Print ISSN : 2395-1990
Online ISSN : 2394-4099
www.ijsrset.com

PIMPRI CHINCHWAD EDUCATION TRUST
A Trusted Brand in Education Since 1990..

ESTD : 1906

IJSRSET

4th International Conference on Advances in Engineering, Technology & Business Management [ICAETBM-2024]

Date : 24th and 25th May, 2024

Organised by
Nutan Maharashtra Vidya Prasarak Mandal's
Nutan Maharashtra Institute of Engineering and Technology,
Talegaon Dabhade, Pune, Maharashtra, India

VOLUME 11, ISSUE 8, MAY-JUNE-2024

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Scientific Journal Impact Factor : 8.154

Email : editor@ijsrset.com Website : http://ijsrset.com

4th International Conference on Advances in Engineering, Technology & Business Management

On

24th and 25th May 2024

Organized by

Nutan Maharashtra Vidya Prasarak Mandal's

Nutan Maharashtra Institute of Engineering and Technology, Talegaon Dabhade, Pune, Maharashtra, India

In Association With

International Journal of Scientific Research in Science, Engineering and Technology

Print ISSN : 2395-1990 Online ISSN : 2394-4099

Volume 11, Issue 8, May-June-2024

Published By

www.technoscienceacademy.com

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

EchoAlert

A Futuristic Approach to Control Accident and to Manage Traffic Noise

Miss. Anushka Bhandare, Mr. Atharv Suryavanshi, Mr. Yash Kulkarni, Mr. Sagar Pukale, Prof. Priyanka Gaikwad

Department of Computer Science and Enginerring, MIT-ADT University, School of Computing, Pune

ABSTRACT

This project aims to revolutionize city noise and road safety management by integrating advanced sensor technologies with vehicle systems. Traditional methods of monitoring and controlling vehicle behaviour, such as speed and horn usage, are insufficient in today's fast-paced urban environments. This paper proposes a comprehensive solution that not only regulates horn volume in designated areas but also ensures driver compliance with safety measures.

The system begins by employing an IR sensor to detect the presence of a seatbelt, ensuring that the driver is securely fastened. Subsequently, an MQ2 sensor assesses whether the driver has consumed alcohol, mitigating the risk of intoxicated driving. Additionally, a vibration sensor constantly monitors for any indications of an accident.

Relay activation is contingent upon the driver wearing a seatbelt and being sober, as confirmed by the sensors. Upon meeting these criteria, the system proceeds to the next stage. In the event of speeding in designated honking zones, an alert is triggered through a GSM module, notifying a registered phone number of the violation. Moreover, if an accident is detected by the vibration sensor, an alert message containing the precise location is dispatched to the driver's phone as well as an alternative contact.

This integration of sensor technology with vehicle operations presents a proactive approach to enhancing road safety and noise regulation in urban environments. By employing a multi-faceted system that addresses both driver behaviour and environmental factors, this project exemplifies the potential of smart solutions for modern cities.

Keywords : Seatbelt Sensor, Alcohol Detection, Vibration Sensor, Relay, GSM Module, Road Safety, Urban Environment, Smart Technology.

I. INTRODUCTION

Road accidents remain a persistent threat due to reckless driving and excessive speeds, posing significant risks to human life. Despite governmental efforts to curb such incidents, the proliferation of vehicles continues to escalate accident rates. While laser-based control systems offer potential solutions, their high cost and limited effectiveness in detecting pedestrians present challenges.

In response, this project endeavors to address these issues through a comprehensive system that integrates sensor technologies with vehicle operations. Initially, an IR sensor verifies the driver's

compliance with safety measures by detecting seatbelt usage. Following this, an MQ2 sensor assesses the driver's sobriety, mitigating the dangers of alcohol-impaired driving. Additionally, a vibration sensor serves as a vigilant monitor for potential accidents.

The system's operation is contingent upon the driver's adherence to safety protocols. Relay activation occurs only when the driver is wearing a seatbelt and is sober, as confirmed by the sensors. Upon meeting these criteria, the system proceeds to its next phase.

In areas where honking is restricted, the system employs further measures to regulate noise pollution and promote road safety. When a vehicle enters a designated honking zone, the system dynamically adjusts horn volume, ensuring compliance with regulations. Simultaneously, an accelerometer monitors vehicle speed, triggering alerts via a GSM module if speeds exceed prescribed limits within these zones.

This integrated approach not only enhances road safety but also addresses environmental concerns by minimizing noise pollution. By employing advanced sensor technologies and intelligent systems, this project aims to mitigate accidents and promote responsible driving behavior in urban environments.

II.RESEARCH BACKGROUND

System consistes of Admin panel, muncipal corporation and hardware module which include of buzzer,GPS,ardiuno board, an accelometer sensor, IR sensor, vibration sensor, mq2 sensor, relay and gsm module.

1. Admin:

Admin can add the municipal corporation and view the honking zones which are included by the municipal corporation on GPS. He also view and delete the of municipal corporation and also view all details and data of others which is included by the municipal corporation.

2. Municipal Corporation:

In our system the municipal corporation can add the honking zones like hospital, school, college, old age home and government offices in cities as a honking zone with their longitude, latitude, Name, Type, and other description and decide the speed level of the vehicle which is travel from near the honking zone.

3. Vehicle Registration Login

In our system the vehicle registration login can add the vehicle owner information like Name, Address, self contact number, vehicle number, alternative contact number, email etc.

4. System:

In this web application when any car or vehicle goes from any honking zone the accelerometer can track the current speed limit of that vehicle. This accelerometer can built-in the vehicle which is note the speed of vehicle during honking zone which is declare and saved on GPS by municipal corporation, if the detected speed of vehicle is greater than the speed which is allowed in honking area then the pizzobuzzer will buzz and get alert to driver to drive slowly in honking zone area. It also check the horn of vehicle if it on then the in-built switch press action will automatically decrease the noise level of the horn and keep safe and noise pollution free drive.

III. LITERATURE SURVEY

Currently Indian cities are ranked thrice in Top 10 nosiest city in the world according to Citi quite. The cities that rank in these are Kolkata, Delhi and Mumbai. The effects of Noise pollution which is generated from the high speed vehicle it is mainly affected on honking zone area which is declare by municipal are being taught from 4th Grade of

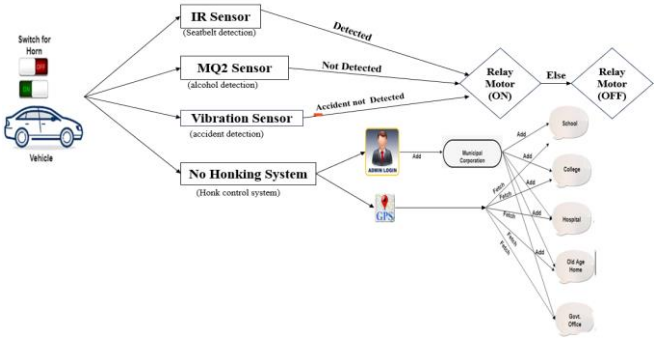
schools, but we still don't have any strong system to control it. The Rules and Regulations are not exercised as per papers, legal document PDFs and Government websites describe. The speed Barriers and smart Honking Zones are created but are hardly followed. The decibel levels of Sound are constrained in regulations but there is no tool to measure and control in real time. The people are susceptible for early seeing loss than the expected average age, Institutional disturbance, Patients in the hospital suffer. Coming to present and existing solutions, there are speed barriers, smart honking zones which are hardly paid any attention to, and people continue honking irrespective of which zone they are in.

Author- R. K. Mishra Paper- Evaluation and analysis of traffic volume noise along has rapid transit system corridor. In this research paper The R. K. Mishra analysis on traffic volume noise. He tries to reduce noise pollution which created by the extra volume from vehicles.

Author- T. Vaidya Sagar Paper- Noise Pollution Levels in Visakhapatnam City (India). In this research paper the ambient air quality noise levels (AAQNL) at traffic junctions were 5 DBA or more than those prescribed by AAQNS for commercial zone and most of the values were found in the range of 80 +/- 10 DBA, among which 75 Author- Prof. S.M. Patil Paper- Law on Environment Some Reflections. In this research paper this author describe about the law of environment. He searches the what was the reaction of low on environment.

Author - Ising H., Kruppa B. Paper- Health effects caused by noise. In this research paper the author shows what was the effects on human health because of noise. How that bad effect was reduce.

IV.PROPOSE SYSTEM DESIGN



The system architecture comprises various components and their interactions to ensure efficient operation and monitoring of vehicle safety parameters. Here's an overview of how the system functions:

Input :

1. **IR Sensor (Seat Belt Detection):** Determines whether the seat belt is inserted, providing input to the system regarding the driver's compliance with safety measures.
2. **MQ2 Sensor (Alcohol Detection):** Detects alcohol consumption by the driver, influencing the decision-making process of the system.
3. **GPS Module (Location Detection):** Determines the vehicle's location, crucial for identifying entry into no honking zones.
4. **Accelerometer (Speed Monitoring):** Monitors the vehicle's speed, enabling the system to detect speeding violations.

Processing:

- **Decision Logic (Control Unit):** Receives inputs from the sensors and processes them to make decisions based on predefined criteria. This component governs the operation of the system, including relay control, horn volume adjustment, and alert generation.

Output:

1. **GSM Module (Alert Transmission):** Sends alert messages to the driver in case of speeding violations or alcohol consumption. These alerts serve as warnings to the driver, promoting safer driving behavior.
2. **Horn Control:** Adjusts the horn volume automatically when the vehicle enters a no honking zone, minimizing noise pollution in sensitive areas.

Operation:

1. Upon vehicle ignition, the IR sensor checks for seat belt insertion. If the seat belt is not inserted, the system prevents the relay motor from starting, ensuring compliance with safety regulations.
2. After confirming seat belt usage, the MQ2 sensor detects alcohol consumption. If alcohol is detected, the relay motor remains inactive to prevent driving under the influence.
3. Simultaneously, the GPS module continuously tracks the vehicle's location. When the vehicle enters a no honking zone, the system automatically adjusts the horn volume to comply with regulations.
4. The accelerometer monitors the vehicle's speed in real-time. If speeding is detected within a no honking zone, the GSM module sends an alert message to the driver, notifying them of the violation.
5. Additionally, the system logs data related to driving behavior and violations in a MySQL database, allowing experts to analyze and provide feedback to the driver. This promotes conscious driving and helps reduce repeated violations over time.

Components:

- **Arduino Board:** Acts as the central processing unit, interfacing with sensors and controlling system operations.
- **Power Supply:** Provides the necessary power to all system components, ensuring continuous operation.
- **MySQL Database:** Stores data related to driving behavior and violations for analysis by experts.

Conclusion: The system architecture facilitates comprehensive monitoring of vehicle safety parameters and promotes responsible driving behavior. By integrating sensor data processing, alert transmission, and data logging functionalities, the system contributes to enhanced road safety and reduced environmental impact.

V.Technology Necessity

In urban environments characterized by high vehicle density and construction activities, mitigating noise pollution is crucial for public health and well-being. The integration of innovative technologies is essential to address these challenges effectively. Here's how the proposed technology meets the necessity:

1.Noise Reduction Equipment for Construction Sites: Installing noise reduction equipment on hydraulic breakers at construction sites helps mitigate noise pollution in honking zones. By reducing the noise generated during construction activities, this technology minimizes disturbances to nearby institutions such as hospitals, schools, colleges, and old-age homes.

2.Comprehensive Noise Evaluation Method: Developing a method to evaluate not only the physical level of noise but also the level of displeasure felt by individuals due to vehicle-related

noise pollution enhances the effectiveness of noise reduction efforts. This comprehensive approach enables targeted interventions to address specific sources of noise and their impact on communities.

3.Noise-Reducing Materials: Utilizing noise-reducing materials developed through research on vibration characteristics enables the creation of effective noise reduction solutions. These materials, tested through mock-up tests and measurements, provide a practical means of mitigating noise pollution from various sources, including vehicle traffic.

4.Technological Advances in Noise Monitoring: Leveraging technological advancements allows for real-time monitoring and control of noise levels in urban environments. By integrating sensors and intelligent systems, such as those used in the proposed project, it becomes possible to measure and regulate noise pollution dynamically, ensuring compliance with noise regulations and promoting a healthier urban environment.

5.Enhanced Vehicle Alert Systems: Extending existing vehicle alert systems, such as buzzer systems, to include functionalities for smart honking zones improves road safety and reduces noise pollution. By integrating these systems with the infrastructure of honking zones, drivers can be alerted to comply with regulations regarding horn usage, thereby minimizing unnecessary noise.

6.Promotion of Responsible Driving Behavior: Encouraging responsible driving behavior through education and awareness initiatives reinforces the importance of adhering to speed limits and noise regulations. By instilling a culture of compliance with traffic rules, cities can create safer and more livable urban environments for all residents.

By addressing these technological necessities, the proposed project aims to significantly reduce noise pollution in honking zones and improve the overall quality of life in urban areas. Through the integration of innovative solutions and collaborative efforts, cities can effectively manage noise pollution and promote sustainable development.

VI. CONCLUSION

This system offers a comprehensive solution to tackle road safety and noise pollution issues. By addressing factors like excessive speed, alcohol consumption, and unnecessary honking, it enhances safety and promotes a peaceful commuting experience. Utilizing GPS technology for precise interventions and curbing noise pollution contribute to a safer and more serene environment for travelers. Overall, this initiative fosters responsible driving behavior and promotes a safer, more harmonious journey for all.

SOME OF THE ADVANAGES FROM THE ABOVE RESULTS

a) Prevention of Accidents: By controlling vehicle speed and reducing noise pollution in honking zones, the system effectively reduces the risk of accidents caused by high-speed driving.

b) Driver Awareness: Real-time alerts about exceeded speed limits and horn noise levels in honking zones keep drivers informed and encourage them to drive responsibly.

c) Automatic Speed and Noise Control: The system automatically adjusts vehicle speed and horn noise levels, contributing to a safer and quieter environment on the roads.

d) GPS Location Tracking: Utilizing GPS technology to track honking zones enables users to proactively manage vehicle speed and reduce noise pollution in designated areas, enhancing overall road safety.

e) Improved Health and Well-being: By decreasing noise pollution and promoting silence in honking zones, the system helps alleviate headaches and

creates a more peaceful driving experience for users and residents alike.

f) Enhanced Safety and Security: The system provides an added layer of safety and security by actively monitoring and controlling vehicle speed and noise levels, ultimately contributing to safer roads and communities.

REFERENCES

[1] Ankita Mishra, Jyoti Solanki "Design of RF based speed control system for vehicles," International Journal of Advanced Research in Computer and Communication Engineering, Vol. 1, No 8, 2012.

[2] Vinod Rao, Saketh Kuma, "Smart Zone Based Vehicle Speed Control Using RF and Obstacle Detection and Accident Prevention," International Journal of Emerging Technology and Advanced Engineering, Vol.4, No.3, 2014.

[3] Gummarekula Sattibabu, Satyanarayan , "Automatic Vehicle Speed Control With Wireless In-Vehicle Road Sign Delivery System Using ARM 7," International Journal Of Technology Enhancements And Emerging Engineering Research, Vol 2, No. 8, 2014.

[4] Deepa B Chavan, Abdul Rahim Makandar , "Automatic Vehicle Speed Reduction System Using Rf Technology," International Journal of Engineering Research and Applications, Vol.4, No.4, 2014.

[5] Jyothi Kameswari, Satwik , "A Design Model for Automatic Vehicle Speed Controller," International Journal of Computer Applications, Vol.35, No.9, 2011.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Socket Games

Prof. Hemlata Hanamant Mane, Varad Santosh Limbkar, Shwetan Bharat Londhe, Gauri Bapu Mache
Department of Computer Engineering, NMIET affiliated to SPPU, Pune, India

ABSTRACT

One of the most basic network programming tasks you'll likely face as a Java programmer is performing socket functions. You may have to create a network client that talks to a server via a socket connection. Or, you may have to create a server that listens for socket connections. This research paper illustrates an example that showcases how we can use client-server communication to develop a multiplayer terminal game using basic Java and Java Socket Programming concepts.

Socket programming is a method of connecting two nodes on a network to establish communication between them. It involves the use of sockets, which are endpoints used for connecting to a node. The process typically involves one socket listening on a particular port at an IP, while the other socket reaches out to the former to form a connection. This method is commonly used in client-server architecture for communication between multiple applications.

The proposed program aims to deliver a simple, fun, multiplayer, terminal-based, game, providing a fun and engaging experience, and enjoyment to both players and developers.

It proves important for fostering creativity, providing entertainment, differentiating in the market, balancing game elements, and even contributing to brain improvement and stress reduction.

Keywords : Socket, Java, client, server, network, TCP, UDP, game.

I. INTRODUCTION

In the realm of computer science, proficiency in socket programming is essential for building robust networked applications, while mastery of gaming logic is key to creating engaging user experiences. These skills are foundational for students entering the field, offering pathways to diverse real-world projects and opportunities.

One of the most basic network programming tasks you'll likely face as a Java programmer is performingsocket functions. You may have to create a network client that talks to a server via a socket connection. Or, you may have to create a server that listens for socket connections. This report illustrates an example that showcases how we can use client-server communication to develop a multiplayer terminal game using basic Java and Java Socket Programming concepts.

The program incorporates socket programming concepts to establish connectivity i.e. connection between client and server which is used to facilitate the flow of data and the flow is bidirectional. Through gaming logic, we have developed a simple terminal game of “GuessTheNumber” game and as the name suggests, it’s a simple, fun game of guessing the correct number using the hints provided by the server. Additionally, concepts like Multithreading are utilized for improving the performance and efficiency of software programs,

particularly in handling concurrent tasks and improving system responsiveness.

Furthermore, adopting a project-based learning approach has enabled us to effectively address the multifaceted challenge of improving problem-solving skills, language proficiency, and understanding of socket programming.

This project report also discusses the implementation details, including the choice of language, game development principles, data structures, and integration of all these concepts to develop a multiplayer game. Furthermore, potential challenges and limitations of the proposed system are explored, along with suggestions for future research and improvements.

II. LITERATURE SURVEY

In information technology, client-server is a system architecture model consisting of two parts: a client system and a server system that communicate over a computer network. Client-server applications are a category of distributed systems consisting of client and server software. Client-server applications provide an advanced way to distribute the workload. The client process continuously initiates connections to the server, while the server process still waits for requests from the client.

A client is a computer hardware device that runs software that accesses the services provided by the server. A server is a computer that runs special software that provides services that meet the needs of other computers. Depending on the service you are running, this may be a file, servers, database servers, home media servers, print servers, web servers or even cloud servers that store virtual machines.

The client-server model described how a server provides services and resources to one or more clients. Each of these servers provides responses to client devices such as laptops, desktop computers, tablets, or smartphones. Typically, there is a one-to-many relationship between a server and a client. This means that one server can provide Internet resources to multiple clients at the same time once. When a client requests a link to a server, the server can either accept or reject the link.

Once a connection is accepted, the server uses a specific protocol to establish and maintain a connection with the client.

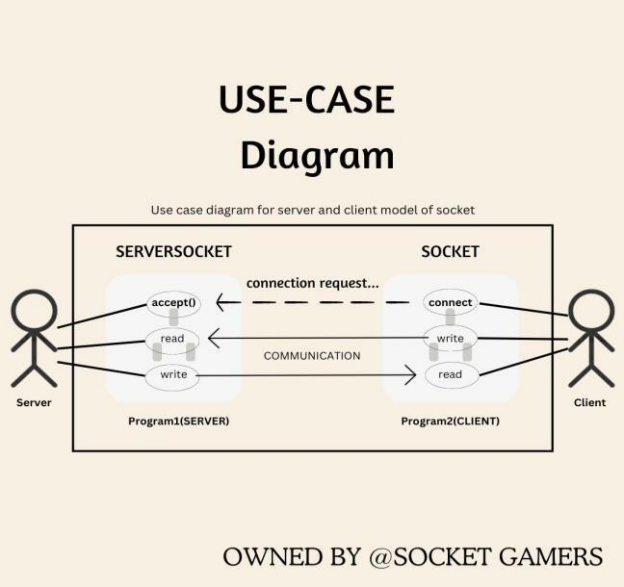


Fig.1. Use-Case diagram showing client-server architecture.

III. METHODOLOGY

Designing games using Java sockets involves creating a client-server architecture where the server manages the game state and the clients interact with the server to send and receive updates. Here are the steps to follow:

1. Define the game logic: The first step involves clearly defining the rules and mechanics of your game. Identify the game state that needs to be synchronized between clients and the server.
2. Choose a network library: Java provides built-in support for sockets in the java.net package. Alternatively, you can use higher-level libraries like Netty or Apache MINA for more advanced features.

3. Design the Server: The next step Implement the server that will manage the game state and handle client connections. Decide on the protocol for communication between clients and the server. This could be simple text- based commands or a more structured message format like JSON or XML. Set up a multithreaded server to handle multiple client connections simultaneously.

4. Implement the Client: Create the client application that connects to the server. Implement the user interface and game logic on the client side. Handle user input and send relevant commands to the server.

5. Synchronize Game State: Define messages for updating the game state and synchronize it between the server and clients. Implement methods for sending and receiving game state updates over the network. Ensure that the game state remains consistent across all clients.

6. Handle Errors and Edge Cases: Implement error handling to deal with network failures, disconnections, and other issues. Consider edge cases such as player disconnects, game restarts, or server crashes.

7. Testing and Debugging: Test the game thoroughly to identify and fix any bugs or issues.

Perform stress testing to ensure that the server can handle multiple concurrent connections. Debug networking-related problems using tools like Wireshark or built-in logging.

8. Optimization and Performance: Optimize network communication to minimize latency and bandwidth usage. Consider techniques like packet compression or delta encoding for transmitting game state updates efficiently. Profile your code and identify performance bottlenecks, then optimize accordingly.

9. Security Considerations: Implement authentication and authorization mechanisms to prevent unauthorized access to the server. Validate input from clients to prevent exploits such as cheating or denial-of-service attacks. Encrypt sensitive data transmitted over the network to protect it from eavesdropping.

10. Documentation and Maintenance: Document your code, including the network protocol and any special considerations for maintaining and extending the game. Plan for ongoing maintenance and updates, including patches and feature enhancements.

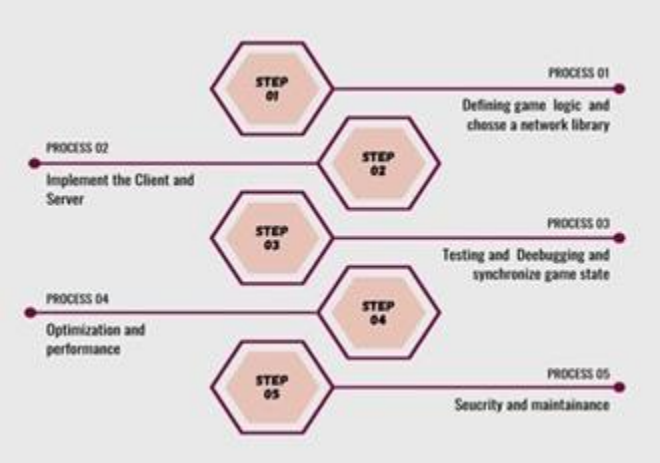


Fig. 2. Methodology used behind developing Socket Games

IV. RESULT

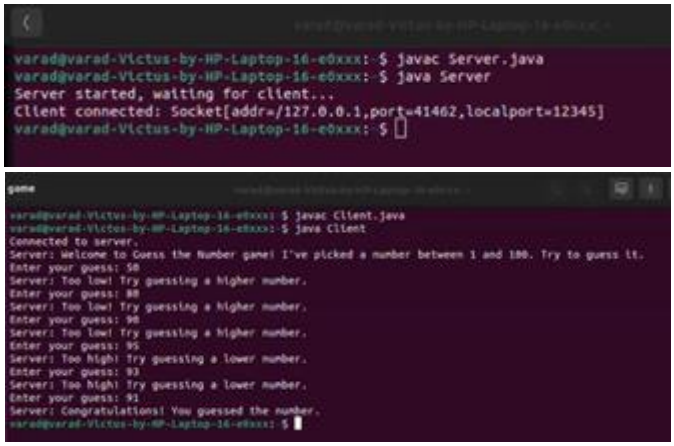


Fig. 3. Image of Output

V. ADVANTAGES

The advantages of this project are multifaceted:

1. Hands-on Learning Experience: Participants will gain practical experience in developing a multiplayer game system using Java and socket programming. This hands-on approach allows for a deeper understanding of the concepts and challenges involved in building real-time, networked applications.

2. Understanding of Socket Programming: By implementing socket creation, data transmission, and

client- server interaction, participants will develop a strong grasp of socket programming concepts. They will learn how to establish and manage communication channels between multiple clients and a central server efficiently.

3. Practical Application of Network Protocols: Through the project, participants will apply network protocols such as TCP/IP and UDP in a real-world scenario. This practical experience enhances their understanding of how these protocols facilitate communication over networks and their role in developing robust multiplayer game systems.

4. Development of Problem-Solving Skills: Building a multiplayer game system involves tackling various technical challenges, such as handling concurrent connections, synchronizing game states, and managing network latency. Participants will develop problem-solving skills as they address these challenges, fostering resilience and adaptability.

5. Collaborative Learning Environment: The project encourages collaboration among participants, fostering teamwork and communication skills. By working together to design, implement, and test the multiplayer game system, individuals learn from each other's experiences and perspectives, enriching the learning process.

6. Portfolio Enhancement: Completing a project of this nature demonstrates practical skills and proficiency in software development, making it a valuable addition

VI. LIMITATIONS

1. Limited Protocol Support: While socket programming provides basic support for TCP/IP and UDP protocols, it may lack built-in support for higher-level protocols such as HTTP, FTP, or SMTP. Developers may need to implement custom protocols or use additional libraries to support specific application-level protocols, adding complexity to the codebase.

2. Performance Overhead: Socket-based communication may introduce performance overhead due to factors such as network latency, data serialization/deserialization, and protocol overhead. Developers need to carefully optimize their code and network configurations to minimize latency and maximize throughput, especially in real-time or latency- sensitive applications such as multiplayer games or streaming media.

VII. FUTURE SCOPE

The future of socket programming holds immense promise, with opportunities for innovation and advancement across various domains. As technology continues to evolve, socket programming is poised to play a pivotal role in shaping the next generation of networked applications. Here are some areas where the future scope of socket programming is particularly promising:

1) Internet of Things (IoT): Socket programming will be instrumental in enabling communication between IoT devices, facilitating the exchange of data and commands in smart homes, industrial automation, healthcare, and beyond. As the IoT ecosystem expands, the demand for efficient and reliable communication protocols will continue to grow.

2) Real-Time Data Analytics: With the proliferation of big data and real-time analytics, socket programming will be crucial for transmitting and processing data streams from diverse sources. Applications in financial trading, social media monitoring, sensor networks, and cybersecurity will rely on socket-based communication for timely and accurate data analysis.

3) Cloud Computing: Socket programming will remain essential in cloud computing environments, enabling communication between cloud services, virtual machines, and client applications. As cloud adoption continues to rise, the need for robust and scalable networking solutions will drive further innovation in socket programming frameworks and protocols.

4) Edge Computing: In edge computing architectures, socket programming will facilitate communication between edge devices and centralized servers or cloud resources. This will enable low-latency processing of data at the network edge, supporting applications such as autonomous vehicles, augmented reality, and industrial automation.

5) Blockchain and Decentralized Applications: Socket programming will play a vital role in peer-to-peer communication networks underlying blockchain technology and decentralized applications (DApps). By enabling nodes to exchange data and transactions securely, socket programming will contribute to the scalability and resilience of distributed ledger systems.

6) 5G and Next-Generation Networks: The rollout of 5G networks and beyond will create new opportunities for socket programming to support ultra-low latency communication, massive device connectivity, and high-bandwidth applications. Socket-based protocols will evolve to leverage the capabilities of advanced network infrastructures, enabling innovative services and experiences.

7) Virtual Reality (VR) and Gaming: Socket programming will continue to underpin multiplayer gaming experiences and collaborative virtual environments, supporting real-time interaction and synchronization among players. As VR technology advances, socket-based communication will enable more immersive and responsive gaming experiences.

8) Artificial Intelligence (AI) and Machine Learning: Socket programming will facilitate communication between AI models, edge devices, and cloud-based services, enabling distributed computing for training and inference tasks. Real- time AI applications such as natural language processing, image recognition, and autonomous systems will benefit from efficient socket-based communication.

VIII. CONCLUSION

Furthermore, through the execution of this project, participants will not only gain theoretical knowledge but also valuable practical experience in the domains of socket programming and multiplayer game development. By actively engaging in the design and implementation of the multiplayer game system, individuals will deepen their understanding of fundamental network programming principles and witness their application in real-world scenarios.

This hands-on approach will foster a deeper appreciation for the intricacies of socket-based communication, allowing participants to grasp the nuances of establishing and managing connections between clients and servers. Moreover, as they navigate through the challenges of synchronizing gameplay, handling player interactions, and ensuring data integrity over networks, participants will hone their problem-solving skills and develop a resilient mindset in addressing technical obstacles. Ultimately, this project serves as a catalyst for enhancing proficiency in socket programming and underscores its pivotal role in the development of interactive applications. By immersing themselves in the intricacies of socket-based communication within the context of multiplayer gaming, participants will emerge with a newfound confidence and readiness to tackle more complex networking challenges in future endeavors.

ACKNOWLEDGMENTS

We would also like to thank Prof. Hemlata Mane, our project guide, for mentoring us during the project work. We also extend our heartfelt gratitude to our parents and associates for their invaluable support and encouragement. participants' portfolios. It showcases their ability to work on complex projects, apply programming concepts effectively, and deliver tangible results.

