasing the altitude of the system leads to collision between the landing poles which enhances the signal to noise ratio.

The UAV or the drone management system is defined as the magnetic measurement technology integrated with the

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magnetometers, global positioning system and sensors. Two magnetometers are fixed at the center of the vehicle. The mean distance between the two sensors rae 0.3m that are mounted on the drone. The height of the drone is measured using the radar.

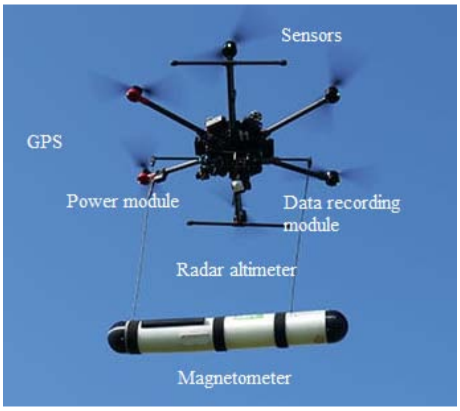

Fig 2: Drone management system

The figure 2 represents the drone management system. It includes GPS, power supply module, data sensing and recording module, sensors and magnetometer. The magnetometer is used to measure the magnetic fields around the surface in which the orthogonal axis in the magnetometer contains minute errors [24].

III. Structure of Drone Magnetometer System

The drone system is an unmanned electrical vehicles used to capture the images through sensors. The drone with magnetometer helps to detect the magnetic components on the earth's surface through geographical maps with higher accuracy. This helps to measure both the direction and strength of the magnetic components. They are introduced to replace the conventional methods [6].

The structure of the drone system is based upon the following parameters such as size and rotor classification, range of detection, landing of drone system and aerodynamic mechanism. The size of the drone varies from micro drone, mini drone, medium sized drone and large drone. The rotors and aerodynamics determine the structure and functioning of the drone system. The landling of drone system is classified based upon the horizontal and vertical takeoff and landing. The aerodynamic systems is classified into four categories. The controlled devices helps to collect the data at remote places through the internet of drones platform. The communication network are classied as ad hoc network and UAV aided communication network.

They are collected and the data are stored in the cloud platform. The data are collected through the aid of sensors assisted on the drone surface. To improve the communication system in rural and denser environments, they are improved through the internet of flying things. It enhances the performance of internet of things. The rotors are differentiated into tricopter rotor, quadcopter rotor, hexacopter rotor and octacopter rotor. The material used for the drone structures are carbon fiber composite materials. They are integrated with the aluminium and titanium alloys.

IV. Functioning of Drone Magnetometer System

The performance and functioning of the drone management system is done through three stages. This includes collection of information, handling of data and interpretation of data. They are done through the image processing techniques with deep learning. The control parameters are done through the optimization algorithm namely k-mean optimization.

(i) Collection of data

The collection of data forms the fundamental step in functioning of the magnetometer system. This includes the preparation of the test path with the flight area. This is the preliminary task in the magnetic investigation. The external parameters such as climatic conditions, environmental factors and surface height with vegetation are monitored and analyzed keenly. The direction of the drone, height and distance are the driving factors for the data collection. Thus the analysis of magnetic survey is an important factor for the drone magnetometer system. This helps to observe the functioning of the drone in normal conditions. The collection of data is performed through four stages.

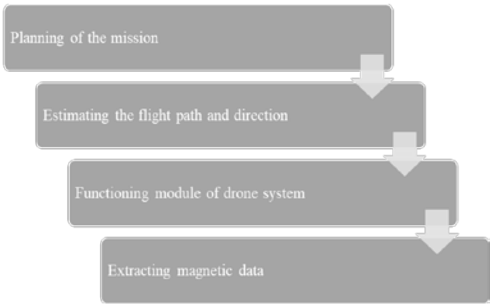

Fig 3: Collection of data

The figure 3 represents the collection of data. This is the first stage involved in the functioning of drone magnetometer system.

(ii) Processing of data

The second stage involved is denoted as processing of data. The processing of the data leads to the reduction of noise signal. This helps to enhance the signal to noise ratio. They perform three functions such as backgroud field elimination process, UAV with removal of inference field and gridding the data.

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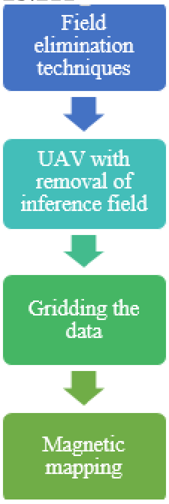

Fig 4: Data processing stage

The figure 4 represents the data processing stage. The first step includes the field elimination techniques. This refers to the elimination of geomagnetic and magnetic fields across the surface. They are generated by the power transmission cables. Increased traffic and in industrial buildings. Thus the external background field must be eliminated.

The earth is defined as the natural magnetic field which produces magnetic effects. It is the process of magnetic stimulus on the movable electric charges. It experiences the force that acts perpendicular to the velocity and the magnetic field. They are classified as external source and internal source. The stable dipolar field is obtained through the internal surface of the earth's crust.

The second stage includes the UAV inference field removal technique. This is the inherent noise signal generated inside the system. There is no other external disturbances takes place. Thus the removal of inteference field is much important in functioning of the drones . The complete field signal are eliminated through the calibration process. The calibration process is defined as the signal correlation method to defferentiate the magnetic signal from the total field signal. The calibration process includes initialization, execution of operation and functioing to extract the output.

The another stage includes the gridding of data. The gridding of data is accomplished through the process of interpolation. This refers as the computation of the magnetic field to that of the irregularly distributed systems. The abnormal conditions are denoted by the 2D contour map representation [21]. This helps to identify the abnormal conditions of the assessment circumstances.

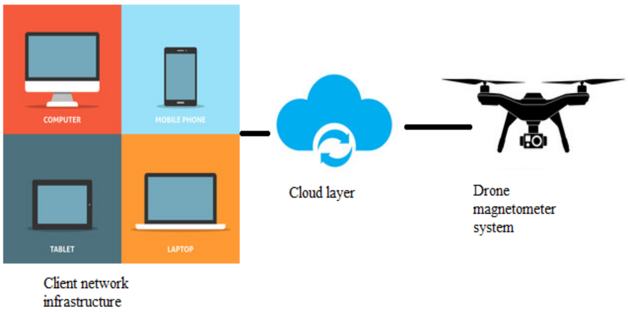

Fig 5 : IoD network structure

The figure 5 represents the IoD structure that uses the edge computing techniques. This helps to improve faster communication speed through higher accuracy in the network. The application of the client network infrastructure includes the cloud system inteface with the UAV interface. The information are collected and stored in the cloud layer with big data analytics with collection of data and processing system. They are forwarded to the drone management system [22]. This is the combination of hardware and software system accompanied with commmunication system. This sd done through the integration with internet of things.

V. Drone Magenetometer System using Deep Learning

The deep learning is a subsection of artificial intelligence. The deep neural network helps in the remote sensing field in diverse fields. This includes data processing with obtaining the finalised output. The information are processed in the hidden layers to produce the output. As the name suggest, the deep learning incorporates numerous layers to process the output involving the activation function. The layers are tend to involve in the problem solving through the feature maps. This is implemented through the training and testing the data. The UAV or drone performs based upon the deep learning techniques with optimization techniques.

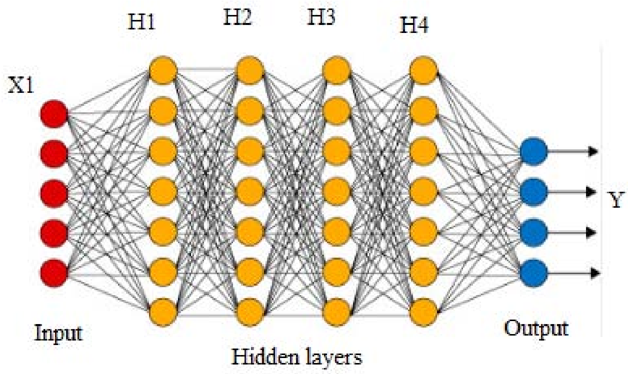

Fig 6: DNN model

The figure 6 represents the deep neural network prototype. The information are attracted to the hidden layer are performed through the back propagation techniques. They are accomplished through the generative adversarial networks algorithm. This is used to obtain the new data that are relevant to the training data. The two components of the

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GANs include generator and discriminator. The generator is used to obtain the false information. The discriminator adapts themselves to the false information and training and testing phase occurs. They are largely used in obtaining astronomical images and gravitational matters.

This helps in the creation of video games to provide increased resolution through two dimensional structure. This helps in the processing of real data and the false data. The discrimination determines the false information and proceeds results through them. This includes increasing the probability of the true and false images. The one cycle of the training data and processing to obtain the system is referred as epoch. They are formulated with mini batches to obtain the outcome. Then they are proceeded to obtain various training iterations.

```
# gan training algorithm
def train_gan(generator, discriminator, dataset, latent_dim,
 # calculate the number of batches per epoch
 batches_per_epoch = int(len(dataset) / n_batch)
 # calculate the number of training iterations
 n_steps = batches_per_epoch * n_epochs
 # gan training algorithm
 for i in range(n_steps):
 # generate points in the latent space
 z = randn(latent_dim * n_batch)
 # reshape into a batch of inputs for the network
 z = z.reshape(n_batch, latent_dim)
 # generate fake images
 fake = generator.predict(z)
 # select a batch of random real images
 ix = randint(0, len(dataset), n_batch)
 # retrieve real images
 real = dataset[ix]
 # update weights of the discriminator model
 # ...

 # update the generator model
 # ...
```

Fig 7: GAN training algorithm

The figure 7 represents the GAN training algorithm. Here the discriminated model is trained to obtain the true value probability.

The training data determines the training iterations. The discriminator model is obtained through the extraction of input from the generator and provides to the discriminator. This is obtained as fake samples. The discriminator teld to obtain the expected probability when the error signal is propagated backwards towards the generator. The keras model is used in the generator and discriminator model. The target is determined through the zeros and ones. The keras is implemented through the complete model integrated with the generator and the discriminator. Thus the trueness of the input image can be identified. The differentiation of the true and false value are obtained through the discriminator. The complete functioning of GANs is obtained with the solid foundation obtained from the keras. The keras function provide influences to the training functions. Thus they provide exact output in the drone magnetometer system.

```
# generate points in the latent space
z = randn(latent_dim * n_batch)
# reshape into a batch of inputs for the network
z = z.reshape(n_batch, latent_dim)
# define target labels for real images
y_real = ones((n_batch, 1))
# update generator model
gan_model.train_on_batch(z, y_real)
```

Fig 8: The composite model

The figure 8 represents the composite model integration of generator and discriminator. This shows the complete GAN algorithm with weights and functions for the estimation and detection of the discriminator and generator models.

VI. Performance Analysis and Outcome

The detection of drone magnetometer through artificial intelligence is designed and implemented in MATLB simulink. This helps to detect the performance of the drone before the execution in the real environment. This includes the observation of various parameters of the drone system ranging from phyical analysis and functioning of the system.

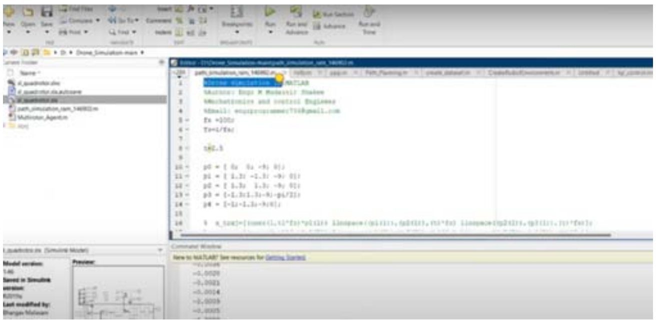

Fig 9: Implementation in MATLAB

The figure 9 represents the programming code for the implementation in MATLAB.

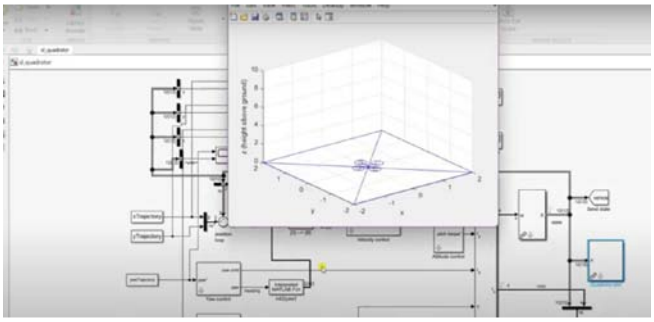

Fig 10: Calibration process

The figure 10 demonstrates the calibration process. They are done through the accelerometer. This helps the drone to fly without any oscillation in functioning.

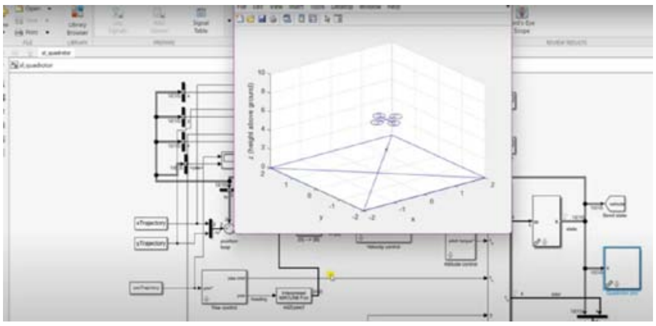

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Fig 11: Drone functioning with altitude 1 m

The figure 11 represents the functioning of drone at an altitude of 1 m. This must be stable to improve and maintain the performance of the drone system. It is attached with a magnetometer in pendulam structure. This detect the occurrence of magnetic components on the surface. The evaluation of the substances are recorded and captured as images.

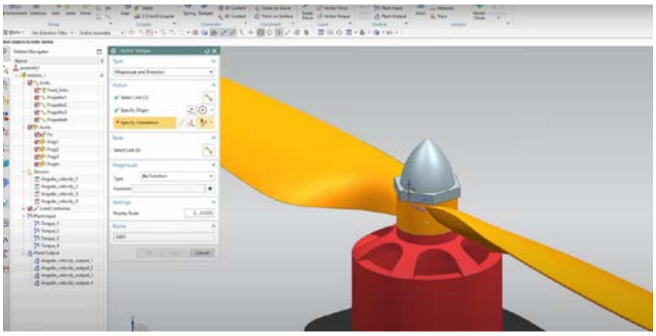

Fig 12: Rotor with controllable devices

The figure 12 represents the rotor with controllable devices and sensors.

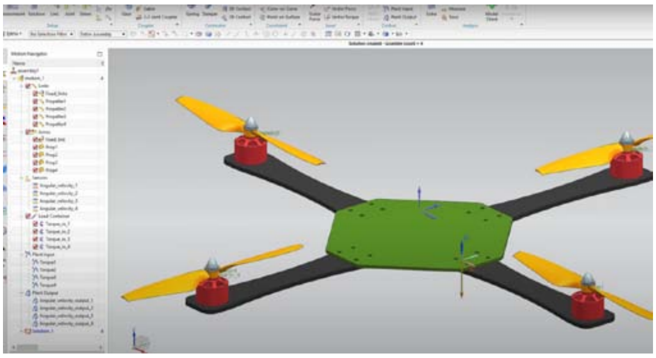

Fig 13: Performance analysis

The figure 13 represents the performance analysis of drone magnetometer system. The overall performance are sensed and recorded in cloud system.

VII. Conclusion

The drone magnetometer system are largely used in the mine detection and military areas. The remoteness between the bottom surface and the magnetometer are reduced through installing it in a pendulum method. This includes the capturing and visualizing the objects, detection of magnetic components on the surface through artificial intelligence and image processing techniques with optimization techniques. The internet of things paved a platform for the development of internet of drones. They are functioned with innovative automation techniques. Thus it overcomes the problems faced by the conventional methods and enhances the detection of metallic components in remote areas through reduced computation time and increased efficiency.

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Design and Implementation of Automatic Speed Control of Ceiling Fan through PWM Technique with Optocoupler to Reduce Energy Consumption

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***Abstract*—The evolution of automation and innovations helps in diverse field. This helps to create human lives much easier. It tend to produce various automatic devices. These devices must include the control system to improve the automation in the equipment. The important equipment used in our day to day life is the ceiling fan. This is the largely used equipment. The conventional system includes manual speed control. To enhance automation in the system, the proposed system is implemented to replace the conventional system with automatic speed control system. This helps to automatically control the speed of the fan based upon the surrounding temperature. This is sensed through the use of sensors. This includes pulse width modulation techniques with brushless permanent magnet DC motors and microcontroller. Here PIC microcontrollers are used for controlling and processing. Thus these techniques are employed for the automatic detection of ceiling fan. This leads in the reduction of energy consumption and reduced cost.**

***Keywords*—Automatic speed control, sensors, PWM power convertors, microprocessor, control, power grids, power generation control, energy consumption**

I. Introduction

The modern decade are looking forward with advanced innovations and automations. The automation is a technique of adopting the machines to perform and function without the aid of humans. The automations play a versatile role in various sectors. These automations helps to make human lives much easier. The pros of automation includes reduced operational cost and increased production in the system [1]–[3].

The advent of newer innovations in the automation of machinery is due to the increased cost parameter and demand. Thus the automations provides an optimum solution for the constraints in various sectors. The automation in diverse fields are introduced due to the evolution of digitalization. This enhances the productivity in the industrial and production sectors [4]–[7]. This helps to increase the standard and quality of the equipment's. This helps in the innovation of robotic technology. This is the combination of hardware and software system with communication technology. These leads to the increase in automation system in motion in a single platform. These automations play a prominent role in the development of various equipment's to improve the standard of living. These innovations helps in the control and monitoring parameters to enhance the performance and functioning of the equipment's and its life time [8]–[10].

The automations are differentiated into fixed, programmable and flexible automation systems. These are based upon the performance and functioning of the system. The automations in the electrical sectors helps to control and monitoring the consumption of power with respect to time. This leads to automatically control the electrical equipment's using the control devices. This leads to obtain a balanced in the supply system thereby maintaining the demand side management. Thus the automation refers to the usages of the information through the electronic components. This includes the control and monitoring of the system through remote places with implementing the two way communication system. Thus the automation is implemented through the integration of various components in a sequential manner [7], [11], [12].

In automation, the communication network and the control system shows a significant part in the analysis and functioning. In the power sectors, the automations are monitored by the SCADA systems. This helps to monitor the overall functioning of the system. In power system, the monitoring and controlling of the power distribution helps in the reduction of outrages. The control system provides instructions to perform accordingly. The components to improve automation includes motor and drive system, safety devices, controllers and communication technology. In

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industrial sectors, the mechanical devices that aid in the control of speed includes pulleys, various gear system and clutch system. These systems are controlled and monitored through control devices and communication protocols. This leads to proper functioning through the aid of automation system. The automation in the power system enhances the home energy management system. There are various equipment's used in our day to day life. The most important equipment includes the fan [13]–[16].

Nearly 25% of the energy consumption in the electricity bill is occupied by the fan. The automation system is used in the operation of fan. In conventional methods, the fan is available with manual speed control devices. This helps to control the speed based upon the need through manually.

The proposed system includes the speed control of ceiling fan through involving automations in the system. It is demonstrated as the conversion of non-adjustable speed to adjustable speed drive system. The speed control helps in many ways through production and economic benefits. The speed control includes various methodologies. This includes controlling the speed of the fan through detecting the surrounding temperature. They can adjust automatically through the prevailing weather conditions. The speed control is defined as the decreasing or increasing the working performance of the equipment. This is done through the voluntary change in load. The change of speed varies with various equipment's based upon the range and operating speed. The speed control of ceiling fan includes the determination of external temperature to function accordingly [17]–[19].

This is done through the sensors. The sensors are used to analyze the external physical parameters. This helps to function of equipment through the sensed data. The important component includes motors. There are various motors used in the equipment in which the permanent magnet synchronous motor are largely used due to its various significances. It is a light weight motor with reduced structure, lower cost, improved torque-current ration and higher efficiency. The components of permanent magnet motor incudes rotor with permanent magnets. They does not produce any heat in the interior and exterior surfaces. Due to the absence of brushes, it does not tend to create mechanical damage to the motors [20]–[22].

This helps to protect the motor from reducing the winding failure. This is the smart way of power saving with lower maintenance cost parameter. Their structure are smaller when compared to the universal motors. The permanent magnet brushless DC motor consumes lesser power. They must be equipped with proper safety and control mechanism. The motor includes must have to adopt both the short circuit protection and overload protection. In some cases, the motors with the controllable devices are self-protected. Hence this does not require any external protecting devices. The safety and protection of the equipment's are the important factor. The microprocessor is used for the purpose of processing and controlling. The PWM (Pulse Width Modulation) techniques is a control technique that provides the analog signal obtained through the microcontroller. This is obtained through the time duration of on and off of the devices. These time duration between these two parameters are referred as duty cycle. The PMW signals are generated through a comparator. These signals provides the pulse that are generated in a square waveform. This helps in the conversion of the signals into a discrete portions. The comparator helps to compare the signals and produces the square waveform.

The pulse width modulation are classified in to trail edge, lead edge and pulse center edge modulation techniques. The Pulse width modulation helps in regulating the voltage and hence they are used to regulate the speed of the motors. This also helps to dissolve the heat through the attachment of fan inside the system in computers.

The PMW techniques produces accurate results with higher response time duration. This helps the motor to produce maximum torque even when the motor operates at reduced speed. It also helps to reduce the radio frequency interference. The optocoupler are used for safety purposes. This helps to separate the circuits that send signals. It perform in both AC and DC signals. They functions with reduced noise parameter. It is used for driving the permanent magnet brushless DC motor. The ultrasonic sensor and temperature sensor are included to sense the sound and temperature of the surrounding environment. This senses the information and proceeds to process further. This is used in the sensors to detect the availability of the physical systems. This sends the signals through light. This helps to prevent the signal from rapid high voltages that damages the equipment. This is also known as photocoupler. This can be used as a switching device and can be used as an electronic devices. The controlling devices helps to reduce the electricity consumption. This helps to reduce the electricity bills.

II. PROPOSED SYSTEM

The proposed system consists of microcontrollers, optocoupler, temperature and ultrasonic sensor with motors. The permanent magnet brushless DC motor are used.

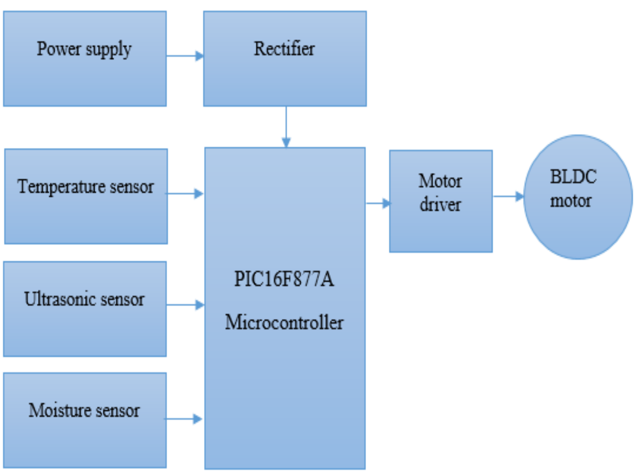

Fig 1: Proposed system

The figure 1 represents the proposed system.

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The components of permanent magnet brushless DC motor includes a fan blade attached with a permanent magnets with electromagnetic coils, rotor with rotor core section, stator, windings and bearing support.