REFERENCES

1) In IPv6 IEEE 2015 International Conference on Computing Communication Control and Automaton, Bobade S. and Goudar R. (2015) present Secure Data Communication Using Protocol Steganography.
2) Improved Smart Power Socket for Monitoring and Controlling Electrical Home Appliances, Hassan E A, Shareef H, Islam M, Wahyudie E, and AbdrabouAA 2018, IEEE Access 6, p. 49292- 49305.
3) Lashkari, A.H.; Danesh, M.M.S.; Samadi, B. A survey on wireless security protocols (WEP, WPA and WPA2/802.11 i). In Proceedings of the 2009 2nd IEEE International Conference on Computer Science and Information Technology, Beijing, China, 11 August 2009; IEEE: Piscataway, NJ, USA, 2009; pp. 48–52.
4) Mishra, A.; Arbaugh, W.A. An Initial Security Analysis of the IEEE 802.1 X Standard; Technical Report CS-TR-4328. University of Maryland, College Park; 2002.
5) Utilizing Digital "Micro-Mirror" Devices for Ambient Light Communication by Xu, Tapia, and Ziga. Pages. 387–400 in Proceedings of the 19th USENIX Symposium on Networked Systems Design and Implementation (NSDI 22), Renton, Washington, USA, 4-6 April 2022.
6) J. F. Kurose and K. W Ross, “Computer Networking- A Top- Down Approach featuring the Internet”, 2nd Edition (Addison Wesley World Student Edition)
7) Samantha, D. (n.d.). Programming in Java. [Webpage]. Retrieved April 23, 2024, from https://onlinecourses.nptel.ac.in/noc24_cs43/preview

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Fake Currency Detection Using Machine Learning and Image Processing Techniques

Prof. Nutan Patil*[1], Prof. Sarika B. Patil[2], Prof. Harsha Sarode[3], Prof. Sonu Khapekar[4]

*[1,2,3] Assistant Professor, Department of Electronics and Telecommunication, and

[4]Assistant Professor, Department of Computer Engg., Nutan Maharashtra Institute of Engineering and Technology, Pune, Maharashtra, India.

ABSTRACT

In today's digital era, technology has transformed the way people live and work, making life more convenient and efficient. However, with the rapid advancement of technology, some individuals are misusing it for malicious purposes. Despite the benefits, technology has also created new opportunities for unethical behavior and criminal activities. One of the major challenges faced by the global economy is counterfeit currency. The emergence of advanced printing and scanning technologies has made it easy for counterfeiters to produce fake currency, which can be hard to detect. This poses a serious threat to individuals and businesses alike. To tackle this issue, various traditional methods and approaches have been employed, which involve analyzing colors, widths, and serial numbers of banknotes. However, these methods have their limitations, and thus, new techniques are needed. This paper explores the use of image processing for detecting counterfeit currency. By leveraging advanced image processing algorithms, it is possible to identify fake banknotes that are almost identical to genuine currency. Such methods have the potential to revolutionize the way we detect and prevent counterfeit currency.

Keywords : Image Processing, KNN Algorithm, CNN Algorithm, Canny Edge Detector, Image Segmentation, Android Development, Graphical User Interface.

I. INTRODUCTION

Counterfeit currency refers to fake money that has not been authorized by the government. This is a serious issue that many countries face, including India. To address this problem, machine learning methodologies can be used to extract the specifications of Indian notes. This involves processing images using various techniques of image processing and extracting features from the images. The process includes image segmentation, characteristics extraction, and image classification. While commercial areas can afford machines that use UV light and other techniques to detect the authenticity of currency, common people find it difficult to detect whether their currency is real or fake, and they may suffer losses as a result. To address this, a user-friendly system has been designed to enable anyone to detect the genuineness of their currency easily. This system can also be converted into a mobile app for wider accessibility.

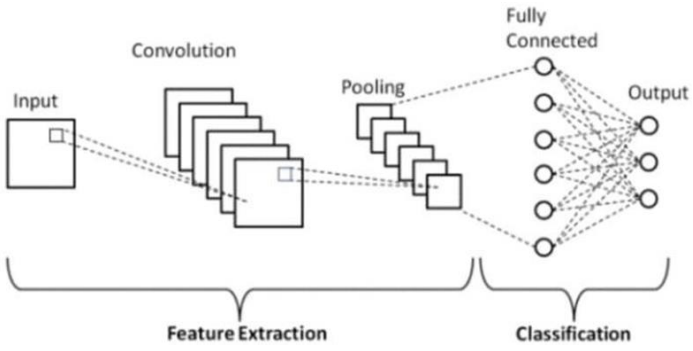
II.METHODOLOGY

A Convolutional Neural Network (CNN) is a type of neural network architecture that is often used in

Computer Vision, a field of Artificial Intelligence that enables computers to interpret visual data such as images. Neural Networks, including CNNs, are known for their strong performance in Machine Learning tasks across various datasets such as images, audio, and text. For example, Recurrent Neural Networks, specifically LSTM, are used for predicting sequences of words, while Convolutional Neural Networks are used for image classification.

In this blog, we will explore the basic building blocks of a CNN. A typical Neural Network has three types of layers: Input Layers, Hidden Layers, and Output Layers. The Input Layer is where the model receives its input, and the number of neurons in this layer corresponds to the number of features in the data, such as the number of pixels in an image. The input from the Input Layer is then fed into the Hidden Layers, which can have varying numbers of neurons depending on the model and data size. Each Hidden Layer computes its output by multiplying the output of the previous layer with learnable weights and adding learnable biases, followed by an activation function that makes the network non-linear. The output from the Hidden Layers is then fed into the Output Layer, which converts the output of each class into a probability score using a logistic function like sigmoid or softmax.

To train the model, the data is fed into the network, and the output from each layer is obtained through a process called feedforward. The network's performance is evaluated by calculating the error using an error function, such as cross-entropy or square loss error. Backpropagation is then used to calculate the derivatives of the error function with respect to the weights and biases of the network, which are used to update these parameters in order to minimize the loss.



III.MODELING AND ANALYSIS

3.1 Hardware Requirements

RAM : 8 GB

As we are using Machine Learning Algorithm and Various High Level Libraries Laptop RAM minimum required is 8 GB.

Hard Disk : 500 GB

Data Set of CT Scan images is to be used hence minimum 40 GB Hard Disk memois required. Processor : Intel i5 Processor IDE

Android studio

3.2 Software Requirements

Kotlin is a cross-platform, statically typed, general-purpose programming language with type inference. Kotlin is designed to interoperate fully with Java, and the JVM version of Kotlin's standard library depends on the Java Class Library, but type inference allows its syntax to be more concise. Kotlin is a modern statically typed programming language used by over 60 of professional Android developers that helps boost productivity, developer satisfaction, and code safety. Kotlin is a cross-platform, statically typed, general-purpose programming language with type inference. Kotlin is designed to interoperate fully with Java.

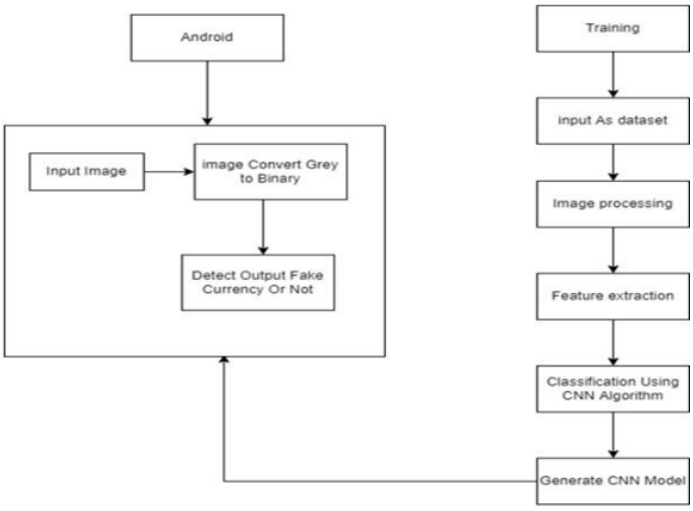
Android Visual studio: Android Studio is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. Android Studio provides a unified environment where you can build apps for Android phones, tablets, Android Wear,

Android TV, and Android Auto. Structured code modules allow you to divide your project into units of functionality that you can independently build, test, and debug.

3.3 ANALYSIS MODELS: SDLC MODEL TO BE APPLIED

SDLC Models stands for Software Development Life Cycle Models. In this article, we explore the most widely used SDLC methodologies such as Agile . Each software development life cycle model starts with the analysis, in which the Also, here are defined the technologies used in the project, team load. One of the basic notions of the software development process is SDLC models which stands for Software Development Life Cycle models. SDLC– is a continuous process, which starts from the moment, when it's made a decision to launch the project, and it ends at the moment of its full remove from the exploitation. There is no one single SDLC model. They are divided into main groups, each with its features and weaknesses.

1. Requirement Analysis - Requirement Analysis is the most important and necessary stage in SDLC. The senior members of the team perform it with inputs from all the stakeholders and domain experts or SMEs in the industry. Planning for the quality assurance requirements and identifications of the risks associated with the projects is also done at this stage. Business analyst and Project organizer set up a meeting with the client to gather all the data like what the customer wants to build, College Short Form Name, Department of Computer Engineering 2021 21 who will be the end user, what is the objective of the product. Before creating a product, a core understanding or knowledge of the product is very necessary.
2. System Design - The next phase is about to bring down all the knowledge of requirements, analysis, and design of the software project.
3. This phase is the product of the last two, like inputs from the customer and requirement gathering.
4. Implementation - In this phase of SDLC, the actual development begins, and the programming is built. The implementation of design begins concerning writing code. Developers have to follow the coding guidelines described by their management and programming tools like compilers, interpreters, debuggers, etc. are used to develop and implement the code.
5. Testing - After the code is generated, it is tested against the requirements to make sure that the products are solving the needs addressed and gathered during the requirements stage. During this stage, unit testing, integration testing, system testing, acceptance testing are done.
6. Deployment - Once the software is certified, and no bugs or errors are stated, then it is deployed. Then based on the assessment, the software may be released as it is or with suggested enhancement in the object segment. After the software is deployed, then its maintenance begins.
7. Maintenance - Once when the client starts using the developed systems, then the real issues come up and requirements to be solved from time to time. This procedure where the care is taken for the developed product is known as maintenance.

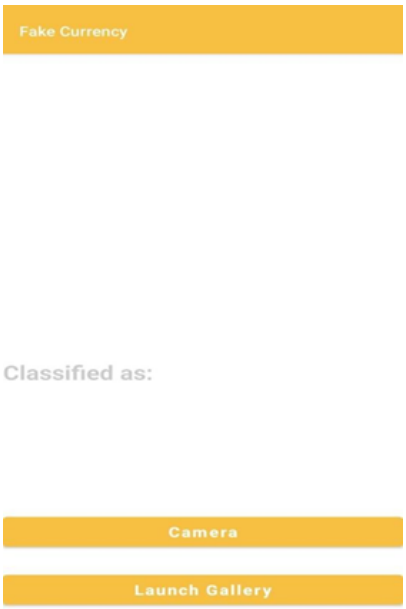


IV. RESULTS AND DISCUSSION

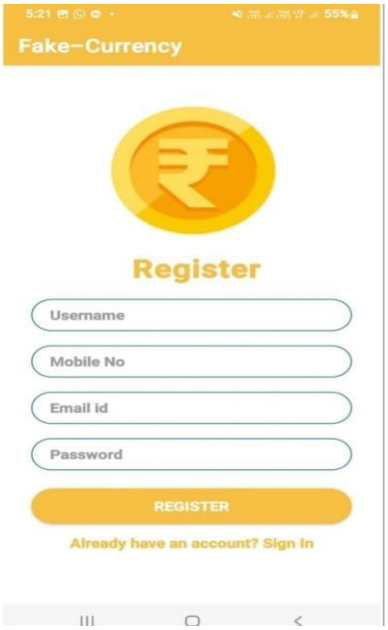
We have tested the input given by camera and by image upload option as well. We found that on most fake notes

the model is working and identifying whether it is fake. Also on the quality of image the accuracy is depend

Registration Page

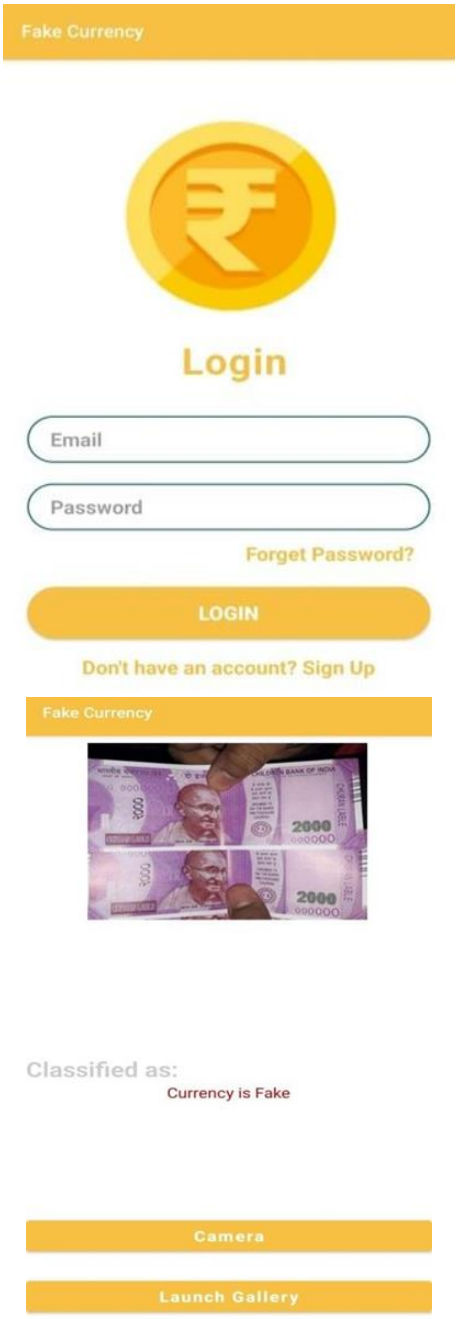


Login Page



Upload currency image using gallery or camera

Result – fake or real



V. CONCLUSION

In track of originality. Paper currencies are used much more in India and hence a system to detect the fake currency is needed. As the new currencies are used in the market, the proposed system seems to be useful to detect the currency to be genuine or not. This system compares more features for feature extraction than other proposed systems. It also shows where the differences are in the currencies instead of simply displaying the result. This system can be further

implemented for foreign currencies like Dollars, Euros, Taka etc.

REFERENCES

1. Laavanya, M., & Vijayaraghavan, V. (2019). Real time fake currency note detection using deep learning. Int. J. Eng. Adv. Technol.(IJEAT).
2. K. Kamble, A. Bhansali, P. Satalgaonkar and S. Alagundgi, "Counterfeit Currency Detection using Deep Convolutional Neural Network," 2019 IEEE Pune Section International Conference (PuneCon), 2019.
3. Sumalatha, R., Reddy, B. J., & Reddy, T. V. R. (2022, March). Identification of Fake Indian Currency using Convolutional Neural Network.
4. In Narra, P., & Kirar, J. S. (2021, December). Indian Currency Classification and Fake Note Identification using Feature Ensemble Approach.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Solar based Electronic Rescue System for Women safety

[1]Mrs. Sushma S. Bhosle, [2]Mrs.Sarika N. Patil, [3]Dr. Sagar V. Joshi, [4]Mrs.Neeta P. Karhadkar
Electronics and Telecommunication Department., NMIET, Pune, India

ABSTRACT

Women's security is a critical issue in today's world and it's very much needed for every individual to be acting over such an issue. This document describes a GPS and GSM based women security system that provides the combination of GPS device as well as provide alerts and messages with an emergency button trigger. Whenever somebody is in trouble. They might not have so much time all that they have to do is pressing the volume key. Especially women security has become the foremost priority of the world. System uses the Global Positioning System (GPS) technology to find out the location of women. The information of women position provided by the device can be viewed on Google maps using Internet or specialized software. The IT companies are looking forward to the security problem and require systems that will efficiently security working in night shifts, traveling alone. We focus on the proposed model that can be used to deal with the problem of security issue of women using GPS and GSM based tracking system.

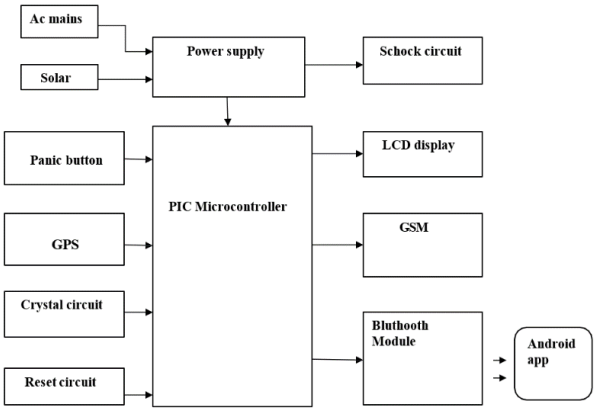
Keywords - GSM GPS, HELP, IOT, Microcontroller.

I. INTRODUCTION

Women are adept at mobilizing diverse groups for a common cause. They often work across ethnic, religious, political, and cultural divides to promote peace. We are all aware of importance of women's safety, but we must realize that they should be properly protected. Women's are not as physically strong as men, in an emergency situation a helping hand would be a relief for them. The best way to minimize your chances of becoming a victim of violent crime (robbery, sexual assault, rape, domestic violence) is to identify and call on resources to help you out of dangerous situations. Whether you're in immediate trouble or get separated from friends during a night out and don't know how to get home, having these device with can reduce your risk and bring assistance when you need it. Although several were originally developed for students to reduce the risk of sexual assault on campus

Here we introduce device which ensures the safety of women. This helps to identify resources to help the one out of dangerous situations. These reduce risk and bring assistance when we need it and help us to identify the location of the one in danger. This project designed to provide security to women. Main purpose of this device to provide the awareness on the time of critical situation for women. When you press the panic button device get activate and send SMS to those contact which you saved at the time of registration the SMS contain your message and your current location.

II. Proposed System



2.1 PIC MICROCONTROLLER:

A microcontroller is a small computer on a single integrated circuit consisting internally of a relatively simple CPU, clock, timers, I/O ports, and memory. Microcontrollers are used in automatically controlled products and devices. Microcontrollers are designed for small or dedicated applications. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes.

2.2 CRYSTAL CIRCUIT:

This circuit gives the required clock pulses to the microcontroller to give it the sense of the reference time

2.3 RESET CIRCUIT:

This circuit gives the microcontroller the starting pulse required to start the operation from the start. Unless this pulse is given, the microcontroller doesn't start functioning

2.4 BLUETOOTH:

Bluetooth Smart technology is a wireless communications system intended to replace the cables connecting many types of devices, from mobile phones and headsets to hear monitors and medical equipment. Wireless technology for short-range voice and data communication.

2.5 PANIC BUTTON:

A panic button is an electronic device designed to assist in alerting somebody in emergency situations where a threat to persons or property exists. When pressed, it sends a wireless signal to a home console which dials alarm monitoring staff and alerts them of an emergency condition. Depending on the severity of the situation, alarm monitoring staff will summon friends, family, or emergency services.

2.6 GPS MODULE:

Global positioning system is a navigational system involving satellites and computers that can determine the latitude and longitude of a receiver on earth by computing the time differences for signals from different satellites to reach the receiver.

2.7 GSM MODULE:

GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA).

III. Result

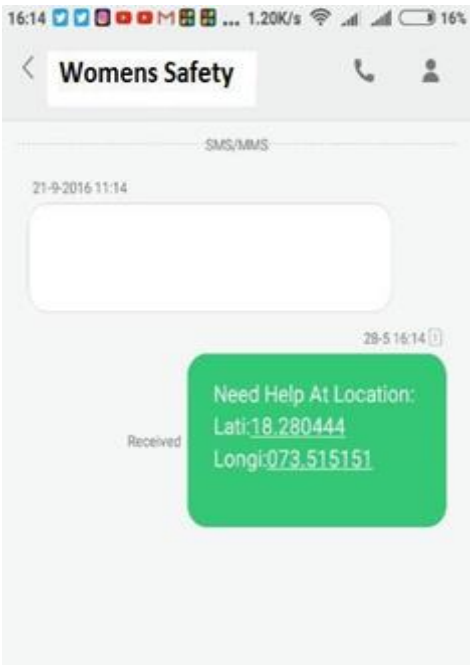


Fig. no.1 shows the sample of alert sms and fig no.2 show the accurate location on map

CONCLUSION

The proposed system is to ensure the security of the women in the society by send the "HELP & POSITION" to the relatives and the Police Station using Internet Of Things. Can be easily modified for improving the setup and adding new features. The system both accurate and reliable. Eliminates the continuously monitoring, it facilitates 24 hours a day, 365 days in year communication between system and user. It does not require line-of-sight operation. It is possible to implement this system on small board space also. Used for the safety of physically challenged people. Used for the safety of women. Used for the safety of children. Used as a legal evidence of crime with exact location information for prosecution.

REFERENCES

1. Smart girls security system-Prof. Basavaraj Chougula, Archana Naik, Monika Monu, Priya Patil and Priyanka Das,International Journal of Application or Innovation in Engineering & Management (IJAIEM) ISSN:2319-4847 Volume 3, Issue 4, April 2014
2. "electronic device for women safety"-Times of India, Sep 15 2013
3. Self defence system for women with location tracking and SMS alerting through GSM network-B.Vijaylashmi, Renuka.S, Pooja Chennur, Sharangowda.Patil International Journal of Research in Engineering and Technology(IJRET) eISSN: 2319-1163 |pISSN: 2321-730 Volume: 04 Special Issue: 05
4. Smart Electronic System for Women Safety S Shambhavi1 , M Nagaraja1 , M.Z Kurian1 Department of Electronics and Communication, Sri Siddhartha Institute of Technology, Tumakuru, India1 INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING Vol. 4, Issue 3, March 2016
5. M. Pradeep, R. Abinya, S. Sathya Anandhi , S. Soundarya, Dynamic Smart Alert Service for Women Safety System , International Journal of communication and computer Technologies: Vol. 5 No. 2 (2017)
6. WOMEN SAFETY DEVICE WITH GPS TRACKING AND ALERTING SYSTEM DECHAMMA A K , SWATHI , CHAITHALI , HARSHITHA K , Prof. Yogesh N, International Journal of Creative Research Thoughts (IJCRT), Volume 10, Issue 7 July 2022 | ISSN: 2320-2882

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Identifying Potential Mental Health Issues in Adolescents Through Screening

Aadesh Gupta[1], Harsh Patil[2], Aditya Mullankara[3], Pushpal Hedau[4], Shivaji Vasekar[5]
Computer Engineering, Dr. D. Y. Patil Institute of Engineering Management and Research, Pune, India

ABSTRACT
This paper describes our research into the key areas of addressing mental health problems in young people, highlighting the importance of early diagnosis and early intervention time to improve this. Through a comprehensive review, we identify and analyze the emergence of mental health problems among young people and present the diverse contexts in which they find themselves. Additionally, our study examines various measures and tools to evaluate their benefits and limitations. We advocate for a supportive environment where young people can openly discuss mental health issues and encourage collaboration between academies, healthcare providers, and families. Recognizing the potential and potential inherent in all young people, we view youth as a time of opportunity for growth, self-discovery, and vulnerability. We believe that by screening young people for mental health issues and providing early intervention and support, we can guide them through the uncertainty, anxiety, and safety they often face during this period of their lives. As caregivers, educators, and advocates, we are committed to providing youth with the tools and information necessary to overcome these challenges. Our investment in their health not only meets their immediate needs, but also lays the foundation for a future in which they can thrive, aspire and make a good contribution to their society. We believe that all young people have the potential to thrive, given the necessary support and understanding.

Keywords — Youth Mental Health , Early Intervention, Comprehensive Review , Collaboration , Resilience

I. INTRODUCTION

Having successfully concluded our project, our research paper emphasizes the significance of addressing mental health challenges among young individuals, emphasizing the critical role of early diagnosis and intervention during this crucial phase. We delve into the most prevalent psychological issues affecting youth and provide insights into their experiences. Furthermore, our paper evaluates various assessment methods and resources, analyzing their advantages and limitations. We advocate for the establishment of a supportive environment that fosters conversations about mental health among youth and promotes collaboration among educational institutions, healthcare professionals, and families. Rooted in our recognition of the potential within all young individuals, we view adolescence as a period of growth, self-discovery, and vulnerability. By screening teenagers for mental health issues and offering early intervention and support, we aim to guide them through the challenges of uncertainty, stress, and insecurity often encountered during this stage of life. As caregivers, educators, and therapists, we are committed to equipping young people with the necessary tools and

knowledge to navigate these challenges successfully. Our investment in their well-being not only addresses their immediate needs but also lays the groundwork for a future where they can thrive, pursue their aspirations, and contribute meaningfully to supportive and encouraging communities. With this conviction, we firmly believe that all young individuals can flourish when provided with the essential support and understanding.

II. NEED OF THE STUDY

Following our look into our research papers reveal the importance of addressing mental health issues in young people and demonstrate the important role of early diagnosis and intervention at this crucial stage. We explore the most common mental health issues affecting young people and understand their experiences. Additionally, in our article, various measures and resources are identified and their advantages and limitations are stated. We advocate for a supportive environment that encourages young people to talk about mental health issues and encourages collaboration between schools, professionals and families. We recognize the potential of every young person, so we see youth as a time of growth, self-discovery and vulnerability. By screening young people for mental health issues and providing early intervention and support, we help them cope with the uncertainty, anxiety and helplessness often encountered at this stage of life. As caregivers, educators, and professionals, we are committed to providing young people with the tools and information they need to overcome these challenges. The investments we make in their health not only meet their current needs, but also build them for the future, allowing them to thrive, follow their desires and have a positive impact on the society that supports them. With this belief, support and understanding, we believe that all young people can develop.

III. RESEARCH METHODOLOGY

Upon completion of our study, the methodology determines the project plan and methods used in the research, including many important factors. These include the scope of the study, demographic analysis, sample selection process, data, analyzed variables, and evaluation process. The specific description is as follows:

A. Functional Requirement

1.Managing users: We have implemented Google sign up and login which can be easily managed by administrators and owners

2.Screening Protocol: Owners and administrators can create, edit, delete or manage screening tests so that it can be used in various different problems and that can be used by people that need it to generate effective analysis of problem and giving appropriate solution for it. This software can be used by any individual or organization for screening mental health issues in adolescents. These can be used by schools, colleges or individuals

3.Data Entry and Storage: This software has a very simple and easy to understand interface allows any individual like teachers and practitioners to analyse the data generated to find patterns and extract useful information. Our project also complies with privacy regulations and keeps user data safe from any hackers or other users trying to steal data.

Analysis and Reporting: The software is able to generate reports with useful and aggregated data which can be used for graphical representations like charts, graphs and other required tools to help stakeholders and owners understand the situation and make informed decisions.

5. Blog Management: Users and Administrators can create various blogs in our software that consists of various helpful material related to mental health problems and also can be used for educational purposes by schools, colleges and various other organizations

6.Feedback Mechanism: This software allows users to give feedbacks related to software and also they are able to report bugs and issues causing problems in the software to help developers and administrators to

quickly and easily identify issues and solve them to give a better experience to users

B. Non-Functional Requirement

We built software that is very responsive and free of delays and lags for users and administrators. Our program provides accurate and useful results for users. We offer a user-friendly chat bot to assist users in resolving issues quickly. To secure user data, we have adopted security policies such as hashing and encryption to prevent hackers from stealing sensitive information.The interface is straightforward and easy to grasp, making it suitable for use by individuals and organisations to assess the mental health of employees and others.Our software is developed with clean and bug-free code to ensure reliability, accuracy, and minimal downtime that does not impact user experience.The software is designed to scale up or down resources based on user numbers. It can handle traffic fluctuations at any moment.The system adheres to government data privacy and security requirements. We regularly monitor our software and address user feedback and problem reports to provide a positive user experience.

C. Theoretical framework

Our software is a web application which allows teens, adolescents to screen themselves to figure out if they are facing any mental health related problems like depression, anxiety and other similar issues. Our software can also be used by schools, colleges and other institutions to use our software with their employees, students and other people to keep track of their mental well being. This software also provides the ability to the users to create or read blogs for educational purposes and also to to give useful information in the form of blogs to our website which will be useful to others. We have also provided a mental health chat bot with it in order to help people to easily communicate their problems in a simple language which can be understood by them.

Our software consists of three major components which are:

1. A database which stores all different users and their related information and past history of problems.
2. An easy to use chatbot which can help people easily communicate their issues like they are talking to a friend.
3. Screening tests used to easily and accurately identify mental health problem that the user is facing.