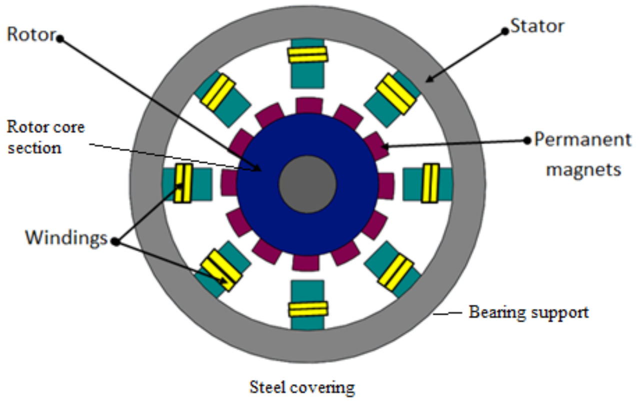

Fig 2: BLDC motor

The figure 2 represents the permanent magnet brushless DC motor. This contains four electromagnetic coils. The functioning of the electromagnetic coils function in combined pairs. In which the pair of A and C forms one phase and B and D forms the second phase. The rotor position is used to monitor the hall effect sensor. The rpm form the fan is monitored from the hall sensor through feedback. The conventional method is replaced through the proposed system. The power consumption is reduced through the optimization of the commutation angle. This helps to sustain the efficiency of the brushless DC motor[23]–[25].

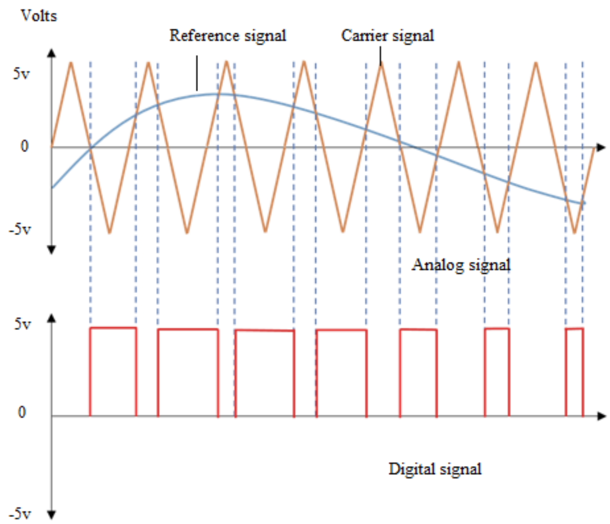

Fig 3: PWM signal

The figure 3 represents the pulse width modulation signal. They helps to regulate the functioning and speed control of fan externally through adjusting the duty cycles. It helps to obtain the results accurately. The duty cycle of the PWM is calculated as follows.

Duty cycle = T1/T* 100

Frequency Fpwm = 1/(TON+TOFF)

Vout = Vmax * duty cycle

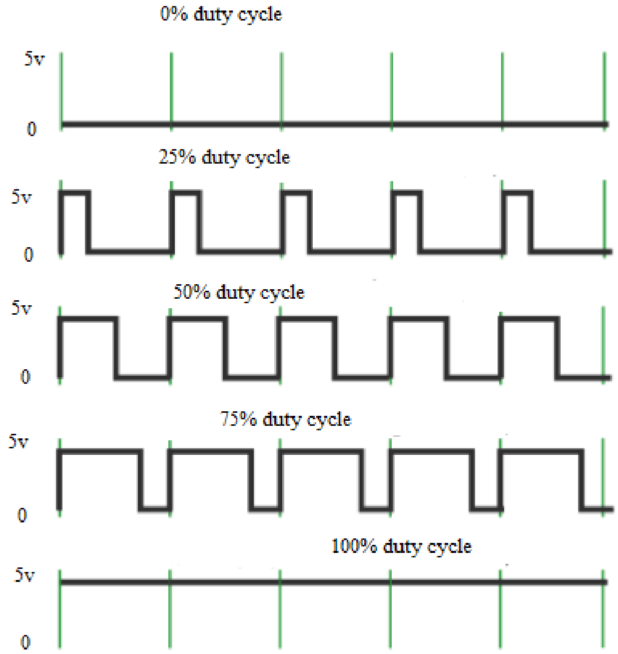

Fig 4: PWM with duty cycles

The figure 4 represents the PWM with duty cycles. The physical parameters are more important to be sustain in limit to intensification of the operational efficiency of the equipments. The sensor helps to function the equipments without any deviation in performance. The ultrasonic sensor is used to detect the sound signal and proceeds to the microcontroller whereas the temperature sensor (LM 35) is used to detect the surrounding temperatue through which the speed of the ceiling fan gets adjusted. The pulse width modulation is a digital parameter used to achieve the signal between 0 and 1. This is obtained through the duty cycle i.e is the amount of time interval at which the digital signal remains active. In the conventional methods, the potentiometer is used for speed control. This is replaced through the proposed system with increased automation in the system. It is denoted in percentage. The information is projected through the LCD display. This is a dot matrix liquid crystal display that is used to represent the alphanumerical characters and various symbols.

Here 16x2 LCD display is used. This is a form of digital system used for demonstration. It displays the room temperature. They are seven segment in nature. They are largely used due to flexibility in programming and are much economical in nature. This is accompanied with two registers. These are called command and data. The command register is used to save the command in the LCD. The initialization and predefining the data are done through the command instructions. They helps to perform various instructions. The data register is used to save the data that are need to be projected on the display unit. The data is the ASCII values that are needed to be proejected on the display of the LVD display. The consumption of energy is

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increasing rapidly due to the rise in demand. This must be maintained to limit the demand side management.

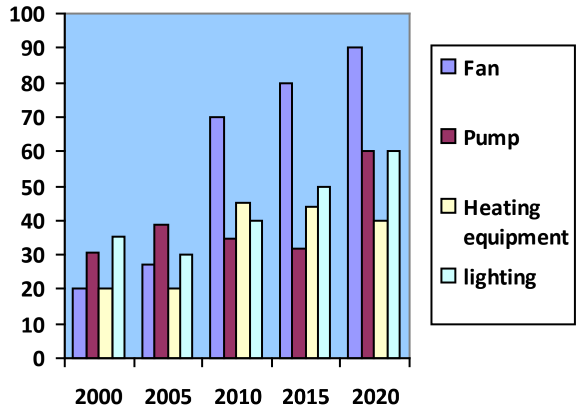

Fig 5 : Energy consumption

The figure 5 demonstrates the amount of increasing energy consumption annually. To balance the energy consumption, the smart automation techniques are employed. The smart meter is used to record and maintain the energy consumption. This is obtained throught the automation techniques. The smart meter records the consumptions of power and indicate them frequently. This helps to reduce the usage of power and electricity bills. The smart meter record the consumption of electricity and monitors them through involving machine learning techniques. The energy consumption is implemented by the forecast of the aforementioned data that are progressed to the preprocessing technique. This includes the preprocessing of the obtained data. They are proceeded with the optimization techniques. This helps to obtain a clean dataset. This includes two major modalities such as fitness function and crossover.

The data are pre-processed and evaluated with fitness function to obtain the desired outcome. This helps to limit the over usage of equipments. It also helps to function automatically based upon setting the operating time of the fan in prior. Thus the smart meter helps to make the functioning of the ceiling fan as fully automated in nature.

TABLE I. OPERATING CONDITION

Sl.no	Room temperature	Accuracy	Fan speed
1	32.8	87%	Medium
2	25.9	87%	Low
3	67.9	97%	High
4	45.9	92%	Low
5	59.1	85%	Medium
6	82.3	91%	High

The table I represents the functioning of ceiling fan based on the temperature in the surrounding atmosphere.

III. SIMULATION RESULTS AND OUTCOME

The proposed automatic speed control of ceiling fan is implemented in MATLAB Simulink is calculate and monitor the performance of the system.

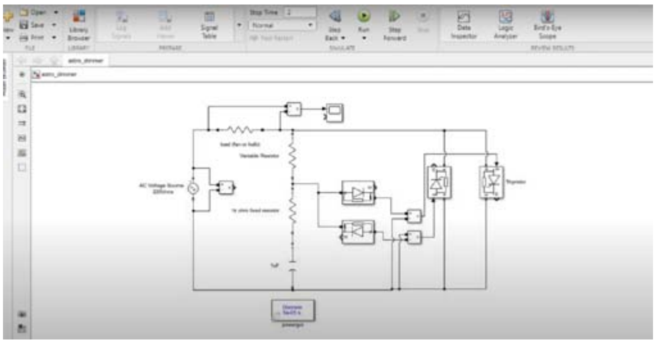

Fig 6: Simulation diagram

The figure 6 demonstrates the simulation diagram in MATLAB. This includes the analysis of speed of the ceiling fan and proceeded to control the speed using microcontroller. The input power supply to the microcontroller is 5v. The conversion of analog to digital signal is done through ADC. The sensed output is given to the microcontroller. This helps to obtain the control signals. The system is operated through varying the duty cycle that helps to change the speed of the fan based upon the temperature around the surrounding system.

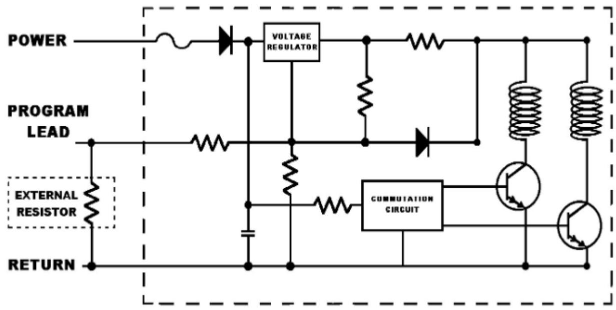

Fig 7: Regulation of fan speed

The figure 7 represents the regulation of fan speed. The proposed system is adopted to replace the use of tripot and potentiometer. The automatic speed control is implemented in simulation through adjusting the temperature to determine the routine of the ceiling fan. The speed is differentiated into three categories such as medium, low and high speed. These are based upon the room temperature. These automatic adjustment helps in proper functioning of the ceiling fan through the use of sensors. Thus the waveforns helps to observe the performance analysis.

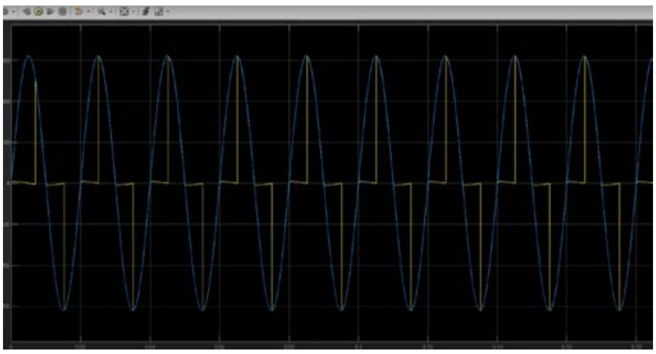

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Fig 8: PWM waveform

The figure 8 represents the PWM waveform.

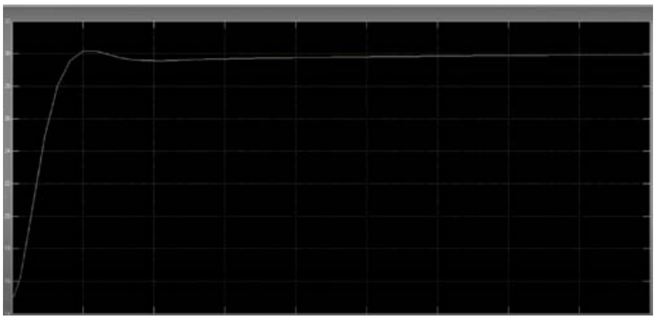

Fig 9: Energy consumption and monitoring

The figure 9 represents the energy consumption and monitoring. Through by adopting the proposed system the energy utility can be balanced. This helps to maintain the demand side management. Thus the energy consumption can be reduced and maintained stable through the pulse width modulation technique.

IV. Hardware Implementation

The PIC microcontroller is used for controlling and processing in which it can be easily write and erase numerous times because it adopts the FLASH memory technology. The PIC microcontroller are versatile in functioning and thus it is inexpensive in nature. This includes 40 pins whereas the 33 pins are developed for input and output. They have versatile applications ranging from sensors, safety devices and automation systems. This can function upto 20MHz frequency with instruction set. The operating voltage lies between 4.2 to 5.5 v respectively. It is available in four IC packaging with any internal oscillator in the unit. The PIC6F877A is obtained with low power high performance functioning CPU, providing with microcontroller of 8 bit with 8k bytes of programmable flash memory, maximum user application, extensive accessibility, presented with unrestricted enlargement tools. Various data such as the frequency, data and transmission codes are saved and identified in EPROM. They are flexible to operate and user friendly in nature.

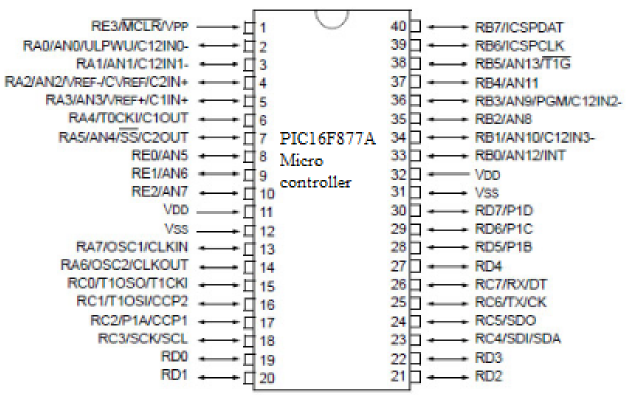

Fig 10: PIC16F877A

The figure 10 represents the pin diagram configuration of PIC16F877A microcontroller. They are used to obtain simpler programming with interfacing which helps to perform numerous task. The EPROM and EEROM are initiated for the end-user to perform the task much convenient manner through digital signal processing. The PIC microcontrollers are largely used in both industrial and domestic purposes due to its lower cost and easier functioning performance.

```
#include<htc.h>
#include<pic.h>
#define _XTAL_FREQ   20000000
void rundutycycle(unsigned int x );
#define s1          RA0
#define s2          RA1
#define s3          RA2
#define s4          RA3
#define s5          RA4
#define s6          RA5
void main()
{
ADCON1=0x06;            //All pins as digital
        TRISA=0b111111;         //PortA as Input
        TRISC2  = 0;            //Make CCP1 pin as output
CCP1CON = 0x0C;         //Configure CCP1 module in PWM mode
PR2   = 0xFF;           //Configure the Timer2 period
rundutycycle(512);
}
```

Fig 11: Programming code

The figure 11 represents the programming code for PIC microcontroller. The three fundamental step for programming a microcontroller includes writing programming code on computer, then used to compile the code with the compiler and finally helps to upload the compiled version in the microcontroller. The generation of code for the PIC microcontroller include various stages. The first step includes building the hardware. This is the primary step for program coding in microcontroller. Then obtaining software. The XC8 compiler and MPLAB X IDE are used by the instructions. The another set involves the configuration of oscillator and used to set the configuration bits in the system. The C programming language is used for the programming of PIC microcontroller.

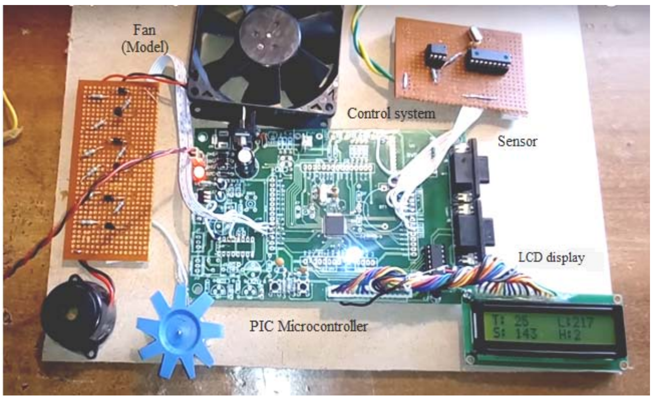

Fig 12 : Hardware implementation

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The figure 12 represents the hardware implementation of the planned system. The functioning of the system factors are projected in the LCD display. Through the control and monitor of microcontrollers through the sensed data helps to operate the ceiling fan automatically.

V. Conclusion

The advancement in the technology helps to make lives much sophisticated. The proposed system implement the automatic speed control of ceiling fan. This is enhanced through the use of pulse width modulation techniques. They are done through various devices that are performed through sensing the surrounding conditions. They are integrated with the control system with communication technology. The speed of the motor is measured by the power electronic devices that leads to regulate the speed of the ceiling fan. Thus the PMW technique with optocoupler helps to obtain the automatic speed control which leads in the decline of energy consumption.

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An innovative approach in modelling and design of smart washing machine with automatic drying with estimating energy and water consumption using AI

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***Abstract*—The automations in smart appliances play a vital role. The evolution of automation is the adoption of smart machines and appliances for industrial and domestic purposes. This helps to obtain smart home. They are implemented through artificial intelligence with optimization techniques. To replace the convention washing machine, the proposed system is introduced. This is functioned through adopting artificial intelligence to operate automatically through various devices. The smart washing machine is designed through machine learning techniques with sensors. This helps to adopt a newer way in washing that helps to reduce energy consumption through estimating the power utility. This is accompanied with automatic drying techniques. The system is completely automatic to perform the washing process. It is enhanced through internet of things to enable the two way communication system. The smart meter is used to record the energy consumption. The efficiency and performance parameter are higher when compared to conventional washing machines. Thus the proposed system enhances automation in washing machines with automatic drying and estimates the amount of energy consumption.**

Keywords—Washing machine, smart machines, artificial intelligence, induction motor drives, microgrids, energy management system, smart meters

I. Introduction

The rise of artificial intelligence play a versatile role in the sophistication and development of human lives through improvement in various fields ranging from industry and domestic applications. The control and monitoring of these appliances are complex and hence they are done through automation through artificial intelligence [1]. The artificial intelligence is defined as the progression of training the machines to function as similar to that of human intelligence. This helps to solve various complex problems to achieve the obtained results. They are functioned without human interference. These artificial intelligences are used to obtain the decision-making techniques rapidly. The advancement of artificial intelligence from the past decade is due the increase in demand. This includes machine learning, artificial neural network and deep learning techniques. The application of artificial intelligence helps in agriculture, industry, education and energy management system. They play a significant role in various fields through improving automations and performing the functions without the assistance of humans [2]–[4].

Hence this helps to reduce the computational time and hence helps to obtain reduction in cost parameter. This is accomplished through the data monitoring and integration, smart control system with communication system helps to the rise of artificial internet of things. The automations also helps in load forecasting. This is done through the machine learning with artificial intelligence to enhance energy consumption. This is done through the optimization techniques. This includes long term and short term load forecasting techniques [5]–[7].

The load forecasting helps to predict the power consumption and thus leads to the reduction of power utility. The load forecasting is done through analyzing the physical parameters such as weather, climatic conditions and consumers need at the particular period of time. This plays an important role in the complex systems. These automations and advanced innovations helps to determine the performance efficiency and helps in the reduction of carbon emission in the ecosystem. The adoption of automations in the renewable energy system helps to improve a greener environment. They are highly reliable and much efficient in performance. The control and

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functioning of the system are enhanced through the optimization techniques. They help to monitor and control the system based upon the priority and interest of the user. They are largely used in complex problems to obtain an accurate results [8]–[10]. Thus the automation in diverse field are achieved through the artificial intelligence techniques. These techniques are largely used in the hybrid renewable energy system to control and monitor. Thus utilizing it in an efficient way. These artificial intelligence paved way for the development of introduction of digital platform. It includes the evolution of virtual technology. They are formed through the virtual and augmented reality through the internet of things. In automation in the domestic appliances, the machine learning plays a vital role. They are implemented with forecasting mechanism to adopt automation in the functioning system [11]–[13].

This helps to increase the efficiency of the system through various control parameters. They are accompanied with the internet of things to achieve the two way communication systems. This helps to provide the monitored information to the user at other the end even at the remote places [14]–[16].

Thus the domestic appliances are controlled to achieve much sophistications in day to day life. Thus the appliances in the home are tend to completely automated through the machine learning and optimization algorithms that takes in to another world. The advancement in the technology are increasing largely due to the various sophistications and it helps to make lives easier. The machine learning provides a different approach in the functioning of the washing machine. The washing machine is an electrical and electronic system used to wash clothes. The washing machines are classified into top load and front load categories. The washing machine includes washing drum, sensors and inner drum. The washing machine are controlled through the control mechanism [17]–[19].

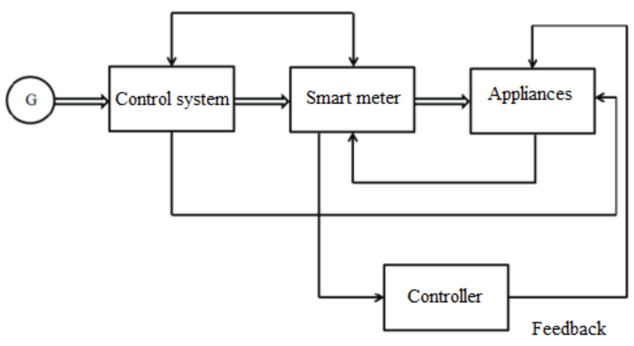

Fig 1: Smart meter drives

The figure 1 demonstrates the smart meter drives. This includes control system, smart meter, appliances and controller. This electronic control mechanism is denoted as programmer. This is done through the microcontroller through sensors and actuators. It includes ultrasonic cleaners for enhancing numerous functions. The real time operating system is used to function the washing machines. They are classified into hard real time and soft real time operating systems. These are classified based upon their functioning properties. The microprocessors and the microcontrollers are functioned and programmed using 2nd language programming languages. The various topographies of washing machine includes spin settings, washing types based upon the material of the cloths and capacity of the load. This helps in various advantages through adopting faster washing speed. This leads to obtain a newer way in washing the cloths with automatic drying. This also helps to determine the water quantity and energy consumption[27]. These helps to develop the overall home energy managements system. Due to the demand in the electricity, these artificial intelligence techniques helps to eliminate the increasing demand.

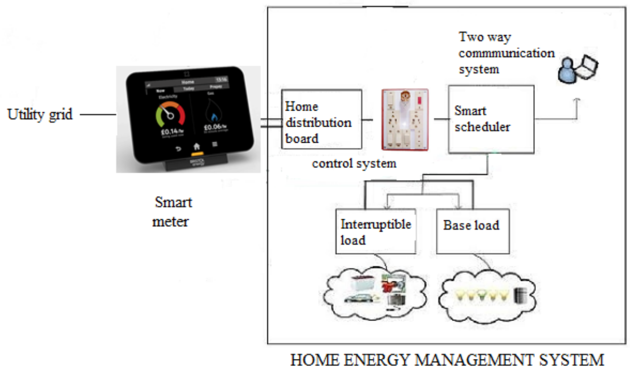

Fig 2: Home energy management system

The figure 2 represents the home energy management system. The expansion of the smart machines leads to the implementation of smart home and smart grid. This helps in diverse ways through communication system. The development of smart washing machine includes the two way communication to monitor and provide instruction to the washing machine through remote places.

The complete washing of clothes are done through the smart washing machine. This includes image processing techniques with feature extraction techniques. The washing machine used in the industry are highly profited through the machine learning techniques. They are tend to function much faster and hence helps to save time. The overall functioning of the washing machines are instructed externally using the smart touch screen which provides various options for washing. They are provides with various visual effects and automations. This helps to create an interest to operate and function the washing machines. This helps to reduce the manual efforts. Thus the proposed system is used to replace the use of the conventional washing machine. The smart washing machine involves the detection of clothes through which the quantity of water, detergent quantity and the time of washing is estimated and provides. The functioning of the washing machine includes four stages such as water consumption, soaking, washing process and drying [20]–[22].

This also helps to determine the amount of power consumption. This helps to maintain the usage thereby saving the power consumption. The energy consumption of the electrical utilizations are estimated independently

DOI: rp-9788770040723.213

through the energy disaggregation. This helps to determine and estimate the power consumed by the each and each appliances in the home and industry. These data are collected and processed to complete the smart functioning of the washing machine. This includes numerous data that are need to be stored. This is done through the internet of things with cloud computing techniques. They are also beneficial in the analysis and detection of fault and its performance. Thus the automations leads to improve the home energy management system [26].