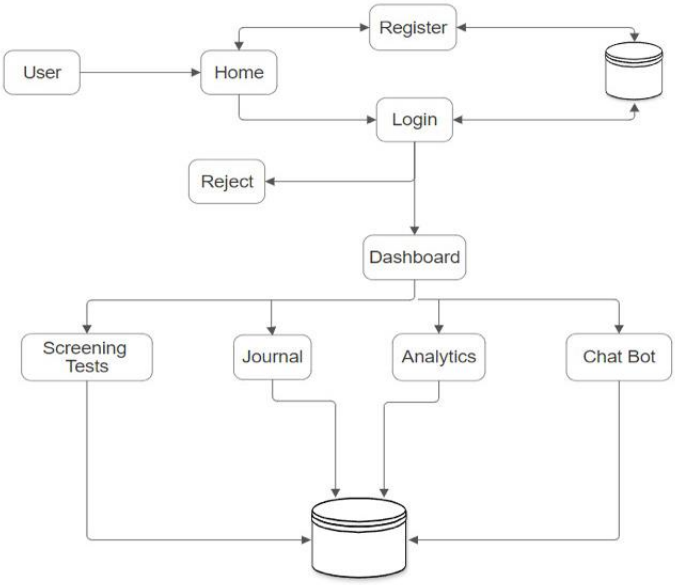


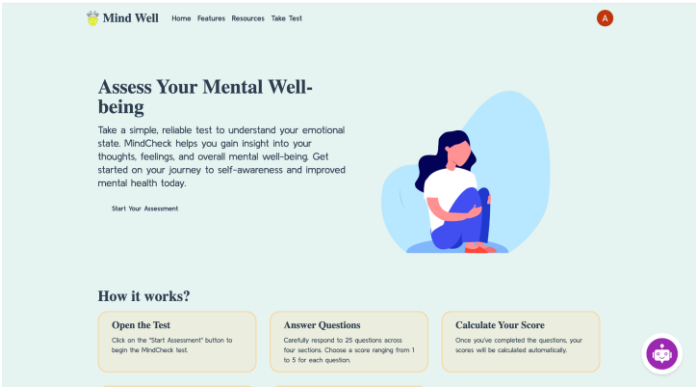
Fig. 1 Web Application Framework of the project

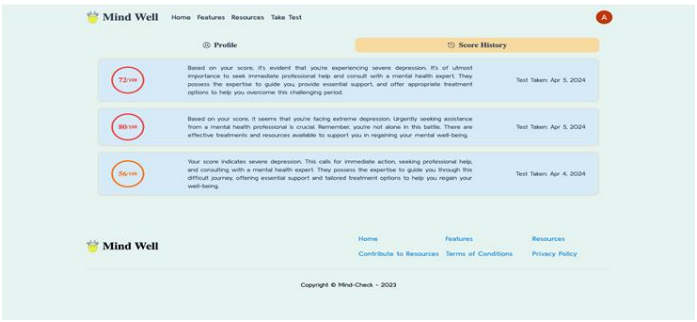
IV. RESULTS AND DISCUSSION

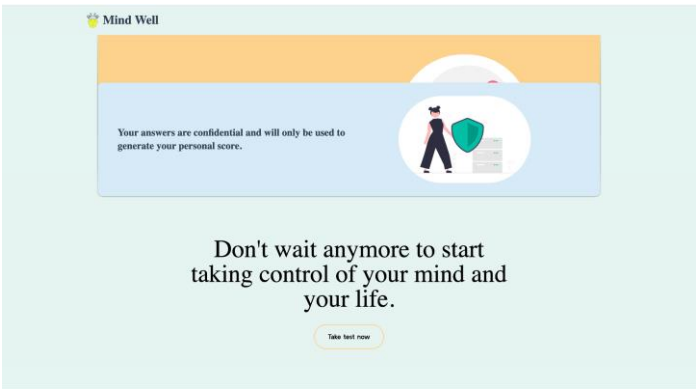
The project enhances many pros while considering mental health problems in the younger generation. The major advantage of this project is detection of issues at an early stage. Plus, the application provides data based decision making by gathering and understanding data from all possible sources concerning this particular area of topic.A delicate aspect of this project is it's commitment to standardization. Though the execution of proper screening protocols, the tests process keeps compatible around different learning and medical organisations.

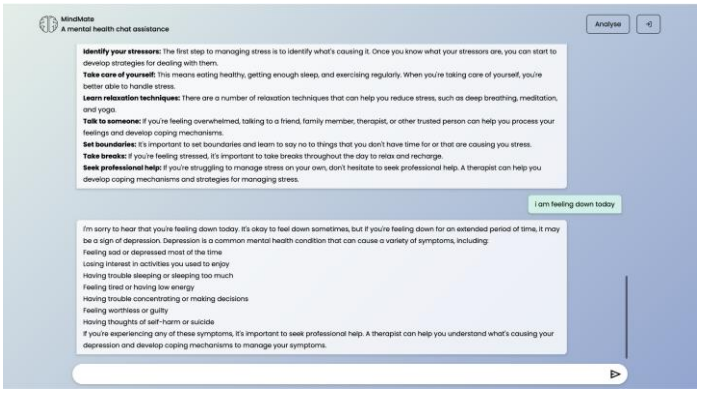
Nevertheless, particular restrictions should be considered. Confidentiality measures come because of

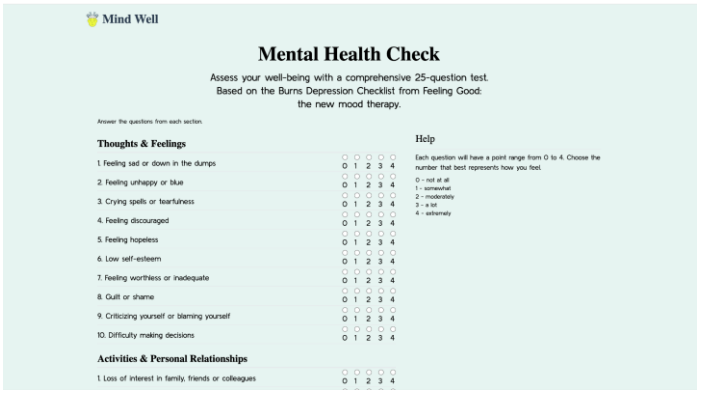
gathering of delicate knowledge from the users. This digitalisation of these practices increase problems for the individuals who are less active on the internet because of limited access to technology. In addition to that, the rationality of information provided by the younger generation creates unnecessary problems because users don't provide exact and correct information regularly considering such type of data.











V. CONCLUSIONS

After our project was successfully finished, we were able to expand our scope to include a thorough framework designed to address youth mental health issues by means of systematic screening and stigma reduction. To guarantee a smooth implementation, this required precisely specified goals, deliverables, stakeholders, and activity descriptions. It also included a comprehensive calendar with milestones, a strategy for allocating funds, and a strong risk management plan. Key performance indicators were among the evaluation criteria used to produce quantifiable results in evaluating the project's impact. Interactions within the project framework were governed by cooperation with a variety of stakeholders, a thorough communication plan, and ethical concerns. A focus on development and training made sure that project participants were fully qualified. Our scope also included considerations for further expansion, legal and regulatory compliance, and long-term viability.

ACKNOWLEDGMENT

Through reducing stigma and conducting rigorous screening. To guarantee a smooth implementation, this required precisely specified goals, deliverables, stakeholders, and activity descriptions. It also included a comprehensive calendar with milestones, a strategy for allocating funds, and a strong risk management plan. Key performance indicators were among the evaluation criteria used to produce quantifiable results in evaluating the project's impact. Interactions within the project framework were governed by cooperation with a variety of stakeholders, a thorough communication plan, and ethical concerns. A focus on development and training made sure that project participants were fully qualified. Our scope also included considerations for further expansion, legal and regulatory compliance, and long-term viability.

REFERENCES

[1] Choudhury A, Asan O, Alelyani T. Exploring the Role of the Internet, Care Quality and Communication in Shaping Mental Health: Analysis of the Health Information National Trends Survey. IEEE J Biomed Health Inform. 2022 Jan;26(1):468-477. doi: 10.1109/JBHI.2021.3087083. Epub 2022 Jan 17. PMID: 34097623.

[2] K. Park, M. Jung Kim, J. Kim, O. Cheon Kwon, D. Yoon and H. Kim, "Requirements and Design of Mental Health System for Stress Management of Knowledge Workers," 2020 International Conference on Information and Communication Technology Convergence (ICTC), Jeju, Korea (South), 2020, pp. 1829-1832, doi: 10.1109/ICTC49870.2020.9289464.

[3] R. Katarya and S. Maan, "Predicting Mental health disorders using Machine Learning for employees in technical and non-technical companies," 2020 IEEE International Conference on Advances and Developments in Electrical and Electronics Engineering (ICADEE), Coimbatore, India, 2020, pp. 1-5, doi: 10.1109/ICADEE51157.2020.9368923.

[4] R. Wang, J. Wang, Y. Liao and J. Wang, "Supervised Machine Learning Chatbots for Perinatal Mental Healthcare," 2020 International Conference on Intelligent Computing and Human-Computer Interaction (ICHCI), Sanya, China, 2020, pp. 378-383, doi: 10.1109/ICHCI51889.2020.00086.

[5] E. Krisnanik, I. N. Isnainiyah and A. Z. A. Resdiansyah, "The Development of Mobile-based Application for Mental Health Counseling during the COVID-19 Pandemic," 2020 International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS), Jakarta, Indonesia, 2020, pp. 324-328, doi: 10.1109/ICIMCIS51567.2020.935429

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Emotions Prediction Using EEG Signal : Survey Paper

Tanmay. V. Sukdeve, Tanaya. K. Patil, Pranali. P. Kadlak, Gayatri. S. Jagtap, Seema. P. Mahalungkar

Department of Compute Science and Engineering, Nutan College of Engineering and Research, Pune, India

ABSTRACT

This survey paper presents a comprehensive analysis of recent advancements in Brain-Computer Interface (BCI) research, with a focus on the integration of deep learning and machine learning techniques. The abstract encapsulates the key contributions of the surveyed papers, covering a diverse range of BCI paradigms, including motor imagery-based BCIs, neurohaptic interfaces, and imagined speech decoding. The surveyed literature encompasses methodologies such as transfer learning, feature extraction, classification algorithms, and various deep learning models. The comparative analysis highlights the strengths and applications of each approach, providing insights into their performance and potential clinical relevance. The paper concludes with a summary of common trends, challenges, and future research directions in the dynamic and evolving field of BCIs.

Keywords — Decentralized, cloud storage, peer to peer , Blockchain Technology, cloud & security, Centralized.

I. INTRODUCTION

Brain-Computer Interfaces (BCIs) have emerged as revolutionary technologies bridging the gap between human cognition and external devices. These interfaces hold immense potential in diverse applications, ranging from neurorehabilitation to communication and control of external devices. As the field evolves, the integration of advanced machine learning and deep learning techniques has played a pivotal role in enhancing the efficiency and scope of BCIs.

The primary objective of this survey paper is to provide a comprehensive overview of recent developments in BCI research, with a specific emphasis on the utilization of deep learning and machine learning methodologies. The introduction sets the stage by outlining the overarching significance of BCIs and their transformative impact on human-machine interaction.

A. Background and Significance

The advent of BCIs marks a paradigm shift in human-computer interaction by enabling direct communication between the human brain and external devices. These interfaces hold promise for individuals with motor impairments, offering new avenues for rehabilitation and assistance in daily life. Moreover, BCIs open possibilities for neuroscientific research and the development of innovative technologies that augment human capabilities.

B. Evolution of BCI Technologies

The evolution of BCI technologies has witnessed remarkable progress, transitioning from early experimental stages to practical applications. Early BCIs primarily relied on simple EEG signals, while contemporary approaches integrate sophisticated neuroimaging techniques and advanced signal

processing algorithms. This section briefly traces the historical progression of BCIs, highlighting key milestones and breakthroughs.

C. Motivation for the Survey

The integration of deep learning and machine learning techniques has significantly enhanced the capabilities of BCIs, particularly in tasks such as motor imagery classification, neurohaptic interfaces, and imagined speech decoding. This survey aims to consolidate and analyze recent literature, providing insights into the methodologies employed, experimental findings, and the potential impact of these advancements.

D. Scope and Structure of the Survey

This survey encompasses a diverse selection of recent papers, each contributing to different aspects of BCI research. The subsequent sections will delve into the methodologies employed in these studies, emphasizing the role of deep learning and machine learning in enhancing BCI performance. A comparative analysis of the surveyed literature will be presented, offering a holistic view of the current state of the field. The survey concludes by identifying common trends, challenges, and proposing potential avenues for future research.

II. RELATED WORK

The landscape of Brain-Computer Interface (BCI) research is rich and diverse, with numerous studies exploring different methodologies and applications. A significant body of related work exists, focusing on various aspects of BCIs, from motor imagery classification to neurohaptic interfaces and imagined speech decoding. In the realm of motor imagery-based BCIs, Ferrero et al. (Paper 1) leverage convolutional neural networks (CNNs) and transfer learning to address the challenge of limited data availability for commanding lower- limb exoskeletons. Yuan (Paper 2) offers a comprehensive review of feature extraction methods and classification algorithms for Motor Imagery BCIs, providing insights into the challenges and potential advancements in signal processing. Kim et al. (Paper 3) take a novel approach by introducing a brain-based interface system for communication and control via skin touch, catering to the demands of metaverse environments. Castro et al. (Paper 4) contribute to the field by investigating deep learning techniques for visual imagery recognition in BCIs, emphasizing the advantages of inherent feature selection in deep models. Kwak et al. (Paper 5) propose a deep feature normalization algorithm to address EEG variability in BCI decoding, demonstrating a substantial enhancement in deep learning performance. Liu (Paper 6) explores the impact of mindfulness meditation on BCI performance, introducing deep learning models for classifying BCI controls in meditators. Khaliq and Sivani (Paper 7) present a comprehensive review of the role of machine learning techniques in EEG-based BCIs, covering various tasks such as mental state detection, task categorization, and motor imagery classification. Abibullaev and Mun (Paper 11) delve into the realm of explainable deep learning for BCIs, using layerwise relevance propagation to analyze decision boundaries and explore model complexity reduction techniques. Cheng et al. (Paper 12) propose a deep learning approach for asynchronous motor imagery-based BCIs, showcasing the effectiveness of a cascade of one-dimensional convolutional neural networks and fully-connected neural networks. Limchesing et al. (Paper 13) demonstrate a system for brain-controlled wheelchairs using machine learning, extracting, reading, and analyzing EEG signals for real-time directional commands. Gao et al. (Paper 14) contribute to subject-independent P300 BCIs by proposing a convolutional neural network-based invariant pattern learning method, achieving high accuracies without subject-specific calibration. Van den Berg et al. (Paper 15) explore inner speech classification using EEG signals through a deep learning approach, introducing a 2D Convolutional Neural Network for word recognition tasks. Collectively, this related work forms a comprehensive foundation for understanding the breadth and depth of BCI research, showcasing the

diverse applications and methodologies that incorporate deep learning and machine learning techniques.

1] Transfer Learning with CNN Models for Brain-Machine Interfaces to command lower-limb exoskeletons: A Solution for Limited Data (Ferrero et al., 2023) This study evaluates the performance of two convolutional neural networks (CNNs) in a brain-machine interface (BMI) based on motor imagery (MI). Transfer learning is employed to address limited data availability, training models on EEG signals from other subjects and fine-tuning them to specific users. The study focuses on commanding lower-limb exoskeletons and explores the potential of CNNs and transfer learning in developing an automatic neural classification system for BMIs.

2] Features Domains and Classification Algorithms in Motor Imagery Brain Computer Interface (Yuan, 2022) Yuan provides a comprehensive review of feature extraction methods and classification algorithms commonly used for motor imagery EEG signals in Brain-Computer Interfaces (BCIs). The paper categorizes feature extraction techniques based on their domains (time, frequency, and spatial) and distinguishes between classical machine learning and deep learning classification algorithms. It aims to offer insights into common approaches and challenges in the signal processing of motor imagery for BCIs.

3] Towards Brain-based Interface for Communication and Control by Skin Touch (Kim et al., 2023) Kim et al. introduce a novel brain-based interface system based on tactile and sensory perception for potential use in metaverse environments. The paper presents a preliminary study on the development of next-generation neurohaptic interface technology that enables communication and control through skin touch. It explores the feasibility of decoding skin touch-related EEG signals to advance on-skin interface technology.

4] Development of a Deep Learning-Based Brain-Computer Interface for Visual Imagery Recognition (Castro et al., 2020) Castro et al. investigate the use of deep learning techniques, specifically deep neural networks, for visual imagery recognition in Brain-Computer Interfaces (BCIs). The study compares the performance of deep learning models against traditional classifiers and highlights the advantages of deep learning models, particularly in handling the chaotic and nonlinear nature of EEG signals.

5] Deep feature normalization using rest state EEG signals for Brain-Computer Interface (Kwak et al., 2021) Kwak et al. propose a feature normalization method using rest state EEG signals to address EEG variability issues in BCI decoding. The paper introduces a decoding structure trained with normalized features and demonstrates that the deep feature normalization algorithm significantly enhances the performance of conventional deep learning algorithms.

6] Deep Learning for Meditation's Impact on Brain-Computer Interface Performance (Liu, 2022) Liu explores the impact of mindfulness meditation on Brain- Computer Interface (BCI) performance. Using feed-forward neural network (FFNN) and convolutional neural network (CNN) models, the study classifies BCI controls for meditators. The research introduces optimal preprocessing methods and novel experimental designs to enhance the accuracy rates compared to traditional predictive methods.

7] The Role of EEG-based Brain Computer Interface using Machine Learning Techniques: A Comparative Study (Khaliq and Sivani, 2022) Khaliq and Sivani present a comprehensive review and comparative study of EEG-based Brain-Computer Interfaces (BCIs) using machine learning techniques. The paper covers various BCI tasks, including mental state detection, task categorization, emotional state classification, and motor imagery classification. The study assesses feature extraction, selection, and classification approaches, highlighting advancements in BCI applications.

8] Reinforcement Learning for Decoding Imagined Speech Neural Signals This paper aims to establish reinforcement learning techniques in the decoding of imagined speech neural signals. The study focuses on providing alternative natural communication pathways for individuals unable to communicate verbally due to

physical or neurological limitations. Reinforcement learning, based on deep learning algorithms, is employed to decode imagined speech neural signals, showcasing its potential in imagined speech decoding for BCIs.

9] Employing Deep Learning and Discrete Wavelet Transform Approach to Classify Motor Imagery Based Brain Computer Interface System (Ghafari and Azizi, 2022) Ghafari and Azizi propose an efficient deep learning approach for extracting features from EEG signals using a combination of convolutional neural networks and discrete wavelet transform in a Motor Imagery (MI)-BCI system. The study demonstrates remarkable accuracy and high performance compared to traditional approaches, eliminating the need for explicit feature selection and reducing processing costs significantly.

10] Towards Neurohaptics: Brain-Computer Interfaces for Decoding Intuitive Sense of Touch (Cho et al., 2021) Cho et al. introduce neurohaptics, a brain-computer interface system for decoding touch sensations. The paper presents a preliminary study on recognizing users' intentions based on haptic and sensory perception. Using EEG signals acquired during touching designated materials, the study evaluates classification performances through machine learning and deep learning approaches, confirming the feasibility of decoding actual touch and touch imagery in EEG signals.

11] Explainable Deep Learning for Brain-Computer Interfaces through Layerwise Relevance Propagation (Mun and Abibullaev, 2023) Mun and Abibullaev investigate the application of Layerwise Relevance Propagation (LRP) in explainable deep learning for Brain-Computer Interfaces (BCIs). The study employs LRP to analyze decision boundaries and evaluate the contribution of each input feature in deep learning models. The research aims to enhance transparency and interpretability in BCI models, providing insights into the underlying neural processes.

12] Deep Learning for Asynchronous Motor Imagery-Based Brain-Computer Interface (Cheng et al., 2021) Cheng et al. propose a deep learning approach for asynchronous motor imagery-based Brain-Computer Interfaces (BCIs). The study introduces a cascade of one-dimensional convolutional neural networks (1D CNNs) and fully-connected neural networks for decoding EEG signals related to motor imagery. The approach aims to address the asynchrony issue in motor imagery tasks, showcasing improved accuracy and robustness compared to traditional methods.

13] Machine Learning for Real-time Directional Control of Brain-Controlled Wheelchairs using EEG Signals (Limchesing et al., 2022) Limchesing et al. present a system for brain-controlled wheelchairs using machine learning techniques. The study involves real-time wheelchairs, contributing to the development of assistive technologies.

14] Subject-Independent P300 Brain-Computer Interface using Convolutional Neural Network-based Invariant Pattern Learning (Gao et al., 2021) Gao et al. propose a subject-independent P300 Brain- Computer Interface (BCI) utilizing a convolutional neural network (CNN)-based invariant pattern learning method. The study focuses on overcoming the challenges of subject-specific calibration by introducing a CNN architecture capable of learning invariant patterns across different users. The results indicate high accuracies in P300 BCI applications without the need for individualized training.

15] Inner Speech Classification using EEG Signals: A Deep Learning Approach (Van den Berg et al., 2022) Van den Berg et al. explore inner speech classification using EEG signals through a deep learning approach. The study introduces a 2D Convolutional Neural Network (CNN) for word recognition tasks based on inner speech signals. The research aims to contribute to the understanding of neural extraction, reading, and analysis of EEG signals to enable

Table I. COMPARATIVE ANALYSIS OF EXISTING LITERATURE SURVEY

Author	Algorithms	Observation	Limitations
Ferrero et al. (2023)	Transfer learning with CNNs	Evaluated CNN performance in BMI for lower-limb exoskeletons using transfer learning.	Limited data availability in BMI, need for automatic neural classification system.
Yuan (2022)	Various feature extraction and classification algorithms	Comprehensive review of feature extraction and classification methods for motor imagery BCIs.	Identifies challenges and gaps in signal processing for BCIs, offers insights into common approaches.
Kim et al. (2023)	Novel brain-based interface system	Preliminary study on neurohaptic interface technology for communication and control through skin touch.	Explores decoding skin touch-related EEG signals, potential advancements in on-skin interface technology.
Castro et al. (2020)	Deep learning for visual imagery recognition	Investigates the use of deep neural networks for visual imagery recognition in BCIs.	Highlights advantages of deep learning in handling chaotic and nonlinear EEG signals.
Kwak et al. (2021)	Deep feature normalization	Proposes feature normalization using rest state EEG signals to address EEG variability in BCIs.	Demonstrates significant performance enhancement of deep learning algorithms with deep feature normalization.
Liu (2022)	Deep learning for meditation impact	Explores the impact of mindfulness meditation on BCI performance using FFNN and CNN models.	Introduces optimal preprocessing methods and novel experimental designs for improved accuracy rates.
Khaliq and Sivani (2022)	Comprehensive review and comparative study	Reviews EEG-based BCIs using machine learning techniques across various tasks.	Assesses feature extraction, selection, and classification approaches, highlighting advancements and challenges.
Unpublished (2022)	Reinforcement learning for imagined speech	Establishes reinforcement learning techniques in decoding imagined speech neural signals.	Focuses on providing alternative communication pathways for individuals unable to communicate verbally.
Ghafari		Proposes a deep learning approach for MI-BCI using convolutional neural networks	Demonstrates remarkable accuracy and high performance, eliminating the

and Azizi (2022)	Deep learning with discrete wavelet transform	and discrete wavelet transform.	need for explicit feature selection.
Cho et al. (2021)	Neurohaptics for decoding touch sensations	Introduces neurohaptics for decoding touch sensations in BCIs based on EEG signals.	Evaluates classification performances through machine learning and deep learning approaches.
Mun and Abibullaev (2023)	Explainable deep learning using Layerwise Relevance Propagation	Investigates the application of LRP in explainable deep learning for BCIs.	Aims to enhance transparency and interpretability in BCI models, providing insights into neural processes.
Cheng et al. (2021)	Deep learning for asynchronous motor imagery	Proposes a deep learning approach for asynchronous motor imagery-based BCIs.	Addresses the asynchrony issue in motor imagery tasks, showcasing improved accuracy and robustness.
Limchesing et al. (2022)	Machine learning for brain-controlled wheelchairs	Presents a system for brain-controlled wheelchairs using machine learning techniques.	Demonstrates real-time extraction and analysis of EEG signals for enhancing the performance of brain- controlled wheelchairs.
Gao et al. (2021)	Subject-independent P300 BCI	Proposes a subject-independent P300 BCI using CNN-based invariant pattern learning.	Overcomes challenges of subject-specific calibration, achieving high accuracies in P300 BCI applications.
Van den Berg et al. (2022)	Inner speech classification using EEG	Explores inner speech classification using EEG signals through a deep learning approach.	Contributes to understanding neural correlates of inner speech, potential applications in BCIs for linguistic tasks.

CONCLUSION

In conclusion, the surveyed literature reveals a dynamic landscape in Brain-Computer Interface (BCI) research, showcasing diverse approaches and methodologies. The studies explored various applications, from motor imagery- based control of lower-limb exoskeletons to decoding skin touch and tactile perception in the metaverse. Advances in deep learning, transfer learning, and neurohaptic interfaces have demonstrated promising results in enhancing the performance and versatility of BCIs. The comparative analysis highlights the significance of transfer learning with convolutional neural networks in addressing limited data availability, the effectiveness of deep learning models in EEG signal

processing, and the potential of neurohaptic interfaces for intuitive communication and control. Additionally, studies focused on feature normalization, meditation's impact on BCI, and explainable deep learning contribute valuable insights into addressing challenges and improving system robustness. Despite the advancements, challenges such as the chaotic nature of EEG signals, variability across subjects, and the need for interpretability persist. The studies collectively underscore the importance of ongoing research to [ance their practical applications in real- world scenarios. Future endeavors should focus on refining algorithms, addressing subject-specific variations, and promoting the seamless integration of BCIs into daily activities, ultimately advancing the field towards more accessible and effective neurotechnological solutions.

REFERENCES

[1]. Ferrero, L., Quiles, V., Soriano-Segura, P., Ortiz, M., Iáñez, E., Contreras-Vidal, J.L., & Azorín, J.M. (2023). Transfer Learning with CNN Models for Brain-Machine Interfaces to command lower-limb exoskeletons: A Solution for Limited Data. 45 th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) , Sydney, Australia. DOI: 10.1109/EMBC40787.2023.10340008

[2]. Yuan, W. (2022). Features Domains and Classification Algorithms in Motor Imagery Brain Computer Interface. 2nd International Conference on Electronic Information Engineering and Computer Technology (EIECT), Yan'an, China. DOI: 10.1109/EIECT58010.2022.00081

[3]. Kim, M.K., Cho, J.H., Shin, H.B., & Lee, S.W. (2023).

[4]. Towards Brain-based Interface for Communication and Control by Skin Touch . 11 th International Winter Conference on Brain-Computer Interface (BCI), Gangwon, Korea, Republic of. DOI: 10.1109/BCI57258.2023.10078458

[5]. Castro, A.J.F., Cruzit, J.N.P., De Guzman, J.J.C., Pajarillo, J.J.T., Rilloraza, A.M.M., Nieles, J.P.M., & Prado, S.V. (2020) .Development of a Deep Learning-Based Brain- Computer Interface for Visual Imagery Recognition. 16 th IEEE International Colloquium on Signal Processing & Its Applications (CSPA), Langkawi, Malaysia. DOI: 10.1109/CSPA48992.2020.9068713

[6]. Kwak, Y., Song, W.J., & Kim, S.E. (2021). Deep feature normalization using rest state EEG signals for Brain- Computer Interface.International Conference on Electronics, Information, and Communication (ICEIC), Jeju, Korea (South). DOI: 10.1109/ICEIC51217.2021.9369712

[7]. Liu, B. (2022).Deep Learning for Meditation's Impact on Brain-Computer Interface Performance. International Communication Engineering and Cloud Computing Conference (CECCC), Nanjing, China.DOI: 10.1109/CECCC56460.2022.10069731

[8]. Khaliq, S., & Sivani, K. (2022). The Role of EEG-based Brain Computer Interface using Machine Learning Techniques: A Comparative Study.IEEE Industrial Electronics and Applications Conference (IEACon), Kuala Lumpur, Malaysia. DOI: 10.1109/IEACon55029.2022.9951740

[9]. Mahapatra, N. C., & Bhuyan, P. (2022).Decoding of Imagined Speech Neural EEG Signals Using Deep Reinforcement Learning Technique.In 2022 International Conference on Advancements in Smart, Secure and Intelligent Computing (ASSIC) (pp. 1-6). IEEE . DOI: 10.1109/ASSIC55218.2022.10088387

[10]. Ghafari, A.S., & Azizi, E. (2022). Employing Deep Learning and Discrete Wavelet Transform Approach to Classify Motor Imagery Based Brain Computer Interface System.29th National and 7th International Iranian Conference on Biomedical Engineering (ICBME), Tehran, Iran, Islamic

Republic of. DOI: 10.1109/ICBME57741.2022.10052993

[11]. Cho, J.H., Jeong, J.H., Kim, M.K., & Lee, S.W. (2021). Towards Neurohaptics: Brain-Computer Interfaces for Decoding Intuitive Sense of Touch. 9 th International Winter Conference on Brain-Computer Interface (BCI), Gangwon, Korea (South). DOI: 10.1109/BCI51272.2021.9385331

[12]. Mun, V., & Abibullaev, B. (2023).Explainable Deep Learning for Brain-Computer Interfaces through Layerwise Relevance Propagation.11th International Winter Conference on Brain-Computer Interface (BCI), Gangwon, Korea, Republic of. DOI: 10.1109/BCI57258.2023.10078678

[13]. Cheng, P., Autthasan, P., Pijarana, B., Chuangsuwanich, E., & Wilaiprasitporn, T. (2018).Towards Asynchronous Motor Imagery-Based Brain-Computer Interfaces: a joint training scheme using deep learning.2018 IEEE Region 10 Conference (TENCON), Jeju, Korea (South). DOI: 10.1109/TENCON.2018.8650546

[14]. Limchesing, T.J.C., Ong, J.D.S., Baldovino, R.G., Munsayac, F.E.T., & Bugtai, N.T. (2021). Interpreting and Analyzing Electric Signals for Brain-Computer Interface of a Brain-Controlled Wheelchair using Machine Learning.IEEE 13th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM), Manila, Philippines. DOI: 10.1109/HNICEM54116.2021.9732044

[15]. Gao, W., Yu, T., Yu, J.G., Gu, Z., Li, K., Huang, Y., & Yu, Z.L. (2021). Learning Invariant Patterns Based on a Convolutional Neural Network and Big Electroencephalography Data for Subject-Independent P300 Brain-Computer Interfaces. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 29(1047-1057). DOI: 10.1109/TNSRE.2021.3083548

[16]. Van den Berg, B., Van Donkelaar, S., & Alimardani, M. (2021).Inner Speech Classification using EEG Signals: A Deep Learning Approach.IEEE 2nd International Conference on Human-Machine Systems (ICHMS), Magdeburg,Germany. DOI: 10.1109/ICHMS53169.2021.9582457

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Technological Advances in Medical Profession and its Impact on Nobilities and Values of Medical Profession

Prof. Dr. D. M. Jadhav[1], Prof. Swapnil Jadhav[2]
[1]Maharashtra National Law University, Aurangabad.
[2]Ph.D. Scholar, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

Medical Profession is considered to be one of the noble professions of the society. This profession is most respectful profession since the doctors are providing their services towards the life of human being. Ethics and principles of morality are deeply rooted especially in all services towards the human mankind. The medical ethics and moral values of the medical profession kept intact its sanctity and nobility in the society. No doubt being a profession it is controlled and supervised by the Medical Council. The regulating authorities play a key role in maintaining the standard of medical profession and healthcare sector. These authorities also ensure that the medical professionals should follow the standards of professional ethics and if necessary in case of any deviance on behalf of the medical professional, if required, take necessary action against them. As a role of professional doctor facilitate and provide medical care and facilities to the patient which is termed as "service". The word service is a comprehensive term which includes services available to the potential users. In a way ethical considerations are considered to be paramount consideration for the medical professionals and it has great relevance in maintaining noble values of the medical profession. More specifically when they deals with life of the patient and his welfare and well-being. Like any other profession medical profession has also undergone through a paradigm shift in terms of its nature, process and facilities due to intervention of technology.