The energy disaggregation plays a prominent role. They are classified into two categories based upon the intrusive and non-intrusive load balancing and monitoring system. The intrusion load balancing and monitoring is the hardware approach in which the smart meters and externally attached to the appliances to measure the performances. The non-intrusion load balancing and monitoring is the software approach. These energy segregation plays an important role in the large scale industrial sectors to estimates the consumption of power with estimating individually.

II. Proposed System

The smart washing machine is introduced to enhance innovation in the home automation system. This is developed through the energy decomposition techniques to improve smart home automation system. The smart washing machines are the innovative approach that are implemented through digital platform. The washing machine is the integration of electrical and electronic equipment's used for rapidly washing the clothes. This washing process includes soaking of clothes in combination of water and soapy solution to remove the dirt particles through the process of spinning. Then it is allowed to drain the water after the completion of the spinning process. This overall process is implemented through fully automatic manner using artificial intelligence adopting machine learning techniques. This helps in automatic drying of clothes after the specified spinning time based upon the loads. The complete functioning of the machine are intimated to the user through internet of things [23]–[25].

Fig 3: Smart washing machine

The figure 3 represents the smart washing machine. The components of washing machine includes hot water inlet valve, cold water inlet valves, door, inner drums, oulet water hose, filter and oulet line. These smart washing machine helps in analysis of clothes based on material and then initialise the washing process. They are differentiated through the image processing techniques. The sensors are used to sense the temperature of water used in the operation process. This automatically detects the quantity of water and detergents that are needed for the particular amount of loads.

III. Functioning of Smart Washing Machine

The operation of the smart washing machine includes two way communication system that seems the complete functioning process to the user. This internet of things play a prominent role in the monitoring and controlling the operation. The first step involved in the washing machine includes the processing the command to the machine through smart screen display unit.

Here the detailed information regarding the number of clothes are initiated. The machine itself recognised the amount of water and detergent needed for the prescribed loads. Then it automatically fetches the water from the water inlet valve. This includes both the hot water valve and cold water valve based upon the requirements. The clothes are dumped into the inner steel tub in which the process takes place. The diamond drum used inside the washing machines are highly efficient and gives best results. The quick wash is more reliable and fastest wash cycle with higher energy saving mode of functioning. The smart motion technology is employed. The smart motion techology are differentiated into three types. This rotating movement helps the clothes to remain tangle free and protects the clothes from earlier fading without causing any torn. The advanced techniques employed in smart washing machine involves the improved drum with twinwash process, wash technology with O_2, automatic dispenser technology with internet of things.

The smart washing machine tends to provide sophistication through automatic on and off through the instruction provided by the user through their mobile phone. This helps to function rapidly. This includes sending and receiving of instructions to mobile phone during the working conditions of the washing machine. This also helps to pause the functioning and can able to revine later. The functioning of washing machines includes top load and front load washing machines. They are classified based upon the operation and designing parameters. In which the top load washing machine is the efficient way to utilize. This includes the use of impellers that helps to achieving minimum quantity of water for washing purposes. Hence it helps to save water. The drying process is proceeded after washing the clothes. The drying process depends upon the rpm. This determines the spin speed in washing machines. The increased rpm leads to faster drying of clothes. The spin cycle ranging between 300-500 rpm is usually used for drying the clothes. This varies based upon the material and colour of the clothes. Thus the overall progression is done through the integration of machine learning with optimization algorithm. Here genetic algorithm used for optimize the overall functions.

IV. Smart Washing Machine Through Artificial Intelligence

The combination of machine learning with internet of things constitute the functioning of smart washing machines. This helps to adopt the decision making techniques similar to human intelligence. This helps to obtain well-organized functioning through adopting comfort in operation, advanced design parameters, safety and easier maintenance. These parameters helps in efficient energy saving. The energy saving includes the demand side management. This is accompanied with image processing and feature extraction techniques. This includes sensors for sensing the external physical parameters. The various sensor used in functioning of washing machine includes pH sensor, light sensor, temperature sensor and heat sensor. They helps to indicate the appropriate functioning in washing the clothes. The image processing techniques are used to identify the material of clothes based upon the predefined data. They are proceeded through the feature extraction techniques. This helps to convert the obtained raw data into numerical data to perform the functioning. These data are used for the optimization techniques that performs the overall functioning in washing machines.

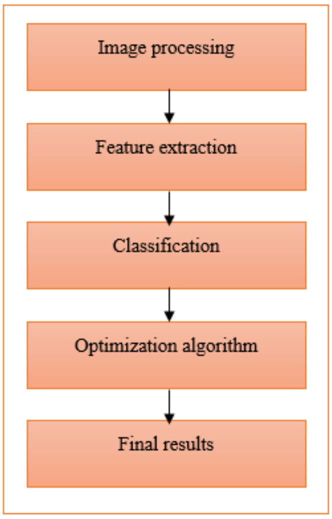

Fig 4: Smart washing machines through optimization techniques

The figure 4 demonstrates the functioning of smart washine machines. Here genetic algorithm is used to program the functioning based upon the needs and priority of the users with enhancing instructions to control and monitor the functioning of the washing process. They are implemented through the pre-procesed information in the dataset. This stores the complete information regarding the material of clothes, detergent amount and water level dependent upon the load. This is employed through the testing and training process which helps to make the system fully automatic. The speed of the rotating drum determines the drying process and it is regulated based upon the fabrics. The higher rpm leads to faster performance in washing and drying process. This also helps to reduce the occurrence of noise occurred in washing machine. The noise can be neglected through active casting technique. This includes the feedforward structure to control the noise parameter. The noise level of low frequency upto 500hz is acceptable. Increase in the noise level need to be reduced. The increase in noise leads to vibrations in the machine. These vibrations are caused due to the improper suspension of the drum inside the machine.

V. Mathematical Model Analysis and Functioning of Washing Machine

The suspension co-ordination of the drum in washing machine is refered as spring damping system. The vibrations occurred in the machines are obtained through the differential equations. Some of the assumptions are denoted as disregarding the mass of spring and damper and avoiding the deformation in the system.

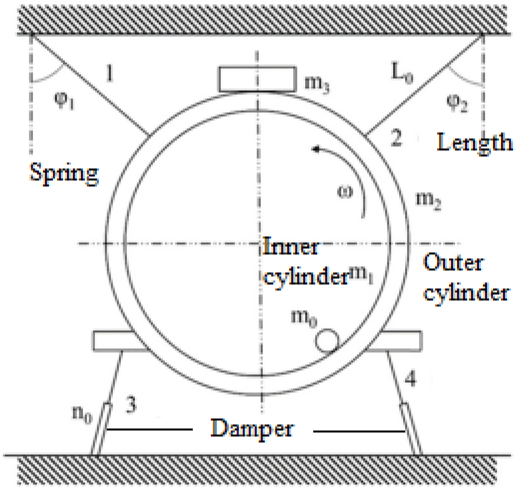

Fig 5: Mathematical model

The figure 5 demonstrates the mathematical model of suspension system. Accoroding to Lagrange equation, the dynamic equation is states as follows,

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{q}_j}\right) - \frac{\partial T}{\partial q_j} + \frac{\partial P}{\partial q_j} + \frac{\partial L}{\partial q_j} = Q_j(t)$$

T is the kinetic energy of the system,
P is the potential energy,

L is denoted as energy dissipation function

The kinetic energy of system is denoted as,

$$T = \frac{1}{2}m_1\left|v_G\right|^2 + \frac{1}{2}I_1(\dot{\theta}+\omega)^2 + \frac{1}{2}m_2\left|v_G\right|^2 + \frac{1}{2}I_2\dot{\theta}^2 + \frac{1}{2}m_0\left|v_{m0}\right|^2 + \frac{1}{2}m_3\left|v_{m3}\right|^2 + \frac{1}{2}I_3\dot{\theta}^2 + \frac{1}{2}J_1\omega_1^2 + \frac{1}{2}J_2\omega_2^2$$

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where vg is the centroid velocity of the inner and outer cylinder respectively. The interconnection between the box and the inner cylinder are immovable in nature. There are two types of cylinders inside the machine namely inner and outer cylinder. They are inflexible in nature.

TABLE I. MOMENT OF INERTIA

Moment of inertia kg-mm^2	
Motor shaft	2.27×10^4
Inner cylinder	4.6×10^5
Outer cylinder	1.01×10^4
Counterweight	2.4×10^4
Damping of spring	1.98
Suspension of spring	6.1

The table 1 represents the moment of ineria of the components of washing machine. The vibrations in the system are neglected through magnetorheological dampers. This is used to interconnect with the drum and cabinent. This reduces the vibrations adopted with control strategies. The control strategies includes adoption of fixed (current) values through a constant spin operating condition. This includes when a constant spinning condition, the training stage is initiated in multiple times with reduced ramp signal. The vibration and noise of the machine are identified and examined at the training phase [25].

The logical understanding of the functioning of washing machine is demonstrated as follows,

D = 0 (Door open condition), D =1 (Door closed condition)
L = 0 (Low water level), L = 1 (Higher water level)
T = 0 (Low temperature), T = 1 (Higher temperature)

The motor operates when the value of D, L and T are higher.

The heater functions when the D and L are higher and T is lower.

The water valve operates when D and T are higher and reduced value of L.

TABLE II. LEVEL OF FUNCTION

Door (D)	Level (L)	Temperature (T)	Valve (V)	Motor (M)	Heater (H)
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	0	0	0
0	1	1	0	0	0
1	0	0	1	0	0
1	0	1	1	0	0
1	1	0	0	0	1
1	1	1	0	1	0

The table II represents the logical functioning parameters for operation and functioning of washing machines. The washing machine consists of three sensors namely the temperature sensor, door sensor and water sensor. They forms the basics for the operation of the drum. Thus the mathematical model determines the functioning of the system to neglect vibrations and to achieve higher efficiency. Through a smoothening of current vibration map, it helps to determine the current value at which the vibration responds during the training phase. This helps to find out the optimum solution thus maintaining the constant spin functioning condition. This helps to enhance reduction in the power consumption. The overall process is optimized through genetic algorithm. The genetic algorithm is a tool for resolving both the controlled and unconfined problems. These complex problems are solved to obtain optimum results.

Algorithm 1: Genetic Algorithm for flexible Load shaping in Demand Side Management (GADSM)

```
Take load types 'L', total number of matrices 'n', number of devices 'I', current matrix 'm' and power
consumption 'p' from the table of load data
  while 1< L < n do
    while 0 < I < m do
      (1) Calculate the total 'p' consumption of 'I' no. of devices
      (2) Compute the fitness function
          (a) Fitness function – without GA-DSM
          (b) Fitness function – with GA-DSM
              i. Population initialization
              ii. best optimal fitness function selection based on the minimal 'p' during peak hour 'ph'.
              iii. Crossover is carried out on 'I' based on the minimal 'p' for time slot 't'.<crossover>
              iv. After analyzing the behavior of the new population, mutation is done on 'I'
                  based on 't' during 'ph'. <mutation>
              v. The fitness function matrix of the 'I' with minimal 'p' during 'ph' is taken as
                 the best fitness function for each 'L'. <optimal solution>
end while
Same process is repeated for each 'L' and the best optimal fitness function is chosen.
end while
123
```

Fig 6: Genetic algorithm

The figure 6 represents the genetic algorithm for control and functioning of the machine learning. They are obtained through the process of crossover and mutation. This helps to optimize the system to achieve optimum solutions.

VI. SIMULATION RESULTS

The proposed smart washing machine using artificial intelligence is implemented in proteus platform. This helps to analyse and estimate various functioning parameters of washing machines.

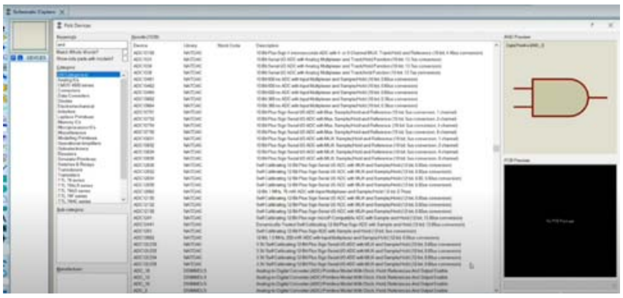

Fig 7: Simulation through Proteus

The figure 7 demonstrates the proteus simulation model to estimate the energy and water consumption. The simulation results are functioned through the logic functioning.

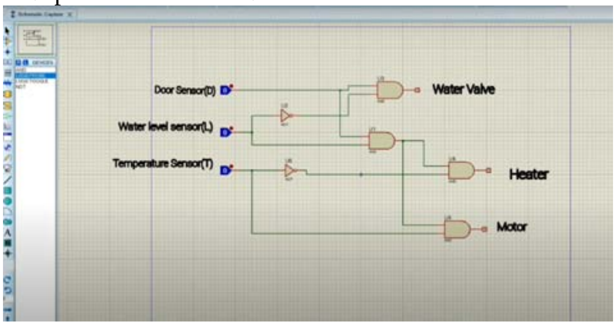

Fig 8: Simulation model and results

The figure 8 demonstrates the simulation model. This helps to analyze the accurate solution to various constraints in the functioning of washing machines. The output results are evaluated through the simulation model. Thus the proposed system provides 100% outcome in achieving automatic drying with efficient energy and water consumption through the aid of machine learning techniques.

VII. Conclusion

The proposed system helps to obtain automation in washing machine through artificial intelligence. This includes control and monitoring of the system through machine learning techniques with internet of things. Thus the two way communication system helps to provide the information to the user even at remote places to monitor and visualise the functioning. Thus the smart washing machine helps to estimate the energy consumption through smart meters. Various smart techniques are inculcated to improve automations and smartness in functioning of the washing machine. This supports to decrease the energy consumption thus maintaining the demand side management.

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Design and Implementation of Thyristor Controlled System to Function and Control the Illuminance of Lamp Using Matrix Keypad with IoT

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***Abstract*—The lighting is the important phenomena that are used in our day to day life. They must be utilised in a proper way without any consequences. The rise in the demand is caused due to functioning of equipment unnecessary that leads to increase in the consumption of power. To overcome these drawbacks, the digitalization is implemented. This is done through the internet of things. This helps to function through evolving the two way communication system. The lighting system must be properly functioned through analysing the illuminance and luminance. Higher or lower illuminance level can cause various constraints in physical and mental health. To overcome these constraints, the proposed system is implemented. This is done through the thyristor controlled system. The thyristor is a solid state switching devices that are used to withstand the rated voltage until it gets triggered. The thyristor once triggered, the current through the triggering phase can be removed without turning off the equipment. The illuminance percentage is visualised through matrix keypad. The overall system is functioned and monitored through internet of things.**

Keywords—Illuminance, luminance, digitalization, matrix keypad, lamp, voltage control, inverters, rectifiers, voltage source converters, internet of things

I. Introduction

The lighting is considered as one of the essential system in our day to day life. They are mandatory in every field. This much be obtained with correct functioning parameters. Any deviation in the lighting system leads to various problems such as eye strain, health issues and various accidents occur in roads due to poor lighting system [1]–[3].

Hence the lighting system must be functioned with optimum care. The proper functioning of the lamp is determined through the illuminous. The illuminous is defined as the quantity of light that cover the surface. The SI unit of illuminance is referred as lux. This is frequently represented as brightness. This is replaced through the SI unit to attain equality in standards. The increased value of light is obtained when the value of lux is higher in range. They are expressed in candela and lumen. The range of lighting must be maintained properly without minimum or maximum lux. The maximum illuminance can also causes various barriers to human health. The increased in the illuminance does not recommended as proper lighting [4], [5].

The average level of illuminance must be maintained. This is also relied on the surface in which if the surface area is smaller, the illuminance reflects brighter. If the same amount of light falls on a larger area, the illuminance becomes lesser leads to dim in appearance. Thus the surface of the area also play an important role in the illuminance of lamp. If the lux values are obtained higher, this helps to provide higher level to light to the surface [6]–[8].

The lighting system must analyzed for domestic and industrial purposes, based upon the needs the illuminance are needed to provide. This helps to obtain exact lighting for the particular area. The reduction and rapid increase in the lighting system leads to imbalance in the surface area. The value of lux is maintained using the lux meters. These instruments are only used to measure the light and they are cheaper in cost. The level of illuminance is denoted by the lux value through which the lighting system is obtained. This helps to adopt a proper lighting system to the particular area. There are various types of lighting system is designed based upon the usages and the needs. This includes domestic purposes, industrial purposes and designing purposes [9]–[12]. These lighting varies in color in the designing purposes. There is a vast difference between the luminance and illuminance. The illuminance is the amount of light that falls in unit area whereas the luminance is the amount of light that are reflected back to the surface after the light

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absorbed through illuminance. These two technology plays a vital role in the lighting system. The measurement of light based upon the luminance and illuminances determines the intensity of the lighting arrangement. The detection of light waves are denoted as optical radiometry. This is the amount of light waves that falls in the optical portion of the electromagnetic spectrum. These waves are referred as visible light, infrared light and ultraviolet light [13]–[16].

The electromagnetic radiations are also measured using radiometry. This is done through the application on sensing the detecting the brightness across the surface. The terminology used for the detection of light system is called photometry. This includes the detection of visible light in the electromagnetic spectrum. This helps to measure the light based upon the human perception towards brightness. Thus the photometry is the branch of science that contracts with the measurement of intensity of light. The sensitivity level at which the brightness of light affects the human health is analyzed. This helps to separate wavelength through the electromagnetic spectrum [17]–[20].

The ultraviolet rays can be detected through the photometry. Thus the important part of photometry includes the differentiation of the visible light with that of human perspectives. This helps to neglect the disadvantages caused by the brightness level through proper functioning and detection of the illuminance level.

The usage of spectrometer in analysis and detection in the measurement is referred as spectrometry. The spectrometry is the interaction of matter and light. This is the relationship between the reactions and the adverse measurements of the intensity and wavelength. The application of spectrometry includes in diverse areas. They are largely used in astronomy, improvement in the structure of drugs and in biomedical applications. They are used to analyze the objects far away. The another process of measurement of light at the particular wavelength at a particular electromagnetic spectrum are referred as the spectroradiometer. They are measured through the spectrum or through wavelength. The two important concepts that are involved in the spectroradiometry includes spectral radiance and spectral irradiance [21]–[23].

The intensity of the light is measured through the source of light and the direction in which the light radiates. This is denoted as the number of lumens that falls on the unit area. This helps to find out the illuminance and light intensity. The instrument used to measure the light are termed as photometer. This is used to observe the intensity of light. This is also refers as the instrument that are used to measure the visible light. The luminance and illuminance both are measured to obtain proper lighting system. The measurement of luminance and illuminance are estimated through the measuring device known as luminance meter and illuminance meters [24], [25].

The accumulation of electromagnetic radiation is done through the integrating sphere. The lights are measured and break into spectral components are done through the spectrometer. This helps to digitalize the obtained signals and can able to display through computers. The measurement of depth of light is measured through the light meters . The level of light falls on the surface is measured through plane. Illumination of high power is mandatory to achieve effective lighting system. The illumination can be controlled through power electronic devices. The various power electronic devices used for illumination are thyristor, transistor and diode. The various kinds of thyristor includes silicon controlled rectifier (SCR), triac, programmable unijunction transistor. The thyristor is a three terminal controllable device which works much efficient in power frequency.

The proposed system is used to maintain the illumination of lamp using thyristor. This is adopted with matrix keypad with IoT. The internet of things (IoT) helps to enable the two way communication system through which the functioning can be monitored even at remote places. The illumination of the lighting system is employed through varying the voltage across them. The matric keypad is defined as the circuit that are used to monitor the amount of illumination used by the user end. This is indicated through percentage. The total functioning of the system are adopted through the solid state mechanism through switching control parameters.

The overall process is performed and controller through microcontroller for enhancing and maintain the illumination control through the surface area. The display unit is used to visualize the percentage of illuminance that are used. Thus the proposed system is much efficient in functioning and controlling illuminance of lamp through thyristor control accompanied with internet of things. The overall process of illuminance is visualized in the matrix keypad.

II. Proposed System

The planned system involves the regulation of the illuminance of lamp through the thyristor control. The most frequently used thyristor are silicon controlled rectifier (SCR). The SCR contains three terminal in which the conductor is allowed to control by the input current. The three terminals are anode, cathode and gate. The gate is used for triggering the device into latch through minimum voltage.

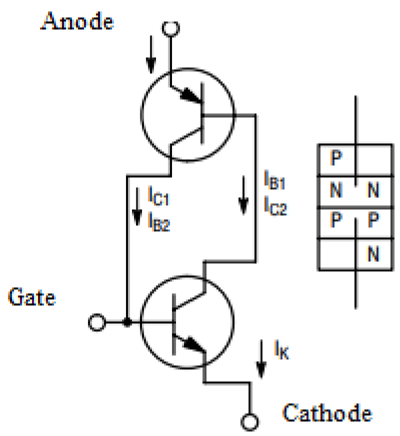

Fig 1: Silicon controlled rectifier

DOI: rp-9788770040723.214

The figure 1 represents the silicon controlled rectifier. The analysis of the SCR provides the bistable operation. The triggering of thyristor requires the intrusion of current to increase the gain. The anode current leads to the avalanche breakdown which results in variation of the breakdown voltage. The thyristor includes the junction temperature. This affects the characteristics of thyristor. The increase in the temperature helps the thyristor to turn on and remain in operating state. The applied voltage attains the breakdown voltage when the gate current is zero. This includes the latching and holding current. The minimum current used for the thyristor to remain in operating conditions rapidly after switching from off state are termed as latching current. The holding current is defined as the slightest current required to maintain the thyristor to remain in on state.

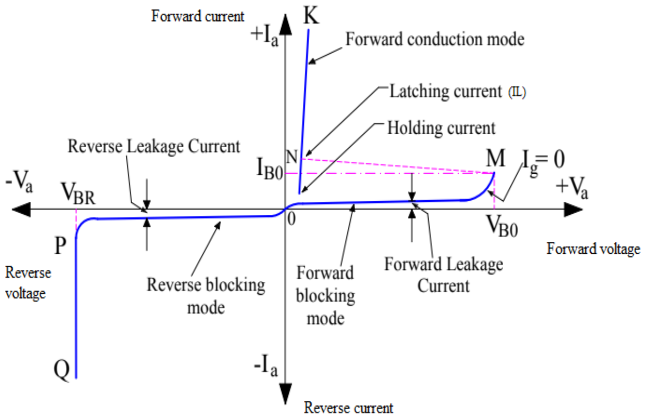

Fig 2: VI characteristics of SCR

The figure 2 demonstrates the VI characteristics of SCR. There are three approaches of process of SCR includes forward blocking and conduction mode and reverse blocking mode. In the forward blocking mode the SCR is at forward bias mode. The gata current is found to be 0.

The figure represents the VI characteristics of SCR.

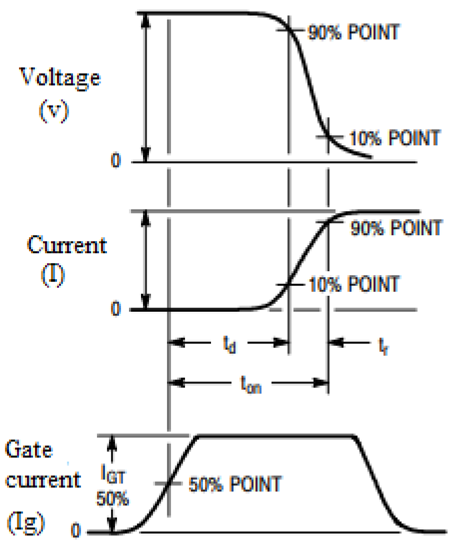

Fig 3: SCR turn on time

The figure 3 represents the turn on time of SCR. The forward breaking voltage is defined as the voltage at which the SCR turns on and when the gate current remains 0. The functional votage falls to the breakover voltage of the thyristor when the gate current becomes zero. Through obtaining particular value of the gate current, the thyristor starts to perform and function as rectifier.

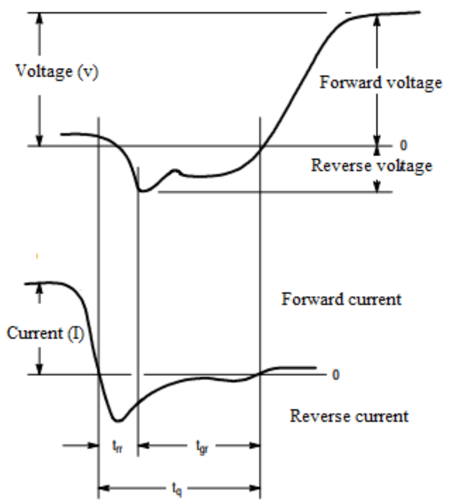

Fig 4: SCR turn off time

The figure 4 represents the turn off time. The turn off in thyristor is defined as the time duration in which the anode current lies to zero and obtainig forward blocking phase.

III. Automatic Illumination Control of Lamp

The control of illuminance of lamp is controlled and performed using thyristor and maintained using microcontrollers. Here 8051 microcontrollers are used. The firing angle is automatically initiates through the microcontroller using input. This helps to control the functioning of thyristor.

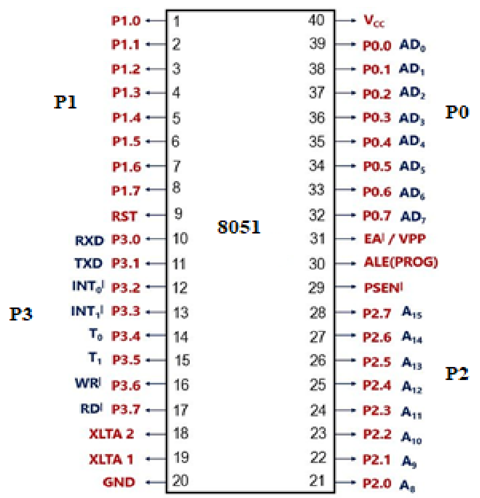

Fig 5: Pin diagram configuration

The figure 5 represents the pin diagram configuration of 8051 microcontroller. The illumination control is classified

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into two types such as manual illumination control and automatic illumination control module. The automatic illumination control module is used to replace the manual illumination control. This includes the illumination through adopting the rotor switch to intact through the switching position. They operates based upon the day and night times.

During night time there is no light that falls on the LDR1, this helps to enhance the intensity of the light that causes the lamp to glow automatically without any external assistance. This causes reduction of resistance on LDR2. During day time, the light falls on the LDR2, hence no emission of light is done through LED light. This causes the UJT firing circuit leads the SCR to incapable to trigger. The control strategy must be maintained properly to achieve automation. The automatic illumination of lamp is achieved through firing circuit in the SCR. The lamp with the variations of output voltage need to be maintained and controlled. The another kind of switching includes the complementary switching. The complementary switching is done through the photo sensitive controller [20]. They are accomplished through light source such as sun light. This is done for two lamp. The photoactive elements emits the light in the complementary lighting.

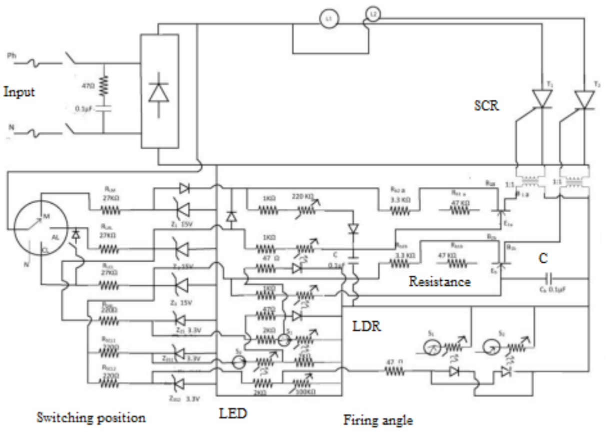

Fig 6: Circuit diagram

The figure 6 demonstrates the circuit diagram representation of automatic control of illuminance of lamp. The device is initiated through the matrix keypad. The matrix keypad are largely used in the embedded applications. They are also used in telephones and fax machines.

The matrix keypad is the integration of four rows and columns through buttons. The functioning of the matrix keypad includes the combination of rows and columns through which touching the button helps connect and perform the operation accordingly. In a 4 × 4 keypad matrix, the 4 connects are in rows and 4 connections are in columns. This constitutes totally 8 connections. There are various kinds of matrix keypad, out of which the 4 × 4 matrix keypad and 4 × 3 matrix keypad are highly used in various applications. The various layers that constitutes the matrix keypad includes overlay through graphic, interior metallic domes, first layer of circuit, spacer unit, button model, adhesive portion with connector section.

These layers helps to constitute the production of the keypad matrix. The overlay through graphic layer are made through polyester due to its increased flexibility in nature. The next layer are obtained with polydomes. The outer circuit layer is the integrated portion to the external environment. This is made up of the combination of polyester with coating done with electrical conductive solutions.

The switch always remain in open until the keypad is fixed. These in-between layer is termed as spacer unit. The bottom unit of the matrix keypad is also a flexible layer made up of polyester material. The adhesive unit helps to stich the layers without any gap between them internally and externally.

Through touching one button, the connections is adopted between the interconnections with rows and columns. The larger use of the matrix keypad is due to it tends to decrease in the number of pins. The number of pins in the network are reduced through the interconnection of rows and columns in the matrix keypad. This enhances the process of multiplexing. This is a method of functioning of larger number of inputs through lesser number of pins. This is a minute input devices works based upon the user instructions and proceeds to the microcontroller. They are performed through 0 and 1 which demonstrates the high and low values. This scans the rows and columns when pressed. The matrix keypad is connected with the pins in opposite order. The pin 8 defines the starting stage. They are largely used due to the lower cost with higher efficiency with longer withstanding capacity.

TABLE I. Amount of Energy Consumption

Sl.no	Space for illumination	Utility hours	Light intensity (lux)	Output (watts)	Energy (kWh)
1	Living room	24	300	42.5	42.8
2	Dinning room	12	500	12.9	35.9
3	Kitchen	14	200	5.98	24.9
4	Bedroom	10	300	16.8	6.9
5	Studying room	5	400	25.6	35.5
6	Store room	2	150	17.9	20.1
7	Bathroom	1	125	12.1	10.2

The table I represents the amount of energy consumption in each room in a house. Calculating and monitoring the consumption helps to maintain the demand. This is done to reduce the excessive usage of lights even in day time or forget to turn off the lights leads to increase in the consumption. This leads to increase the demand in the supply system. To maintain the demand side management in both the domestic and industrial applications, the proposed system provides a optimum solution. Through proper utilization nearly 35% of the power can be saved.

IV. Simulation Results

The implementation of the proposed system is monitored and calculated through simulation output. This helps to estimate the consumption of power, thyristor functioning, control of illuminance lamp during day and night times are observed. This gives an appropriate value of

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illuminance in lux and the amount of power consumed throughout the day and proceeded with months. This is done through the MATLAB Simulink.

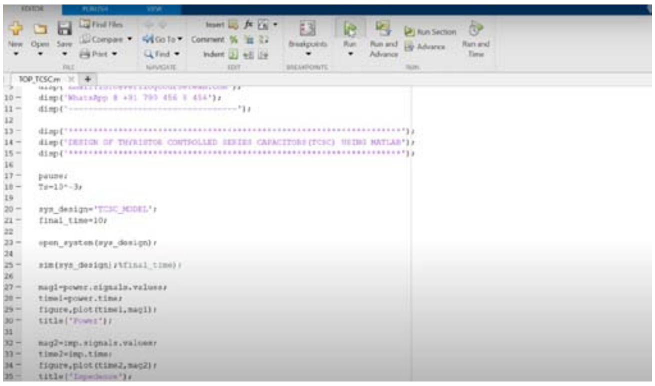
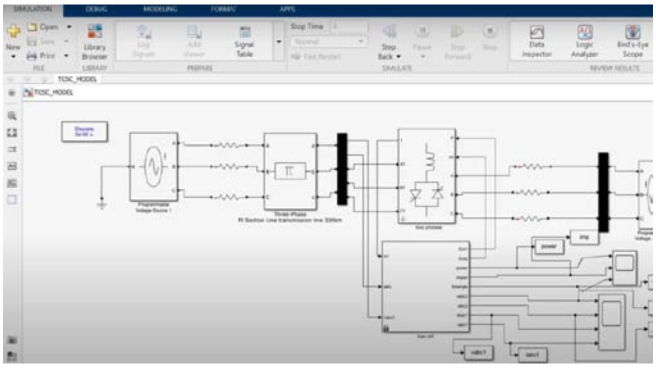


Fig 7 : Implementation of system

The figure 7 represents the implementation of the proposed system in MATLAB.



Fg 8 : Simulation diagram

The figure 8 demonstrates the simulation diagram. This includes thyristor, LDR, sensors and LED lamps. The readings are denoted to extract the output function. They are analyzed through varying the voltage values. Thus the illuminnace of the lamp gets deviated based upon the change in voltage. This helps in the control of illuminance in the lamp.

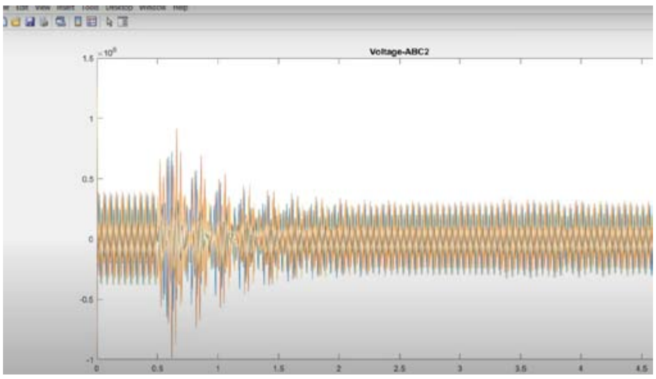


Fig 9 : Capacitor voltage

The figure 9 represents the capacitor voltage at charged condition. The capacitor in the system are connected across the supply system. This is used to make rectifications in the power factor. The occurrence of arc caused by the inductance are reduced by the capacitor.

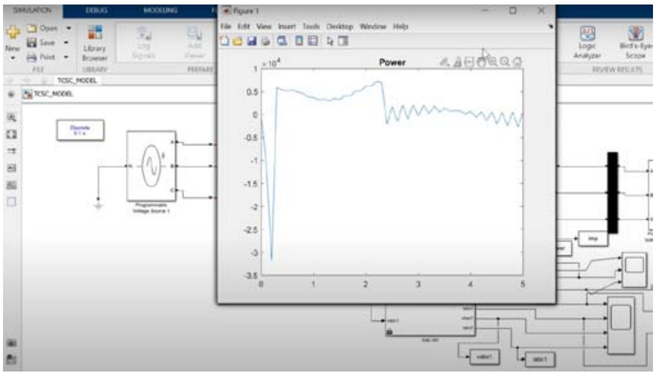


Fig 10: Output power

The figure 10 represents the output power. This helps to estimate and calculate the amount of power consumption.

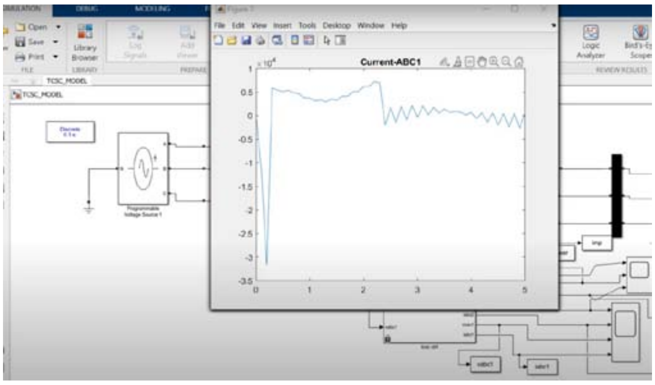


Fig 11 : Output current

The figure 11 represents the output current. The current rating is 0.2 A.

V. Hardware Description

The proposed model is implemented through hardware prototype to estimate and evaluate the functioning of the proposed system. This helps to calculate the amount of energy consumption. The overall illuminance control of lamp is intimated as message to the user’s phone. This is implemented through internet of things. This helps to automatically detect the working of the lamp and able to provide instructions to the system.

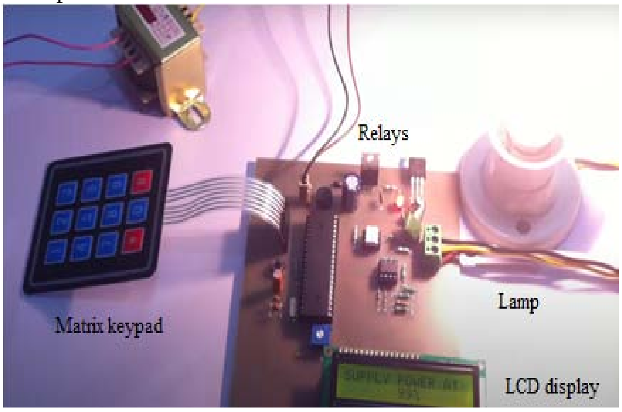


Fig 12 : Hardware representation

The figure 12 demonstrates the hardware representation of the proposed system. Thus the control of illuminance is achieved.

VI. CONCLUSION

The control of illuminance of lamp is introduced through control and monitoring system using matrix keypad is implemented experimentally through internet of things. They are adopted through controlling the illuminance through manually and automatically. This is also done through balancing switching techniques. The automation in illumination is done through thyristor control with control parameters. This helps to provide optimum illumination through automatic control for both the indoor and outdoor lighting system through balancing the illuminance and luminance. The matrix keypad is used to reduce the number of pins through integrating rows and columns. The internet of things are employed to enhance the communication system from one end to another end. The functioning of the lamp can be controlled through the user even at remote places. Thus the proposed system helps to control the illuminance through thyristor control that helps in reduction of energy consumption. This proposed system helps to obtain higher efficiency when associated to the conventional organisation.

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Online Examination Portal for Effective Assesment

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Abstract—The aim of the work is to develop an online exam and classroom portal which can serve as the advancement in terms of examination pattern and educational services in today's virtual life. The project aims to provide a platform with easy-to-use interface. The central nature of the work needs to save time and increase the accuracy aspect of the work as the demand for the sme is rapidly increasing. Not only does this benefit the students, but it also helps the administrators or professionals like teachers who can work seamlessly on the backend through a well-designed interface. The work has also introduced its own randomizer to implement random logic The project can serve as a perfect service to the educational industry.

I. Introduction

The project aims to develop a virtual platform for students to have an easy access to their classrooms as well as their examination portal, all at one place. This project will be developed with a vision to solve the problems of not just the examiner but the examinee too, with a modern GUI and integrated platforms and plagiarism checks, it will be beneficial to not one but many users who use it including the students as well as the teachers.

II. Literature Survey

We have conducted a survey about 14 research papers from different conferences across various journals. We have noted down a lot of points, both positive and negative. We came across a paper which discussed the implementation of a similar kind of application in the MVC architecture. On consider the perks of the deployment we decided that the best way to approach our project was the MTV(Model-Template-View) approach. We also came across various AI algorithms to implement remote proctoring systems in our system. Randomizing the questions was a tedious task for which we referred some techniques. A paper emphasized on the implementation as an object-oriented approach which was discarded as it was not compactable with our requirements. A paper also recommended tab locking techniques to secure the online testing. Detection of anomalous behavior was also studied in a paper which provides remote proctoring help. Co learning methods was also shown in a paper. Thorough studying of the papers we referred we came across a lot of factors and hence created our own approach to design the portal and implement it in our point of view.

III. Opinion Survey

As the project topic was new and in demand in the current scenario, we conducted a survey to see and evaluate the opinions and gather people's expectations from their view of point. We had created s survey form and spread it across all stakeholders of the education industry. A good response was received from 450+ people from different institutions, we have generalized the requirements. Most of the teachers have complained that managing multiple classes or subjects, so the UI needs to be improved or made such that it can be managed easily. From the students we got a lot of inputs, Improvements were suggested in proctoring systems and meaning stuff. Examinations needed certain amendments from both teachers and students. Considering all the inputs we framed a model for our portal and the design was carefully designed using these all considerations in mind.

IV. Approach

As we are developing a web solution, the front end is designed with HTML, styled by CSS, and the JavaScript included in the code till provide support some functions which ease the user interface and improves the user experience. Python Django is used as the backend along with sqllite3 as the main database. The main advantage of using Django as the framework is that we can use certain AI algorithms using for remote proctoring. MTV architecture plays an important role in the implementations. The design is flexible and open for future improvisations.

V. Architecture

The most basic architecture for running the whole implementation is the MTV architecture over MVC architecture. It increases the speed and performance of the model.

A. *MTV Architecture*

The major advantage of using the MVT over MVC is that in MTV Flow is sometimes harder to understand as compared to MVC., URL pattern mapping takes place, Controller part is managed by the framework itself.

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Modifications are easy, the application is loosely coupled, and it is suitable for small and large projects.

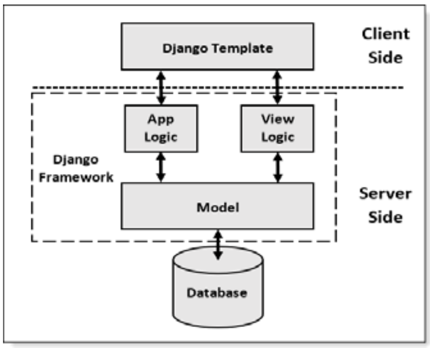

Fig 1. Standard MTV Architecture

VI. Algorithms Used

As security is one of the most important concerns in modern day projects, we used the famous Secure Hash Algorithm (SHA 1) in our project to implement security.

B. *Secure Hash Algorithm*

Hash algorithms are usually used to provide security to any form of confidential data. The major advantage of using hashes is that it uses encoding and comparison instead of classical decryption adding more to the confidentiality element of security.

SHA is used over MD5 as it is the latest version and has more strength over message digests. However, this consumes a little bit more memory, which may not be a major concern in implementation.

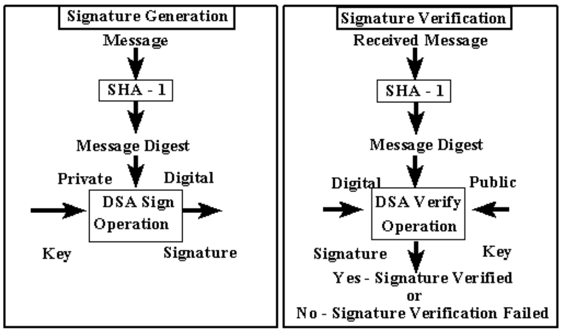

Fig 2. SHA Algorithm

C. *Randomizer Algorithm*

This algorithm is basically used to shuffle the questions in case of an examination or can be also used wherever we need randomization.

This algorithm comprises a pseudo random generator, upon providing the input the pseudo random generator generates a bit stream exactly of the same length as given in the input. The bit stream is then incubated with the data and hence the randomized data is incorporated.

Then again after the process the shuffled data is again sent through a filter which checks the data for further any discrepancy and then commutes the final data to the client ot the user.

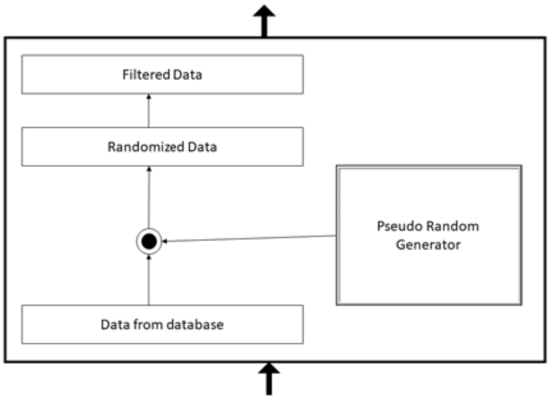

Fig 3. Randomizer Algorithm

VII. Modules Of The Product

The most basic architecture for running the whole implementation is the MTV architecture over MVC architecture. It increases the speed and performance of the model.

D. *Administrator Based*

- Can monitor the activity logs of all the users.
- Can add/remove users.
- Defines departments, classes, subjects and assigns them to the particular instructor, teacher.
- Add new events to the calendar.
- Generate and release results.
- Monitor overall progress for the entities.
- Simulate the working of modules overall.
- Keep eye on all the assignments and documents uploaded at different times at a single place.
- Use search option at all stages for better interactions.
- Perform audits.

E. *Teacher Based*

- Can create, invite, and organize different classrooms for students.
- Take regular classes and their backups.
- Provide study material, give it access controls and manage multiple classes data simultaneously.
- Create assignments with deadlines, alter them, evaluate them, and grade them.
- Create and conduct examinations using features of our remote proctoring system and examination environment.
- Run plagiarism checks on assignments and examination answer scripts.

F. *Student Based*

- The student can join any class, but only an approval is sent and only when the instructor validates it one can be part of it.
- He can attend classes, check for assignments, see pending tasks, see backdated data at his own ease.

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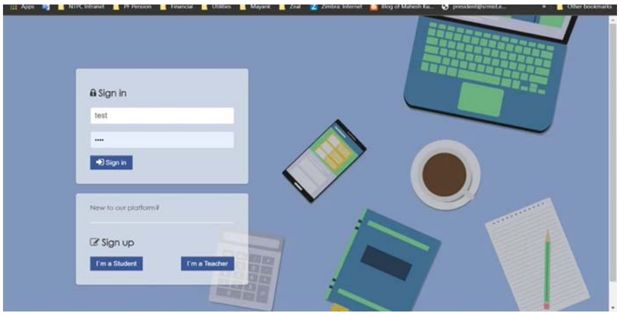
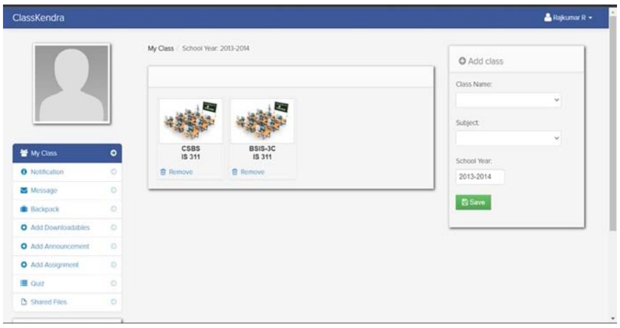
- Can request back data of a particular instance from the controller.

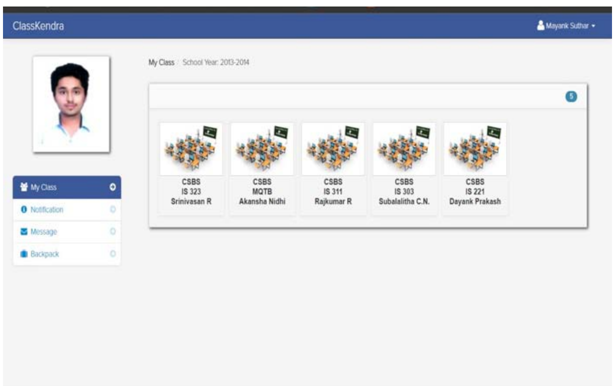
Role specific tasks can be introduced, but it needs the server to be strong enough as the complexity increases.