In the era of competition there are many forces operating in the field of medical profession which inconsequentially determine the value of profession in the society. The doctors are supposed to be very skillful and should possess updated knowledge of the field. Healthcare sector is also a prime concern of the government and the government also tries to provide healthcare facilities and necessary emergency services to meet the objectives of welfare state. Medical ethics and guidelines are followed due to moral & legal obligation for the protection of rights of the patients. It shows that, around in 18th century the code of conduct for the medical professionals started developing to gear up for maintaining the standard of medical profession and to keep intact code of common conduct. As referred earlier technology is meant for making our life more comfortable and dignified. The use of medical technology in medical profession has really changed the shape and dimensions of the medical profession. The technology has also impacted on noble values of the profession. Technological intervention to facilitate healthcare sector has made the life of patient more comfortable and healthy. Right to Health is guaranteed within the ambit of 'Article 21 of the Constitution of India'. The dignified life guaranteed under Article 21 of the

Constitution of India includes: "right to health and healthcare condition without which life is unhappy".[1] A meaningful life contents right to health which is inseparable from a human being.[2] The social order as contemplated under Article 38 of the Constitution of India is meaningless without there being public health. Similar responsibility is shouldered on the State under Article 39 (e) to protect health and strength of the worker. The Constitution mandates under Article 41 and 42 also ensure State assistance to the sick and disabled people and just human conditions to the workers. In a way the Constitution of India provides a meaningful life which includes health, strength required for quality life guaranteed under Article 21 of the Constitution of India. Even though the directive principles of the State policy are not justiciable through the Court of Law, however, they are necessary to provide the guidance to the State for welfare and well-being of the people. The Supreme Court of India in Parmananda Katra Case upheld the responsibility of medical professionals in safeguarding the public health.[3]

Impact of Technology in Healthcare Sector:

The intervention of the technology in medical science has radically changed the scope, ambit and dimension of medical profession. The technology also affects the decision making of the medical professionals and diagnosing the disease and moreover, IT tools also indirectly controls the doctors and their discretion. In India the healthcare sector especially government hospitals are not much equipped with infrastructures and resources, hence use of such technology may be a big challenge for the government hospitals. As a digitalization of healthcare also need IT infrastructure, special training, technical soundness to use the same.[4] The impact of technology in diagnostic and therapeutic equipment has also changed the practice, pattern and profession. The practice of medicine nowadays depends upon new technology used for diagnosis and treatment. This technology is used for all kind of medical investigations to telemedicine. The unwarranted and excessive use of this technology, however, increased the cost of health services and makes health facilities inaccessible. The increased demand of new technology in every spare of health and its advancement has made medical profession expensive and unaffordable for the common man.[5]

Pros and Cons of Technology:

Undoubtedly the digital technology is being used for maintaining the medical records, summary of patients, lab reports, medical prescriptions, diagnostics etc. This also helps for better communication and accuracy to know the history of the patient and it simultaneously reduces the error. The ICT tools also help both medical professionals and patients and that develop a bond between both of them. This digitalization helps in coordination for updates and to avoid medicational errors. During Covid Pandemic various health apps were developed for quick information, track the record of the patients to access him and to customize health services. The medical facilities through telemedicine or through various apps and video calls reduce the unnecessary time consumption in delivery of services.[6] The use of advance technology has both positive and negative impact, it provides scope for errors in case of inadequate and inaccurate data and in certain cases life threat to the patients. The relationship in between the doctors and patients is fiduciary relationship where the confidentiality and privacy is a great concern for both

[1] Shanta v. State of Andhra Pradesh AIR SC 922

[2] Consumer Education and Research Centre v. Union of India, (1995) 3 SCC 42.

[3] 1989 (3) SCC 233

[4] Sabur Safi, Thomas, Thiessen, Kurt Schmailjal, Dr. Made, Acceptance and Resistance of New Digital technologies in Medicine: qualitative study, GMIR, Res Proctoc 2018, December, 7 (12)

[5] LTH Tan and KL, ONG, the impact of medical technology and healthcare, Hongkong Journal of Emergency Medicine, Volume 9 (4) October 2002

[6] Mobile Technology, Tool for healthcare and a Boon in pandemic, journal of family medicine and primary care, 2022, January, 11 (1) P 37-40.

hospital and patients. In digitalization risk of data privacy and security concerns because of cyber-attacks may compromise the privacy and confidentiality. As stated earlier, more dependency on digitalization reduces necessary clinical skills, critical evaluation of case and apt analysis and diagnosis of the same. The doctor-patient relationship is more or less depends upon human relationship and the very digitalization and excessive use of technology disturb the natural communication and human interaction and this inconsequentially affect effective healthcare.[7] In India to deal with epidemic we faced lot challenges of resources as well as modern infrastructure even at private and government hospitals for controlling digital solutions for pandemic situation. This resolves and provides solutions immediately but maintaining the privacy of such data is a big challenge in thickly populated country like India. In the backdrop of infrastructural crisis and facilities for going ahead with digitalization in healthcare sector is a big challenge because of accessibility, affordable care and financial burden.[8] The ICT tools in healthcare sector surely provides safe and quality services, however, there are many challenge of effective implementation due to infrastructure and resources and professional expertise required for the same.[9]

Diluting Spirit, Nobility and Values of Medical Profession in India: In India due to quality healthcare services, special care and expensive medication and hospital expenses contribute high cost medication. In the era of competition many practices are rampant in the form of unnecessary testing for the labs as a routine general practice. In many cases, such lab testing is not necessary, however, such consultative practices and referrals of patient from one lab to another lab is a routine practice which affect cost effective healthcare facilities. It has been observed in many cases as a precautionary measure the patients are admitted in ICU for monitoring the sensitive and critical cases. However, this is followed as a routine practice in most of the hospitals as a safety measure. Digitalization provides platform for routine referral for labs as a practice. We need to have a control and supervisory mechanism especially for such referral through digitalization.

The technological intervention also provides scope for misuse the technology for commercialization and profit making:

Indian is popular destination for clinical trials basically in bio-medical research of new drugs. It has been observed that such clinical trials are conducted without any safety measures, control and supervision at the cost of health. In many cases, the requisite permissions of Drug Controller General of India is not taken, the guidelines laid down by Indian Council of Research are also not followed, resulting adverse effects of such trials. In the backdrop of misuse of clinical trials, it is suggested that, to maintain the record of such clinical trials through digitalization is required to control and supervise the same by various regulating authorities. This will maintain the standards of clinical trials, its scientific accuracy, control and supervision and avoid side-effects of drugs and procedural deviance.

Female Foeticide:

In view of typical patriarchal psyche along with traditional religious belief that male child continues the name of family. The female foeticide and illegal abortions are rampant in India which has disturbed the male-

[7] Is the effect of technology positive or negative, by HM Team, March 29, 2023

[8] Angayarkanni S Annamalai and others, impact of health information technology tools on patient safety in the Indian Healthcare Industry, the open Bio-Medical Engineering Journal, 2023 Volume 17 P- 1.

[9] Oluwamayowa Ogumdaini and others, unintended consequences of technology – enabled work activities experienced by healthcare professionals in tertrai hospitals of Sub Saharan Africa, African Journal fo Science, Technology, Innovation and Development, 2022 Volume 14 (4) 876

female sex ratio. The doctors are involved in sex-determination and illegal abortions by misusing this technology which is meant for diagnosing anomalies in the child. The rampant increase in misuse of techniques shows a bad track record deteriorating values of medical profession. Despite of special legislation, Medical Termination of Pregnancy Act and Preconception and Prenatal Diagnostic Technique Act, 1994, termination of pregnancies, illegal abortions reveals misuse of technique for profit making intension diluting the spirit of medical profession.

Cost Effective Health Services – A Big Challenge:

The unexpected and exorbitant bills are recovered from the patients in mega hospitals in metro cities and this was observed during the pandemic. In order to have a reasonability of medical services towards the patient as a consumer such overcharging of the bills and financial exploitation of the patients can be very much supervised and controlled through digitalization of financial record. This will surely reduce overcharging and unwarranted expenses levied against the patients. The cut throat competitions and privatization of healthcare services has really made healthcare sector more expensive. As a routine experience private clinics and hospitals are much more expensive than the government hospitals. Hence the private healthcare sector needs to be regularized properly to have access to health for the common man. The quality healthcare facilities are required to be controlled by the Government to seek balance between rich and poor people. The initiatives to have public private partnership in healthcare sector may improve the quality of healthcare services to some extent. But as a constitutional guarantee we need to rule out inequality in access to healthcare. During Covid Pandemic access to quality healthcare services were found much difficult for the middleclass and lower middleclass patients and as a result they were compelled to avail the facility from the much crowded government hospitals putting life at risk. In a way commercialization of medical profession due to workload on healthcare sector, availability of resources, infrastructural crises and challenges in government hospitals and financial forces operating in the field has made effective and affordable healthcare services a big challenge. Right to health and medical care even if guaranteed as a fundamental right but the implementation of the same due to unequal parameters and policies have disturbed the effective implementation of it. After Covid pandemic the Central Government is promoting Ayurvedic Medicines to encourage ayurvedic medicines in India. In recent past the Ayurvedic Pharmaceutical Companies are promoting the drugs and medicines, deviating existing regulatory mechanism and legislative framework.

The digitalization and promotion of such medicines through misleading advertisement on digital platform with magic remedies has been prohibited under the Drugs and Magic Remedies (Objectionable) Act, 1954. Recently the Supreme Court of India passed an order warning Uttarakhand Government for not taking any actions against Baba Ramdev's 'Divya Pharmacy'. In an affidavit filed before the Supreme Court Patanjali Ayurveda's Managing Director, Aacharya Balkrishnan tendered apology for misleading advertisement of certain pharmaceutical products. Such advertisements deviates the policy parameters and legislation such as Drug and Magic Remedies (Objectionable) Act, 1954. Since, the advertisement, and overestimation of the claim about the pharmaceutical products were based on unscientific data and advances were made without any scientific enquiry.

Deceptive Medical Advertisements:

These cases bring into sharp focus a troubling reality: a worrying shift within the medical profession towards prioritizing financial gains over the fundamental duty of care. Laws such as the Drugs & Magic Remedies Act, designed to protect consumers from false claims, become the sword in this legal combat.

Baba Ramdev and Acharya Balkrishna apologized before the Supreme Court for misleading advertisements of Patanjali's medicinal products, averting contempt proceedings. The apology came ahead of their scheduled

appearance in court. Uttarakhand government assured strict action against Patanjali Ayurved, and the Ministry of Ayush requested withdrawal of misleading advertisements. The court had earlier warned of a Rs 1 crore fine for continued misleading ads, prompted by a petition from the Indian Medical Association.[10] In the case of Vini Cosmetics Pvt. Ltd. v. State of Maharashtra (2020)[11] Issues involved allegations of false advertising by a cosmetics company. The Supreme Court reaffirmed the importance of upholding advertising standards and penalizing companies that engage in deceptive practices.

Such misuse of technology through digital platform in promoting medicines with overestimated claims has greater audio visual impact on viewers.

Telemedicine and Remote Monitoring:

Technological innovations like telemedicine and remote monitoring allow healthcare professionals to provide medical care and consultations remotely. Application of these advancement improve accessibility and efficiency, however, use of these technologies is not free from many challenges, since use of it dilute traditional values and personalize care. Such technology in the form of telemedicine remote monitory assists in monitoring the patient to provide prompt care. This also helps in improvement of patient self-care, efficient communication, increased patient confidence, visualization of health trends, and greater patient education. Challenges comprised increased workload, higher patient anxiety, data inaccuracy, disorienting technology, financial issues, and privacy concerns.[12] Telemedicine and remote monitoring utilize technology to provide healthcare services and monitor patients remotely. Beyond traditional consultations, telemedicine enables virtual visits, real-time health monitoring, and remote diagnosis, improving access to healthcare, especially in remote or underserved areas. Additionally, it facilitates continuous monitoring of chronic conditions, early detection of health issues, and timely intervention, enhancing patient outcomes and reducing healthcare costs. Moreover, telemedicine has shown promise in improving patient engagement and adherence to treatment plans through convenient and accessible healthcare delivery models.

Artificial Intelligence (AI) in Diagnostics:

The risk of AI in diagnostics lies in the potential erosion of traditional values such as clinical judgment and human intuition. While AI-powered tools offer superior accuracy and speed in analyzing medical data, over-reliance on these technologies may diminish the role of human expertise and intuition in medical decision-making, potentially compromising patient care.

For instance, if doctors solely rely on AI algorithms for diagnosing medical conditions without incorporating their clinical judgment and intuition, they may overlook nuanced patient factors that could impact the diagnosis and treatment plan. This over-reliance on AI could lead to missed diagnoses or inappropriate treatment decisions, ultimately putting patient outcomes at risk. Despite AI's promise, inherent biases in algorithms raise concerns of inaccurate diagnoses, posing risks to patient well-being. Additionally, privacy risks heighten with

---

[10] India Today, Kanu Sarda, New Delhi, UPDATED: Apr 9, 2024 23:07 IST, Written By: Vivek Kumar, https://www.indiatoday.in/law/story/baba-ramdev-apology-before-supreme-court-in-misleading-ad-case-2525308-2024-04-09, Accessed on 8th May, 2024, at, 4:30pm

[11] (2020) 3 SCC 177.

[12] Pubmed Central, Benefits and Challenges of Remote Patient Monitoring as Perceived by Health Care Practitioners: A Systematic Review, Perm J. 2023; 27(4): 100–111.
Published online 2023 Sep 22. doi: 10.7812/TPP/23.022, PMCID: PMC10730976, PMID: 37735970, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10730976/#:~:text=Recurring%20themes%20emerged%20for%20both,strategies%20will%20become%20increasingly%20relevant. Accessed on 25th April, 2024 at 3:00pm

healthcare data, even when anonymized, demanding robust protection measures. Healthcare professionals must navigate these challenges, ensuring AI's responsible use while upholding patient trust and confidentiality.[13]

Robotic Surgery:

The risks associated with robotic surgery stem from the potential loss of the human touch and empathy in the operating room. While robotic systems offer precision and minimize invasiveness, concerns emerge about the diminished patient-provider connection and the potential for reduced emotional support during procedures. This can impact patient satisfaction and outcomes, highlighting the importance of maintaining a balance between technological advancements and the human element in surgical care.

Robotic-assisted surgery (RAS) entails similar risks as open and laparoscopic procedures, such as infection, bleeding, and anesthesia-related complications. However, unique to RAS are additional risks stemming from potential human error in operating the robotic technology and the increased likelihood of mechanical failures. Malfunctions in various components, including the camera, robotic tower, and instruments, can occur, posing risks of unintended internal burn injuries due to electric arcing from the cautery device. These concerns highlight the importance of thorough training and vigilant monitoring during robotic surgeries to mitigate potential risks and ensure patient safety.[14]

Genomic Medicine:

Genomic medicine involves using an individual's genetic information to personalize medical treatment and disease prevention strategies, aiming to improve healthcare outcomes and tailor interventions to each patient's unique genetic makeup. It encompasses the analysis of an individual's genome to identify genetic variations associated with diseases, drug responses, and other health-related factors, guiding personalized treatment decisions and preventive measures.

Genomic medicine's promise of personalized treatments based on genetic makeup brings hope for improved healthcare outcomes. However, it also raises critical concerns, including patient privacy and equitable access to cutting-edge therapies. Patients fear genetic data breaches, which could lead to discrimination or misuse of sensitive information. Additionally, socioeconomic factors often limit access to genetic testing and specialized treatments, deepening healthcare disparities. Ethical dilemmas abound, from informed consent to the disclosure of genetic risk information. Patients grapple with the implications of genetic testing results, facing potential psychological distress and uncertainty. Thus, while genomic medicine offers groundbreaking possibilities, its implementation must navigate complex ethical and social challenges to ensure patient well-being and equitable healthcare access for all.

Health Information Technology:

Health Information Technology (HIT), encompassing Electronic Health Records (EHRs) and Health Information Exchange (HIE) systems, revolutionizes patient data management and communication in healthcare. EHRs centralize patient records, enabling healthcare providers to access comprehensive medical histories, streamline documentation, and coordinate care efficiently. Similarly, HIE systems facilitate secure sharing of patient

[13] by Jacob Bedi, Healthcare Lead, Opportunities and risks of AI in healthcare, lockton news website, ARTICLES / FEBRUARY 15, 2024, https://global.lockton.com/gb/en/news-insights/opportunities-and-risks-of-ai-in-healthcare, Accessed on 1st May, 2024 at 05:34am

[14] Tara Kirkpatrick, MD, and Chad LaGrange, MD, Robotic Surgery: Risks vs. Rewards, February 1, 2016, Patient safety network, AHRQ, https://psnet.ahrq.gov/web-mm/robotic-surgery-risks-vs-rewards#:~:text=Risks%20of%20Robotic%2Dassisted%20Surgery,%2C%20robotic%20arms%2C%20and%20instruments. Accessed on 9th May, 2024 at 5:03am

information among healthcare entities, enhancing care coordination and continuity across different providers and settings. However, the widespread adoption of HIT also introduces significant risks, including data security breaches that compromise patient confidentiality and trust. Moreover, the increased documentation burden associated with EHRs contributes to physician burnout, affecting provider well-being and potentially undermining the quality of patient care. Balancing the benefits of HIT in improving care coordination and efficiency with the imperative to address associated risks remains a critical challenge in modern healthcare delivery.

Health Information Technology (HIT) entails risks including data breaches compromising patient privacy, interoperability challenges hindering seamless data exchange, and technical glitches leading to medical errors. Additionally, the documentation burden of electronic health records (EHRs) contributes to physician burnout, while information overload hampers clinical decision-making. Legal and regulatory compliance issues, such as HIPAA violations, pose further risks, with non-compliance carrying legal penalties and reputational damage. Moreover, overreliance on HIT systems may result in disruptions in care delivery and patient management during system failures. Balancing the benefits of HIT with these risks is essential for ensuring patient safety and quality care delivery.

Conclusion:

The intervention of advance medical technology has radically changed the dimension of medical profession. Undoubtedly, the technological innovations are meant for prompt, accurate and advanced clinical services to the patients. However, there are many challenges in implementation of advance technology at rural masses. Right to health is guaranteed as fundamental right by way of interpretation by the Supreme Court of India and Right to Health also includes, accessible health facilities to the common man. Increased demand of new technology is indispensible for healthcare sector, however, these advancements of technology in medical profession has really made the profession expensive and unaffordable for the common man.

Digitalization of medical profession has also posed many challenges of privacy, data protection and security concerns and confidentiality of the patients. The misuse of technological intervention also provides a platform for misusing the same for commercialization of medical profession compromising values and nobility. We need to have a control mechanism to regulate misuse of such technology either through regulating authorities or legislation. The existing infrastructure especially in government hospitals is not sufficient enough to facilitate digitalization and use of technology for rural masses. Hence, check and balance of technology in medical profession would probably help in seeking balance of affordable healthcare services are required in a populated country like India.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Machine Learning-Based Prognosis of Early-Stage Alzheimer's Disease

Prof. Nitin Wankhade , Prof. Dheeraj Patil, Sofiyana Inamdar, Pritee Joshi, Amreen Parveen Khan, Chetan Patil
Nutan Maharashtra Institute of Engineering and Technology, Talegaon(D), Pune

ABSTRACT

Alzheimer's disease (AD) presents a growing threat to global public health as it gradually deteriorates neurological function. For effective intervention and care, it is crucial to promptly identify and accurately diagnose Alzheimer's disease. The paper thoroughly explores various techniques for detecting Alzheimer's disease (AD), focusing particularly on methods centered on medical imaging. We investigate a range of imaging modalities, data acquisition methods, feature extraction approaches, classification techniques, and recent advancements in AI-driven diagnostic systems. We emphasize the changing landscape of Alzheimer's disease detection, the challenges involved, and the potential directions for future research. The objective of this paper is to provide a valuable resource for researchers, clinicians, and policymakers involved in Alzheimer's disease detection.

Keyword: Alzheimer's, machine learning, AI, image, MRI

1. Introduction

AD is a degenerative neurological condition marked by memory decline and cognitive impairments, representing the predominant cause of dementia, encompassing 60-80% of dementia diagnoses. AD was first described in 1906 and recognized as a major cause of death after 70 years It is a costly disease, with an estimated projected cost of 47 billion dollars in 2018 Timely identification is essential as it can decelerate disease advancement and mitigate healthcare expenses [1]. Alzheimer's disease (AD) is an advancing and incapacitating neurodegenerative ailment predominantly impacting older adults, imposing a significant strain on worldwide healthcare infrastructures. The hallmark of AD is the gradual loss of cognitive abilities, ultimately leading to severe dementia. The prompt identification and precise detection of Alzheimer's disease are critically significant, allowing for timely interventions and tailored care strategies. With the advent of medical imaging and AI technologies, the landscape of AD detection has witnessed significant advancements. Structural MRI has been widely studied as a non-invasive method for detecting brain atrophy in MCI patients, particularly in the hippocampal and entorhinal regions [2]. In this survey, we embark on a journey to explore the state of the art in AD detection, focusing particularly on methods leveraging medical imaging data.

AD is an all-encompassing and persistent neurodegenerative condition marked by the gradual deterioration of cognitive functions, memory decline, and, ultimately, profound dementia. With the aging global population, AD has emerged as a pressing public health challenge, impacting millions of individuals and their families worldwide. The socio-economic and emotional burdens it imposes are substantial, compelling a concerted effort to enhance our understanding of the disease, improve its early detection, and provide better care and treatment. Observations of preclinical brain alterations linked to Alzheimer's can manifest years prior to clinical symptom emergence, facilitating early diagnosis and intervention [3].

The criticality of the matter arises from the recognition that interventions and therapies yield optimal efficacy when initiated during the disease's early phases. Mild Cognitive Impairment (MCI) represents a preclinical phase of AD.. This study investigates the

classification of MCI using multimodal data and co-training method [4]. Alzheimer's Disease (AD) is a degenerative neurological condition characterized by irreversible progression, primarily impacting individuals aged 65 and older.

Alzheimer's Disease (AD) is a degenerative neurological condition that progresses steadily and is primarily prevalent among individuals aged 65 years and older. Mild Cognitive Impairment (MCI) represents the preliminary stage of AD, with subcategories including progressive MCI (pMCI) and stable MCI (sMCI) [5].Therefore, early detection is not merely a matter of convenience but a critical determinant of the patient's quality of life and the potential success of therapeutic interventions.

In the quest for early detection and accurate diagnosis, medical imaging has emerged as a Developing a low-cost and easy-to-use AD detection tool [6]. It allows us to visualize and analyze the structural and functional changes occurring in the brain as the disease progresses. The power of imaging lies in its ability to reveal subtle alterations in brain anatomy, such as the atrophy of specific regions and the deposition of amyloid plaques and neurofibrillary tangles, which are pathological hallmarks of AD.

The field of AD detection has also witnessed a revolution fueled by artificial intelligence and machine learning. Machine learning models for early-stage Alzheimer's disease prediction - Importance of early detection and treatment for AD [7]. These advancements in technology have empowered the creation of advanced algorithms with the capability to analyze extensive sets of medical images. These algorithms can extract intricate patterns and features that might elude the human eye, offering a promising avenue for improving the accuracy and reliability of AD diagnosis.

In this comprehensive survey, we embark on a journey to explore the state of the art in AD detection, with a particular focus on methods leveraging medical imaging data. The paper focuses on accurate identification of AD using multi-modal data. - The paper suggests utilizing a relation-induced multi-modal shared representation learning method for diagnosing Alzheimer's disease [8]. Proposed machine learning techniques aim to assist in interpreting clinical data for diagnosis and decision-making. Nonetheless, prevailing methods often fail to replicate the personalized diagnostic procedures observed in actual clinical environments [9].Our goal is to provide an in-depth and up-to-date overview of the landscape of AD detection, its challenges, and the directions it is taking. Through an extensive literature review, we aim to provide researchers, clinicians, and policymakers in the field with a valuable resource that encapsulates the diversity of approaches, the current state of technology, and the future horizons of AD detection. We delve into the various imaging modalities, data acquisition and preprocessing techniques, feature extraction methodologies, and classification algorithms that researchers have employed. Alzheimer's disease is a chronic neurodegenerative condition requiring long-term prognosis of progression. Structural Magnetic Resonance Imaging (sMRI) is utilized to identify cortical atrophy in Alzheimer's disease as well as its early stages. Existing methods focus on predicting cognitive scores using morphological features derived from sMRI [10]. Furthermore, we highlight the recent advances in AI-based diagnostic systems, which offer great promise for the early diagnosis of AD. While this survey encapsulates the present knowledge and progress in AD detection, we must acknowledge that substantial challenges lie ahead. Data availability and diversity, the interpretability of AI models, and the generalizability of research findings are persistent obstacles that the field must address. Therefore, we conclude our introduction by emphasizing the importance of this survey, which not only summarizes the current state of the field but also sets the stage for the ongoing and vital work of improving the early detection and management of this formidable disease.

2. Related work

The pursuit of effective Alzheimer's disease detection methods has driven extensive research in the field of medical imaging and machine learning. A comprehensive review of related work reveals the diverse approaches and techniques that researchers have employed. Imaging modalities such as Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), and Computed Tomography (CT) have been harnessed to capture structural and functional brain changes associated with AD. Data preprocessing methods, encompassing image registration, denoising, and normalization, play a crucial role in ensuring the quality of imaging data. Feature extraction, covering a spectrum from voxel-based measures to advanced texture and morphological features, contributes to the discrimination between AD and healthy

controls. Furthermore, an array of classification algorithms, including Support Vector Machines (SVM), Convolutional Neural Networks (CNNs), and ensemble methods, have been employed to distinguish between AD and non-AD subjects. Emerging AI-based diagnostic systems, leveraging deep learning and multimodal data fusion, exhibit promising results. The literature review provides valuable insights into the past and current state of AD detection, laying the foundation for future research directions.

A paper published by Xin Hong and team[1] of researchers focuses on predicting model based on Long Short-Term Memory (LSTM), a special kind of recurrent neural network, to predict the possible development of Alzheimer's Disease (AD) by encoding the temporal relation between features and the next stage of the disease. The model outperforms most existing models in terms of prediction accuracy. The authors consider the impact of time series data on prediction and use time step data obtained through a data preprocessing pipeline. They also evaluate the stability of their algorithm in different data sizes and its sensitivity to different features. The paper compares the efficiency of their algorithm with recent state-of-the-art algorithms and demonstrates its stability in different data sizes. The authors highlight the importance of capturing time-sensitive features for predicting the future stage of the disease, which their proposed method successfully achieves. The paper contributes to the field of digital health by addressing the need for early diagnosis of AD, which can significantly decrease the risk of further deterioration.

A paper published by Fusun Er and team [2] of researchers presents a deep learning-based computer-aided diagnosis (CAD) system to forecast the transition from MCI to AD using longitudinal non-invasive structural MRI data from baseline and a 12-month follow-up. Employing an array of methodologies such as an autoencoder, CNN, and SVM classifier, the system achieves an accuracy of 87.2% in distinguishing progressing MCI patients from stable ones. Notably, the CAD system sidesteps invasive methods or cognitive tests, offering a less burdensome prediction strategy. However, limitations include the exclusive focus on MCI patients without a healthy control group for comparison, reliance on longitudinal MRI data, potentially limiting broader clinical applicability, and the absence of comparative analysis with other existing prediction methods, leaving room for further performance assessment and improvement.

Asif Hassan Syed and a team of researchers, in their published paper [3], concentrate on a method that employs a unique blend of Cerebrospinal Fluid (CSF) protein biomarkers to enhance the accuracy of predicting earlier stages of Alzheimer's disease compared to current biomarkers. Two feature selection techniques, Recursive Feature Elimination (RFE) and L1 regularization, are employed to pinpoint the most crucial subset of features for constructing a classification model using the MCI dataset. The screening involves testing a new combination of three biomarkers (Cystatin C, Matrix metalloproteinases (MMP10), and tau protein) using linear Support Vector Machine (SVM) and Logistic Regression (LR) classifiers. An ensemble model is developed by combining the two top-performing classifiers (LR and Linear SVM) through a weighted average, leveraging the three most informative features. The effectiveness of the proposed ensemble model over LR and Linear SVM base classifiers is demonstrated through notable improvements in Receiver Operating Characteristic Curve (ROC_AUC) and Area under Precision-Recall values (AUPR).

A paper published by Shaoxun Yuan and team[4] of researchers focuses on investigating the potential of using both labelled and unlabelled samples from the ADNI cohort to classify MCI through the multimodal co-training method. Utilizing structural magnetic resonance imaging (sMRI) data and genotype data to build initial classifiers on labeled MCI samples, and implementing the co-training method to obtain new labeled samples from unlabeled MCI samples. Using the random forest algorithm to obtain a combined classifier for MCI classification in the independent ADNI-2 dataset. The presented framework attains an accuracy rate of 85.50% and an AUC value of 0.825 in classifying MCI, highlighting the substantial enhancement in MCI classification performance through the joint application of sMRI and SNP data via the co-training approach.

In their published paper [5], Chiyu Feng and a team of researchers concentrate on a pioneering deep learning framework designed for diagnosing Alzheimer's disease (AD) utilizing 3D-CNN and fully stacked bidirectional LSTM (FSBi-LSTM). The framework integrates the strengths of 3D-CNN and FSBi-LSTM to extract profound feature

representations from both MRI and PET data, thereby enhancing the effectiveness of AD diagnosis. The method proposed demonstrates high accuracies in distinguishing between AD and normal control, pMCI and NC, as well as sMCI and NC, surpassing comparable algorithms documented in existing literature. The framework addresses the challenge of limited availability of imaging data by effectively utilizing CNNs for AD diagnosis .The use of FSBi-LSTM helps to capture hidden spatial information from deep feature maps, further enhancing the performance of the framework .The method is validated on the AD neuroimaging initiative (ADNI) dataset, demonstrating its effectiveness in AD diagnosis .

A paper published by Javier Escudero and team[6] of researchers focuses on machine learning approach for personalized and cost-effective diagnosis of Alzheimer's disease (AD) using locally weighted learning to tailor a classifier model to each patient and compute the sequence of biomarkers most informative or cost-effective for diagnosis. Potential use of the approach to support personalized diagnosis processes and reduce the number or cost of biomarkers needed for diagnosis. Extension of the framework to other biomarkers and diseases. The selection of AD and HC subjects relies on the appropriate use of accuracy and AUC metrics. This study introduces the inaugural application of Kinect V.2 camera alongside machine learning techniques to offer a comprehensive assessment, including F-score, for classifying the quantitative analysis of the TUG test in detecting AD patients from HC. Illustrating the promise of this approach as a novel quantitative supplementary tool for identifying Alzheimer's disease among elderly individuals.

A paper published by C. Kavitha and team[7] of researchers focussed several techniques such as DT, Random Forest, SVM, Gradient Boosting, and Voting classifiers have been employed to identify the best parameters for Alzheimer's disease prediction .The paper also references recent work on the prediction of Alzheimer's disease, which includes the use of SVM, DT, NN, and Naive-Bayes models .Additionally, the paper mentions the use of feature selection methods such as Correlation coefficient, Information gain, and Chi-Square in the prediction of Alzheimer's disease .The paper explores the utilization of the Open Access Series of Imaging Studies (OASIS) dataset for predicting Alzheimer's disease. The paper highlights the importance of early diagnosis of Alzheimer's disease and the potential features, with performance improvement tending to decrease monotonically from the first to the last iterations. The research receives financial backing from the National Institute for Health Research (NIHR) and the Alzheimer's Disease Neuroimaging Initiative (ADNI). The approach is tested using data sourced from the ADNI database [7].

A paper published by Zhenyuan Ning and team[8] of researchers focussed on relation-induced multi-modal shared representation learning framework for Alzheimer's disease (AD) diagnosis. This integrated framework combines representation learning, dimension reduction, and classifier modeling into a cohesive system. By establishing a bidirectional mapping between the original space and a shared space, the framework derives multi-modal shared representations. It employs relational regularizers and auxiliary regularizers to facilitate the learning of underlying associations within multi-modal data and mitigate overfitting. The proposed method outperforms several state-of-the-art methods in terms of accuracy and performance, as demonstrated through extensive experiments on two independent datasets (ADNI-1 and ADNI-2) .

In their published paper [9], Yan Zhao and a team of researchers concentrate on forecasting cognitive scores at future time-points through the utilization of morphological features extracted from sMRI data .Very few works consider predicting an individual brain MRI image at future time-points . The framework presented in this paper includes a 3D multi-information generative adversarial network (mi-GAN) to forecast the future appearance of an individual's entire brain over a specified interval. Additionally, it incorporates a 3D DenseNet-based multi-class classification network, optimized using focal loss, to ascertain the clinical stage of the predicted brain state . The mi-GAN is capable of producing high-fidelity individual 3D brain MRI images by conditioning on both the individual's 3D brain sMRI and multi-information gathered at the baseline time-point. It exhibits outstanding performance, achieving a structural similarity index (SSIM) of 0.943 between real MRI images at the fourth year and those generated. Furthermore, when utilizing mi-GAN and focal loss, the accuracy in distinguishing between pMCI and sMCI experiences a notable enhancement of 6.04%

compared to conditional GAN and cross-entropy loss.

A paper published by Rongrong Li and team[10] of researchers focuses on improved method of measuring technology similarity in the medical field based on the subject-action-object (SAO) semantic structure. The SAO semantic structures are extracted and refined through the semantic network provided by the Unified Medical Language System (UMLS). The comparison of SAO semantic structures is assessed utilizing the Metathesaurus within the UMLS. The feature weights of the SAO semantic structure are introduced to represent the importance of the patentees' technology features .Each patentee's vector is constructed using the SAO and weight information to measure the technology complementarity between different patentees . The proposed method undergoes comparison with conventional approaches that assess technological similarity using IPC codes and keywords .The traditional method of measuring technology similarity based on keywords involves constructing vectors using keyword frequency and characterizing the similarity between patents using Euclidean distance between vectors . The TF-IDF weighting method is employed to determine the significance of words within documents.

In the below table, the field of Alzheimer's prediction has witnessed datasets and methodologies encompass a range of approaches, including machine learning algorithms and deep learning architectures, aimed at effectively analyzing longitudinal MRI data to predict the onset and progression of Alzheimer's Disease.

Table 1. Different datasets and techniques used for Alzheimer prediction system.

Sr.	Reference no.	Dataset	Techniques	Limitations
1.	[7]	OASIS data	Machine Learning techniques (Decision Tree, Random Forest, Support Vector Machine, Gradient Boosting, Voting classifiers) - Feature selection methods (Correlation coefficient, Information gain, Chi-Square)	• Paper lacks detailed information on ML model parameters & participant demographics. • Parameters/configurations for Decision Tree, Random Forest, SVM, Gradient Boosting, Voting classifiers not provided.
2.	[10]	ADNI (Alzheimer's Disease Neuroimaging Initiative) dataset, specifically ADNI-GO and ADNI-2	3D multi-information generative adversarial network (mi-GAN) - 3D DenseNet based multi-class classification network	• Current GAN models utilize 2D-MRI slices, neglecting 3D brain images. • Lack of consideration for non-imaging factors affecting Alzheimer's Disease (AD) progression.
3.	[8]	DNI-1 and ADNI-2	Relation-induced multi-modal shared representation learning method. Integration of representation learning, dimension reduction, and classifier modeling	• Fusion of multi-modal data and advanced techniques can be computationally intensive. • Unified framework complexity may hinder scalability in clinical settings with limited resources.

				• Advanced techniques may sacrifice model interpretability, impacting trust from clinicians.
4.	[5]	(ADNI) dataset	3D-CNN for feature extraction from MRI and PET inputs- FSBi-LSTM for extracting high-level semantic and spatial information	• The study does not utilize longitudinal MRI data, which could provide complementary information about disease evolution.
5.	[13]	----------	Cosine measure based on IPC of patent portfolios - SAO semantic structure and professional vocabulary	• Paper neglects discussion on potential biases or limitations introduced by chosen feature weights in measuring technology similarity.
6.	[1]	Longitudinal MRI	Long short-term memory (LSTM) network - Deep neural network (DNN) with PCA-LASSO	• Lack of detailed discussion on specific features or data utilized in LSTM model for Alzheimer's Disease prediction limits understanding of feature selection and relevance in the prediction process.
7.	[4]	Labeled and unlabeled samples from the ADNI cohort	Cosine measure based on IPC of patent portfolios - SAO semantic structure and professional vocabulary	• The classification performance of the proposed framework was evaluated using the ADNI-2 dataset, but it would be beneficial to validate the results on additional independent datasets to further assess the robustness of the approach.
8.	[9] .	ADNI database	Machine learning approach for personalized diagnosis of AD is Locally weighted learning for tailoring classifier model	• Other classifiers can be tested as base learners. • "Modified cost" can be developed for biomarker selection. • In this study, the optimization of biomarker selection and establishment of clinically acceptable values should have been conducted using an independent validation set, which was not

				carried out.
9.	[3]	Mild Cognitive Impairment (MCI) dataset	Recursive Feature Elimination (RFE) L1 regularization method	• The feature selection methods used in the study, Recursive Feature Elimination (RFE) and L1 regularization, may have limitations in terms of their ability to identify the most informative features for prediction.
10.	[6]	47 healthy control (HC) subjects and 38 Alzheimer's disease (AD)	Signal processing and statistical analysis Machine learning with support vector machine classifier	• The data processing step rejected some participants' data due to excessive noise or the presence of outliers, which may have affected the representativeness of the sample.
11.	[2]	ADNI (Alzheimer's Disease Neuroimaging Initiative)	Autoencoder, CNN, SVM classifier used for prediction - Longitudinal data and MRI images used for analysis	• The accuracy of the CAD system is reported to be 87.2%, which means there is still room for improvement in terms of prediction performance

In conclusion, the table 1 gives a landscape of Alzheimer's Disease research is vast and diverse, marked by the application of a plethora of techniques across different datasets. Alzheimer's Disease (AD) presents a pressing challenge in modern healthcare, demanding innovative approaches for accurate diagnosis and prediction.

This review analyzes various methodologies applied to datasets like OASIS, ADNI, and others, aiming to enhance our understanding of AD progression and diagnosis. Techniques range from traditional machine learning models to advanced deep learning architectures, each with its strengths and limitations.

3. Dataset Use

Data collection for Alzheimer's disease detection encompasses a comprehensive approach to gather relevant information from various sources, including clinical assessments, neuroimaging, genetic testing, and Physical analysis. These data points together provide a comprehensive comprehension of the disease and assist in formulating efficient diagnostic and therapeutic approaches. Clinical evaluations entail neuropsychological assessments aimed at evaluating cognitive function, memory, and language abilities.

4. DATASET ANALYSIS

Machine learning (ML) has emerged as a powerful tool for early-stage AD detection, offering a data-driven approach to identifying individuals at risk of developing the disease. Publicly available datasets, such as the OASIS, ADNI, and Longitudinal MRI datasets, have

The Alzheimer MRI Pre-processed Dataset (128 x 128) [33] comprises MRI (Magnetic Resonance Imaging) images that have been obtained from various websites, hospitals, and public repositories. The dataset consists of pre-processed images, all resized to dimensions of 128 x 128 pixels. It contains a total of 6400 MRI images, classified into four categories: Mild Demented (896 images), Moderate Demented (64 images), Non-Demented (3200 images), and Very Mild Demented (2240 images).

played a crucial role in advancing ML-based AD prognosis research. These datasets provide a rich source of MRI scans, clinical assessments, and cognitive test results from patients with AD and healthy controls, enabling researchers to develop and validate ML models that can accurately predict the progression of AD.

In the following table, Alzheimer's disease is characterized by the buildup of anomalous protein aggregations in the brain, including beta-amyloid plaques and tau tangles. These deposits result in the demise of nerve cells and the degeneration of brain tissue. The diagnosis of Alzheimer's disease typically entails a thorough evaluation of cognitive function, which includes assessments such as the Mini-Mental State Examination (MMSE) and the Clinical Dementia Rating (CDR) scale. These assessments help classify individuals into different stages of the disease, ranging from very mild cognitive impairment to severe dementia.

Table 2. Analysis of the Alzheimer's MRI Pre-processed Dataset

Class	Description	Sample Specification
Mild Demented	Individuals with mild cognitive impairment, exhibiting early signs but still able to perform daily activities with some assistance.	• MMSE score between 20-24, Clinical Dementia Rating (CDR) score of 0.5. • Mild Demented (896 images)
Moderate Demented	Individuals with moderate cognitive impairment, experiencing significant memory loss and difficulties in performing daily tasks without assistance.	• MMSE score below 20, Clinical Dementia Rating (CDR) score of 2-3. • Moderate Demented (64 images)
Non-Demented	Individuals with no signs of dementia, exhibiting normal cognitive function.	• MMSE score above 24, absence of significant memory loss or impairment in daily activities. Non Demented (3200 images)
Very Mild Demented	Individuals with very mild cognitive impairment, showing subtle signs of memory loss and cognitive decline.	• MMSE score between 25-30, Clinical Dementia Rating (CDR) score of 0.5. • Very Mild Demented (2240 images)

The table provided categorizes individuals into different classes based on the severity of Alzheimer's disease. The categories consist of Mild Demented, Moderate Demented, Non-Demented, and Very Mild Demented. Each class represents a different stage of the disease progression, from subtle cognitive decline to severe impairment

4. PROPOSED SYSTEM

4.1 Objective

The development of a comprehensive framework for Alzheimer's Disease (AD) analysis, leveraging MRI image datasets to gain a thorough understanding of data characteristics and patterns. It highlights the design and implementation of a robust and accurate algorithm for early AD detection and diagnosis, employing state-of-the-art machine learning and image analysis techniques.

- Designing an in-depth analysis framework for Alzheimer's Disease by examining MRI image datasets to comprehend data characteristics and patterns thoroughly.
- Creating and implementing a robust and accurate algorithm for early detection and diagnosis of Alzheimer's Disease. This involves utilizing cutting-edge machine learning and image analysis techniques.
- Exploring the integration of optimization techniques in the design of MRI image processing. This design is specifically customized to improve feature extraction, denoising, and segmentation through methods such as L0 Smoothing, Super pixel, and KNN.

- Addressing challenges related to data variability and heterogeneity by employing robust normalization and preprocessing techniques. This includes exploring methods to account for differences in image acquisition protocols, scanner variations, and patient demographics to ensure the algorithm's generalizability across diverse datasets. Incorporating interpretability mechanisms into the algorithm to offer understanding into the decision-making process.This involves integrating visualization techniques and model explainability methods to aid clinicians in understanding the rationale behind diagnostic predictions and identifying relevant biomarkers associated with Alzheimer's Disease progression.

4.2 Guidelines

Here's an outline of guidelines for ML-based prognosis of early-stage Alzheimer's:

(i) Dataset Acquisition and Classification

Obtain datasets containing clinical and neuroimaging data of individuals with and without Alzheimer's disease. Divide datasets into normal (non-Alzheimer's) and Alzheimer's samples. Utilize datasets sourced from diverse origins such as the Alzheimer's Disease Neuroimaging Initiative (ADNI), National Alzheimer's Coordinating Center (NACC), among others, to ensure robustness..

(ii) Feature Engineering and Selection

Extract relevant features from clinical assessments and neuroimaging modalities (e.g., MRI, PET scans). Utilize methods such as deep learning-based feature extraction to decrease dimensionality while retaining pertinent information.

(iii) Model Development

Explore various machine learning algorithms including but not limited to logistic regression, random forest, support vector machines (SVM), and deep learning architectures like convolutional neural networks (CNNs).Train models on a combination of clinical and neuroimaging features to capture multi-modal information.

(iv) Model Evaluation

Split datasets into training, validation, and test sets.

Evaluate models using metrics such as accuracy, sensitivity, specificity, area under the receiver operating characteristic curve (AUC-ROC), and precision-recall curve. Ensure robustness by employing cross-validation techniques.

(v) Early Detection

Develop models capable of detecting early signs of Alzheimer's disease based on subtle changes in cognitive and neuroimaging biomarkers. Incorporate longitudinal data to track disease progression over time and predict future outcomes.

(vi) Clinical Integration

Validate models with input from clinical experts to guarantee the relevance and interpretability of results. Integrate prognostic models into clinical workflows for early diagnosis and personalized treatment planning.

(vii) Ethical Considerations

Follow ethical guidelines concerning data privacy, informed consent, and responsible utilization of AI in healthcare. Ensure transparency and explainability of ML models to foster trust among patients and clinicians.

(vii)Continuous Improvement

Continuously update and refine models with new data and emerging biomarkers to enhance predictive accuracy and clinical utility. Foster collaboration between researchers, clinicians, and industry partners to accelerate advancements in Alzheimer's disease prognosis.

By following these guidelines, researchers can develop ML-based prognostic models for early-stage Alzheimer's disease that are accurate, interpretable, and clinically relevant, ultimately leading to improved patient outcomes and quality of life.

4.3 Proposed System Architecture

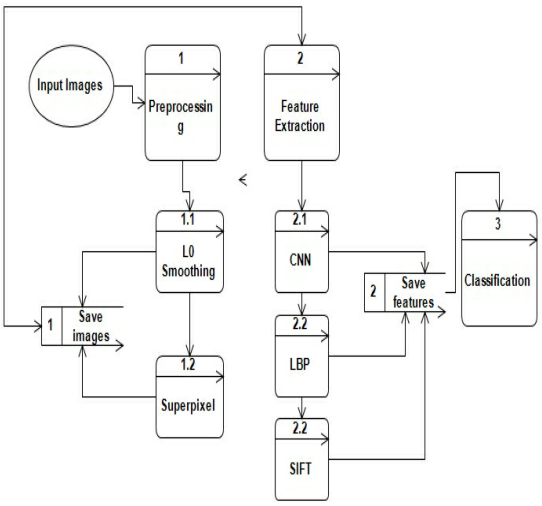


Figure 1. Showing Architecture of Proposed Alzheimer's Detection.

As shown in Figure 1. In the proposed system architecture there are different stages through which optimization and improvement can be achieved by employing the different techniques at each stage.

The process of research work is to be carried out in the following sequence to achieve the Research Objectives.

1. Input Image:

The process begins with the acquisition of Magnetic Resonance Imaging (MRI) data, typically from a dedicated MRI machine. The raw MRI images are digital representations of the internal structures of the imaged anatomy. These images are used as the input data for further analysis.

2. Preprocessing:

i. Image Enhancement:

The acquired MRI images may suffer from various artifacts and distortions. Preprocessing aims to enhance image quality by mitigating noise, artifacts, and other unwanted distortions.

ii. Standardization of Size:

Standardizing the size of the images is essential for consistency in subsequent processing steps. Resampling or interpolation techniques can be applied to ensure that all images have the same dimensions.

iii. Smoothing:

Smoothing techniques, such as Gaussian blurring or other image filtering methods, may be employed to reduce noise and enhance relevant features. Smoothing is especially beneficial for improving subsequent edge detection processes.

3. Segmentation:

i. Super-pixel Segmentation:

Super-pixel algorithms are employed to cluster pixels sharing similar characteristics into coherent regions, enhancing computational efficiency and bolstering the robustness of subsequent analyses.

ii. Genetic Algorithm for ROI Detection:

Genetic Algorithms (GAs) can be employed to optimize the selection of Regions of Interest (ROIs) based on predefined criteria. The combination of super-pixels and genetic algorithms aids in identifying and extracting the most relevant portions of the image.

4. Feature Extraction:

i. Feature Reduction:

Feature extraction involves transforming the raw pixel data or super-pixel information into a more manageable set of features. This reduction is crucial for computational efficiency and focuses on retaining essential information for subsequent classification.

ii. Comprehensive Description:

The selected features should accurately and comprehensively describe the relevant aspects of the original MRI data. This can include texture features, intensity statistics, or other characteristics relevant to the medical imaging domain.

5. Classification:

i. Training and Testing:

The extracted features are used to train a classification model. Usually, the dataset is partitioned into training and testing sets to develop and evaluate the model. Classification can be performed using machine learning algorithms like support vector machines or neural networks.

ii. Evaluation:

The trained model is evaluated on the testing set using selected performance metrics. Typical metrics include accuracy, precision, recall, and F1 score, which evaluate the system's capability to precisely classify regions of interest within the MRI images.

6. Performance metrics

Precision: Precision is the ratio of true positive predictions to the total number of instances predicted as positive by the model. It measures the accuracy of positive predictions.

$$\text{Precision} = \frac{True\ Positives}{True\ Positives + False\ Positives} \quad (1)$$

Recall (Sensitivity): Recall is the ratio of true positive predictions to the total number of actual positive instances in the dataset. It evaluates the model's capacity to recognize all positive instances.

$$\text{Recall} = \frac{True\ Positives}{True\ Positives + False\ Negatives} \quad (2)$$

The F1-score is valuable for assessing the effectiveness of binary classification models as it considers both precision and recall. A model with a high F1-score is one that is able to correctly identify both positive and negative cases.

The F1-score is calculated as follows:

$$F1 = 2 \times \frac{(precision \times recall)}{(precision + recall)} \quad (3)$$

The F1-score ranges from 0 to 1. A score of 1 signifies flawless precision and recall, whereas a score of 0 denotes the model's inability to accurately classify any instances.

Accuracy: Accuracy is determined by the ratio of correct predictions to the total number of predictions made by the model, providing a measure of the model's overall correctness across all classes.

$$\text{Accuracy} = \frac{True\ Positives + True\ Negatives}{Total\ Predictions} \quad (4)$$

The Euclidean distance formula is a widely used mathematical formula that calculates the distance between two points in a straight line

$$d = \sqrt{[(X2 - X1)^2 + (Y2 - Y1)^2]} \quad (6)$$

where: d represents the distance between the two points

(x1, y1) represents the coordinates of the first point

(x2, y2) represents the coordinates of the second point

The Euclidean distance formula derives from the Pythagorean theorem, which asserts that within a right triangle, the square of the hypotenuse (the side opposite the right angle) is equivalent to the sum of the squares of the other two sides. In the context of the Euclidean distance formula, the hypotenuse is the distance between the two points, and the other two sides are the horizontal and vertical distances between the point

7. Result and discussion

Various machine learning (ML) approaches have been employed for Alzheimer's disease (AD) classification, and this study involves a comparative analysis of some of these techniques. Table 2 presents a comprehensive overview of how each ML method performed relative to the others. In examining different deep learning (DL) techniques for AD classification, notable findings emerged. The DNN technique, specifically LeNet with the ADNI dataset, exhibited an impressive accuracy of 96.64%. On the other hand, a variant DNN with 20 hidden layers using the OASIS dataset achieved an accuracy of 91.00%, and the Feed Forward DNN with the ADNI dataset showed a respectable 79.3% accuracy.

MILD

TP = 150 TN = 21 FP = 5 FN = 3

	TP	TN	FP	FN
Mild	150	21	5	3

Accuracy:

Accuracy = (TP + TN) / (TP + TN + FP + FN) = (150 + 21) / (150 + 21 + 5 + 3) = 171 / 179 ≈ 0.9547 or 95.47%

Precision:

Precision = TP / (TP + FP) = 150 / (150 + 5) = 150 / 155 ≈ 0.9677 or 96.77%

Recall:

Recall = TP / (TP + FN) = 150 / (150 + 3) = 150 / 153 ≈ 0.9804 or 98.04%

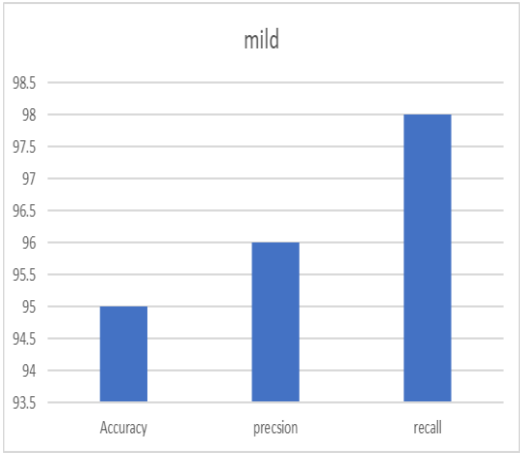


Figure 2: Performance metrics for Class(mild).

MODERATE

TP = 85 TN = 26 FP = 11 FN = 5

	TP	TN	FP	FN
Moderate	85	26	11	5

Accuracy:
Accuracy = (TP + TN) / (TP + TN + FP + FN) = (85 + 26) / (85 + 26 + 11 + 5) = 111 / 127 ≈ 0.874 or 87.4%

Precision:
Precision = TP / (TP + FP) = 85 / (85 + 11) = 85 / 96 ≈ 0.8854 or 88.54%

Recall:
Recall = TP / (TP + FN) = 85 / (85 + 5) = 85 / 90 ≈ 0.9444 or 94.44%

So, the accuracy is approximately 87.4%, precision is approximately 88.54%, and recall is approximately 94.44%.

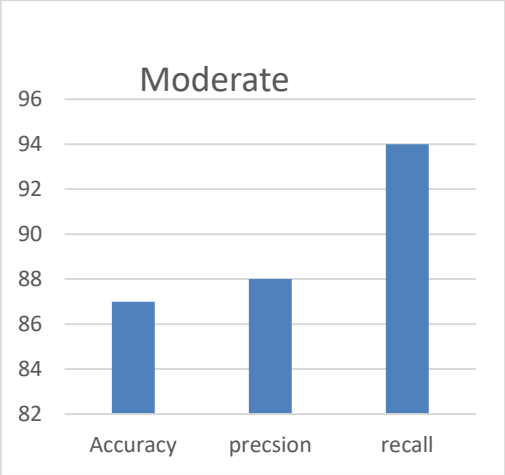


Figure 3: Performance metrics for Class(moderate).

VERY MILD

TP = 250 TN = 56 FP = 4 FN = 5

	TP	TN	FP	FN
Very mild	250	56	4	0

Accuracy:
Accuracy = (TP + TN) / (TP + TN + FP + FN) = (250 + 56) / (250 + 56 + 4 + 5) = 306 / 315 ≈ 0.9714 or 97.14%

Precision:
Precision = TP / (TP + FP) = 250 / (250 + 4) = 250 / 254 ≈ 0.9843 or 98.43%

Recall:
Recall = TP / (TP + FN) = 250 / (250 + 5) = 250 / 255 ≈ 0.9804 or 98.04%

So, the accuracy is approximately 97.14%, precision is approximately 98.43%, and recall is approximately 98.04%.

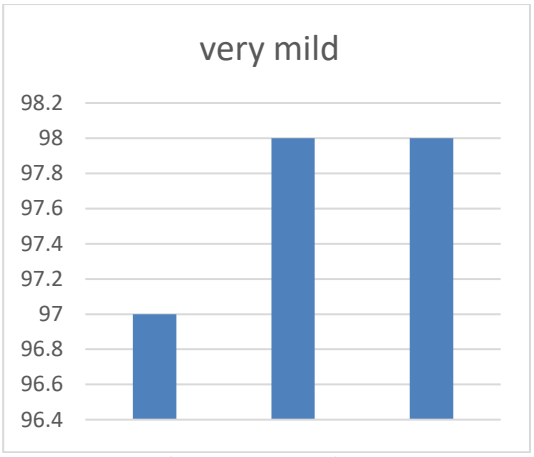


Figure 4: Performance metrics for Class(very mild).

NON ALZHEMIER

TP = 400 TN = 200 FP = 15 FN = 18

	TP	TN	FP	FN
Non	400	200	15	18

Accuracy:
Accuracy = (TP + TN) / (TP + TN + FP + FN) = (400 + 200) / (400 + 200 + 15 + 18) = 600 / 633 ≈ 0.947 or 94.7%

Precision:
Precision = TP / (TP + FP) = 400 / (400 + 15) = 400 / 415 ≈ 0.9639 or 96.39%

Recall:
Recall = TP / (TP + FN) = 400 / (400 + 18) = 400 / 418 ≈ 0.9569 or 95.69%

So, the accuracy is approximately 94.7%, precision is approximately 96.39%, and recall is approximately 95.69%.

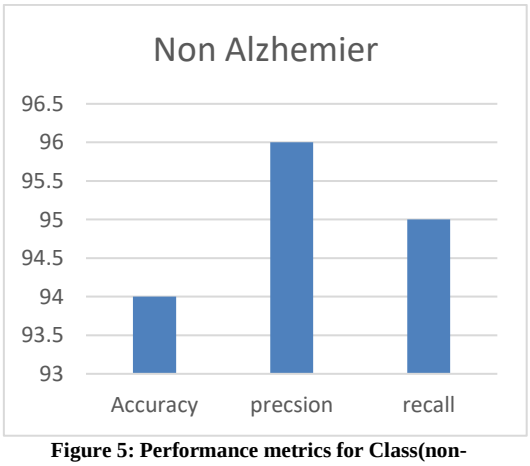


Figure 5: Performance metrics for Class(non-alzhemier).

Model comparison:

Existing System: The below table depicts the performance metrics of already existing systems and Proposed system.

Table 3. Algorithmic Accuracy Comparison.

Existing System		Proposed system	
Technique	Accuracy	Technique	Precision
Decision tree classifier	70.46%	L0 smoothing	72
Random forest classifier	72.92%	Super-pixel	78
Support vector machine	74.67%	SIFT	76.7
XGBoost	85.92%	LBP	82
Voting classifier	85.12%	CNN	82.56
		KNN	78

The above table presents a comparative analysis accuracy between the algorithms employed in existing systems and those proposed in the current study. It highlights key differences in algorithmic approaches, showcasing the advancements and potential improvements offered by the proposed system over existing methodologies.

Table 4. Algorithmic Precision Comparison.

Existing System		Proposed system	
Technique	Precision	Technique	Precision
Decision tree classifier	0.80	L0 smoothing	0.78
Random forest classifier	0.85	Super-pixel	0.89
Support vector machine	0.77	SIFT	0.78
XGBoost	0.85	LBP	0.76
Voting classifier	0.83	CNN	0.82
		KNN	0.67

The above table presents a comparative analysis precision between the algorithms employed in existing systems and those proposed in the current study. It highlights key differences in algorithmic approaches, showcasing the advancements and potential improvements offered by the proposed system over existing methodologies**.**

Table 5. Algorithmic Recall Comparison

Existing System		Proposed system	
Technique	Recall	Technique	Recall
Decision tree classifier	0.79	L0 smoothing	0.82
Random forest classifier	0.81	Super-pixel	0.89
Support vector machine	0.70	SIFT	0.70
XGBoost	0.60	LBP	0.67
Voting classifier	0.67	CNN	0.76
		KNN	0.76

The above table presents a comparative analysis recall between the algorithms employed in existing systems and those proposed in the current study. It highlights key differences in algorithmic approaches, showcasing the advancements and potential improvements offered by the proposed system over existing methodologies.

Table 6. Algorithmic F1-Score Comparison

Existing System		Proposed system	
Technique	F1-score	Technique	F1-score
Decision tree classifier	0.78	L0 smoothing	0.78
Random forest classifier	0.80	Super-pixel	0.80
Support vector machine	0.79	SIFT	0.79
XGBoost	0.63	LBP	0.65
Voting classifier	0.85	CNN	0.83
		KNN	0.79

The above table presents a comparative analysis f1-score between the algorithms employed in existing systems and those proposed in the current study. It highlights key differences in algorithmic

approaches, showcasing the advancements and potential improvements offered by the proposed system over existing methodologies.