Security of the system has a large scale for improvement for and can be improved in further years by implementing blockchain technology.

VIII. Implementation And Result







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Diet Recommendation System Using Machine Learning

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***Abstract* — A healthy diet is vital for maintaining overall health and well-being. It is essential to ensure that we consume a variety of nutrient-rich foods. The importance of a healthy diet is underestimated and we as humans often don't focus on the food we are consuming and if it is fulfilling the nutritional requirements of our body. Having a healthy diet can boost our immune system, It aids in maintaining a healthy weight, enhances mental and emotional well-being, and lowers the chance of developing chronic diseases. The quantity of energy provided by food is measured in terms of calories. Every day, we use calories to perform essential bodily functions such as breathing, moving around, walking, running, and more. An average person requires 2000 calories in their daily life but the precise amount depends on the physical attributes of a person like body weight, height, age, BMI etc. The food we consume everyday has a significant impact on our body. Consuming a balanced diet in conjunction with regular physical activity can promote overall health and well-being, leading to a better quality of life. Following a healthy diet is a difficult task firstly, unhealthy food options are often more readily available, cheaper, and more convenient than healthier alternatives. Additionally, many people have busy schedules that leave little time for meal planning and preparation, hence there is a need for a personalized diet recommendation which is based on a person's preferences. Diet recommendation system can save time and effort for individuals who may not have the knowledge or resources to create a healthy diet plan themselves. By providing personalized recommendations, the system can simplify the process of meal planning and make it easier to maintain a healthy diet in the long run. Machine Learning can be used to provide a solution to this problem, using Machine learning an alternative diet can be provided to the user which is familiar to their daily diet and fulfils the nutritional requirement of the body. The recommendation system provides a healthy diet for any person and devises a meal plan tailored to meet the requirements of the individual. It additionally suggests a diet program for people suffering from specific nutrition deficiencies such as Goiter, Osteoporosis, Anemia.**

Keywords*— *BMI, Machine Learning, Recommendation System, Calorie, Nutritional Deficiency.

I. Introduction

Health plays an important role in every human's life. What we end up consuming as humans impacts our health , hence it is essential to have a complete food diet which provides all the essential nutrients required by the body. Due to our hectic daily routine, it becomes difficult to follow a diet which provides all the nutrients required by our body. Not having a healthy diet can have a negative impact on our body, hence a solution to this problem is proposed by the diet recommendation system. The suggested system aims to assist the user in suggesting dietary plans for weight loss, weight gain or if they are suffering from a nutrition deficiency. In this paper we have modelled a diet recommendation system which provides a solution weight loss and weight gain in the form of a healthy diet plan. It also focuses on some specific diseases caused due to nutrition deficiency. The diseases covered by our system are Anemia, Osteoporosis, Goiter. Anemia is caused due to deficiency of iron, Osteoporosis due to deficiency of Calcium and Goiter due to deficiency of iodine. These illnesses are the most prevalent among people, necessitating regular health monitoring and treatment. The recommendation system is designed to offer information that aligns with the user's specific needs and limitations. Our system has been divided into two modules 1. Diet for Weight Loss / Weight Gain 2. Diet for specific nutrition deficiency.

The upcoming part of the paper is structured as follows: A literature review is present in Section 2. Section 3 presents the suggested methodology. Workflow of the system is described in Section 4. Section 5 provided the output and the result of the system. Section 6 provides with the conclusion of the project. Section 7 provides directions for future research.

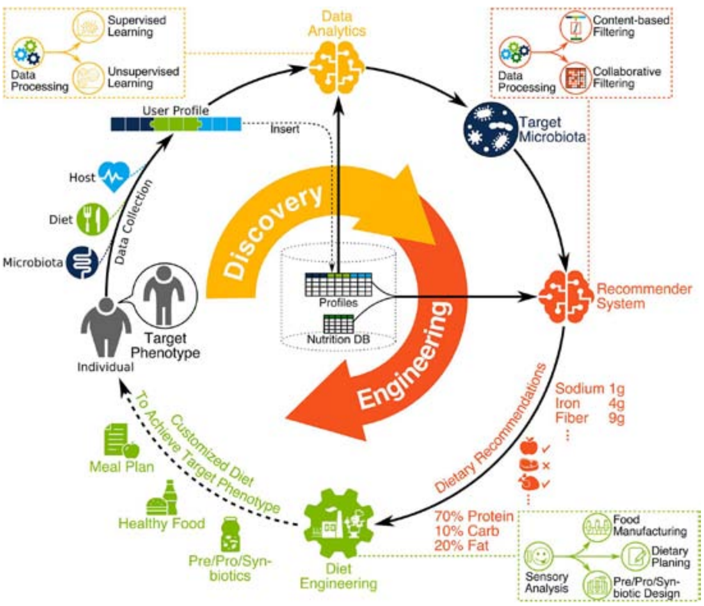

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Fig.1. Working of a Diet Recommendation System

II. Literature Survey

In [1], a health care recommendation system was developed by utilizing an ontology framework for providing recommendations regarding exercise and food. The available dataset was used to extract user information using the decision tree technique. Maintaining the Integrity of the Specifications.

In [2], four different type of algorithms were used (namely k-nearest neighbors, Random forest, AdaBoost, Support vector machine SVM) to monitor the health of patients with LQTS genetic disorder. Random forest algorithm yielded better accuracy and score (60% to 70%) than the other three algorithms. The system identified patients who are at a high risk of cardiac complications by analyzing their ECGs.

[3] employed three different types of algorithms (random forest, logistic regression, gradient boosting) to monitor and verify the Fitbit credentials of a user. The logistic regression algorithm achieved higher accuracy and score (87%) compared to the other two algorithms.

In [4], the model uses the correlation between several resources to build the recommendation. Resources are referred to in content-based recommendation systems as a vector of attributes. Based on the features of the objects the user has assessed, the system then develops a profile of the user's interests. The algorithm looks at the connections between other products and the products that users have evaluated in order to forecast customer preferences. It accomplishes this by comparing the features or qualities of the various items. This helps the system determine which products are most likely to appeal to a given user based on their historical behavior and preferences.

The system created by Romeshwar Sookrah et al. [5] has a recommendation engine that gives hypertension patients tailored food regimens using content-based filtering and machine learning techniques. The recommendation engine takes into account various factors such as age, allergies, food preferences, alcohol consumption and smoking, blood pressure, and dietary intake to generate personalized diet plans for each user. This system is available as a smartphone application that is user-friendly and portable. Based on a survey, the application has been found to assist users in regulating and decreasing their blood pressure.

A recommendation system has been created for dietary food in [6], which takes into account patients' health conditions and other features, by utilizing gated recurrent network and K-clique algorithms. The dataset obtained from the internet has been processed, encoded, and organized based on similarities before being utilized to train the model. The gated recurrent network algorithm was utilized to enable faster training of the model. The developed design has undergone training, testing, and cross-validation. The outcomes of these processes demonstrate that the proposed system outperforms other machine learning and deep learning procedures that are similar to RNN, MLP, Navies' Bayes and Logistic Regression and in terms of precision and accuracy.

III. Proposed Methodology

The diet recommendation system utilizes algorithms and data analysis to provide personalized diet plans and recommendations to users. The systems take into account various factors such as gender, age, height, weight, body mass index. Personalized diet is provided with the use of K-means algorithm which categorizes the given food items on the basis of breakfast, lunch and Dinner then Random Forest algorithm is used to choose the food items based on its attributes such as calories, amount of Calcium, Sugar, iron, iodine, etc.

A. *About the Dataset*

The dataset consists of nutrition values of 90 food items. The columns are display the different nutrition values for example: Amount of Calories, fat, sugar, Calcium, Potassium present in a particular food item. The feature selection depends on the specific food nutrient on which the recommendation is focused.

A	B	C	D	E	F	G	H	I
Food_iter	Breakfast	Lunch	Dinner	VegNovVe	Calories	Fats	Proteins	Iron
Asparagus	0	1	1		22	0.2	2.4	0.91
Avocados	1	0	0	0	160	15	2	0.55
Bananas	1	0	0	0	89	0.3	1.1	0.26
Bagels ma	0	1	1	0	250	1.5	10	2.76
Berries	1	0	0	0	349	0.4	14	6.8
Brocolli	0	1	1	0	25	0.5	3.8	1.27
Brown Ric	0	1	1	0	362	2.7	7.5	1.8
Cauliflow	0	1	1	0	32	0.3	3	0.72
American	1	0	0	0	331	24	20	0.84
Coffee	1	0	0	0	2	0	0.3	0.02
Corn	1	1	1	0	97	1.4	3.3	0.55
Dark choc	0	0	1	0	556	32	5.5	2.13
Grapes	1	0	0	0	93	2.1	5.6	2.63
Milk	1	0	1	0	97	6.9	3.8	0.12
Cashew N	1	0	0	0	553	44	18	6.68
Onions	0	1	1	0	40	0.1	1.1	0.21
Orange	1	0	0	0	97	0.2	1.5	0.8
Pasta canr	0	1	1	0	71	0.7	2.2	0.91

Fig. 2. Dataset used

B. *K – Means Algorithm*

K-Means algorithm is an un-supervised algorithm which is used to group unlabeled dataset into different clusters.

The k-means algorithm begins by selecting the desired number of clusters (k) and randomly assigning centroids to them. Each data point is then assigned to the nearest centroid, creating k clusters. The centroids of each cluster are adjusted by computing the mean of the data points within that cluster.

The process is repeated until the centroids remains stable or until a maximum number of iterations allowed is attained.

The procedure for the algorithm is as follows:

1) *Selecting the Number of Clusters to be made*
2) *Selecting the centroids of clusters randomly.*
3) *Assigning datapoints to each of the predefined clusters based on the distance from the centroid of each cluster.*
4) *Calculating the variance and recalculating the centroids of each cluster.*
5) *Reassigning each datapoint to the new closest centroid of each cluster.*

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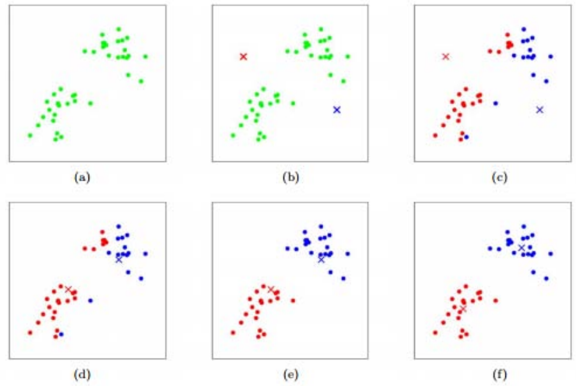
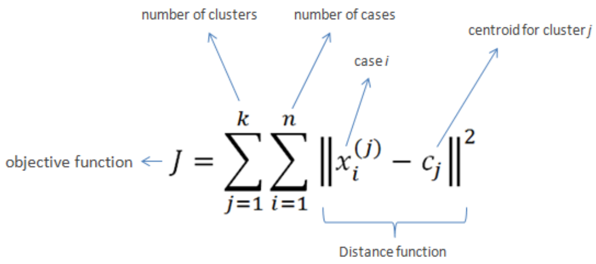


Fig. 3. Steps of K-Means Algorithm



$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2$$

Fig. 4. Euclidean distance formula from centroid

C. *Random Forest Algorithm*

The popular machine learning algorithm Random Forest is a component of the supervised learning approach. It can be used to solve problems using ML Classification and Regression. The principle of ensemble learning, which is the act of combining different classifiers to solve a difficult problem and improve the performance of the model, serves as its theoretical underpinning.

In order to improve the predicted accuracy of the dataset, the Random Forest classifier, as its name suggests, "contains a number of decision trees on diverse subsets of the input dataset and takes the average." The random forest uses forecasts from all of the trees, rather than relying on just one, to predict the result based on which predictions earned the most votes.

Random Forest works based on the following assumptions, since there is a chance that while some decision trees will correctly predict the output, whereas some others decision tress might not. But together, these trees will correctly predict the right output. Therefore, these 2 assumptions are to be made for better forest classifier:

- There must be some actual values in the dataset for the feature variable to forecast actual outcomes as opposed to speculative outcomes.
- The prediction of each tree must have very low correlations between them.

First, N decision trees are combined to generate the random forest, and then predictions are made for each tree that was produced in the first phase.

The Working Process is as follows:

1. Select K random data points for the dataset.
2. Make decision trees connected to the selected data points. (Subsets)
3. Choose N for any decision trees you plan to build.
4. Repeat the 1st and 2nd steps.
5. Locate the forecasts from each decision tree for any new data points, then group them into the category with the most support.

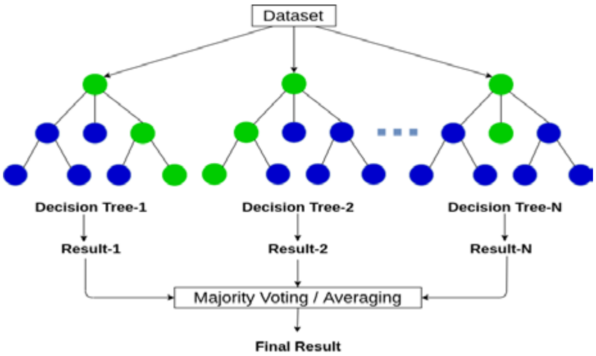


Figure 5. Working of the Random Forest Algorithm

IV. Proposed Workflow

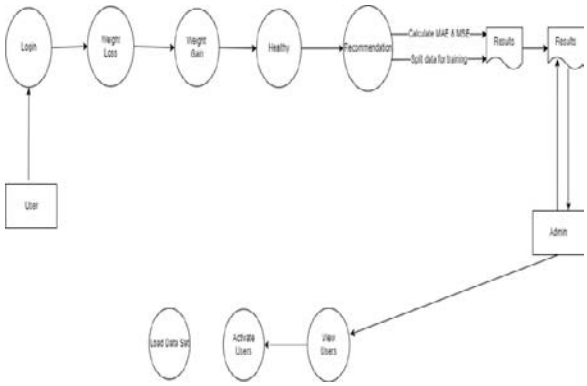


Fig. 6. Architecture Diagram for the Project

D. *Front End Workflow*

At the Front end, the user has to register to the application initially. After registering, the user enters their health information i.e. User weight, Height , Age and the nutrient deficiency they are suffering from. Based on the user information, the recommendation system in the back end of the project provides a suitable diet for the user which gets displayed on the user interface.

HTML, CSS and JavaScript languages are used to develop the application and Django is used to provide the back-end server-side framework for the recommendation system. The key reason of using Django is that it provides built in features which allow the development of the application to be quick and efficient. Django is also highly scalable and is capable of handling heavy workload.

E. *Data Preprocessing*

In order to separate the breakfast, lunch and dinner food items one hot encoding is performed on the data . Hence,

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food items are categorized based on the meal in which they are consumed.

F. Recommendation System

The clustering of various food nutrients based which are essential for weight loss, weight gain or dealing with a specific nutrition deficiency is performed. Clusters for the nutrients are made with the use of K–Means Algorithm. With the help of K–means algorithm nutrient specific clusters are formed. Using these clusters, food items are recommended based on the user input.

Random Forest Classifier takes the k -means based clusters as input and predicts the food item for the user based on the user's input. The nearest food items which are best suited for the user are hence predicted. Random Forest classifiers provides the output from various decision trees and it makes sure the best decision tree is used to predict an outcome.

This process is performed on breakfast, lunch and Dinner food items and a list of all the recommended items is displayed to the user as final output.

V. RESULT AND OUTPUT

- Install Django, Pandas and other required packages to the device that will act as a server for the web application
- Run the "manage.py" script as sever using the command "python manage.py runserver" in the command prompt with the file location as target.
- Once the server starts running access it using any web browser
- The user has to register by selecting the "REGISTER" option in the top-right side of the home page and entering the required information of the user in the "User Registration Form".

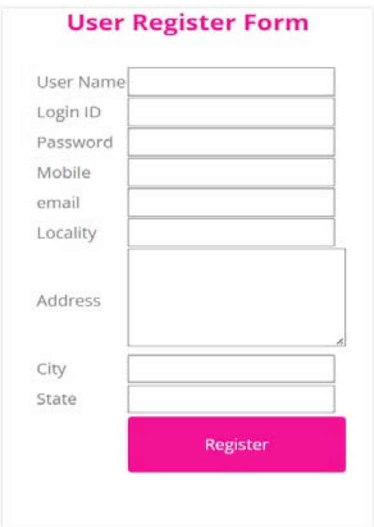

Fig. 7. User registration Form

- Once registered the user needs to be accepted by the admin in order to login and use the service.
- After register with username and creating a password to use this system. Login with registered username and password.

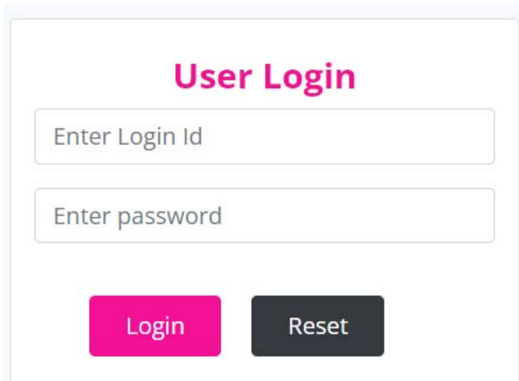

Fig. 8. Login page

- Once logged in, the user can get their diet based on their BMI or deficiency by selecting "BMI-DIET" or "DISEASE-DIET" on the top right corner.
- Once the user, enters their age, Veg/ Non_veg preference, weight and height in the "BMI-DIET" page and selects recommend option the system will give a recommended list of items for consumption based on the users BMI Index.
- User profile is created by height, weight and age, to estimate the BMI of user.

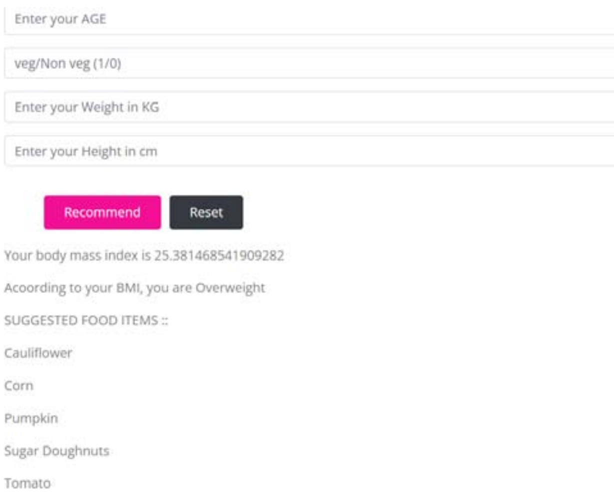

Fig. 9. BMI-DIET page with output

The diet is recommended in such a way as to return the users BMI back to the normal range by controlling the calories and making sure that no other nutrients levels are compromised.

This enables the user to follow a health and well-balanced diet based on his BMI in order to tackle obesity and underweight disorders.

- Once the user selects the nutritional disease on the "DISEASE-DIET" page the system recommends a list of

DOI: rp-9788770040723.216

food items recommended for consumption in order to prevent/fight the disease.

Figure 10. DISEASE_DIET page with output for diabetes

- The food items recommend in the figure 10, are suitable for users to fight/prevent against diabetes
- The nutritional content of the food items suggested are as given below in the figure 11

Food_items	Breakfast	Lunch	Dinner	VegNovVeg	Calories	Fats	Proteins	Iron	Calcium	Sodium	Potassium	Carbohydrates	Fibre	VitaminD	Sugars
Asparagus Cooked	0	1	1		22	0.2	2.4	0.91	23	14	224	4.1	2	0	1.3
Brocolli	0	1	1	0	25	0.5	3.8	1.27	118	56	343	3.1	2.8	0	0.6
Cauliflower	0	1	1	0	32	0.3	3	0.72	32	259	278	6.3	3.3	0	0
Coffee	1	0	0	0	2	0	0.3	0.02	2	1	50	0.2	0	0	0
Onions	0	1	1	0	40	0.1	1.1	0.21	23	4	146	9.3	1.7	0	4.2
Pumpkin	0	1	1	0	18	0.1	0.7	0.57	15	237	230	4.3	1.1	0	2.1
Tomato	1	1	1	0	16	0.2	1.2	0.47	5	42	212	3.2	0.9	0	2.63
Mushrooms	1	1	1	0	22	0.3	3.1	0.5	3	5	318	3.3	1	7	2
Green Tea	1	0	0	0	1	0	0.2	0.02	0	1	0.2	0	0	0	0
Tea	1	0	0	0	1	0	0	0.08	2	1	9	0.2	0	0	0
Strawberries	1	0	0	0	32	0.3	0.7	0.41	16	1	153	7.7	2	0	4.9

Fig. 11. Nutritional info of the food recommended

The user that are suffering from diabetes need to take care of their sugar/glucose intake and minimize it in order to fight/prevent diabetes. These food items have very low amount of sugar and glucose content when compared to other food items.

These food recommendations not only cut down the users intake of sugar but also allows users to take a balanced amount of other nutrients and stay health and fit.

These food nutritional values are based on USDA organization. USDA is a food database that contains the food items and their nutritional values.

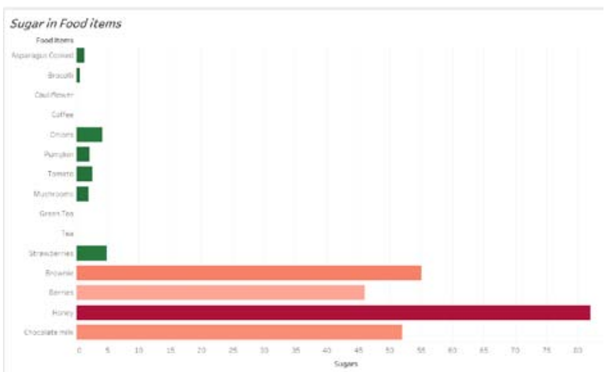

Fig. 12. Comparison of sugar content in recommended food items and other food items

Figure 12 shows the sugar/glucose content of the recommended food items in comparison with the other food items not being recommended by the system in order to prevent diabetes.

The food items that are not recommended by the system and have a high quantity of sugar content in them are highlighted in red, whereas the food items recommended are coloured green, these food items are suitable for consumption for the user as they provide with all the other necessary nutrients, making a well-balanced diet.

- Once the user is done with the information and the web page, he can logout of the webserver or close the webpage as a whole.

V. Conclusion

A diet recommendation system that caters to the user's nutritional demands was successfully built. Using the user's BMI and diet preferences, a personalized diet was generated from the list of food items available in the dataset used for this project which can help them improve their health and lead a disease-free life. The complex task of searching for a diet which is capable of providing all the nutrients required by the human body was made easy with the help of Machine Learning. By following the nutrition recommendations, users can maintain and enhance their overall health.

VI. Future Scope

As we all know, Exercise and a healthy diet are essential components of a healthy lifestyle. In addition to engaging in regular physical activity, it is crucial to maintain a balanced and diverse diet that includes fruits, vegetables, whole grains, lean proteins, and healthy fats in order to achieve optimal health. By combining these two lifestyle factors, the body can receive the necessary nutrients to function efficiently and maintain overall well-being. Keeping in mind the importance of physical exercise, an additional functionality to the present project which provides the user a regular exercise routine according to their health status can help improve the results in terms of a person's health. The user can follow the workout plan provided to them and be aware of the number of calories which are burnt while following the exercise routine. This functionality will improve the overall health of the user.