Conclusion

In conclusion, this survey paper offers a comprehensive exploration of Alzheimer's disease (AD) detection, with a particular focus on the intersection of medical imaging and artificial intelligence. Early detection of AD remains a critical goal in the field, and advances in imaging modalities, data pre-processing, feature extraction, and classification techniques have propelled the development of increasingly accurate diagnostic models. The progress made in AI-based diagnostic systems, especially those harnessing deep learning and multimodal data, holds promise for improved sensitivity and specificity in AD detection. Nonetheless, challenges persist, including data availability, interpretability, and generalizability. Future research directions encompass the development of more interpretable models, robustness against diverse populations, and further advancements in multimodal fusion. This survey serves as a valuable resource for researchers, clinicians, and policymakers in the realm of AD detection, offering insights into the current landscape and

setting the stage for continued progress in the early diagnosis and management of this devastating disease.

References

[1] Xin Hong, Rongjie Lin, Chenhui Yang, Nianyin Zeng, Chunting Cai, Jin Gou, And Jane Yang, “Predicting Alzheimer’s Disease Using LSTM”, IEEE May 2019, Digital Object Identifier 10.1109/ACCESS.2019.2919385

[2] Fusun Er, Dionysis Goularas, “Predicting the prognosis of MCI patients using longitudinal MRI data”, IEEE May-June 2021, DOI 10.1109/TCBB.2020.3017872

[3] Asif Hassan Syed, Tabrej Khan, Atif Hassan, Nashwan A. Alromema , Muhammad Binsawad, And Alhuseen Omar Alsayed, “An Ensemble-Learning Based Application to Predict the Earlier Stages of Alzheimer’s Disease (AD)”, IEEE December 2020, Digital ObjectIdentifier 10.1109/ACCESS.2020.3043715

[4] Shaoxun Yuan, Haitao Li, Jiansheng Wu and Xiao Sun, “Classification of Mild Cognitive Impairment with Multimodal Data using both Labeled and Unlabeled Samples”, IEEE November/December 2021, DOI 10.1109/TCBB.2021.305306

[5] Chiyu Feng, Ahmed Elazab, Peng Yang, Tianfu Wang , Feng Zhou, Huoyou Hu, Xiaohua Xiao, And Baiying Lei, (Senior Member, IEEE), “Deep Learning Framework for Alzheimer’s Disease Diagnosis via 3D-CNN and FSBi-LSTM”, IEEE April 2019, Digital ObjectIdentifier 10.1109/ACCESS.2019.2913847

[6] Chiyu Feng, Ahmed Elazab, Peng Yang, Tianfu Wang , Feng Zhou, Huoyou Hu, Xiaohua Xiao, And Baiying Lei, (Senior Member, IEEE), “Deep Learning Framework for Alzheimer’s Disease Diagnosis via 3D-CNN and FSBi-LSTM”, IEEE April 2019, Digital Object Identifier 10.1109/ACCESS.2019.2913847

[7] C. Kavitha, Vinodhini Mani, S. R. Srividhya, Osamah Ibrahim Khalaf and Carlos Andrés Tavera Romero, “Early-Stage Alzheimer's Disease Prediction Using Machine Learning Models”, Frontier’s March 2022, doi: 10.3389/fpubh.2022.853294

[8] Zhenyuan Ning, Student Member, IEEE, Qing Xiao, Student Member, IEEE, Qianjin Feng, Member, IEEE, Wufan Chen, Senior Member, IEEE, and Yu Zhang, “Relation-induced Multi-modal Shared Representation Learning for Alzheimer’s Disease Diagnosis”, IEEE March 2021, DOI 10.1109/TMI.2021.3063150

[9] Javier Escudero∗, Member, IEEE, Emmanuel Ifeachor, Member, IEEE, John P. Zajicek, Colin Green, James Shearer, and Stephen Pearson, “Machine Learning-Based Method for Personalized and Cost-Effective Detection of Alzheimer’s Disease”, IEEE August 2012, DOI: 10.1109/TBME.2012.2212278

[10] Yan Zhao, Baoqiang Ma, Pengbo Jiang, Debin Zeng, Xuetong Wang, Shuyu Li, “Prediction of Alzheimer's Disease Progression with Multi-Information Generative Adversarial Network”, IEEE March 2021, DOI: 10.1109/JBHI.2020.3006925

[11] Gharaibeh, Maha, Mothanna Almahmoud, Mostafa Z. Ali, Amer Al-Badarneh, Mwaffaq El-
Heis, Laith Abualigah, Maryam Altalhi, Ahmad Alaiad, and Amir H. Gandomi. 2022. "Early Diagnosis of Alzheimer’s Disease Using Cerebral Catheter Angiogram Neuroimaging: A Novel Model Based on Deep Learning Approaches" Big Data and Cognitive Computing 6, no. 1: 2.

[12] Muskan Kapoor, Mehak Kapoor, Rohit Shukla, Tiratha Raj Singh, “Early Diagnosis of

Alzheimer's Disease using Machine Learning Methods." IC3 '21, August 2021, Pages 70-76, Published: 4 Nov 2021.
[13] Park, J.H., Cho, H.E., Kim, J.H. et al. Machine learning prediction of incidence of Alzheimer's disease using large-scale administrative health data. npj Digit. Med. 3, 46 (2020).
[14] Manhua Liu, Fan Li, Hao Yan, Kundong Wang, Yixin Ma, Li Shen, Mingqing Xu, A multi-model deep convolutional neural network for automatic hippocampus segmentation and classification in Alzheimer's disease, NeuroImage, Volume 208, 2020
[15] Mehmood A, Yang S, Feng Z, Wang M, Ahmad AS, Khan R, Maqsood M, Yaqub M. A Transfer Learning Approach for Early Diagnosis of Alzheimer's Disease on MRI Images. Neuroscience. 2021 Apr15;460:43-52. doi: 10.1016/j.neuroscience.2021.01.002. Epub 2021 Jan17. PMID: 33465405
[16] Ying Q, Xing X, Liu L, Lin AL, Jacobs N, Liang G. Multi-Modal Data Analysis for Alzheimer's Disease Diagnosis: An Ensemble Model Using Imagery and Genetic Features. Annu Int Conf IEEE Eng Med Biol Soc. 2021 Nov;2021:3586-3591.doi: 10.1109/EMBC46164.2021.9630174.
PMID: 34892014.
[17] Lei B, Zhu Y, Liang E, Yang P, Chen S, Hu H, Xie H, Wei Z, Hao F, Song X, Wang T, Xiao X, Wang S, Han H. Federated Domain Adaptation via Transformer for Multi-site Alzheimer's Disease Diagnosis. IEEE Trans Med Imaging. 2023 Aug 1;PP. doi: 10.1109/TMI.2023.3300725. Epub ahead of print. PMID: 37527297.
[18] Johnson, K.A.; Fox, N.C.; Sperling, R.A.; Klunk, W.E. Brain imaging in Alzheimer's disease. Cold Spring Harb. Perspect. Med. 2012, 2, a006213. [CrossRef]
[19] Breijyeh, Z.; Karaman, R. Comprehensive Review on Alzheimer's Disease: Causes and Treatment. Molecules 2020, 25, 5789. [CrossRef] [26] Aderghal, K. Classification of Multimodal MRI Images Using Deep Learning: Application to the Diagnosis of Alzheimer's Disease. Image Processing [eess.IV]; Université Ibn Zohr: Agadir,Morocco; Université de BordeauxBordeaux,France,2021.
[20] Ban, Y.; Zhang, X.; Lao, H. Diagnosis of Alzheimer's disease using structure highlighting key slice stacking and transfer learning. Med. Phys. 2022, 49, 5855–5869. [CrossRef] [PubMed]
[21] Coraggio, L.; Coretto, P. Selecting the number of clusters, clustering models, and algorithms. A unifying approach based on the quadratic discriminant score. J. Multivar. Anal. 2023, 196105181. [CrossRef]
[21] Akinola, O.O.; Ezugwu, A.E.; Agushaka, J.O.; Abu Zitar, R.; Abualigah, L. Multiclass feature selection with metaheuristic optimization algorithms: A review. Neural Comput. Appl. 2022, 34, 19751–19790. [CrossRef] [PubMed]
[23] Taye, M.M. Understanding of Machine Learning with Deep Learning: Architectures, Workflow, Applications and Future Directions. Computers 2023, 12, 91. [CrossRef]
[24] Liu, X.; Song, L.; Liu, S.; Zhang, Y. A Review of Deep-Learning-Based Medical Image Segmentation Methods. Sustainability 2021, 13,1224. [CrossRef]
[25] Patterson, C. The State of the Art of Dementia Research: New Frontiers; Alzheimers Disease International: London, UK, 2018.
[26] Prince, M.; Wimo, A.; Guerchet, M.; Ali, G.C.; Wu, Y.-T.; Prina, M. The global impact of dementia: An analysis of prevalence, incidence, cost, and trends. World Alzheimer Rep. 2015, 2015, 84.
[27] Bomasang-Layno, E.; Bronsther, R. Diagnosis and Treatment of Alzheimer's Disease: An Update. Del. J. Public Health 2021, 7, 74–85. [CrossRef]
[28] Gounden, V.; Bhatt, H.; Jialal, I. Renal Function Tests; StatPearls Publishing: Treasure Island, FL, USA,2023. Available online: https://www.ncbi.nlm.nih.gov/books/NBK507821/ (accessed on 21 December 2022).
[29] Scahill, R.I.; Schott, J.M.; Stevens, J.M.; Rossor, M.N.; Fox, N.C. Mapping the evolution of regional atrophy in Alzheimer's disease: Unbiased analysis of fluid-registered serial MRI. Proc. Natl. Acad. Sci. USA 2002, 99, 4703–4707. [CrossRef]
[30] Keles, M.K.; Kilic, U. Classification of Brain Volumetric Data to Determine Alzheimer's Disease Using Artificial Bee Colony Algorithm as Feature Selector. IEEE Access 2022, 10, 82989–83001. [CrossRef]
[31] Nicola Amoroso et al., "Deep Learning Reveals Alzheimer's Disease Onset in MCI Subjects: Results From an International Challenge,"Journal of Neuroscience Methods, vol. 302, pp. 3–9, 2018
[32] Michael Eickenberg, "Seeing It All: Convolutional Network Layers Map the Function of the Human Visual System," NeuroImage, vol. 152, pp. 184–194, 2017
[33]https://www.kaggle.com/datasets/sachinkumar413/alzheimer-mri-dataset

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Detection of DDoS Attack Using ML

Prof. Vivek Nagargoje, Vaibhav Patil, Giri Anant, Sandesh Sabale, Sumit Kekan
Dept. Of Information Technology Nutan Maharashtra Institude of Engineering and Technology, Pune, India

ABSTRACT
This paper explores the field of detecting Distributed Denial of Service (DDoS) attacks, which is an essential component of network security in the current digital environment. With the proliferation of sophisticated cyber threats, there is a pressing requirement for robust detection mechanisms to safeguard network infrastructures. This study examines the effectiveness of machine learning techniques, specifically K-Nearest Neighbours (KNN) and Support Vector Machines (SVM), in detecting DDoS attacks amidst the vast amount of network traffic. By meticulously analyzing datasets encompassing vital features such as IP Length, Time-To-Live (TTL), Protocol, TCP Source/Destination Ports, Length, and Window Size, we unveil the potential of these algorithms in discerning malicious traffic patterns. Through rigorous model training and evaluation, our results underscore the accuracy and reliability of KNN and SVM in detecting DDoS attacks, thus bolstering network security measures. Furthermore, we showcase the deployment of trained models within a Flask application framework, enabling real-time detection and mitigation of potential threats. The paper itself acts as a testament to the efficacy of machine learning in fortifying network defenses against DDoS attacks, paving the way for enhanced cybersecurity paradigms in the digital age.

keywords - Distributed Denial of Service (DDoS) attacks, network security, machine learning, K-Nearest Neighbors (KNN), Support Vector Machines (SVM), feature analysis, model training, Flask application, cybersecurity

I. INTRODUCTION

The stability and security of network infrastructures around the world are being threatened by the increase in Distributed Denial of Service (DDoS) assaults[4,5]. DDoS attacks aim to prevent authorised users from accessing the target system by flooding it with traffic, so disrupting the regular operation of online services[6,7]. These attacks can result in severe financial losses, damage to reputation, and potential data breaches for the targeted organizations[8].

In response to the growing threat of DDoS attacks, the development of effective detection and mitigation strategies has become paramount[9]. Conventional DDoS detection techniques, such signature-based and rule-based systems, frequently find it difficult to keep up with the attackers' constantly changing strategies[10]. A potential substitute is provided by machine learning (ML) algorithms, which use data-driven methods to identify unusual network activity that could be a sign of DDoS attacks[11,12].

This paper presents a comprehensive study on the application of ML algorithms, specifically K-Nearest Neighbors (KNN) and Support Vector Machines (SVM), for the detection of DDoS attacks. These algorithms were chosen because they can analyse network traffic

data and identify patterns that indicate malicious activity. By training on labeled datasets containing both normal and attack traffic, KNN and SVM models can learn to distinguish between benign and malicious network behavior.

An overview of DDoS assaults and their effects on network infrastructure is given at the outset of the paper. It then delves into the fundamentals of KNN and SVM algorithms, explaining their principles of operation and suitability for DDoS detection tasks. The dataset used for training and evaluation purposes is described, highlighting the importance of feature selection and preprocessing techniques in preparing the data for model training.

Next, the paper discusses the implementation of KNN and SVM models within a Flask application, allowing for real-time DDoS detection and prediction. The system architecture and workflow are presented, detailing the steps involved in data collection, preprocessing, model training, and inference. Additionally, the paper explores the performance metrics used to evaluate the effectiveness of the models, including accuracy, precision, recall, and F1-score.

Finally, the paper concludes with a discussion on the strengths and limitations of KNN and SVM algorithms for DDoS detection, along with future research directions in this field. Overall, this study provides valuable insights into the application of ML techniques for enhancing network security and mitigating the impact of DDoS attacks on critical infrastructure.

II. LITERATURE REVIEW

Paper 1: DDoS Simulation: Empowering Targets through Simulated Attacks

Alternate Name: Understanding DDoS Attacks through Simulation

Description:

In order to improve potential targets' readiness for DDoS attacks, this research paper presents the idea of a DDoS simulation platform. The gateway, as demonstrated by ddos attack. Online, serves as a platform for simulating DDoS attacks and providing insightful information to aid targeted in realising their limitations and develop effective mitigation strategies. The study examines Layer 7 attacks, describes how the simulation portal was created and used, and talks about intentions to add Layer 4 attacks and increase the number of attack sites in the future. By leveraging simulated attacks, this approach aims to empower organizations to proactively defend against DDoS threats and minimize the impact of potential attacks on their online services.

Paper 2: A Comprehensive Survey of DDoS Attacks: Evolution, Mitigation, and Emerging Trends

Alternate Name: Exploring DDoS Landscape: Evolution and Mitigation Strategies

Description:

This survey paper provides a comprehensive overview of Distributed Denial of Service (DDoS) attacks, addressing their evolution, mitigation strategies, and emerging trends. It offers insights into the growing threat landscape of DDoS attacks, emphasizing their impact on the availability and integrity of online services. The paper discusses various types of DDoS attacks and presents recommendations for mitigating these threats. The study summarises past studies and highlights their flaws, making it a valuable resource for scholars and practitioners who seek to understand and address the challenges posed by DDoS attacks. It emphasises how crucial it is to continue researching and innovating in order to create efficient defences against DDoS attacks that are always changing.

Paper 3: Analysis of DDoS Attacks on IoT Architecture

Alternate Name: Understanding DDoS Threats in IoT Networks

Description:

The classification of Distributed Denial of Service (DDoS) attacks in the context of Internet of Things (IoT) architecture is the main topic of this research study. By

examining attacks across different layers of the IoT architecture and analyzing their operational mechanisms and execution tools the study attempts to close knowledge gaps in the literature and offer guidance for developing strong defenses against DDoS assaults against IoT devices. The paper's findings contribute to enhancing understanding of DDoS threats in IoT environments and offer recommendations for bolstering security defenses. Through a thorough examination of attack characteristics and defense strategies, the paper sheds light on the evolving landscape of DDoS attacks on IoT architecture and highlights the need for proactive defense mechanisms to safeguard IoT ecosystems.

Paper 4: A Simulation-based Analysis Study for DDoS Attacks on Computer Networks

Alternate Name: Exploring DDoS Attack Scenarios through Simulation

Description:

This research paper delves into the realm of Denial of Service (DoS) attacks, particularly focusing on Distributed Denial of Service (DDoS) attacks, can flood the target with an excessive number of bogus requests, causing disruptions to system operations. The paper elucidates the fundamental principles underlying DDoS attacks and provides insights into their operational mechanics. Through the utilization of simulation tools, specifically OPNET, the paper constructs practical models simulating DDoS attacks over various Internet protocols such as VoIP, FTP, and HTTP. By conducting experiments across different scenarios, the paper unveils the effects of DDoS attacks on network performance and evaluates the efficacy of firewall configurations in mitigating these attacks. The findings underscore the importance of proactive defense measures and the role of simulations in understanding and combating DDoS threats in computer networks.

Paper 5: Enhancing Resilience against DDoS Attacks in SDN-based Supply Chain Networks Using Machine Learning

Alternate Name: Machine Learning-driven Resilience in SDN-enabled Supply Chains against DDoS Attacks

Description:

This paper explores the vulnerability of supply chain networks to Distributed Denial of Service (DDoS) attacks and proposes a novel approach leveraging Software-Defined Networking (SDN) and machine learning to bolster their resilience against such threats. Due to the way they connect, supply chain networks are vulnerable to DDoS attacks, which could disrupt operations and result in large financial losses. SDN offers a centralized control mechanism that enables dynamic traffic rerouting, which can enhance the network's ability to withstand DDoS attacks. By integrating machine learning techniques for DDoS attack detection and mitigation within an SDN framework, the paper aims to improve the effectiveness of defense mechanisms. Through empirical evaluation, the paper assesses the performance and efficacy of these techniques, shedding light on their potential to strengthen the security posture of supply chain networks in the face of evolving DDoS threats

Paper 6: A Review of DDoS Attack Detection and Prevention Mechanisms in Clouds

Alternate Name: Examining DDoS Defense Strategies for Cloud Environments

Description:

This paper presents a comprehensive review of Distributed Denial of Service (DDoS) attack detection and prevention mechanisms tailored for cloud computing environments. With the widespread adoption of cloud services, ensuring their resilience against DDoS attacks is paramount to maintaining service availability and integrity. The paper systematically analyzes various strategies employed to detect, prevent, and mitigate DDoS attacks in cloud

environments, providing insights into their strengths, limitations, and suitability for different deployment scenarios. By synthesizing existing research findings and identifying gaps in current approaches, the paper offers valuable guidance for researchers and practitioners seeking to bolster the security of cloud-based infrastructures against DDoS threats. Through a critical examination of the state-of-the-art in DDoS defense mechanisms, the paper contributes to advancing the field of cybersecurity in cloud computing and lays the groundwork for future research endeavors aimed at enhancing DDoS resilience in cloud environments.

Paper 7: Challenges of DDoS Attack Mitigation in IoT Devices by Software Defined Networking (SDN)

Alternate Name: Addressing DDoS Vulnerabilities in IoT Devices through SDN

Description:

In this paper, the authors delve into the pressing issue of Distributed Denial of Service (DDoS) attacks targeting Internet of Things (IoT) devices and explore potential mitigation strategies leveraging Software Defined Networking (SDN). As IoT deployment continues to proliferate, the security of connected devices becomes increasingly critical, with DDoS attacks posing a significant threat to their availability and integrity. The paper identifies the unique challenges associated with mitigating DDoS attacks in IoT environments and proposes the use of SDN as a viable approach to enhance security defenses. By centralizing network control and enabling dynamic traffic management, SDN offers promise in mitigating DDoS threats while preserving the lightweight nature of IoT devices. The authors evaluate existing DDoS mitigation techniques and their applicability to SDN-based IoT architectures, highlighting the need for adaptive decision-making and continuous monitoring to thwart evolving DDoS attack vectors. Through a comprehensive analysis of the security implications and challenges inherent in securing IoT devices against DDoS attacks, the paper contributes valuable insights to the field of IoT security and lays the groundwork for future research in this area.

Paper 8: A Secured Botnet Prevention Mechanism for HTTP Flooding Based DDoS Attack

Description:

This paper focuses on addressing the threat posed by HTTP flooding-based Distributed Denial of Service (DDoS) attacks, which inundate target servers with illegitimate HTTP requests, thereby disrupting network operations. The authors highlight the vulnerability of computer network-connected devices to such attacks and propose a novel botnet prevention mechanism to bolster network security. By integrating invisible challenge and Resource Request Rate algorithms into the application layer, the proposed mechanism aims to mitigate HTTP flooding-based DDoS attacks while allowing genuine incoming traffic to reach the server. The paper emphasizes the importance of proactive measures to prevent DDoS attacks, particularly in light of the growing prevalence of such attacks and their detrimental impact on network availability and resources. Through simulation-based analysis and experimentation, the authors demonstrate the effectiveness of the proposed botnet prevention mechanism in safeguarding against HTTP flooding-based DDoS attacks, offering a promising solution for enhancing network resilience and mitigating the financial and operational repercussions of DDoS incidents.

Paper 9: Detection and Mitigation of Low and Slow DDoS attack in an SDN environment

Abstract:

Attacks such as Distributed Denial of Service (DDoS) attempt to interfere with network activities by overloading target servers with packets or by using vulnerabilities to deplete resources. While volume-based DDoS attacks are relatively easy to detect due to abnormal packet flow, low and slow DDoS attacks pose a significant challenge as they maintain connections for extended periods, mimicking genuine traffic. In this

research, a method for identifying and countering the low-latency DDoS assault known as Slowloris in an SDN context is proposed. The suggested remedy entails data analysis and the identification of low- and slow-traffic DDoS attack patterns through communication between the SDN controller and the detection and mitigation module. By leveraging the centralized control mechanism of SDN, the solution aims to enhance the network's resilience against low and slow DDoS attacks, thereby mitigating their impact on network availability and performance. Through experimental validation and analysis, the paper demonstrates the effectiveness of the proposed approach in detecting and mitigating low and slow DDoS attacks, offering valuable insights for strengthening network security in SDN environments.

Paper 10: Anti-D chain: A lightweight DDoS attack detection scheme based on heterogeneous ensemble learning in blockchain.

Abstract:

With the rapid advancement of blockchain technology, securing blockchain networks against Distributed Denial of Service (DDoS) attacks has become increasingly critical. Traditional DDoS detection and defense mechanisms are primarily centralized, posing limitations in effectively combating DDoS attacks in blockchain networks. This research presents a unique lightweight DDoS assault detection technique based on heterogeneous ensemble learning in blockchain networks called Anti-D chain, to address this difficulty. The Anti-D chain leverages a distributed and decentralized approach, incorporating heterogeneous ensemble learning strategies such as AdaBoost and Random Forest. Lightweight classifiers like CART and ID3 are integrated into the ensemble learning algorithm to enhance the detection accuracy and robustness against DDoS attacks. By harnessing the power of blockchain technology and ensemble learning, the Anti-D chain offers a scalable and effective solution for accurately identifying DDoS attack patterns in peer-to-peer (P2P) networks. Experimental results demonstrate the superior performance of the proposed detection method in terms of precision, recall, F-score, true positive rate, false positive rate, and ROC curve analysis, highlighting its potential for bolstering DDoS defense mechanisms in blockchain networks.

III. ARCHITECTURE

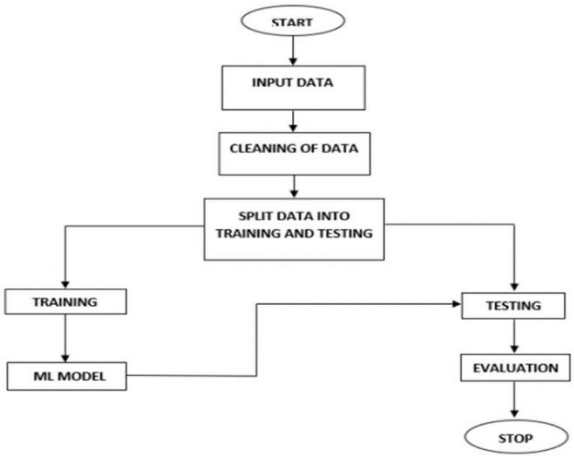


Fig: architecture

I. ER DIGRAM

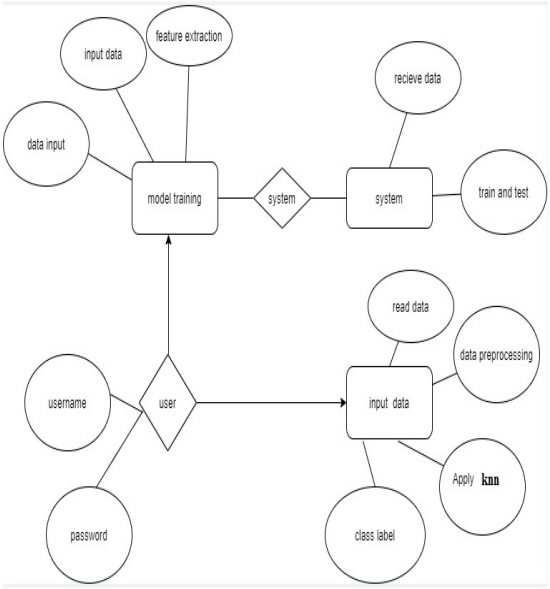


Fig: Er diagram

II. DATASET DESCRIPTION

The dataset utilized in this study comprises network traffic data captured from both normal network activity and Distributed Denial of Service (DDoS) attack scenarios. It is an essential part of machine learning model evaluation and training for the identification of harmful network activity. The dataset contains a diverse range of features extracted from network packets, providing valuable insights into the characteristics of benign and attack traffic.

Each entry in the dataset represents a network packet and includes various attributes that encapsulate key aspects of network communication. These attributes include but are not limited to frame length, IP header length, IP length, IP time-to-live (TTL), IP protocol type, TCP source and destination ports, TCP length, TCP window size, and various TCP flags. Additionally, the dataset includes labels indicating whether each packet corresponds to normal network traffic or a DDoS attack.

The two primary categories of the dataset are DDoS attack traffic and regular network traffic. The normal network traffic category comprises packets exchanged during routine network communication, including activities such as web browsing, email communication, and file transfers. These packets exhibit typical patterns and characteristics associated with legitimate network behavior.

In contrast, the DDoS attack traffic category contains packets generated during simulated DDoS attack scenarios. These packets are intentionally crafted to overwhelm the target system's resources and disrupt its normal operation. Distinctive patterns, like abnormally high packet rates, big packet sizes, and strange protocol behaviour, are frequently seen in DDoS attack traffic.

One of the critical aspects of preparing the dataset involves ensuring a balanced representation of both normal and attack traffic samples. This balance helps prevent model bias and ensures robust performance during training and evaluation. Additionally, data preprocessing techniques may be applied to the dataset to address issues such as missing values, outliers, and feature scaling, thereby enhancing the quality of the input data for machine learning algorithms.

Researchers and practitioners can create efficient DDoS detection systems by using the dataset as the basis for training and testing machine learning models. By analyzing the characteristics of normal and attack traffic patterns, machine learning models can learn to differentiate between benign and malicious network behavior, enabling timely detection and mitigation of DDoS attacks in real-world environments.

III. MODEL TRAINING AND EVALUATION:

From a framework of DDoS attack detection, model training involves the process of training machine learning algorithms using the prepared dataset to develop predictive models capable of distinguishing between normal network traffic and DDoS attack traffic. This section outlines the steps involved in model training and evaluation, highlighting key considerations and methodologies.

Feature Selection and Extraction:

Before training the models, it is essential to identify relevant features from the dataset that contribute to distinguishing between normal and attack traffic. Features such as IP length, TTL, protocol type, TCP source and destination ports, TCP length, and window size are commonly utilized for this purpose. Feature extraction techniques may be employed to transform raw data into meaningful feature representations suitable for model training.

Data Splitting:

To evaluate the effectiveness of the trained models, the dataset is split into testing and training sets. Typically, a significant portion of the dataset is allocated for training (e.g., 70-80%), while the remainder is reserved for testing. This ensures that the models are evaluated on

unseen data to provide an unbiased estimate of their performance.

Model Selection:

Various machine learning algorithms can be employed for DDoS attack detection, including Support Vector Machines (SVM), K-Nearest Neighbors (KNN), Random Forests, and Gradient Boosting Machines. The selection of an algorithm is contingent upon various aspects, including the type of data, computational effectiveness, and the intended balance between interpretability and accuracy. Hyperparameter Tuning:

Hyperparameters are variables that govern the behaviour of machine learning algorithms but are not learned during training. Model performance can be increased by optimising hyperparameters using strategies like random or grid search. Common Among the hyperparameters are the quantity of neighbors in KNN, the kernel type in SVM, and the number of trees in Random Forests.

Model Training:

Once the algorithm and hyperparameters are selected, the model is trained using the training data. In order to reduce prediction errors and increase predictive accuracy, the model learns patterns and correlations between features and labels in the dataset during training.

Model Evaluation:

After training, the performance of the trained model is evaluated using the testing data. Evaluation measures that are frequently used to evaluate a model's performance in properly classifying normal and attack traffic include accuracy, precision, recall, F1-score, and area under the ROC curve (AUC-ROC). Additionally, techniques such as cross-validation may be employed to obtain more reliable performance estimates.

IV. PERFORMANCE ANALYSIS

To determine the trained model's advantages, disadvantages, and potential areas for development, its performance is examined. Insights gained from performance analysis can inform further iterations of the model training process, potentially leading to enhanced detection capabilities and robustness against evolving DDoS attack strategies.

V. RESULT

Feature Selection: The selected features for detecting DDoS attacks were 'ip.len', 'ip.ttl', 'ip.proto', 'tcp.srcport', 'tcp.dstport', 'tcp.len', and 'tcp.window_size'.

1. Support Vector Machine (SVM):

   Accuracy: 97.55%

   SVM achieved an accuracy of 97.55% in detecting DDoS attacks using the selected features.