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Parkinson Disease Prediction Using Deep Learning Algorithm

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***Abstract*—Parkinson's is a neurological disorder that worsens over time. People have trouble communicating, writing, walking, or doing other basic activities once dopamine-producing neurons in specific regions of the brain are damaged or die. Over time, these symptoms worsen the seriousness of the patients' situation. Using Parkinson's Visual Large Dataset from UCI patient populations, which would be dependent on healthy as well as unhealthy of spiral and wave data, we present a technique in this study for determining the prevalence of Parkinson's disease. We have designed a neural network to detect the disorder and predict the severity of the condition. Here, we identify Parkinson's disease using two deep learning models: the convolution neural network and the Alex net. Additionally, this project seeks to investigate how to recognize the Parkinson patient using image data such as healthy and unhealthy spiral and wave data since various databases may record various aspects of this disease. Here, we employ a five-step process that includes data gathering, pre-processing, model application, classification, and estimation based on user-selected input data. Results of the experiments demonstrated the system's improved efficiency. Finally, we compare the classification report and model accuracy score to demonstrate which algorithm is optimal for the system's prediction.**

Keywords—Artificial Intelligence, Deep Learning, Convolution Neural Network, Alex net Algorithm, Parkinson Disease Prediction, Medical Diagnosis, Image Processing, Computer Vision, Python Programming Language, Juypter Notebook Tool.

I. Introduction

According to a recent World Health Organization study, Parkinson's disease patients are becoming more numerous and have a greater health burden. This illness is spreading so quickly in China that it may affect half the population within the next ten years, according to estimates. In the medical industry, classification algorithms are primarily used to divide data into various groups based on a variety of

Characteristics. Anxiety, breathing issues, depression, lack of smell, and speech changes are some of the non-motor signs. If the individual exhibits any of the aforementioned symptoms, the information is recorded. Disease prediction is an important step in early disease diagnosis in the contemporary, overpopulated world. The prediction has gotten much easier thanks to the development of different deep learning algorithms. A precision of the algorithm is, however, significantly impacted by the complexity and choice of the best deep learning method for the provided dataset. [1] The alteration in voice and speaking is one of the traits of PD. The United Parkinson's Disease Symptom Rating System (UPDRS), which measures the frequency and severity of symptoms, is used to monitor the development of PD symptoms. The UPDRS is regarded as the most popular clinical rating system and a reliable test for evaluating Parkinson's patients. [2]

Our body is primarily controlled by the brain. As a result, any harm to this delicate area of a human body will have a negative impact but in the other organs. The condition Parkinson's disease is one of these adverse consequences. Disease (PD) is a long-term, progressive neurodegenerative condition that starts with damage to a specific part of the brain. Particularly in the early phases of these diseases, essential tremor and normal ageing both share symptoms with Parkinson's disease (PD). To ensure that the patient receives the proper care, it is crucial to distinguish among PD and other illnesses. Another of the disorders that develops when cells in the substantial area of the brain stop functioning correctly or are damaged is PD. According to the reports, this condition is generally referred to as a persistent, progressive neurodegenerative illness. People all over the globe suffer from PD, particularly in nations where the median age of the populace is high. Approximately 10 million people globally, including 1 million Americans, have PD, according to the Parkinson's Disease Foundation (2015) [3].

A recent development in the area of neural networks is deep learning. It is a subset of machine learning that works with unstructured (hierarchical) data types like text, voice, and images. A deep system is the human neural system as well. A subset of machine learning called "Deep Learning" works with algorithms that are modeled after the structure and operation of the human mind. With the system's unorganized data, deep learning is mostly used. A machine learning method is deep learning. It trains a computer how to classify and predict information by layering filters over inputs. The way the human mind filters information is the source of motivation for deep learning. Its goal is to imitate how well the human brain functions to perform some true wizardry. There are approximately one hundred billion synapses in the human brain. About 100,000 of each neuron's partners are connected to it[4]. That is how a deep learning system works! You incorporate your feedback into one layer after gathering input from observation. The output of that layer serves as the stimulus for the subsequent layer, and so forth. This keeps happening until you get your ultimate output signal. A transmission or signals are received by the neuron (node) and travel through the neuron. The output signal is sent out by that cell.[5].

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I. Main Contribution Of Our Project

Our project's primary contribution is the use of deep learning algorithms, CNN, and Alex net, to estimate the patient condition in both normal and Parkinson's disease using two sets of images: the spiral and wave dataset. Follow the steps in our instructions to propose our system model.

- Dataset collection is the first stage; here, we gather data in image format for Parkinson categories depending on normal as well as abnormal.
- The data pre-processing phase is the second step, and image data-generator method is used here.
- The model implementation step comes next. To train and evaluate the model, we use deep learning models like CNN and Alex net.
- The following stage is classification and prediction, which divides the data into normal and abnormal PD patients. The user chooses any form of output image in the prediction section based on the normal and abnormal behavior of PD patients.
- Finally, we calculate performance measures such as accuracy and classification report estimates using the CNN and Alex net algorithms. Which algorithm is the best to predict in terms of the system's accuracy.
- The outcome of this paper showed that our system is composed of five chapters: the introduction, the literature review, the proposed methodology, the results and discussion, and the conclusion.

III. Literature Review

Wingate, J et al., "Unified deep learning method for Parkinson's disease prediction". The research offers a novel method for using medical imaging to diagnose Parkinson's disease that is based on deep learning. The method involves the analysis and application of information gleaned from deep convolution as well as recurrent neural networks trained on medical images like dopamine transporter scans and magnetic resonance images. Interior representations of the learned DNNs make up the extracted knowledge that is applied via learning algorithms and domain adaptation to produce a coherent framework for Parkinson's disease prognosis across various healthcare settings. A sizable experimental study is given to demonstrate how the suggested method can accurately predict Parkinson's disease using various medical image sets taken in actual settings [6].

Boutet, A et al., "Utilizing fully functioning MRI and machine learning to forecast the best deep neural stimulation parameters for Parkinson's illness ". Deep brain stimulation (DBS), which is frequently used to treat Parkinson's disease (PD), delivers notable therapeutic advantages when optimized. However, it takes multiple clinic appointments to evaluate the wide range of stimulation settings (i.e., programming). Here, we investigate the possibility of predicting the most effective stimulation parameters for specific individuals using functional mri (fMRI). In previously unseen datasets of both clinically optimized and stimulation-unaware PD patients, the model forecasts the ideal stimulation settings. We suggest that an empirical biomarker of clinical reaction could be found in the MRI brain activation to DBS treatment in PD patients. These results may pave the way for cognitive imaging-assisted DBS programming after further confirmation with additional research [7].

Wang, W et al., "Transfer learning as well as machine learning for early Parkinson's disease diagnosis ". In order to stop the progression of Parkinson's disease (PD) and give people access to disease-modifying therapy, accurate early detection of PD is unquestionably essential. The premotor period in Parkinson should be closely watched in order to achieve this goal. An innovative deep-learning method is presented to quickly determine whether a person has Parkinson or not based on premotor characteristics. A contrast between the suggested deep learning model with twelve learning algorithms and ensemble learning techniques using only a small sample size of 183 healthy subjects and 401 early PD patients demonstrates the designed model's superior detection performance, which averages the highest accuracy of 96.45%.[8]

Chintalapudi, N et al., "Cascaded Deep Learning Frameworks in Contribution to the Detection of Parkinson’s Disease". The precision of illness predictions has increased since computer vision (ML) algorithms have been used in medical diagnoses. In this research, the accuracy of PD diagnosis was evaluated using recurrent neural networks (RNN), multi-layer perception (MLP), and cascaded long-short-term memory (LSTM), which models of neural networks based on audible speech features of PD patients. A database of speech biomarkers from the participants was used to compare the outcomes among the two 3 models. Experimental findings show that the LSTM model outperforms the competitors with 99% accuracy.[9]

Modi, H et al., " PET imaging data for deep learning-based classification of Parkinson illness ". Previously, the PSD was identified by manually examining its signs. Numerous automatic methods to identify the PSD have been developed by researchers around the world. The majority of previous solutions focused less on the PET diagnostic dataset and more on the conventional MRI but also SPECT databases for PSD recognition. Current PET scan dataset-based solutions require human feature extraction and use machine learning methods like SVM and linear regression. We suggested a VGG16-based convolutional neural net (Neural) system to identify the PSD as a result of these. The collection of PET scan images, which is gathered from the PPMI source, is automatically processed to extract features. Selectivity, accurate, sensitivity, and precision are used to assess the proposed system's performance; these metrics yield results of 97% and 84%, 70%, as well as 96.7%, accordingly.[10]

Sahu, L et al., " Effective Parkinson's disease diagnosis using deep learning methods over medical data ". In this study, the illness is accurately diagnosed by probability estimation using the combination of two neural network tools, RA and ANN. In RA, data preprocessing and likelihood estimation are carried out. The second method currently in use compares a patient's PD status to a neuron's

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predetermined cutoff value. The estimation is done using a collection of data that includes people's pulse rates, iron contents, and speech recognition. The suggested method is contrasted with other methods, such as SVM as well as k-NN classifier. The calculated outcome shows that the suggested algorithm is superior with 93.46% accuracy.[11]

Vyas, T et al., "Parkinson's illness diagnosis using deep learning". We have used MRI (magnetic resonance imaging) brain images for this reason. With these goals in mind, we have introduced two cutting-edge deep learning (DL) methods. MRI scans in the axial plane are used to teach both two-dimensional and three-dimensional convolution neural networks (CNN). A two-dimensional CNN as well as a three-dimensional CNN model were trained and tested on an entire set of 318 MRI images. Using various evaluation metrics, including reliability, damage, matrix of confusion, we have evaluated the performance of the models. As a result, it can be seen that the three-dimensional model is more precise and trustworthy than the two-dimensional model [12].

Roobini, M. S et al., “Machine Learning for the Detection of Parkinson's disease”. This method investigates the categorization of acoustic input characteristic dataset to identify Parkinson's disease (PD). The classifiers we like to utilize in this system are from machine learning. Parkinson's disease patients typically include low-volume noise with such a monotone quality. The audio features data from of the UCI dataset repository, as well as provision training and XGboost classifiers, are typically used in our approach. The Mathews parametric statistics (MCC) of 89% and the height correctness of 96% produced by XGBoost allowed the algorithm to determine the health of the palladium patient remains healthy.[13]

Pramanik, M et al., “Parkinson's disease detection utilizing acoustic features and machine learning”. In order to identify people with Parkinson's disease in its earliest stages, this article addresses proposed Parkinson's disease detection algorithm. Starting out, the suggested method chooses 24 voice attributes based on how relevant they are to the target detector. A streamlined model of something like the gradient boosting system was used as the target detector to carry out the discrimination task. The proposed method has an accuracy of 83.23%, a sensitivity of 78.57%, and a specificity of 87.95% in detecting Parkinson's disease [14].

Sharma, S et al., “Parkinson's disease detection using automated means”. Hence, for the sick person, symptom tracking is expensive and logistically challenging. Here, for the first time, we have developed a system that could quickly and clinically accurately identify PD by conducting speech, tremor, and handwriting tests, and so further forecast the stage of the disease. This model will serve as a building block for telemonitoring frameworks that will transform extensive medical studies into quick PD treatments. In order to create an automated technique to extract the required biomarkers that will aid in the diagnosis and classification of Parkinson's disease into stages, our study will concentrate on identifying the optimum model.[15]

IV. PROPOSED METHODOLOGY

The suggested methodology covered how our system would be implemented. In our proposed approach, we develop a deep learning method to identify Parkinson's disease and predict the disease's severity. The field of study for Parkinson's disease is important because systemic health of patients can be enhanced by early diagnosis. Here, depending on the patient's healthy and unhealthy conditions, we use the five modules to predict the disease. The first module is a dataset gathering founded on spiral as well as wave images of system patients who are healthy and unwell. The data preprocessing stage in the second module uses an image data generator technique. The deep learning algorithm's model implementation is covered in the third section. Here, CNN and Alex net are the two algorithms we use. The classification model, which is the module after that, uses the system's healthy and unhealthy conditions to forecast disease. The system's accuracy score is used to compute the performance metrics. In order to determine which algorithm is optimal to employ in terms of the accurate measure we can estimate for our system, we first evaluate both computational intelligence accuracy scores. Results of the experiments demonstrated the system's improved efficiency. Here, we use a few key components in our suggested approach to build our system. The components include,

- **MODULE 1:** Dataset collection
- **MODULE 2:** Data preprocessing
- **MODULE 3:** Splitting of dataset
- **MODULE 4**: Model implementation
- **MODULE 5:** Classification
- **MODULE 6:** Prediction

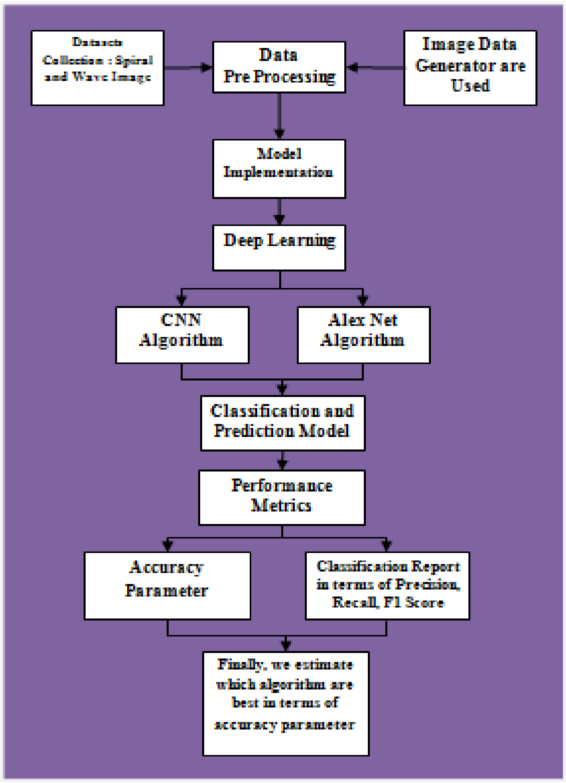

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Fig. 1. Architecture Diagram of our Proposed method

Explanation

Dataset Collection: In order to use analysis of information to discover recurring patterns, data collection enables you to record a record of prior occurrences. You can create forecasting models using deep neural network algorithms that search for trends and forecast future changes based on those patterns. Here, we employ Pictures as a dataset for this assignment. In the context of Category 0 and Category 1, there are two categories of data. A wave collection of healthy as well as unhealthy data is explained for mode 0. The spiral collection of the system's both positive and negative data is explained for Mode 1. The system's Parkinson patient data can be used to create either Model 0 as well as Model 1 databases.

Data preprocessing: Information pre-processing, which entails transforming unorganized data into a more organized structure, may be a part of information mining. Data pre-processing is a technique used in information extraction to transform unusable data into something useful and practical. The method known as the Image Database Generator technique is employed here.In the field of real-time data augmentation, Picture Data Generator is used to create groups that contain data from tensor images. By giving the appropriate settings and the necessary input to the Picture Data Generator resize class, we can use it. To modify the values of pixels from a possible range of 0 to 255 to the range 0-1 recommended for neural network models, use the Image Dataset Generator class. Normalization is the term used to describe scaling data to a 0–1 range.

Splitting of Dataset: When database is separated into multiple categories, this is known as data splitting. A two-part split usually consists of developing the model in one part and assessing or analyzing the data in the other. Data isolation is an essential component of data science, particularly when creating models from data. The simplest method to divide algorithmic knowledge into sets utilized for testing as well as training is to assign a majority of the information elements to the training collection and the remaining 1/3 to the testing set. As a consequence, we train the algorithm on the training set before deploying the model that was learned on the test set. This enables us to evaluate the performance of our algorithm.

Model implementation: Here, we are utilizing deep learning models for this endeavor. In deep learning, the CNN algorithm and the the Alex net algorithm model are used to forecast the occurrence of Parkinson's disease based on the normal and abnormal states of two datasets, such as the spiral as well as wave datasets of acquired images.

CNN: Convolution neural networks are one of the primary types of neural networks used to classify and recognize images. CNN receives a picture as input from the user, which is then categorized and processed in accordance with our users' needs. The pixel density of the picture affects how the computer interprets it as a collection of pixels. It will perceive as height, width, and dimension, depending on the picture resolution. For instance, a grayscale picture is a four * four * a single matrix array, while a picture with RGB values is a six * six * three- matrix array. The CNN method is used in our project to train and learn our datasets, and at the end for prediction the output is displayed based on the user's Parkinson patient.

Alex Net: Alex Net is an eight-layer convolution neural network. The Image Net database contains a pretrained variant of the network that has been learned on over one million images. With its eight layers and deeper design, Alex Net is more capable to derive characteristics from the user's input data. There are eight learnable levels in the Alex net. Relu activation is used in each of the five layers of the model, with the exception of the output layer, which uses maximal pooling followed by three completely connected layers. The alexnet algorithm is primarily used in our project to train and evaluate our data based on system input from users.

Classification: Here, we categorize the information based on two datasets of spiral as well as wave of Parkinson's disease patients using the CNN and Alex net algorithms. The user can input any type of image and based on the system's healthy and unhealthy conditions for Parkinson's disease, the end output will display which type of patient. It can be obtained from both method outputs based on two datasets, such as the system's spiral along with wave of Parkinson's data.

Prediction: The forecast will be made using the Parkinson disease prognosis of a healthy or unwell patient. Finally, the system's classification report and accuracy score are used to compute the success metrics. As a conclusion to our article, we determined which algorithms are best in regard to accuracy score and evaluated them against the system as a whole.

V. Results and Discussion

The results and discussion section can be viewed as the ultimate output graph that displays all of the system's algorithmic results.

Figure 2 depicts the system's Accuracy Graph for the Wave Dataset.

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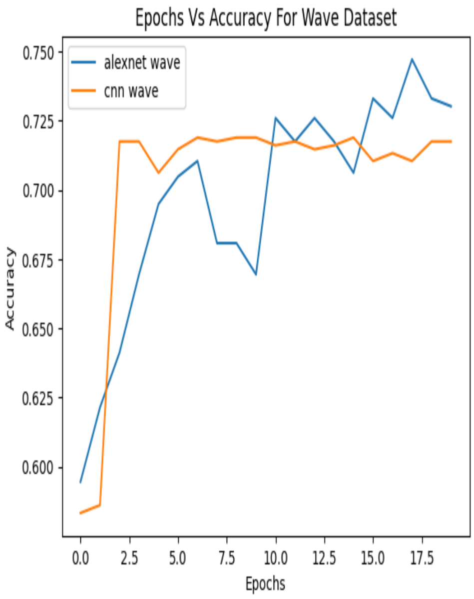

Fig 2 Accuracy Graph of Wave Dataset

Figure 3 depicts the system's Wave Dataset's Loss Graph.

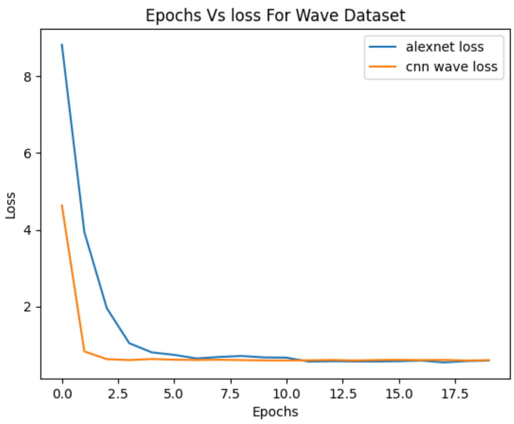

Fig 3 Loss Graph of Spiral Dataset

Figure 4 displays the system's output forecast for the Wave Dataset of Parkinson patient data.

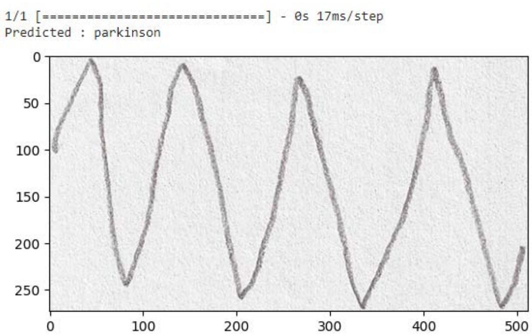

Fig 4 Output Result of Parkinson of Wave

The System Accuracy Curve based on the Spiral Dataset is shown in Figure 5.

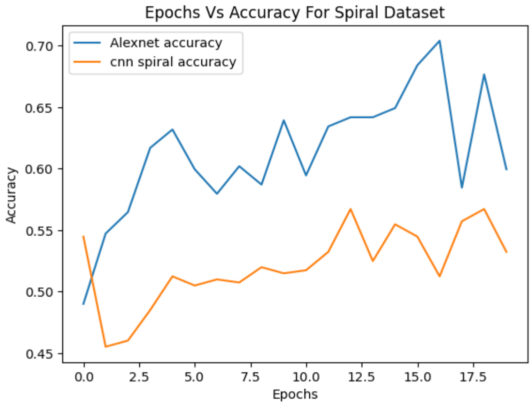

Fig 6 Accuracy Graph of Spiral Dataset

The entire System Spiral Dataset's Loss Diagram is shown in Figure 6.

The output prediction for the Parkinson patient data Spiral Dataset is shown in Figure 7.

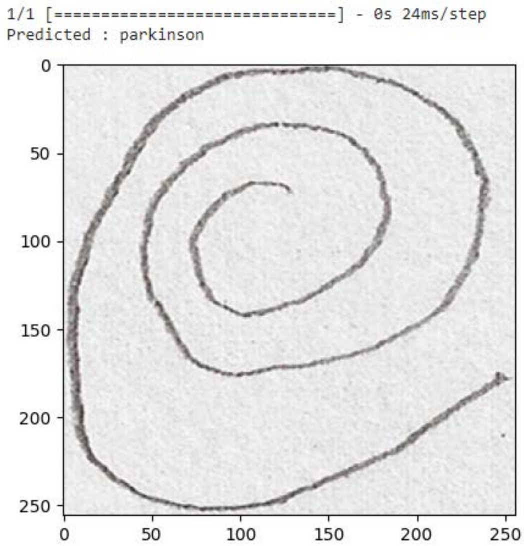

Fig 7. Output result of Spiral Patient

V. Conclusion

In order for predicting the severity of Parkinson's disease, we have employed a network of convolution neural networks in this project. When compared to other methods, the suggested Neural and Alex net models both had higher accuracy. Additionally, the categorization of Parkinson's disease based on two datasets the spiral and wave was discovered. We looked into using deep learning to recognize Parkinson's disease. The simulated workflows were created to examine how well the models trained with deep learning performed on a range of datasets using different deep learning techniques. The processing of some data is the first step in these workflows, which then move on to the classification job and the best results collection. As a result, we came to the conclusion that both algorithm accuracy values were high for the Alexnet algorithm, which demonstrated superior performance and high system performance.

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Pneumonia Disease Prediction Using VGG-16

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***Abstract*—When it comes to image classification and other computer vision problems, the VGG-16 architecture has demonstrated promising results**. In this paper**, we used the VGG-16 model to detect from chest X-ray images, pneumonia.** The total of 5856 **chestX-ray pictures of normal and pneumonia** cases made up the dataset **to train the proposed model. On this dataset, where we trained the model, we attained a high accuracy of 94.3 percent. Pre-processing, data augmentation, and transfer learning** techniques made up the **methodology. Normalization and standardizing the size of the images were both parts of the pre-processing stage. To expand the training dataset and enhance the model's generalizability, data augmentation was used. The pre-trained VGG-16 model, which was enhanced on our dataset, was utilized through transfer learning.**

Keywords—transfer learning, pneumonia, data augmentation, deep learning, normalization

I. Introduction

A significant global cause of morbidity and mortality, particularly in low- and middle-income countries, is pneumonia. For prompt treatment and better patient outcomes, a timely and accurate diagnosis is crucial. To determine if you have pneumonia, chest X-rays are the most popular imaging technique. Yet, radiologists might have to put in a lot of effort and be judgmental when interpreting these images manually. Recent developments in deep learning methodologies have demonstrated promising outcomes in the analysis of medical images, detecting pneumonia from chest X-ray pictures. In this regard, convolutional neural networks (CNNs) have been especially successful, with the VGG-16 architecture being one of the most popular models. This project's objective is to create a pneumonia detection system based on the VGG-16 model. The suggested system will automatically assess chest X-ray images and categorize them as pneumonia cases or normal. Medical professionals can use the system as a screening tool to quickly and effectively identify patients with pneumonia, enabling an earlier diagnosis and course of treatment. Additionally, it can help radiologists interpret chest X-ray images, potentially lightening their load and enhancing the effectiveness of the diagnostic procedure.

II. Literature Survey

A summary of the various studies that have been carried out in this field is provided by the literature survey on pneumonia detection using the VGG-16 architecture. According to the survey, deep learning models built on the VGG-16 architecture have produced results that are highly accurate at distinguishing from chest X-ray images, pneumonia. [1] This research proposes a deep learning algorithm for pneumonia identification using chest X-ray pictures. They apply a convolutional neural network to a batch of 112,120 chest X-ray pictures (CNN) architecture called CheXNet, which is based on the VGG-16 architecture, and they perform at radiologist-level levels. ChestX-ray8: Benchmarks on weakly-supervised classification localisation of, and common using thoracic diseases a hospital-scale a chest X-ray database.

The IEEE meeting on Computer Vision and Pattern Recognition Proceedings, pp. 3462-3471). 108,948 chest X-ray pictures from 32,717 patients with eight prevalent thoracic disorders are part of the ChestX-ray8 dataset, including pneumonia, is introduced in this paper [2]. Additionally, they suggest using the CNN architecture known as ACRNet, which achieves a receiver operating characteristic curve (ROC) area under the curve of 0.92, to detect pneumonia in humans. a network for medical image diagnosis with visual and semantic interpretation. 38(8), 1866–1876 IEEE Transactions on Medical Imaging. This paper [3] suggests a CNN architecture for medical image diagnosis called MDNet that can give both semantic and visual justifications for decisions. They test their model using the ChestX-ray8 dataset, and they are able to detect pneumonia with an AUC-ROC of 0.897.

This paper [4] introduces the Xception architecture, a depth-wise separable convolution-based variation of the Inception architecture. On the ChestX-ray8 dataset, they test their model, and they get an AUC-ROC of 0.922 for pneumonia detection. This study [5] suggests a multi-scale CNN architecture for lung nodule classification that can also be used to identify pneumonia. On the ChestX-ray8 dataset, they test their model, and they come up with an AUC-ROC of 0.946 for the diagnosis of pneumonia. In this essay [6], a hybrid pneumonia deep learning model detection is proposed. It combines a CNN and a assistance vector machine (SVM). On a dataset of 5,056 X-rays of the chest, they test their model, and they achieve a precision of 90%.

This paper [7] suggests a CNN architecture for using an X-ray of the chest to detect pneumonia. On a collection of 5,865 chest They test their model using X-ray scans, and they achieve an AUC-ROC of 0.913 for pneumonia detection. The COVID-Net CNN architecture is suggested in this paper [8], which focuses on detecting COVID-19 using chest X-ray pictures. On a sizable dataset of 13,975 X-rays of the chest, they test their model, and they achieve an AUC-ROC of 0.94 for COVID-19 detection, which includes pneumonia as a symptom.

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This paper [9] suggests a COVID-19 deep learning model screening with CT images. This paper introduces a new dataset called ChestX-ray14K, which contains 14,361 5,485 individuals with 14 prevalent thoracic illnesses had chest X-ray scans, including pneumonia. They evaluate their model on a dataset of 717 CT scans and achieve an AUC-ROC of 0.96 for COVID-19 detection, which includes pneumonia as a symptom. On the ChestX-ray14K dataset, they also suggest a weakly-supervised method for pneumonia detection using a CNN architecture called CP-CAM, which achieves an AUC-ROC of 0.922.

III. METHODOLOGY

A deep learning model is trained on a dataset of X-ray of the chest to categorize them as usual or in situations of pneumonia as part of the suggested approach for pneumonia detection using VGG-16. The foundation of the model is the VGG-16 architecture, which is enhanced on the chest X-ray dataset to enhance its performance on the pneumonia detection task.

Data collection: Chest X-ray images are gathered, including both typical and pneumonia-related images. This dataset ought to be varied and representative of the general public to utilising the model will be applied.

Chest X-ray images are preprocessed in order to make them appropriate for inclusion in the VGG-16 the prototype might entail pixel values are normalised, the photos are resized, and using any required image augmentation methods (like rotation or flipping). In order to classify images, preprocessing tasks frequently involve normalizing and resizing the images to a standard size. During normalization, the image's pixel values are scaled to lie between 0 and 1 or -1 and 1. This contributes to the model's training-related stability and increases the effectiveness of the optimization process. Contrarily, resizing entails scaling the images to a specific size, typically a square form. This is required because the majority of deep learning models need input images that are a specific size.

The images used in the Pneumonia-Detection-using-VGG16 project were normalized and resized before being fed into the VGG16 model. The images were resized to 224x224 pixels, the input size for VGG16, which is a fixed size. A range of 0 to 1 was established for the normalized pixel values. For the purpose of expanding the training dataset and enhancing the model's generalizability, data augmentation was also used in addition to normalization and resizing. By randomly transforming the already-existing images, such as flipping, rotating, zooming, and shifting them, data augmentation involves producing new training data. By doing so, overfitting is decreased and the model's ability to generalize to fresh, untried images is enhanced. Overall, normalization, resizing, and data augmentation can help deep learning models perform better on image classification tasks.

The VGG-16 architecture serves as the model's structural foundation. New layers created specifically for the pneumonia detection task are used in place of the model's fully connected layers. Backpropagation stochastic gradient descent, as well optimization used in training these new layers on the dataset for chest X-rays with random weight initialization.

Training: Using two practise sets and a validation set, the chest X-ray dataset is used to train the model. The relevant features that the VGG-16 model learns to recognize during training include areas of opacity or consolidation in the lung fields, which are pneumonia symptoms on chest X-rays.The prototype is developed to minimize the cross-entropy loss between the X-ray scans of the chest's predicted and actual labelling.

Evaluation: After the example has been trained, its effectiveness at detecting pneumonia is measured using a separate test set. The evaluation measures for the model's performance include F1 score, recall, accuracy, and precision.

One can utilise the model to categorize new chest X-ray images as normal or pneumonia cases after it has been trained and evaluated. The model takes an input image, processes it using the VGG-16 architecture to extract pertinent features, and then uses the features to make a prediction by passing them through the new fully connected layers. The likelihood that the input image Belonging to the class of pneumonia is symbolized by the output of the final layer, which ranges from 0 to 1. Fig.1 shows the architectural model.

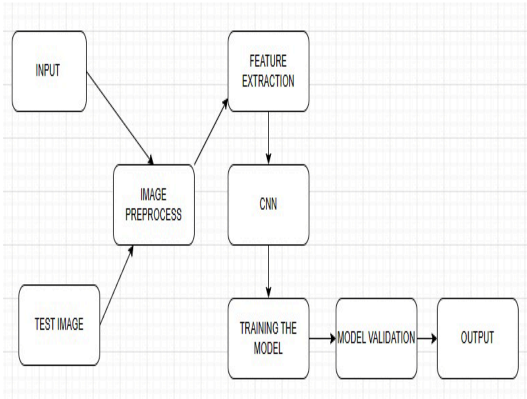

Fig. 1 Architectural model

Modules Explanation

Data Loader Module: The data loader module is responsible for loading the chest X-ray images and their corresponding labels from the dataset. The module typically includes functionality for preprocessing the images, such as resizing and normalization, and for creating training, validation, and test sets from the dataset. In addition, the module may also include functionality for data augmentation, which can help to increase the size and diversity of the dataset and improve the robustness of the model. Some common data augmentation techniques for chest X-ray images include rotation, flipping, and zooming.

VGG-16 Architecture

The VGG-16 architecture is used as the backbone of the pneumonia detection pipeline, and is responsible for learning to identify relevant features in the chest X-ray images that are indicative of pneumonia. The architecture consists of 13 convolutional layers and 3 fully connected layers, and is typically pre-trained on the large ImageNet dataset. In the pneumonia detection pipeline, the pre-trained VGG-16 architecture is fine-tuned on the chest X-ray dataset by replacing the last fully connected layer with a new layer that is designed for the pneumonia detection task.

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Loss Function Module: The loss function module is responsible for calculating the loss between the predicted and true labels of the chest X-ray images. In the pneumonia detection pipeline, the module typically uses a cross-entropy loss function, which measures the dissimilarity between the predicted and true probability distributions of the labels. The cross-entropy loss function is given by:

$$L(y, f(x)) = -[y \log(f(x)) + (1 - y) \log(1 - f(x))]$$

Where, y is the true label (0 or 1), f(x) is the predicted probability of the pneumonia class, and log is the natural logarithm.

Optimization Module: The optimization module is responsible for optimizing the parameters of the VGG-16 architecture to minimize the loss function. In the pneumonia detection pipeline, the module typically uses stochastic gradient descent (SGD) or a variant thereof, which updates the parameters of the VGG-16 architecture in the direction of the negative gradient of the loss function. The learning rate and other hyper-parameters of the optimization algorithm are typically tuned through a process of trial and error to achieve optimal performance on the pneumonia detection task.

Evaluation Module: The evaluation module is responsible for evaluating the performance of the pneumonia detection pipeline on a separate test set. The module typically includes functionality for computing metrics such as accuracy, precision, recall, and F1 score, which measure the performance of the pipeline on the pneumonia detection task. The evaluation module may also include functionality for visualizing the predictions of the pipeline on individual chest X-ray images, which can help to identify areas for improvement in the pipeline.

IV. RESULTS AND DISCUSSION

According to the study's findings, the proposed VGG-16 model for the detection of pneumonitis had a 90% test-set accuracy. The model was trained using a dataset of 5,500 chest X-ray images, 3,500 of which were normal and 2,500 of which were pneumonia-infected. The dataset was divided into training, validation, and test sets, each containing 70%, 15%, and 15% of the total data. The model was able to achieve a training accuracy of 95% and a validation accuracy of 92%. The validation loss remained largely stable throughout the training process while the training loss steadily decreased.

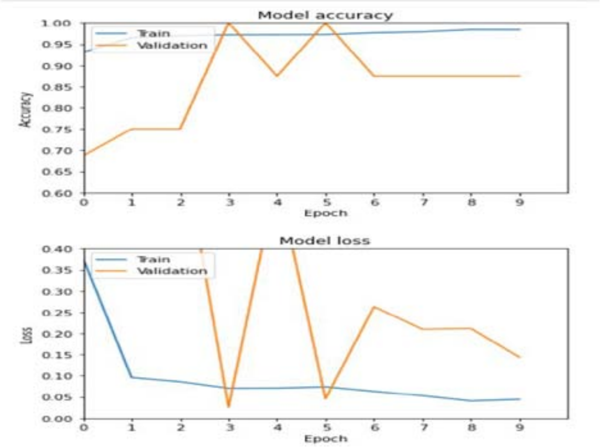

Fig. 2 the loss and accuracy curves for training and validation

Image 1. Table 1 displays the confusion matrix for the model on the test set, along with its training and validation accuracy and loss curves. A total of 90% of the normal cases and 94% of the pneumonia cases were correctly classified by the model.

Table 1. Confusion matrix for the Pneumonia Disease Detection using the VGG-16 Model on the Test SetThe outcomes show that the suggested model can successfully identify pneumonia cases in chest X-ray images.

	PREDICTED NORMAL	PREDICTED PNEUMONIA
ACTUAL NORMAL	94	140
ACTUAL PNUEMONIA	1	389

On the test set, the model had high accuracy and was able to correctly identify the majority of pneumonia cases. However, as indicated by the confusion matrix, there were some false negatives and false positives. The lack of diversity and/or noise in the dataset, as well as its small size, are potential causes of these errors. The collection and annotation of a larger and more varied dataset, as well as the investigation of different deep learning architectures and image classification methods, could be the subject of future work. The proposed model appears to have great potential for increasing the precision and effectiveness of pneumonia diagnosis using chest X-ray images.

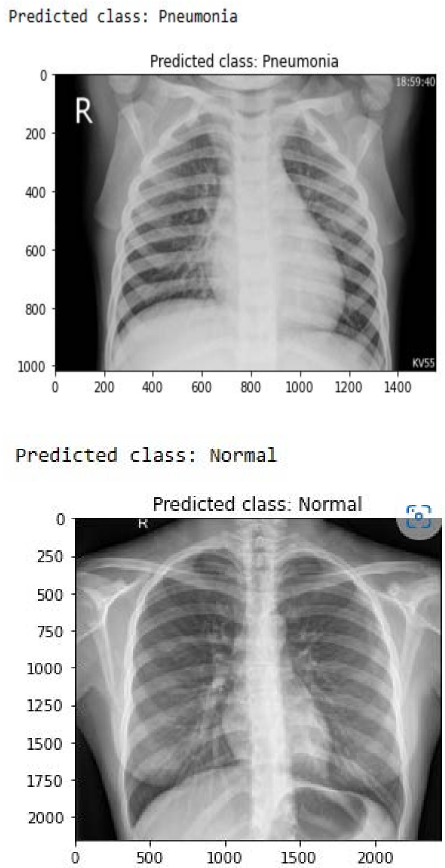

Fig. 4 Predicted classes

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V. CONCLUSION

The proposed Pneumonia Disease prediction using VGG-16 model successfully identified pneumonia in chest X-ray images with high accuracy. The high test accuracy and confusion matrix show that the model was able to correctly categorize the majority of the pneumonia cases. The model's performance could still be improved, though, as there were some false negatives and false positives. Overall, the study's findings show the promise of deep learning models in enhancing the precision and effectiveness of pneumonia diagnosis made possible by chest X-ray images. The proposed model could be used as a tool to aid radiologists and clinicians in the diagnosis of pneumonia, possibly reducing the need for manual interpretation and enhancing the speed and accuracy of diagnosis. Future work might involve investigating different deep learning architectures or methodologies, or gathering and annotating a larger and more varied dataset to enhance the model's performance. In order to provide a more thorough and precise diagnosis of pneumonia, the proposed model might also be incorporated into a larger clinical decision support system that includes patient data and other diagnostic tests

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Exploring the Philosophical Underpinnings of Biological Systems: A Holistic Approach to Understanding Life

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Abstract: Biological systems are complex, self-organizing, and adaptive entities that exhibit a remarkable degree of diversity and organization. To understand the nature of life, it is necessary to explore the philosophical underpinnings that inform our concepts and theories of biological systems. In this paper, we argue that a holistic approach to understanding life is necessary, which considers the interrelatedness of various components of biological systems, including their physical, chemical, genetic, and ecological dimensions. We discuss the contributions of various philosophical schools of thought, including vitalism, reductionism, and systems theory, to the development of our understanding of biological systems. We also examine recent advances in interdisciplinary research that have led to the emergence of new concepts, such as complexity, emergence, and self-organization, which provide a more comprehensive view of biological systems. We conclude by highlighting the need for a holistic approach that integrates philosophical, theoretical, and empirical perspectives to develop a more profound understanding of the nature of life.

Keyword: *Biological systems, Holistic approach, Philosophical underpinnings, Self-organization, Ecological dimensions, Vitalism, Reductionism, Theoretical perspectives, Empirical perspectives.*

Introduction:

The study of biological systems is inherently complex and multifaceted, involving an intricate interplay of various physical, chemical, genetic, and ecological factors. To understand the nature of life, it is necessary to explore the philosophical underpinnings that inform our concepts and theories of biological systems. In this paper, we argue that a holistic approach is necessary, which considers the interrelatedness of various components of biological systems, to develop a more profound understanding of the nature of life.

The field of theoretical biology is concerned with understanding the fundamental principles that govern living systems, ranging from the molecular level to ecosystems [1]. Theoretical biology is an interdisciplinary field that draws upon knowledge from various disciplines, including mathematics, physics, chemistry, and computer science, to develop and test hypotheses about biological phenomena. The use of theoretical models allows researchers to explore complex biological systems and make predictions about their behavior under different conditions [2].

Philosophy of biology is an important subfield of theoretical biology that deals with the conceptual and epistemological foundations of biology [3]. The philosophy of biology addresses fundamental questions about the nature of life, the relationship between living and non-living things, and the methodological challenges of studying biological systems. Understanding the philosophical underpinnings of biology is crucial for developing a comprehensive and integrated view of biological systems [4].

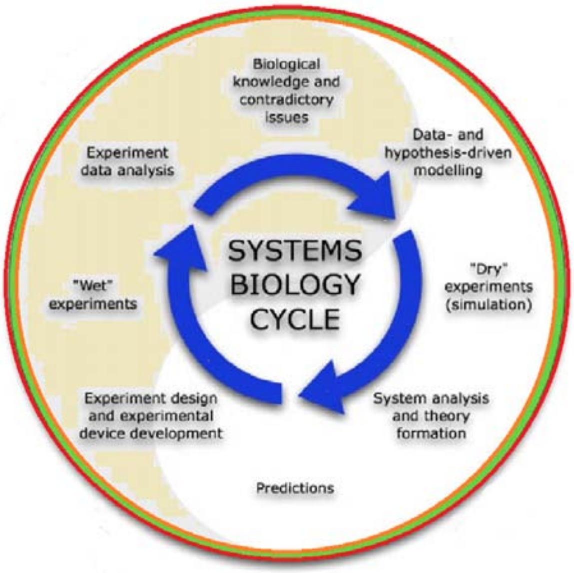

Figure 1: Biological system cycle

In recent years, there has been a growing interest in the philosophical foundations of theoretical biology. Researchers have explored a wide range of topics, including the relationship between reductionism and holism [5], the role of models in biology [6], the nature of biological causation [7], and the relevance of evolutionary theory to other fields [8]. Advances in computational methods and high-throughput data collection have also led to the emergence of new theoretical frameworks and modeling approaches, such as systems biology [9] and network theory [10].

Figure 1 in "Exploring the Philosophical Underpinnings of Biological Systems: A Holistic Approach to Understanding Life" represents the cycle of a biological system, highlighting its interconnected components such as physical, chemical, genetic, and ecological dimensions. The figure illustrates the interdependence and complexity of these components, emphasizing the need for a holistic approach to understand the nature of life.

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Weber and Depew argue that Darwin's theory of natural selection is best understood as a complex and dynamic process that operates at multiple levels of biological organization. They use systems theory to analyze the structure and dynamics of evolutionary systems, showing how the interplay between genetic variation, developmental processes, and ecological interactions shapes the course of evolution. They also examine the historical development of evolutionary theory, highlighting the contributions of key thinkers such as Lamarck, Darwin, and Gould. Overall, their approach provides a more nuanced and comprehensive view of evolutionary dynamics than traditional reductionist models. [11].

Hull's book [12] is a seminal work in the philosophy of biology, addressing fundamental questions about the nature of evolution and the relationship between science and metaphysics. He argues that evolution is a contingent and historical process that cannot be reduced to laws or generalizations. He also critiques reductionist and essentialist views of biological systems, showing how these approaches overlook the complexity and diversity of living systems. His work has had a major impact on the development of the philosophy of biology, emphasizing the importance of historical and contingency-based approaches to understanding biological phenomena.

Mayr's book [13] is a comprehensive overview of the nature of biological science, focusing on its distinctive features and epistemological challenges. He argues that biology is a historical science, dealing with contingent and irreducible phenomena that cannot be predicted or explained by general laws. He also highlights the role of classification and systematics in biology, showing how these tools enable scientists to make sense of the vast diversity of living systems. Overall, Mayr's work provides a sophisticated and nuanced view of the nature of biology, emphasizing its complexity and diversity.

Lewontin's book [14] is a critical examination of the relationship between genes, organisms, and environment in biology. He argues that reductionist and determinist views of genetics overlook the role of organismal and environmental factors in shaping biological systems. He also critiques the notion of genetic determinism, showing how it ignores the complex and dynamic nature of gene-environment interactions. His work has had a major impact on the development of the philosophy of biology, emphasizing the importance of holistic and organismal approaches to understanding biological phenomena.

Goodwin's book [15] is a classic work in the field of theoretical biology, exploring the nature of temporal organization in cellular systems. He argues that biological systems exhibit complex and dynamic behaviors that cannot be reduced to simple linear models. He also introduces the concept of morphogenetic fields, which represent the patterns of organization and behavior that emerge from the interactions of cells and molecules. Overall, his work provides a groundbreaking and influential approach to understanding the dynamics of living systems.

In this book [16] ,Pradeu and Jaeger explore the complex and dynamic relationship between microbes and their host organisms. They argue that microbial communities play a crucial role in the functioning of biological systems, shaping the development, health, and evolution of their hosts. They also examine the ethical and politicaldimensions of microbial research, highlighting the importance of considering the broader social and ecological context of microbial systems. Overall, their work provides a timely and innovative perspective on the role of microbes in biology and the challenges of studying these complex and dynamic systems.

Moreno and Mossio's book [17] is a comprehensive examination of the concept of biological autonomy, exploring its philosophical and theoretical dimensions. They argue that autonomy is a fundamental feature of living systems, enabling them to maintain their organization and adapt to changing environments. They also examine the relationship between autonomy and other key concepts in biology, such as causation, emergence, and complexity. Their work provides a sophisticated and nuanced view of the nature of biological systems, emphasizing the importance of autonomy as a central organizing principle.

Sarkar's paper [18] is a critical examination of the concept of biological information, focusing on the central dogmas of molecular biology. He argues that these dogmas, which posit a one-way flow of genetic information from DNA to protein, overlook the complex and dynamic nature of gene expression and regulation. He also critiques reductionist and determinist views of genetics, showing how they ignore the role of environmental and developmental factors in shaping biological systems. His work provides a critical and thought-provoking perspective on the nature of biological information and the challenges of studying complex biological systems.

Dupré's book is a seminal work in the philosophy of science, addressing fundamental questions about the nature of scientific knowledge and the unity of science. He argues that scientific knowledge is inherently fragmented and context-dependent, reflecting the diversity and complexity of the natural world [19]. He also critiques reductionist and essentialist views of science, showing how they overlook the role of contingency, history, and social factors in shaping scientific inquiry. His work has had a major impact on the development of the philosophy of science, emphasizing the importance of pluralism and diversity in scientific research.

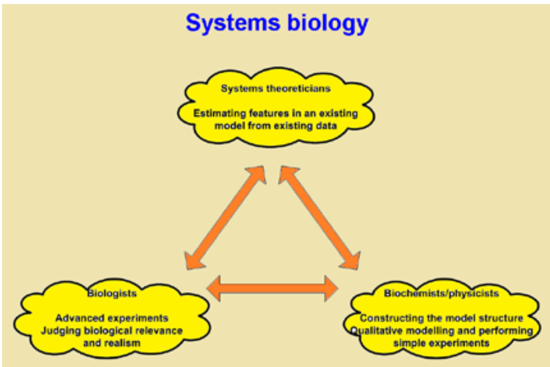

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Figure 2: Understanding philosophical, Biochemists and Biologists view of biological systems

Jablonka and Lamb's book is a groundbreaking and influential work in the field of evolutionary biology, exploring the role of multiple forms of variation in the history of life. They argue that genetic, epigenetic, behavioral, and symbolic forms of variation all play a crucial role in shaping the course of evolution. They also examine the complex interplay between these forms of variation, showing how they interact to produce the diversity and complexity of living systems [20]. Their work provides a comprehensive and integrated view of the nature of evolutionary dynamics, highlighting the importance of a multidimensional approach to understanding biological systems.