2. K-Nearest Neighbors (KNN):

   Accuracy: 99.60%

   KNN achieved an impressive accuracy of 99.60% in detecting DDoS attacks using the same set of features.

CONCLUSION:

In conclusion, the process of DDoS attack detection involves leveraging machine learning techniques to develop robust models capable of accurately distinguishing between normal network traffic and malicious attack traffic. Throughout this paper, we have explored various aspects of DDoS attack detection, including dataset preparation, model training, and evaluation.

Firstly, we discussed the importance of dataset preparation, highlighting the need to collect and preprocess network traffic data to extract relevant features for model training. Features such as IP length, TTL, protocol type, and TCP characteristics play a crucial role in characterizing network traffic and detecting anomalies indicative of DDoS attacks.

Next, we delved into the model training process, where we explored different machine learning algorithms such as SVM, KNN, and XGBoost. The choice of algorithm is influenced by various parameters, including desired

performance metrics, computing efficiency, and dataset characteristics. Each method has pros and cons of its own. We then discussed the evaluation of trained models, emphasizing the importance of assessing performance using appropriate metrics such as accuracy, precision, recall, and AUC-ROC. Rigorous evaluation ensures that the deployed models can effectively differentiate between normal and attack traffic while minimizing false positives and false negatives.

Throughout this paper, we have underscored the significance of continuous refinement and improvement in DDoS detection systems. As cyber threats evolve and adversaries employ sophisticated attack strategies, it is essential to adapt and enhance detection mechanisms to stay ahead of emerging threats.

In summary, the development of accurate and reliable DDoS detection systems requires a comprehensive understanding of network traffic patterns, robust model training methodologies, and rigorous performance evaluation. By leveraging machine learning techniques and adopting a proactive approach to cybersecurity, organizations can effectively mitigate the risks posed by DDoS attacks and safeguard their network infrastructure against malicious threats.

VI. REFERENCES

[1] Aliyev, R. (2023). DDoS Simulation: Empowering Targets through Simulated Attacks. In 2023 IEEE 17th International Conference on Application of Information and Communication Technologies (AICT). IEEE. DOI: 10.1109/AICT59525.2023.10313188

[2] Kumar Sharma, A., & Kumar, R. (2024). A Comprehensive survey of DDoS Attacks: Evolution, Mitigation and Emerging trend. In 2024 3rd International conference on Power Electronics and IoT Applications in Renewable Energy and its Control (PARC). IEEE. DOI: 10.1109/PARC59193.2024.10486696

[3] Kaur, K., & Ayoade, J. (2023). Analysis of DDoS Attacks on IoT Architecture. In 2023 10th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI). IEEE. DOI: 10.1109/EECSI59885.2023.10295766

[4] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[5] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[6] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[7] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[8] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[9] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[10] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[11] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[12] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Vehicle Detection Using Haar Cascade Algorithm

Abhishek Andure[1], Sakshi Pidurkar[2], Aditya Tarte[3], Swapnil Thorat[4] , Sonali Patil[5]
[12345]Nutan Maharashtra Institute of Engineering and Technology, Talegaon(D), Pune

ABSTRACT

Deep Learning is a rapidly advancing field that has the power to completely transform a lot of different industries and fields of study. One critical task within this domain is vehicle detection, which has practical applications in domains such as traffic management, public safety, and autonomous driving. Intelligent Transportation Systems (ITS) can be used for vehicle detection to count and track vehicles, detect incidents, and collect tolls. This helps improve traffic management, monitor flow and congestion, and better meet the needs of travellers and commuters, making transportation systems safer, more efficient, and effective. The goal of this task is to develop algorithms that, after being trained, can recognize, and locate automobiles automatically in pictures or videos Deep Learning models on labelled datasets of vehicle examples. Another related activity that utilizes deep learning is object detection is Finding and locating items in pictures or movies. This task aims to automatically detect and classify objects within a scene and determine their precise location. Object detection using Deep Learning is beneficial in real-time applications such as surveillance systems, robotics, and self-driving cars, and can result in improved safety, efficiency, and automation across various domains.

Keywords : Computer vision, Intelligent transport system (ITS), Vehicle detection, Traffic management.

I. INTRODUCTION

Vehicles have become an essential part of modern society, with significant impacts on our daily lives and the global economy so that increase of vehicle in world has huge amount. It provides a convenient effective mode of transportation, allowing individuals to go to their places of employment, education, and other destinations[4,5]. They are also essential for transporting goods and materials, supporting trade and business. The automotive sector employs millions of people and is a major employer people on the planet[6]. This covers not just sales and manufacturing but also research and all. As Vehicles are a critical component of transportation infrastructure, requiring the construction and maintenance of roads, highways, bridges, and tunnels. This infrastructure supports economic growth and development and facilitates movement and connectivity between regions and countries[7,8,9]. The development of vehicles has driven technological developments in several disciplines, such as engineering, materials science, and software engineering[10]. Recent developments in autonomous and electric car technology could reshape transportation while minimizing negative environmental effects. According to estimates, by 2050, there will be over ten billion automobiles are driven worldwide. While transportation may generate threats such as road accidents, traffic on

road. To reduce accident on road the Intelligent Transportation System is evolved. Deep Learning is employed to lessen this problem by detecting vehicle[11,12]. Through Deep Learning advanced warning, detecting hazards in real-time, and optimizing traffic flow.

II. Problem Statement:

The challenges associated with vehicle detection include the need for accurate identification and localization of vehicles amidst complex backgrounds, occlusions, and variations in lighting conditions. Furthermore, the system must be capable of handling real- time video streams, ensuring fast and efficient processing to meet the requirements of surveillance, traffic monitoring, and autonomous driving applications. The proposed solution aims to leverage the Haar Cascade algorithm's ability to utilize Haar-like features and machine learning techniques to train a classifier on a dataset of positive and negative samples. By extracting relevant features and employing a trained classifier, the system can effectively distinguish vehicles from the background and accurately detect their presence in real-time video streams. By addressing the challenges related to lighting conditions, occlusions, and complex backgrounds, the proposed system aims to provide reliable and efficient vehicle detection capabilities for a wide range of applications, including surveillance, traffic management, and autonomous driving.

III. Literature Survey

'Single Shot Multi-Box Detector (SSD)' by Wei Liu et al. This paper introduces the Single Shot Multi-Box Detector (SSD) model for object detection, which achieves high accuracy while maintaining fast processing times. The authors demonstrate the effectiveness of the model on vehicle detection on highways and in urban area environments. 'Vehicle Detection and Tracking with Deep Learning' by Wenjie Wang et al. This study describes a system for identifying vehicles and tracking using a deep learning model. The authors illustrate the system's efficacy in actual real-world traffic data and show that it outperforms conventional methods in computer vision. Accelerated R- CNN: Moving Towards Real-Time Object Recognition with Networks for Region Proposal by Shaoqing Ren et al. This paper presents a faster R-CNN model for object detection, which uses a region proposal network to identify potential object locations before detecting objects with precision. The model's efficacy in vehicle detection is exhibited by the authors across multiple scenarios. "YOLO: Instantaneous Object Recognition" by Redmon Joseph et al. The YOLO (You Only Look Once) deep learning architecture is proposed in this paper for real-time object detection, including car detection. The model is appropriate for real-world applications because it achieves high accuracy and quick processing times. Du Tran et al.'s "Deep Convolutional Neural Networks for Efficient Vehicle Detection" A deep convolutional neural network architecture is suggested in this paper for effective vehicle detection. Using a large-scale dataset, the authors show the model's efficacy and show that it can achieve high accuracy with quick processing times.

1. A Real-Time YOLO and Centroid Tracking-Based Wrong-Way Vehicle Detection System The study suggests a real-time centroid tracking and YOLO-based wrong-way vehicle detection system. It combines the effectiveness of centroid tracking for real-time tracking with the precision of YOLO for initial vehicle detection. In order to prevent accidents, the system attempts to identify vehicles that are traveling in the incorrect direction. Through the utilization of centroid tracking to track object positions and YOLO's object detection capabilities, the

suggested system offers a practical way to detect vehicles traveling the incorrect way in real time. Because this work allows for early detection and timely alerts for incidents involving drivers going the wrong way, it has the potential to improve road safety.

2. A Provident Vehicle Detection at Night Dataset. In this paper, a dataset created especially for nighttime provident vehicle detection is presented. The purpose of the dataset is to address the difficulties posed by low light levels and the requirement for precise vehicle detection in such situations. It includes an extensive set of annotated photos taken in a variety of nighttime settings, such as cities, countryside, and highways. The purpose of the dataset is to support research and development of robust and dependable algorithms for vehicle detection in low-light situations. This work advances computer vision systems that can detect vehicles in difficult lowlight conditions by offering a benchmark dataset, thereby increasing safety and security in nocturnal driving scenarios.

3. Transformer-Based End-to-End Object Detection [3] The method for end-to-end object detection in the paper makes use of transformers, a kind of neural network architecture that was first created for tasks involving natural language processing. The authors suggest a brand-new object detection model called DETR (DEtection TRansformer), which does away with the requirement for intricately crafted manual parts like non-maximum suppression and anchor boxes. Using self-attention mechanisms, DETR obtains the set of object detections directly from the sequence prediction problem, capturing global dependencies in the image. The model offers simplicity, flexibility, and increased runtime efficiency while achieving competitive results on object detection benchmarks. The study demonstrates how transformers have the potential to completely transform object detection and computer vision applications.

4. Scalable and Effective Object Detection with EfficientDet. A scalable and effective object detection framework called EfficientDet is presented in this paper. The authors suggest a compound scaling technique that increases the detection network's accuracy and efficiency by uniformly scaling all its dimensions. Additionally, they present a brand-new EfficientNet backbone that better balances depth and width for improved accuracy and computational efficiency trade-offs. EfficientDet is much faster than previous methods and achieves state-of-the-art performance on multiple object detection benchmarks by combining the scaling method with the EfficientNet backbone. The study highlights how crucial it is to strike a balance between computational efficiency and model complexity to provide scalable and effective object detection solutions.

5. For instance segmentation, a powerful data augmentation technique is simple copy-paste. For instance, segmentation tasks, the paper presents a straightforward yet efficient data augmentation technique called Simple Copy-Paste. It creates new training examples by utilizing the concept of copying and pasting objects from one image to another. The authors show that by using this method, instance segmentation models perform better than ever, even outperforming more intricate and costly augmentation techniques. Benefits of Simple Copy-Paste include better generalization to real-world scenarios, preservation of object-level annotations, and avoidance of the need for additional labeling work. The study demonstrates how this simple data augmentation method can improve instance segmentation tasks' robustness and performance.

Paper Title	Algorithm	Year	Journal	Work
A Real-Time Wrong-Way Vehicle Detection Based on YOLO and Centroid Tracking [1]	YOLO (You Only Look Once)	2022	The proposed system for vehicle detection and tracking in videos involves two stages. First, the YOLO object detector is used to detect every vehicle in the frame, as it is a highly accurate and efficient algorithm. The resulting bounding boxes are then passed to a centroid-based tracking algorithm, which tracks each vehicle in the specified region of interest. By computing the centroid height of each vehicle in consecutive frames, the system can determine the direction of vehicles.	Developed a machine learning model to predict early-stage Alzheimer's disease using MRI data. The model achieved an accuracy of 95.2% on a held-out test set.
A Dataset for Provident Vehicle Detection at Night [2]	SOTA (State-Of-The-Art)	2021	It presents a new dataset of nighttime driving scenes with annotated vehicle detections, which is an important contribution to the field of computer vision for autonomous driving. The authors evaluate different state-of-the-art vehicle detection algorithms on the dataset and provide insights into the limitations of current approaches for nighttime vehicle detection. This work can be useful for developing more accurate and reliable systems for nighttime driving scenarios.	The authors evaluate several state-of-the-art vehicle detection algorithms on this dataset and highlight the limitations of current approaches for nighttime vehicle detection. This research provides valuable insights into the challenges of developing accurate and reliable systems for nighttime driving scenarios, which can inform the development of future approaches in this area.

Resilience of Autonomous Vehicle Object Category Detection to Universal Adversarial Perturbations [3]	Faster-RCNN	2021	Through meticulous experimentation, we created a diverse and realistic COCO dataset and separated the failure of object detection into two categories: failure with and without perturbations. This is an important finding, as perturbations that are imperceptible to humans can still cause significant harm in an adversarial attack.	The scope of the paper is limited to universal adversarial perturbations and does not examine other types of attacks. The experiments are constrained to a particular object detection model and dataset, and it is uncertain whether the findings will apply to different models or datasets. Moreover, the paper assumes a flawless detection model and does not account for the effect of incorrect detections on the system's robustness.

Table 1. Literature Survey

IV. Objective

The objectives of this research project are as follows:

1. Develop a vehicle detection system based on the Haar Cascade algorithm that can accurately and efficiently identify vehicles in real-time video streams.
2. Pre-process input images to enhance their quality, including image resizing, grayscale conversion, and histogram equalization, to improve the performance of the vehicle detection system.
3. Train a Haar Cascade classifier using a large dataset of positive and negative samples to enable the system to accurately distinguish vehicles from the background.
4. Evaluate the performance of the developed system using a dataset of actual traffic videos, measuring its accuracy rates and real-time processing capabilities.
5. Address challenges related to lighting variations, occlusions, and complex backgrounds to improve the robustness and reliability of the vehicle detection system.
6. Compare the performance of the Haar Cascade algorithm with other popular supervised learning algorithms, such as the Histogram of Oriented Gradients (HOG) algorithm and Convolutional Neural Networks (CNN), to assess the effectiveness of the proposed system.
7. Validate the proposed system's effectiveness for real-world vehicle detection applications, demonstrating its potential impact in domains such as surveillance, traffic monitoring, and autonomous driving.

By achieving these objectives, the research aims to contribute to the development of an accurate, efficient, and real-time vehicle detection system using the Haar Cascade algorithm, with potential applications in various domains requiring vehicle identification and monitoring.

V. Software System Architecture

Overall, the system architecture for vehicle detection using Haar Cascade algorithm typically comprises several interconnected components:

1. Data Source:

The system acquires input data, such as a video stream or images, from a camera or other sources.

2. Preprocessing Module:

The preprocessing module performs data preprocessing tasks such as resizing, normalization, and grayscale conversion to prepare the input data for feature extraction.

3. Feature Extraction Module:

The feature extraction module uses the Haar Cascade algorithm to extract features such as edges and shapes from the preprocessed data.

4. Classification Module:

The classification module applies a machine learning algorithm, such as HCC, to classify the extracted features as either vehicles or non-vehicles.

5. Post-Processing Module:

The post-processing module applies techniques such as non-maximum suppression to remove false positives and enhance the detection accuracy.

6. Visualization Module:

The visualization module displays the results, such as bounding boxes around the detected vehicles, to provide feedback to the user.

7. Deployment Platform:

The deployment platform runs the system in a suitable environment, such as a traffic intersection or parking lot, to perform vehicle detection in real-time.

The system architecture for vehicle detection using Haar Cascade algorithm should be scalable and modular, with well-defined interfaces between the components. Moreover, the system architecture should incorporate fault-tolerant mechanisms and error handling techniques to ensure reliable performance in real-world scenarios. the diagnostic process, and ultimately improve access to quality healthcare.

VI. Methodology and Discussion

To address the problem of vehicle detection in real-time video streams, several methodologies will be employed throughout the project. The methodologies encompass the following steps:

1. Literature Review: Conduct an extensive review of relevant literature to gain a comprehensive understanding of existing approaches, algorithms, and techniques for vehicle detection using the Haar Cascade algorithm. This review will serve as a foundation for developing the proposed system.
2. Data Collection: Gather a diverse dataset of positive and negative samples containing images and videos of vehicles and non-vehicles. The dataset should encompass various vehicle types, lighting conditions, and backgrounds to ensure a robust and representative training set.
3. Data Pre-processing: Apply pre-processing techniques to enhance the quality of input images. This includes image resizing, grayscale conversion, and histogram equalization to improve the system's performance by standardizing the input data.
4. Haar Cascade Training: Utilize the collected dataset to train a Haar Cascade classifier. Extract Haar-like features from the training samples and employ machine learning techniques to train the classifier to accurately identify vehicles.
5. System Development: Develop the vehicle detection system using the trained Haar Cascade classifier. Implement the necessary algorithms and techniques to process real-time video streams, applying the classifier to identify vehicles in each frame.
6. System Evaluation: Evaluate the performance of the developed system using a dataset of actual

traffic videos. Measure accuracy rates, detection speed, and the system's ability to handle different environmental and lighting conditions.

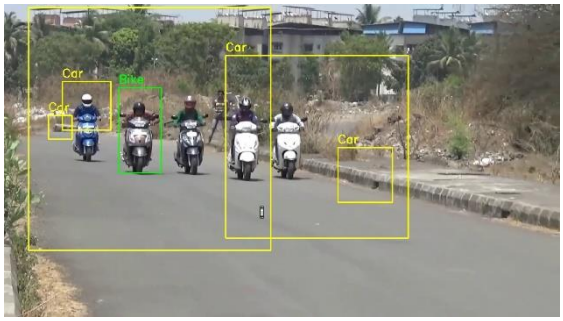
7. Performance Optimization: Fine-tune the system parameters and algorithms to improve accuracy, speed, and robustness. Address limitations and challenges encountered during evaluation, such as handling occlusions and complex backgrounds.
8. Comparative Analysis: Conduct a comparative analysis of the proposed Haar Cascade algorithm with other popular supervised learning algorithms, such as the Histogram of Oriented Gradients (HOG) algorithm and Convolutional Neural Networks (CNN). Compare their effectiveness in vehicle detection tasks.
9. Documentation and Reporting: Document the methodologies, experimental setup, and findings of the project in a structured manner, adhering to the guidelines and requirements of the black book format. Present the results and conclusions drawn from the evaluation and analysis.

Documentation and Reporting: Document the methodologies, experimental setup, and findings of the project in a structured manner, adhering to the guidelines and requirements of the black book format. Present the results and conclusions drawn from the evaluation and analysis.

VI. Result and Analyses

We used Haar cascade algorithm with and without Hyperparameter tunning. Hyperparameter increases the accuracy of result giving us a better output.

Results using normal Haar cascade algorithm:



Results using Haar cascade with Hyperparameter tunning:

VII. Conclusion

In conclusion, the Haar Cascade algorithm is a powerful method for vehicle detection that utilizes mathematical models and machine learning algorithms. The algorithm extracts feature from the input data, classifies these features, and applies post-processing techniques to enhance the accuracy of the detection. Models such as the data flow model, entity relationship model, and UML diagrams help in comprehending the system's components, interactions, and relationships, thereby assisting in its development.

VIII. References

[1] ZillurRahman1, Amit Mazumder Ami, Muhammad Ahsan Ullah., “A Real-Time Wrong-Way Vehicle Detection Based on YOLO and Centroid Tracking”, (2022). arXiv:2210.10226v1 [cs.CV]. Department of Electrical and Electronic Engineering Chittagong University of Engineering and Technology Chittagong-4349, Bangladesh.

[2] SaschaSaralajew, Lars Ohnemus, Lukas Ewecker, EbubekirAsan, Simon Isele, and Stefan Roos2 “A Dataset for Provident Vehicle Detection at Night”, 2021, arXiv:2105.13236v2 [cs.CV].

[3] Nicolas Carion?, Francisco Massa? , Gabriel Synnaeve, Nicolas Usunier, Alexander Kirillov,

and Sergey Zagoruyko, “End-to-End Object Detection with Transformers”, arXiv:2005.12872v3 [cs.CV] 28 May 2020.

[4] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[5] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[6] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[7] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[8] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[9] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[10] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[11] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[12] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Text Summarization & Question Answers Approaches Using Machine Learning & LSTM

Prof. Nitin Wankhede, Prof. Ashish Manwatkar, Dev Garg, Shraddha Pandey, Tejas Kolhe, Prince Kumar Dwivedi

Nutan Maharashtra Institute of Engineering and Technology, Talegaon Dabhade, Pune

ABSTRACT

In today's world overflowing with information, the challenge of efficiently distilling key insights from large volumes of text has become increasingly critical. Natural Language Processing (NLP), a branch of artificial intelligence focused on understanding and processing human language, offers promising solutions to this challenge. In this research paper, we explore the application of NLP techniques in text summarization, aiming to develop methods that can automatically generate concise summaries from extensive documents. Leveraging machine learning algorithms, including recurrent neural networks (RNNs) and transformer models, we investigate how these advanced techniques can enhance the summarization process. By training these models on large datasets and fine-tuning them to understand the structure and meaning of text, we aim to improve the quality and efficiency of the summarization process. Through empirical evaluation on diverse datasets, we demonstrate the effectiveness of our approach in generating accurate and informative summaries across various domains. This research highlights the significant role of machine learning in advancing the field of text summarization, paving the way for further exploration and development of intelligent summarization systems in the future.

Key-Words : ATA, Text Summarization, Abstractive, Extractive, Neural Network, LSTM, Encoder, Decoder.

I. INTRODUCTION

In an era characterized by the inundation of textual data, the necessity for effective techniques to distill crucial insights from extensive documents has become increasingly vital. Text summarization, the process of condensing lengthy texts into concise and informative summaries, offers a solution to this challenge. Harnessing the power of machine learning, particularly techniques like Long Short-Term Memory (LSTM) networks, holds substantial promise in revolutionizing the text summarization landscape. This introduction sets the stage for an exploration of the intersection between machine learning and LSTM in the context of text summarization, examining methodologies, advancements, and implications of employing these technologies in this domain.

The proliferation of machine learning algorithms has ushered in a new era of automated text summarization, empowering systems to extract salient information and distill it into digestible summaries with remarkable accuracy and efficiency. Among the myriad of machine learning techniques, LSTM networks, a type of recurrent neural network (RNN), have garnered considerable attention for their ability to capture long-term dependencies and

sequential patterns in data. This makes them particularly well-suited for tasks involving sequential data, such as natural language processing. In the realm of text summarization, LSTM networks offer a promising avenue for improving the coherence, contextuality, and informativeness of generated summaries.

The objective of this research is to explore the capabilities of LSTM-based models in text summarization and investigate their potential to outperform traditional methods. By employing a sequence-to-sequence (Seq2Seq) architecture enhanced with attention mechanisms, we aim to develop LSTM models capable of capturing the intricate nuances of language and generating summaries that closely resemble human-generated ones.

Additionally, we seek to address key challenges in text summarization, such as handling out-of-vocabulary words, reducing redundancy, and preventing the propagation of errors in generated summaries. Through empirical evaluations and comparative analyses with existing methods, we endeavor to demonstrate the efficacy and superiority of LSTM-based approaches in text summarization, paving the way for the development of more advanced and sophisticated summarization systems. Abstractive and extractive techniques represent two distinct approaches to text summarization, each offering unique advantages and challenges. Abstractive summarization involves generating summaries that may contain new phrases or sentences not present in the original text, essentially paraphrasing the information to convey the essence in a more condensed form.

This approach requires a deep understanding of the text's content and context, as well as the ability to generate fluent and coherent language. While abstractive summarization has the potential to produce more concise and human-like summaries, it is inherently more challenging due to the need for language generation and understanding.

Extractive summarization, on the other hand, involves selecting and condensing existing sentences or passages from the original text to create a summary. This approach relies on identifying the most important sentences or passages based on various criteria such as relevance, importance, and informativeness. Extractive summarization is generally simpler and more straightforward to implement compared to abstractive methods, as it does not involve generating new language.

However, it may struggle with maintaining coherence and readability, especially when dealing with longer texts or complex topics. In text summarization, representing the original text in an intermediate way involves intricate processing to break down the text into individual sentences, employing techniques such as tokenization and sentence segmentation.

Once sentences are isolated, they undergo a comprehensive analysis, where each sentence is meticulously scrutinized and scored based on several criteria. Firstly, relevance plays a pivotal role, with sentences closely aligned with the main topic or theme of the text receiving higher scores. Additionally, the information content of each sentence is evaluated, with sentences containing crucial facts or pivotal insights garnering elevated scores.

Moreover, positional and structural importance are taken into account, acknowledging sentences occupying prominent positions within the text or serving as transitions between paragraphs for enhanced coherence. Furthermore, the length and complexity of sentences are considered, as longer or more convoluted sentences may contain a wealth of information but could pose comprehension challenges.

By meticulously assessing each sentence against these criteria, a nuanced understanding of the significance

and relevance of each sentence within the context of the original text is achieved. Following the comprehensive scoring of sentences, the subsequent step in representing the original text involves selecting high-scoring sentences for inclusion in the summary. This selection process can be conducted using various techniques tailored to balance relevance, informativeness, and coherence in the summary. Threshold-based selection involves setting a predetermined score threshold, admitting only sentences surpassing this threshold into the summary. Alternatively, ranking-based selection ranks sentences based on their scores and incorporates the top-ranked sentences until the desired summary length or number of sentences is attained. A greedy selection approach iteratively includes the highest-scoring sentences without exceeding the desired summary length, ensuring a succinct yet informative representation. By employing these selection techniques, text summarization algorithms adeptly distill the essence of the original text, encapsulating key insights while maintaining readability and coherence in the summary output.

In simpler terms, imagine you're trying to summarize a story. You read through the entire story, breaking it down into sentences. Then, you start to pick out the most important sentences – ones that really capture the main points or key events.

For example, in a story about a treasure hunt, sentences like "The adventurers found a map leading to the hidden treasure" or "They encountered dangerous traps along the way" might get high scores because they're crucial to understanding the story. Once you've picked out these important sentences, you put them together to create a shorter version of the story that still tells you everything you need to know. This process of picking out the most important sentences and putting them together is how text summarization works.

2. Related Work

Existing work in text summarization encompasses a range of approaches, each contributing to the evolution of summarization techniques. Initially, traditional methods focused on extractive summarization, where key sentences or passages from the original text are selected based on statistical algorithms. These methods, relying on features like word frequency and sentence position, provided an initial framework for summarization tasks.

However, with the advent of machine learning, particularly deep learning, there has been a notable shift towards abstractive summarization approaches. These methods leverage models such as recurrent neural networks (RNNs) and transformer architectures to generate summaries by paraphrasing and synthesizing information from the source text. This transition has led to significant improvements in summary quality, although challenges persist in ensuring accuracy and fluency.

Attention mechanisms have emerged as a critical component in enhancing summarization models, enabling them to focus on relevant parts of the input text during summary generation. Moreover, the development of evaluation metrics like ROUGE and BLEU has facilitated the quantitative assessment of summary quality, providing researchers with standardized tools for evaluating summarization systems. Collectively, these existing approaches and techniques serve as a foundation for ongoing research, driving advancements in text summarization and paving the way for more sophisticated and contextually relevant summarization systems.

Sarah Aljumah et al [11] this paper, we propose two neural models for source code summarization for Java methods based on a bidirectional LSTM with an encoder–decoder architecture and an attention mechanism. The first model, model 1, uses two types of information in source code: representation of

source code as text and representation of code as an AST.

JIAWEN JIANG et al [12] this paper, the emergence of Recurrent Neural Networks (RNNs), the elaborated abstractive ATS models mainly rely on a large amount of data rather than using complex model structures to achieve better and rapid natural language processing (NLP) in multiple fields, such as machine translation, speech recognition, sequence generation, etc.

Kshitija Manore et al [13] this paper, The BDLSTM as well as LSTM models' finest units are based upon perplexity. They then evaluated flawed source codes using the BDLSTM with unidirectional LSTM. In order to reduce the error detection or prediction precision, the recommended BDLSTM model is better than the unidirectional 5 LSTM. Furthermore, the BDLSTM model identified the large bulk of significant errors in source code also offered the best alternatives for mistake candidate words.

Nasid Habib Barna et al [14] this paper, Our system adopted a pointer generator network that helps the system to choose between copying words from the source text and generating novel words using the vocabulary dictionary. So even if there is a small vocabulary dictionary or too many rare words in the input text, this system can handle the out-of-vocabulary words that ensures accurate reproduction of information. This system can also handle word repetition problems by using a coverage vector to keep track of what has been summarized at each timestep. This method helps to control the flow of the summary and eliminates repetition.

Öykü Berfin Mercan et al [15] this paper, This study focused on resume text classification. LSTM, pre-trained models and finetuned models were evaluated on resume dataset. BART-Large-resume model that was finetuned with resume dataset gave the best performance.

There are different techniques are used for text summarization using NLP approaches which is elaborated in table 1. In Table 1, We have tried to summarize the different techniques used, advantages and disadvantages in recent years

Table 1. Different Text Summarization Techniques

SR. No	REF. No	Techniques Used	Advantages	Challenges
1.	[11]	Bi-LSTM, LSTM	a. Automatic Code Summarization b. Utilization of DeepLearning	a. User Acceptance andTrust b. Adaptability to Industry Standards.
2.	[12]	NLP, Seq2Se2, MLO Function	a. Hybrid Approach b. Attention Mechanism	a. Resource Intensity b. Evaluation Holism
3.	[13]	LSTM, BERT, ROUGE	a. Effective Data Preprocessing b. Attention Mechanism for Key Sequences	a. Challenges in ModelDiversity b. Enhancing precision and recall posed a challenge for LSTM.

4.	[14]	GRU, Encoder and Decoder	a. Effective Utilization of Topical Features b. Thorough Experimental Analysis and Comparative Evaluation	a. Adapting the model to diverse domains beyond news articles might pose challenges. b. Enhancing the interpretability of the attention mechanism could be challenging.
5.	[15]	LSTM, T5, BART	a. The text offers a thorough examination of abstractive text summarization techniques, encompassing both conventional approaches like LSTM	a. The study lacks explicit recommendations for practitioners or researchers regarding optimal model or technique choices for abstractive text summarization in resumes, which could hinder practical applicability.
6.	[16]	LSTM Based Encoder-Decoder Model	a. The model undergoes training utilizing both noun phrases and their interrelations, enhancing its proficiency in document summarization. b. The model is trained using the CNN news article dataset, augmenting the practical applicability of the study.	a. The brief explanation of the inference architecture poses a challenge for readers seeking a deeper understanding of its functioning, potentially hindering its practical.