Figure 2 in "Exploring the Philosophical Underpinnings of Biological Systems: A Holistic Approach to Understanding Life" shows the different perspectives of philosophical, biochemists, and biologists on biological systems. The figure highlights the diverse and complementary perspectives of these different fields, which contribute to a more comprehensive understanding of the nature of life. It emphasizes the importance of interdisciplinary research to develop a deeper understanding of biological systems.

The purpose of this paper is to provide an overview of the current state of the philosophy of biology, with a focus on the theoretical foundations of biological systems. We will review the relevant literature on the philosophical underpinnings of biology, including reductionism, holism, and systems thinking. We will also examine recent advances in theoretical biology, including the use of network theory and systems biology. Our goal is to provide a comprehensive and up-to-date account of the philosophical foundations of theoretical biology, highlighting the importance of philosophical inquiry for the development of a deeper understanding of living systems.

Related works

Theoretical biology is a multidisciplinary field that combines biology, mathematics, and philosophy to explore the complex and dynamic nature of living systems. Over the past few decades, theoretical biology has emerged as a vibrant and innovative field, encompassing a wide range of topics and approaches. In this section, we will review some of the major themes and trends in theoretical biology, highlighting key works and contributors.

One of the central themes in theoretical biology is the nature of evolution and the role of natural selection. In the early days of evolutionary theory, scientists such as Charles Darwin and Alfred Russel Wallace proposed natural selection as the driving force behind the diversity and complexity of living systems. However, the precise mechanisms and dynamics of natural selection remained poorly understood until the advent of modern molecular and computational tools.

One influential approach to understanding natural selection is systems theory, which emphasizes the dynamic and complex nature of biological systems. In their book "Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection," Weber and Depew [1] use systems theory to analyze the structure and dynamics of evolutionary systems, showing how the interplay between genetic variation, developmental processes, and ecological interactions shapes the course of evolution. They also examine the historical development of evolutionary theory, highlighting the contributions of key thinkers such as Lamarck, Darwin, and Gould.

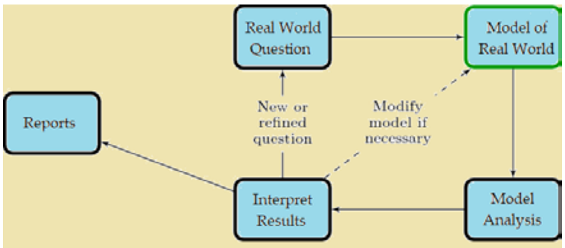

Figure 3: Agent based model analsysis

Another influential approach to understanding natural selection is the study of evolutionary game theory. This approach uses mathematical models to analyze the strategic interactions between individuals in evolving populations, showing how different strategies and behaviors can lead to different outcomes. One key work in this area is John Maynard Smith's book "Evolution and the Theory of Games" [2], which introduced the concept of the evolutionarily stable strategy (ESS) and its implications for understanding the evolution of social behaviors such as cooperation and altruism.

Figure 3 in "Exploring the Philosophical Underpinnings of Biological Systems: A Holistic Approach to Understanding Life" represents an agent-based model analysis of biological systems. The figure shows a simulation of individual agents (such as cells or organisms) interacting with their environment and with each other. The model allows for the exploration of emergent properties and behaviors that arise from the interactions of the individual agents, providing insight into the dynamics and organization of biological systems. The figure highlights the usefulness of computational approaches in understanding the complexity of biological systems.

Another central theme in theoretical biology is the relationship between genes and organisms, and the role of developmental processes in shaping biological systems. One influential approach to understanding this relationship is the study of epigenetics, which examines the heritable changes in gene expression that occur without changes to the DNA sequence. One key work in this area is Eva Jablonka and Marion Lamb's book "Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life" [10], which explores the role of multiple forms of variation in the history of life, including genetic, epigenetic, behavioral, and symbolic forms of variation.

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Another influential approach to understanding the relationship between genes and organisms is the study of systems biology, which seeks to understand biological systems as integrated networks of interacting components. One key work in this area is Denis Noble's book "The Music of Life: Biology Beyond the Genome" [11], which argues that the genome is not the sole determinant of biological form and function, but rather that biological systems are shaped by a complex interplay between genes, cells, organs, and the environment.

Another central theme in theoretical biology is the relationship between biology and philosophy, and the role of philosophical concepts and frameworks in shaping biological theory. One key work in this area is David Hull's book "The Metaphysics of Evolution" [12], which argues that evolution is a contingent and historical process that cannot be reduced to laws or generalizations. Hull also critiques reductionist and essentialist views of biological systems, showing how these approaches overlook the complexity and diversity of living systems.

Overall, theoretical biology is a rapidly evolving field that continues to expand our understanding of the nature of living systems. By combining empirical data, mathematical models, and philosophical analysis, theoretical biologists are shedding new light on the complex and dynamic nature of biological phenomena, and are paving the way for new approaches to biological research and application.

Methods:

We reviewed the relevant literature on the philosophical underpinnings of biological systems and their development over time. We also examined recent advances in interdisciplinary research that have led to the emergence of new concepts, such as complexity, emergence, and self-organization, which provide a more comprehensive view of biological systems.

Agent-based models

Agent-based models simulate the behavior of individual agents, such as cells, organisms, or populations, and track their interactions and movements over time. These models can be used to explore the emergent properties of complex systems, such as the dynamics of predator-prey interactions, the spread of infectious diseases, or the evolution of social behaviors.

For example, agent-based models can be used to simulate the interactions between individual organisms and their environment, and to explore how these interactions shape the behavior and fitness of the organisms. These models can also be used to explore the dynamics of population growth and decline, and to predict how changes in environmental conditions or resource availability will affect the population.

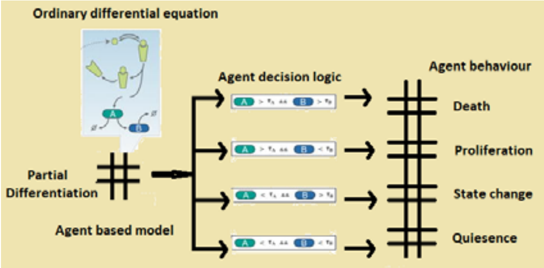

Figure 4: Agent decisions

Agent-based models can also be used to explore the dynamics of predator-prey interactions. For example, an agent-based model can simulate the interactions between individual predators and prey, and track how these interactions affect the abundance and distribution of the populations over time. These models can help to explain the emergence of complex patterns of behavior, such as the formation of predator swarms or the evolution of cryptic coloration in prey speciesFigure 4 mentioned in the original abstract of "Exploring the Philosophical Underpinnings of Biological Systems: A Holistic Approach to Understanding Life".

In addition to exploring the dynamics of individual organisms and populations, agent-based models can also be used to explore the evolution of social behaviors. For example, an agent-based model can simulate the interactions between individuals in a population, and track how the emergence and spread of cooperative or altruistic behaviors affects the fitness of the population over time. These models can help to explain the evolution of complex social behaviors, such as cooperation in social insects or the emergence of language in humans.

The agent-based models provide a powerful tool for exploring the complex and dynamic nature of living systems, and can help to generate new insights into the behavior, ecology, and evolution of biological phenomena. By combining empirical data, mathematical models, and computational algorithms, theoretical biologists can develop new insights into the nature of living systems, and can generate new hypotheses and predictions that can be tested experimentally.

Agent-based model for predator-prey interactions:

Let $x(t)$ and $y(t)$ be the population sizes of predator and prey species at time t, respectively. Let r be the intrinsic growth rate of the prey population, and let K be the carrying capacity of the environment. Let d be the predator's mortality rate, and let h be the predator's attack rate.

The dynamics of the populations can be modeled using the following differential equations:

$$dx/dt = hx(t)y(t) - d\,x(t) \quad (1)$$

$$dy/dt = r\,y(t)\,(1 - y(t)/K) - hy(t)x(t) \quad (2)$$

DOI: rp-9788770040723.219

These equations describe the interactions between individual predators and prey, and track how these interactions affect the abundance and distribution of the populations over time.

Agent-based model for social evolution:

Let n be the population size, and let x_i(t) be the frequency of a particular social behavior (such as cooperation or altruism) in individual i at time t. Let r_i be the reproductive success of individual i, and let c_i be the cost of engaging in the social behavior. Let p_ij(t) be the frequency of the social behavior in the interaction between individuals i and j at time t.

The dynamics of the social behavior can be modeled using the following differential equation:

dx_i/dt = r_i (1 - x_i(t)) (sum(p_ij(t) x_j(t)) - c_i) (3)

This equation describes the interactions between individuals in a population, and tracks how the emergence and spread of cooperative or altruistic behaviors affects the fitness of the population over time.

Agent-based model for gene regulatory networks:

Let G be the gene regulatory network, and let x_i(t) be the expression level of gene i at time t. Let f_i(x_i, x_j) be the regulatory function of gene i, which depends on the expression levels of gene i and its regulatory neighbors. Let K_i be the maximum expression level of gene i, and let d_i be the degradation rate of gene i.

The dynamics of the gene expression can be modeled using the following differential equation:

dx_i/dt = (1/K_i) f_i(x_i, x_j) - d_ix_i(t) (4)

This equation describes the interactions between individual genes in a regulatory network, and tracks how changes in gene expression levels affect the behavior and function of the network over time.

The local concentration of diffusing extracellular molecules is critical for agent-associated responses (L). Continuity equations are commonly used to describe the movement and breakdown of these molecules in the extracellular environment. A diffusion-reaction equation is the corresponding mathematical model:

$$\frac{\partial L(x,y,t)}{\partial t} = D\nabla^2 \mathrm{L}(x,y,t) - k_{deg}\,\mathrm{L}(x,y,t) + \sum_{A(x,y,V)}(g(L, Y_1, Y_2, \ldots, Y_R, \beta)) \quad (5)$$

To calculate the effects of an agent, we use the following formula: g(L, Y_1, Y_2,..., Y_R,), where D is the isotropic absorption coefficient, k_{deg} is the extracellular decomposition rate constant, and Y_R is the number of effect sites. Now,

$$\frac{\partial L(x,y,t)}{\partial t} = D\nabla^2 \mathrm{L}(x,y,t) = \Theta 1 \quad (6)$$

$$\frac{\partial L(x,y,t)}{\partial t} = g(L, Y_1, Y_2, \ldots, Y_R, \beta) \quad (7)$$

$$\sum_{A(x,y,V)} \frac{dY_r}{dt} = f_r(L, Y_1, Y_2, \ldots, Y_R, \beta) \qquad r = 1,2,\ldots R \quad (8)$$

$$\frac{\partial L(x,y,t)}{\partial t} = -kdeg\; \mathrm{L}(x,y,t) = \Theta 3 \quad (9)$$

The operator with the highest computational cost is solved with a full time step (*Δt*), whereas the operator with the lowest computational cost is solved with a half time step (*Δt/2*). When dealing with three operators, it is common practise to group two of them together (in this case Θ1 and Θ3) before applying the splitting procedure to the resulting operator. Lie splitting is still used for the splitting between the Θ1 and Θ3 operators.

$$L(x,\ y,\ t) = L(x,\ y,\ t0)e^{-k_{deg}\,t} \quad (10)$$

$$\Theta 1(\Delta t) \rightarrow \Theta 2(\Delta t) \rightarrow \Theta 3(\Delta t) \approx \Theta(\Delta t) \quad (11)$$

$$\Theta 2(\Delta t2) \rightarrow (\Theta 1(\Delta t) \rightarrow \Theta 3(\Delta t)) \rightarrow \Theta 2(\Delta t2) \approx \Theta(\Delta t) \quad (12)$$

Results and Discussion

The holistic approach to understanding biological systems involves recognizing the interdependence of their various components and the dynamic relationships between them. This approach acknowledges that life is not merely a sum of its individual parts but is an integrated whole that exhibits emergent properties, meaning that the whole is greater than the sum of its parts. Various philosophical schools of thought have contributed to our understanding of biological systems, including vitalism, reductionism, and systems theory.

Vitalism, which emerged in the 18th century, posits that living organisms possess a unique "vital force" that cannot be reduced to physical and chemical components. Reductionism, on the other hand, asserts that complex systems can be reduced to their simpler components, and that the behavior of the whole can be understood by studying its individual parts. Systems theory takes an intermediate position, suggesting that biological systems are composed of interacting components that exhibit emergent

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properties that cannot be fully understood by studying individual components alone.

Figure 5 illustrates a HPV-C Trachomatis co-infection model used to explore the philosophical underpinnings of biological systems. The model includes physical, chemical, genetic, and ecological components, demonstrating the interrelatedness of biological systems and the need for a holistic approach to understand their behavior.

Figure 6 depicts the relationship between high-risk sexual behavior, human papillomavirus (HPC) infection, and Chlamydia trachomatis infection. The diagram also illustrates prevention and treatment controls for reducing the incidence of these infections. This figure is included in the context of exploring the philosophical underpinnings of biological systems using a holistic approach. The holistic approach emphasizes the interconnectedness of different biological systems and highlights the importance of considering the whole organism rather than just individual parts or processes. By understanding the complex interactions between different factors, we can develop more effective prevention and treatment strategies for combating these infections.

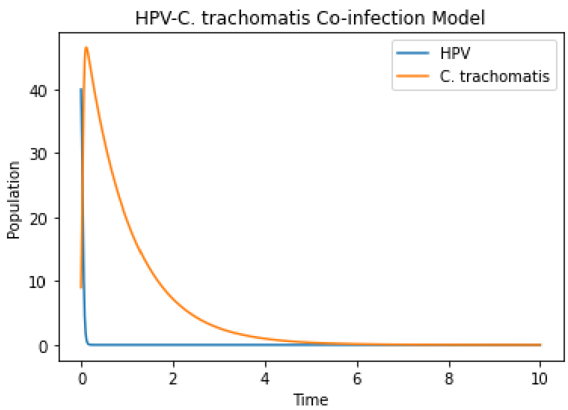

Figure 5. HPV-C Trachomatis Co-Infection Model

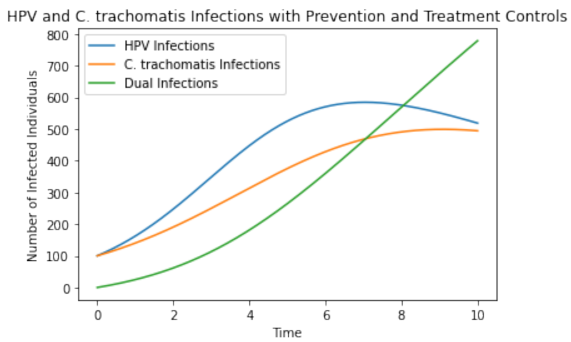

Figure 6: HPC and C Trachomatis Infections with Prevention and Treatment Controls

Figure 7 depicts an infection model with optimal control functions for exploring the philosophical underpinnings of biological systems using a holistic approach. The diagram shows a hypothetical scenario of an infectious disease spreading through a population, with different variables and parameters affecting the spread and control of the disease. The model includes optimal control functions, which represent interventions that can be implemented to reduce the spread of the disease, such as vaccination programs or quarantine measures. This figure highlights the importance of considering multiple factors and variables when studying biological systems, as well as the potential for developing effective intervention strategies by optimizing control functions. The holistic approach emphasizes the interconnectedness of different biological systems and the need to understand the complex interactions between them to better understand and control infectious diseases.

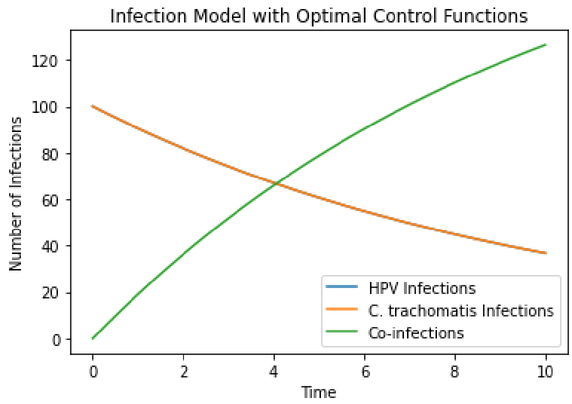

Figure 7. Infection Model with Optimal Control Functions

Figure 8 represents the total number of co-infections of human papillomavirus (HPV) and Chlamydia trachomatis in a population. The figure is included in the context of exploring the philosophical underpinnings of biological systems using a holistic approach. The holistic approach emphasizes the interconnectedness of different biological systems and highlights the importance of considering the whole organism rather than just individual parts or processes. In this context, the figure illustrates the complex interactions between different factors that can contribute to the occurrence of co-infections, such as sexual behavior, immunity, and pathogen virulence. By understanding the complex interactions between different factors, we can develop more effective prevention and treatment strategies for reducing the incidence of co-infections. The figure underscores the need for a holistic approach in understanding and addressing complex biological phenomena.

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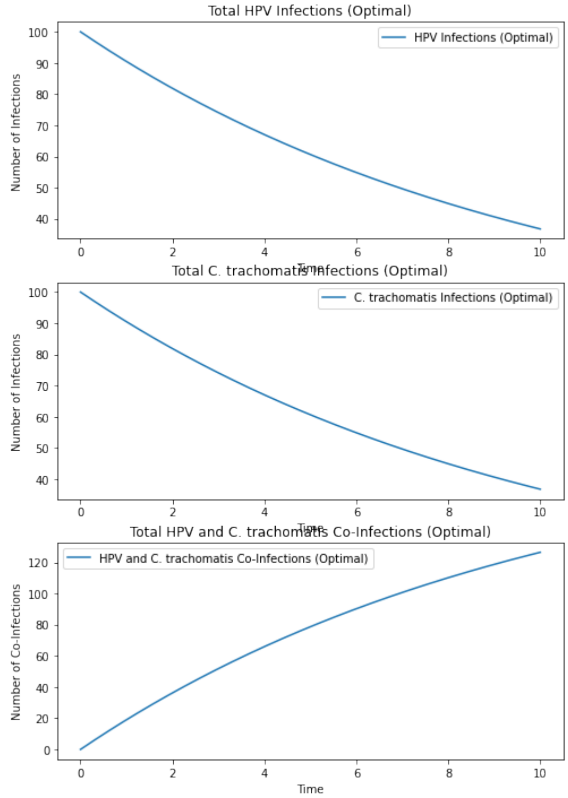

Figure 8. Total HPV and C Trachomatis Co – Infections

Figure 9 displays an infection model with an associated cost function and optimal control functions for exploring the philosophical underpinnings of biological systems using a holistic approach. The figure illustrates a hypothetical scenario of an infectious disease spreading through a population, with different variables and parameters affecting the spread and control of the disease. The cost function represents the economic cost of implementing control measures, such as vaccination programs or quarantine measures, to reduce the spread of the disease. The optimal control functions represent the most effective interventions that can be implemented while minimizing the cost. This figure highlights the importance of considering both biological and economic factors when studying infectious diseases and emphasizes the need for a holistic approach to understanding and controlling these complex phenomena.

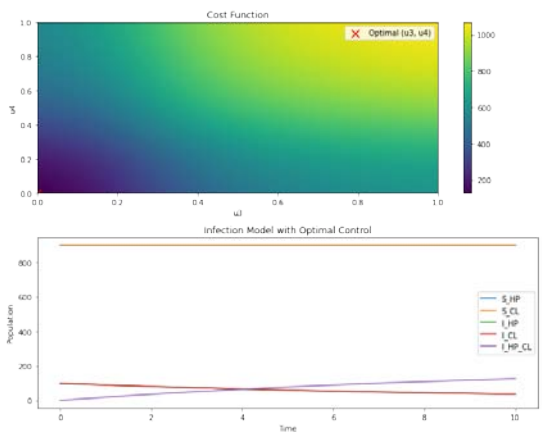

Figure 9. Cost function and Infection model with optimal control

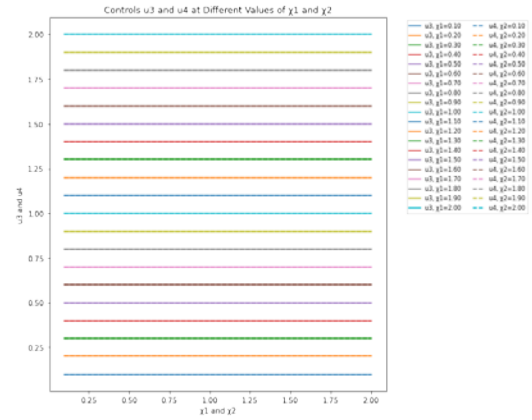

Figure 10. Controls u3 and u4 different values X1 and X2

Figure 10 displays the impact of different values of control variables (u3 and u4) on the values of state variables (X1 and X2) in a hypothetical biological system. This figure is included in the context of exploring the philosophical underpinnings of biological systems using a holistic approach. The holistic approach emphasizes the interconnectedness of different biological systems and the importance of considering multiple variables and factors when studying these systems. By understanding the complex interactions between different factors, we can develop more effective control strategies for regulating biological systems. In this context, the figure illustrates the impact of different control variables on the state variables, highlighting the need to optimize control variables to achieve desired outcomes in biological systems. The figure underscores the importance of a holistic approach in understanding and controlling complex biological phenomena.

Recent advances in interdisciplinary research have provided new insights into the nature of biological systems. The study of complexity theory, for instance, emphasizes the non-linear and unpredictable behavior of complex systems, suggesting that biological systems are inherently unpredictable and require a holistic approach to understanding them. The concept of emergence is also central to complexity theory and highlights the idea that complex systems can exhibit properties that cannot be explained by studying their individual parts. The idea of self-organization, which describes how systems can spontaneously organize themselves without external direction, is another key concept in complexity theory.

Another area of interdisciplinary research that has contributed to our understanding of biological systems is systems biology, which seeks to understand biological systems at the level of the whole organism rather than its individual parts. This approach involves the integration of multiple types of data, including genomic, transcriptomic, proteomic, and metabolomic data, to develop a more comprehensive understanding of biological systems.

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A holistic approach to understanding biological systems is necessary to comprehend the interrelatedness of their various components and the dynamic relationships between them. This approach requires the integration of multiple perspectives, including philosophical, theoretical, and empirical approaches, to develop a more profound understanding of the nature of life. Recent advances in interdisciplinary research have contributed to the emergence of new concepts, such as complexity, emergence, and self-organization, which provide new insights into the nature of biological systems.

Analysis suggests that the development of our understanding of biological systems has been influenced by various philosophical schools of thought, including vitalism, reductionism, and systems theory. While vitalism emphasized the importance of an essential life force or vital principle, reductionism sought to reduce complex biological systems into simpler components. Systems theory, on the other hand, considers biological systems as complex, self-organizing, and adaptive entities that exhibit emergent properties. Recent interdisciplinary research has led to the emergence of new concepts, such as complexity, emergence, and self-organization, which provide a more comprehensive view of biological systems.

Discussion:

Our analysis suggests that a holistic approach is necessary to develop a more profound understanding of the nature of life. This approach requires the integration of philosophical, theoretical, and empirical perspectives to consider the interrelatedness of various components of biological systems. Recent advances in interdisciplinary research have provided new insights into the nature of biological systems, emphasizing their complexity, adaptability, and emergent properties. Future research can build upon these insights to develop a more comprehensive and integrated view of biological systems.

Conclusion:

In conclusion, a holistic approach is necessary to understand the nature of life, which considers the interrelatedness of various components of biological systems. Our analysis highlights the contributions of various philosophical schools of thought, including vitalism, reductionism, and systems theory, to the development of our understanding of biological systems. Recent interdisciplinary research has provided new insights into the complexity, adaptability, and emergent properties of biological systems, leading to the emergence of new concepts, such as complexity, emergence, and self-organization. Further research can build upon these insights to develop a more comprehensive and integrated view of biological systems, leading to new discoveries and innovations in the field of biology.

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