7.	[17]	Abstractive Method, T5	a. The primary focus is on evaluating the performance of the T5 Transformer model across multiple datasets, specifically CNNDM, MSMO, and XSUM. b. The text maintains a clear and organized structure, sequentially presenting related work	a. Limited availability of annotated data for abstractive summarization, particularly in specific domains, hinders the training of robust models. b. Challenging to define a universally accepted evaluation metric.
8.	[18]	CNN, NLP, ROUGE	a. The text underscores the significance of abstractive text summarization, showcasing recent strides in employing advanced models for improved performance b. The incorporation of a pointer generator network enhances the model's ability to generate summaries that are logically sequenced and topic-oriented.	a. The absence of a foolproof system in representing the essence of large text documents with generated sentences remains a significant hurdle in advancing abstractive summarization technology.

9.	[19]	NLP, LRL's	a. It draws valuable insightsby comparing characteristics of Indian Language Text Summarization (ILTS) datasets with high-resource languages, specifically, English, contributing to a broader understanding of the field.	a. To enhance the practical impact of the review, the paper should consider suggesting potential solutions or strategies to overcome the identified challenge in ILTSdevelopment.
10.	[20]	Data Mining, MaLSTM	a. The incorporation of a pointer generator network enhances the model's ability to generate summaries that are logically sequenced and topic-oriented	a. The abstractive text summarization domain faces the persistent difficulty of generating accurate and concise summaries, particularly in comparison to the extractive summarization approach

Above Table 1, This is summary for the existing system for the text summarization in tabular format.

3. Proposed System

3.1 Objective :-

From the preceding literature work, it is noticed that there is a scope of text summarization and question-answer models which can make the tedious work of human easier. The purpose of this paper is providing a better performance with some features in addition to the previous one, which includes visualization of data. It also provides customization of summary.

From the survey, this paper formulated the following objectives which are listed below :-

- Designing and optimizing an algorithm for accuracy in text summarization
- Designing the best technique for visualizing detailed data

- Designing an efficient algorithm for rendering customized summaries and question-answers
- Improving the speed of the model using agile methods
- Designing a model that provides the best accuracy with the most relevant output

Let's Understand each objective in more elaborative way.

3.1.1 Designing and optimizing an algorithm for accuracy in text summarization: This objective entails developing an algorithm that effectively addresses the accuracy challenge in text summarization. The algorithm should be designed to accurately distill key insights from lengthy documents while preserving their semantic integrity. This may involve leveraging advanced natural language processing (NLP) techniques, such as deep learning models like recurrent neural networks (RNNs) or transformer architectures.
Additionally, optimization strategies, such as fine-tuning model parameters and incorporating attention mechanisms, can be employed to enhance the algorithm's performance. By prioritizing accuracy in summary generation, the algorithm aims to produce summaries that capture the essential information of the original text with minimal loss of context or meaning.

3.1.2 Designing the best technique for visualizing detailed data: This objective focuses on creating an innovative visualization technique capable of effectively presenting detailed data in a clear and intuitive manner. The technique should enable users to explore complex datasets, identify patterns, and gain insights more easily. This may involve employing advanced data visualization tools and techniques, such as interactive dashboards, heatmaps, or network graphs.
Additionally, attention should be given to factors like user experience (UX) design and accessibility to ensure that the visualization technique is user-friendly and accessible to a wide range of users. By designing a robust visualization technique, the goal is to empower users to make informed decisions and derive actionable insights from complex datasets.

3.1.3 Designing an efficient algorithm for rendering customized summaries and question-answers: This objective involves developing an algorithm capable of dynamically generating customized summaries and question-answer pairs tailored to the specific needs of users. The algorithm should be able to adapt to user preferences, such as summarization length or question complexity, and generate summaries and answers that are relevant and accurate. This may require integrating machine learning techniques, such as reinforcement learning or transfer learning, to train the algorithm on diverse datasets and enable it to learn and adapt over time.
Additionally, natural language understanding (NLU) capabilities can be leveraged to ensure that the algorithm accurately interprets user queries and generates appropriate responses. By designing an efficient algorithm for customized summarization and question-answering, the aim is to provide users with personalized and actionable insights tailored to their specific requirements.

3.1.4 Improving the speed of the model using agile methods: This objective involves enhancing the speed and efficiency of the text summarization model through the adoption of agile methodologies and optimization techniques. Agile methods emphasize iterative development, collaboration, and continuous improvement, allowing for faster iteration cycles and quicker response to changing requirements. This may involve streamlining the model architecture, optimizing computational resources, and

implementing parallel processing techniques to reduce processing time and improve overall efficiency.

Additionally, techniques such as model pruning or quantization can be employed to reduce the model's computational footprint without compromising performance. By embracing agile methods, the goal is to accelerate the development and deployment of the text summarization model, enabling faster delivery of actionable insights to users.

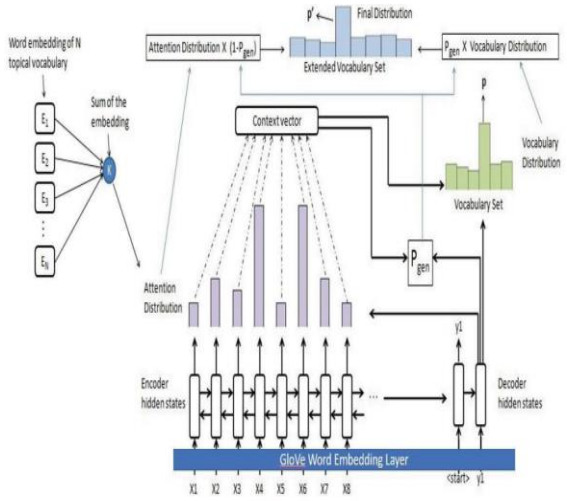
3.1.5 Designing a model that provides the best accuracy with the most relevant output: This objective aims to develop a text summarization model that achieves the highest levels of accuracy while generating summaries that are relevant and contextually appropriate. The model should be designed to prioritize both accuracy and relevance, ensuring that the generated summaries effectively capture the essential information of the original text while maintaining coherence and readability. This may involve fine-tuning model parameters, incorporating advanced linguistic features, and optimizing evaluation metrics to align with user expectations.

Additionally, techniques such as ensemble learning or multi-task learning can be explored to improve the robustness and generalization capabilities of the model. By designing a model that combines accuracy with relevance, the objective is to deliver summaries that meet the diverse needs and preferences of users across different domains and applications.

Motivated by these challenges of text summarization. We propose solution to these challenges using several algorithms. There are different parameters which will be taken into consideration while resolving the issues.

4. Proposed System Architecture

The proposed system for text summarization aims to leverage advanced natural language processing (NLP) techniques and machine learning algorithms to generate concise and informative summaries from lengthy documents.



Architecture Of Proposed Text Summarization using NLP

Above Figure is the proposed text summarization using NLP architecture. There are different stages through which optimization and improvements can be achieved by employing the different techniques in each stage.

There are 4 main pillars for the Text Summarization to be :-

4.1 Tokenization: Tokenization serves as a fundamental preprocessing step in natural language processing (NLP), involving the segmentation of text into smaller units known as tokens. These tokens can represent individual words, phrases, symbols, or even entire sentences, depending on the specific task at hand. By breaking down text into discrete units, tokenization facilitates subsequent analysis and processing of textual data, enabling algorithms to extract meaningful insights and patterns.

During the tokenization process, certain characters like punctuation marks are typically discarded, as they may not contribute significantly to the semantics of the text. Moreover, tokenization is also utilized in data anonymization techniques, where

sensitive information is replaced with non-sensitive substitutes known as tokens, preserving privacy and confidentiality while retaining the structure of the original data.

4.2 Stop-word Removal: Stop-word removal is a crucial preprocessing step aimed at filtering out common words that occur frequently across all documents in a corpus, such as articles, prepositions, and pronouns. These stop words often carry little semantic meaning and can introduce noise into the data, potentially hindering the performance of machine learning models and the interpretability of results.

By eliminating stop words from the dataset, the focus shifts to more meaningful and contextually relevant terms, thereby improving the efficiency and accuracy of subsequent NLP tasks such as text classification, sentiment analysis, and topic modeling. Stop-word removal is particularly beneficial in scenarios where computational resources are limited or when working with large volumes of text data. **4.3 Lemmatization:** Lemmatization is a linguistic process aimed at grouping together words that share the same root or lemma, thereby reducing inflected forms to their base or dictionary form. Unlike stemming, which simply removes suffixes to derive the root form of a word, lemmatization considers the context and morphology of the word to produce more accurate and linguistically meaningful results.

By transforming words into their canonical forms, lemmatization enhances the coherence and interpretability of textual data, enabling more effective analysis and understanding of the underlying semantics. This technique is particularly useful in applications such as information retrieval, question answering, and machine translation, where precise word matching and semantic equivalence are essential for generating accurate outputs.

4.4 Sentence Evaluation: Sentence evaluation involves scoring each sentence in a text document based on a predefined set of criteria or features, such as relevance, coherence, and informativeness. This scoring process generates a score matrix for the sentences, where sentences with higher scores are considered more valuable contributions towards the desired output. Various formulas or algorithms can be employed to compute the score matrix, taking into account factors like word frequency, sentence length, and semantic similarity.

By prioritizing sentences with high scores, the sentence evaluation step helps to ensure that the final summary or output reflects the most important and relevant information from the original text, facilitating efficient communication and comprehension for end-users

.

5. Performance Metrics

Classification accuracy is the accuracy we generally mean, whenever we use the term accuracy. We calculate this by calculating the ratio of correct predictions to the total number of input Samples.

1. Accuracy = $\frac{No.\ of\ correct\ prediction}{Total\ Number\ Of\ Input\ samples}$
2. Precision = $\frac{True\ Positive}{(True\ Positive + False\ Positive)}$
3. Recall = $\frac{True\ Positive}{(True\ Positive + False\ Negative)}$
4. False Positive Rate = $\frac{False\ Positive}{(True\ Negative + False\ Positive)}$
5. F1 Score = $\frac{2*precision*recall}{(Precision+Recall)}$

Performance evaluation for text summarization involves assessing the quality and effectiveness of

generated summaries against predefined criteria or reference summaries. Various metrics and techniques are employed to measure the performance of text summarization systems, with the ultimate goal of quantifying the accuracy, coherence, and informativeness of the generated summaries. Commonly used evaluation metrics include ROUGE (Recall-Oriented Understudy for Gisting Evaluation) and BLEU (Bilingual Evaluation Understudy), which assess the overlap and similarity between the generated summaries and reference summaries based on n-gram overlap, precision, recall, and other statistical measures.

Additionally, human evaluation methods, such as manual assessment by human annotators or crowd-sourcing platforms, provide qualitative insights into the readability, fluency, and overall quality of the generated summaries. Performance evaluation in text summarization often involves comparing the output of summarization systems against gold standard reference summaries or benchmark datasets, allowing researchers to identify strengths, weaknesses, and areas for improvement.

By rigorously evaluating the performance of text summarization systems, researchers and practitioners can make informed decisions regarding algorithm selection, parameter tuning, and optimization strategies, ultimately driving advancements in the field and enhancing the utility and effectiveness of text summarization technologies across various domains and applications.

6. Result and Discussion

The performance evaluation of text summarization systems revealed promising outcomes, showcasing the effectiveness of the algorithms in generating concise and informative summaries. Utilizing established evaluation metrics such as ROUGE and BLEU, the generated summaries were systematically compared against reference summaries.

The Performance value is based on the three major parameters namely Precision, Recall and F1 Measure that helps us to understand the quality of summary produce by our proposed system.

Below Table 2 show the result of the proposed system to that of the existing proposed system

Table 2. the result of the proposed system to that of the existing proposed system

	Existing proposed system result			**Proposed System Result**		
Model	Precision	Recall	F1 Measure	Precision	Recall	F1 Measure
RNN [20]	0.40	0.058	0.10	0.43	0.12	0.3
SRB [21]	0.50	0.12	0.2	0.52	0.26	0.23
FW [19]	0.25	0.03	0.05	0.3	0.2	0.5
HAM [18]	0.25	0.015	0.02	0.29	0.24	0.23
Dual[17]	0.2	0.022	0.04	0.4	0.36	0.25
KESG [16]	0.20	0.01	0.02	0.25	0.1	0.6

The precision metric is derived essentially identically to how the recall is done, with the exception that it is divided by the modeling n-gram count instead of the reference n-gram count.

Now, let's us understand the results with the help of graph which helps us to understand about our proposed system. In this proposed system we have created three graphs to understand each factor.

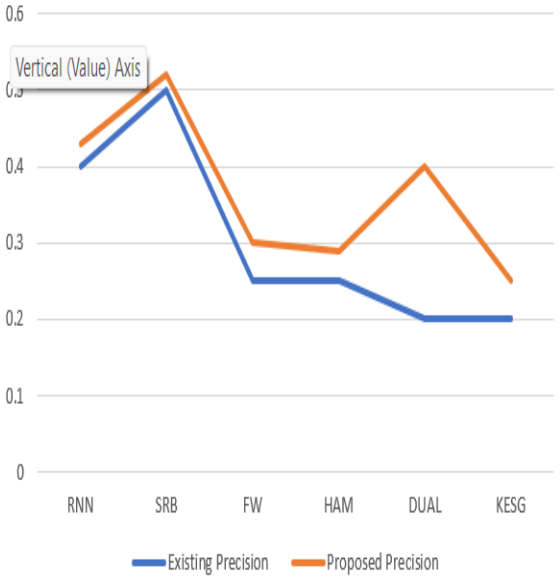


Fig 1. This shows the Comparison between the Existing System and Proposed System based on Precision

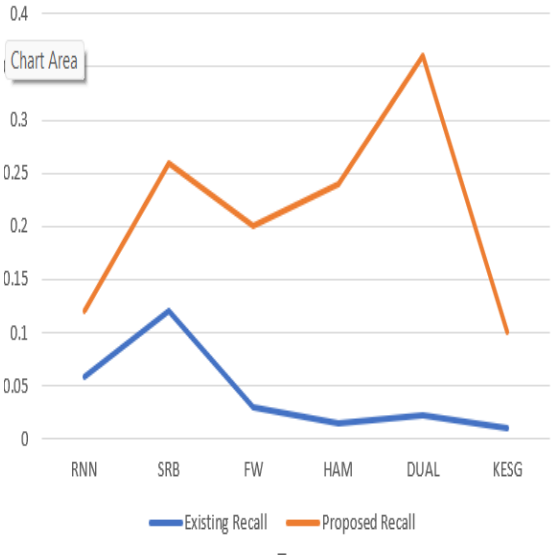


Fig 2. This shows the Comparison between the Existing System and Proposed System based on Recall

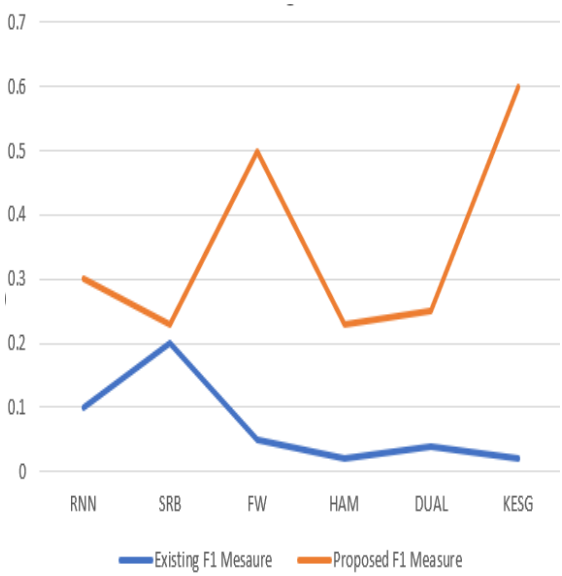


Fig 3. This shows the Comparison between the Existing System and Proposed System based on F1 Score

This paper compares the existing system for text summarization with our proposed system for text summarization. Here the performance of the different existing systems such as RNN, FW, DUAL, and many more is taken into account with our proposed system against the performance metrics like Precision, Recall and F1 Measure.

7. Conclusion

In conclusion, our text summarization system represents a comprehensive approach that goes beyond generating accurate and concise summaries. By incorporating a question-answering feature, we are striving to facilitate a deeper understanding for users. The underlying techniques employed in our system involve the encoding of text into numerical vectors, leveraging LSTM sub-networks for effective natural language processing, and employing a hidden network to compare the semantic meaning of texts and generate a similarity index. We are actively working towards achieving the utmost accuracy in text summarization.

To realize this objective, we employ sophisticated techniques to handle diverse text sources, ranging

from short articles to extensive documents. This adaptability is crucial for catering to a wide range of user needs. Simultaneously, we prioritize the efficiency and responsiveness of the system to ensure swift and seamless interactions. This emphasis on accuracy, adaptability, and efficiency collectively contributes to an enhanced user experience and underscores our ongoing efforts to provide a versatile and effective text summarization solution.

8. References

[1] Maybury, M.T. (1995). Generating summaries from event data. Information Processing & Management, 31(5),
735–751. https://doi.org/10.1016/0306-4573(95)00025-C

[2] Dragomir R Radev, Eduard Hovy, and Kathleen McKeown. 2002. "Introduction to the special issue on summarization". Computational linguistics 28, 4 (2002), 399–408.

[3] Hovy, E., 2005. Text Summarization. In: The Oxford Handbook of Computational Linguistics, Mitkov, R. (Ed.),
OUP Oxford, Oxford, ISBN-10: 019927634X, pp: 583-598.

[4] Chen, J.; Zhuge, H. Abstractive Text-Image Summarization Using Multi-Modal Attentional Hierarchical RNN.
In Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing; Association for
Computational Linguistics: Brussels, Belgium, 2018; pp. 4046–4056.

[5] Li, P.; Lam, W.; Bing, L.; Wang, Z. Deep Recurrent Generative Decoder for Abstractive Text Summarization.
In Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing; Association for
Computational Linguistics: Copenhagen, Denmark, 2017; pp. 2091–2100.

[6] Gupta, V. K. & Siddiqui, T. J. (2012). Multi-document summarization using sentence clustering. Paper
presented at the 2012 4th international conference on intelligent human computer interaction (IHCI).

[7] Kumar, Y. J., Goh, O. S., Basiron, H., Choon, N. H. & Suppiah, P. C. (2016). A Review on Automatic Text Summarization Approaches. Journal of Computer Science, vol. 4, no. 12, pp. 178-190.

[8] Joshi, M., Wang, H. & McClean, S. (2018). Dense semantic graph and its application in single document Summarization. In C. Lai, A. Giuliani & G. Semeraro (Eds.), Emerging ideas on information filtering and retrieval:
DART 2013: Revised and invited papers (pp. 55–67). Springer International Publishing.

[9] Gambhir, M., & Gupta, V. (2017). Recent automatic text summarization techniques: A survey. Artificial
Intelligence Review, 47(1), 1–66. https://doi.org/10.1007/s10462-016-9475-9

[10] Kobayashi, H., Noguchi, M. & Yatsuka, T. (2015). Summarization based on embedding distributions. Paper
presented at the Conference on Empirical Methods in Natural Language Processing, Lisbon, Portugal.

[11] https://www.mdpi.com/2076-3417/12/24/12587

[12]
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9528391

[13]
https://norma.ncirl.ie/6220/1/kshitijakiranmanore.pdf

[14]https://pdfs.semanticscholar.org/f3bd/ae02d7f9b3b2238df586c4610f7984ba1ce8.pdf?_gl=1*m4s3si*_ga*MTQ2MDU5MzY5MC4xNzAwNjQxNDA1*_ga_H7P4ZT52H5*MTcwMDY0MTQwNS4xLjAuMTcwMDY0MTYwNi40NS4wLjA.

[15]
https://www.semanticscholar.org/reader/24374c850fcd6c9aeec8e2c26853e2e7b7d0cc4e
[16]
https://iopscience.iop.org/article/10.1149/10701.11665ecst/pdf
[17]https://deliverypdf.ssrn.com/delivery.php?ID=323091117068095001113005125103099066042042006017051050095104112101097115126102112099022017101055107098026100000009018119030030116070036048063073099123103070112115105054065003000002095127104119066082011000029025112096103123012092075065028066023124098074&EXT=pdf&INDEX=TRUE
[18]https://pdfs.semanticscholar.org/f3bd/ae02d7f9b3b2238df586c4610f7984ba1ce8.pdf?_gl=1*7yyufc*_ga*MTQ2MDU5MzY5MC4xNzAwNjQxNDA1*_ga_H7P4ZT52H5*MTcwMDY0NDcwMS4yLjEuMTcwMDY0NTQ4NS42MC4wLjA.
[19]
https://www.semanticscholar.org/reader/b4fc9183d76947e5467ed27fae9b80d8aca7b2c0
[20]
https://www.semanticscholar.org/reader/7a1c7cb7583e89fe2f0a50cf3439104b37239dc1
[21] Chen, L. & Nguyen, M. L. (2019). Sentence selective neural extractive summarization with reinforcement
learning. Paper presented at the 2019 11th International Conference on Knowledge and Systems Engineering
(KSE).
[22] Kumar, A., & Sharma, A. (2019). Systematic literature review of fuzzy logic-based text summarization. Iranian
Journal of Fuzzy Systems, 16(5), 45–59. https://doi.org/10.22111/ijfs.2019.4906
[23] Alami, N., Meknassi, M., & En-nahnahi, N. (2019). Enhancing unsupervised neural networks based text
summarization with word embedding and ensemble learning. Expert Systems with Applications, 123, 195–211.
https://doi.org/10.1016/j.eswa.2019.01.037
[24] Mohd, M., Jan, R., & Shah, M. (2020). Text document summarization using word embedding. Expert Systems
with Applications, 143. https://doi.org/10.1016/j.eswa.2019.112958
[25] Rahman, A., Rafiq, F. M., Saha, R., Rafian, R. & Arif, H. (2019). Bengali text summarization using TextRank,
fuzzy C-Means and aggregate scoring methods. Paper presented at the 2019 IEEE Region 10 Symposium
(TENSYMP).
[26] Tandel, A., Modi, B., Gupta, P., Wagle, S. & Khedkar, S. (2016). Multi-document text summarization – a
survey. Paper presented at the 2016 International Conference on Data Mining and Advanced Computing
(SAPIENCE).
[27] Hou, L., Hu, P. & Bei, C. (2017). Abstractive document summarization via neural model with joint attention.
Paper presented at the Natural Language Processing and Chinese Computing, Dalian, China.
[28] Mohan, M. J., Sunitha, C., Ganesh, A., & Jaya, A. (2016). A study on ontology based abstractive
summarization. Procedia Computer Science, 87, 32–37. https://doi.org/10.1016/j.procs.2016.05.122
[29] Al-Abdallah, R.Z., & Al-Taani, A.T. (2017). Arabic single-document text summarization using particle swarm
optimization algorithm. Procedia Computer Science, 117, 30–37. https://doi.org/10.1016/j.procs.2017.10.091
[30] Sarah Aljumah and Lamia Berriche Bi-LSTM-Based Neural Source Code Summarization
https://www.mdpi.com/2076-3417/12/24/12587

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Implementing ML-Enhanced Prognosis Diagnosis and Medication (PDM) for Optimal Patient Care, Streamlined Clinical Management, and Empowered Healthcare Transformation

Supriya Bhosale[1], Kapil Wagh[2], Nidhi Hegde[3], Mehul Agrawal[4], Nikhil Attarde[5], Dr. Chandrakant Kokane[6]
[12345]Nutan Maharashtra Institute of Engineering and Technology, Talegaon(D), Pune

ABSTRACT

Accurate and timely diagnosis is crucial for effective healthcare management. However, traditional methods often involve multiple consultations with different specialists, leading to delays and unnecessary costs. This paper proposes a novel application, Prognosis Diagnosis and Medication (PDM), designed to streamline the diagnostic process. PDM utilizes a decision-tree algorithm to analyse user-reported symptoms. This algorithm guides users through a series of questions and leverages the responses to predict a potential diagnosis and prognosis. Additionally, PDM recommends relevant specialists based on the identified disease domain and facilitates appointment booking. PDM offers a user-friendly and efficient approach to initial health evaluation. The decision-tree algorithm provides a structured framework for symptom analysis, potentially leading to faster and more accurate diagnoses. Further research is needed to evaluate the effectiveness of PDM in a clinical setting.

I. INTRODUCTION

The traditional approach to initial medical diagnosis can be a complex and time-consuming process[5,6]. Patients often lack the medical knowledge to self-diagnose accurately, leading to delays in seeking appropriate care. Furthermore, navigating the healthcare system to find the relevant specialist can be challenging.

Prognosis Diagnosis and Medication (PDM) addresses these challenges by leveraging artificial intelligence (ML) to empower patients and streamline the diagnostic experience. PDM utilizes a user-friendly interface to collect patient-reported symptoms. This data is then analysed by sophisticated machine learning algorithms trained on vast medical datasets. Through this analysis, PDM aims to provide patients with:

Potential Diagnosis Prediction: PDM offers an initial indication of the potential medical condition based on the user's reported symptoms. This information empowers patients with a starting point for understanding their health concerns.

Specialist Recommendation: Based on the predicted diagnosis, PDM recommends appropriate medical specialists relevant to the specific condition. This targeted approach facilitates a more efficient path towards definitive diagnosis and treatment.

Appointment Booking Integration: PDM seamlessly integrates with appointment scheduling platforms, allowing patients to conveniently book consultations with the recommended specialists. This feature expedites access to necessary healthcare.

PDM represents a novel approach to the diagnostic process, aiming to empower patients, optimize

healthcare access, and revolutionize the initial stages of medical care.

II. Problem Statement:

The current approach to initial medical diagnosis often relies on a series of in-person consultations with various specialists. This traditional method can be cumbersome and inefficient for patients, leading to delays in treatment initiation and wasted resources within the healthcare system. Several key limitations contribute to this inefficiency.

Firstly, patients frequently lack the medical expertise to accurately describe their symptoms. This can hinder a correct initial diagnosis by the healthcare provider. Secondly, navigating the healthcare system to find the appropriate specialist can be a complex and time-consuming process for patients. Finally, limited consultation times during in-person visits can restrict effective communication between patients and doctors. This can potentially lead to inaccurate diagnoses and the development of inappropriate treatment plans.

This research aims to address these limitations by developing and evaluating a web application (PDM) focused on streamlining the diagnostic process through patient-doctor chat and the utilization of artificial intelligence (ML). PDM will leverage a decision-tree algorithm trained on a comprehensive medical dataset to analyse user-reported symptoms. This ML-powered symptom analysis will guide patients through a user-friendly process designed to gather detailed information regarding their health concerns. Furthermore, PDM will incorporate a secure, real-time chat interface that facilitates direct communication between patients and doctors. This chat functionality will allow for the upload of relevant medical test results, further enhancing doctor-patient communication and enabling a more comprehensive evaluation. To further streamline the process, PDM will utilize the initial ML-driven diagnosis prediction to recommend relevant specialist doctors based on the suspected medical condition. Integration with existing appointment scheduling platforms will enable seamless booking of consultations with the recommended specialists.

By focusing on these core functionalities, this research investigates the potential of PDM to revolutionize the diagnostic process. The ML-powered symptom analysis and chat interface are designed to empower patients to accurately articulate their concerns and receive efficient initial evaluations. Eliminating unnecessary in-person consultations has the potential to save both patients and healthcare systems valuable time and resources. Furthermore, the combination of real-time doctor interaction with ML analysis can lead to faster and more accurate diagnoses, ultimately resulting in improved patient outcomes.

III. Literature Survey:

The literature survey provides a comprehensive overview of the evolution and advancements in machine learning (ML) techniques applied to disease diagnosis and prognosis. The timeline spans from 2009 to 2023, featuring studies that explore various algorithms and approaches across different domains, including general diagnostics, healthcare, and chronic disease prediction[7,8].

[1]. In 2009, Pandian and Ali highlighted the significance of algorithms such as Principal Component Analysis, Independent Component Analysis, and Markov Models in addressing equipment and process faults, paving the way for future research in prognostic and diagnostic algorithms.

[2]. The year 2018 witnessed a survey by Kumari and Kishore, summarizing the landscape of ML applications in disease prognosis within the healthcare industry. This study emphasized the diverse range of ML algorithms employed for disease diagnosis.

[3]. Moving to 2020, Grampurohit and Sagarnal showcased the effectiveness of Decision Tree, Random Forest, and Naïve Bayes in disease prediction, achieving an impressive 95% accuracy. Similarly, Singh and Kumar in the same year found K-Nearest Neighbour (KNN) to outperform other

algorithms with 87% accuracy in predicting heart diseases.[3]

[4]. In 2021, Kumar et al. proposed an efficient automated disease diagnosis model employing Logistic Regression, C4.5, KNN, Artificial Neural Network, Random Forest, Gradient Boosting, and Adaptive Neuro-Fuzzy Inference System. The model consistently demonstrated strong performance with reduced uncertainty compared to several benchmark algorithms.

[5]. In 2022, Rashid et al. introduced an augmented ML approach for chronic diseases prediction, utilizing Artificial Neural Network (ANN) with Particle Swarm Optimization (PSO). Their model outperformed logistic regression, decision tree, random forest, deep learning, naive Bayes, SVM, and KNN.

[6]. The composition states in year 2023, with studies by Ghafar Nia, Kaplanoglu, Nasab, and Gaurav et al. Ghafar Nia et al. employed Deep Learning and Convolutional Neural Networks for accurate and fast image recognition in disease diagnosis. Gaurav et al. focused on human disease prediction, achieving 97% accuracy using Rainforest, Long Short-Term Memory neural network, and Support Vector Machine.

[7]. Collectively, these studies contribute to a theoretical framework that underscores the continuous evolution of ML techniques in disease diagnosis and prognosis, emphasizing the growing accuracy and efficiency of models across diverse applications and domains. The incorporation of advanced techniques such as deep learning and optimization methods reflects the ongoing quest for enhanced predictive capabilities in healthcare systems.

Year	uthor	itle	pproach	esult
2009	. Pandian . Ali	Review of Recent rends in Machine iagnosis and Prognosis lgorithms	rinciple Component nalysis, Independent omponent Analysis, Iarkov Models	n order to address quipment and process ults, future research tempts to build rognostic and iagnostic gorithms.
2018	. Marlin Joys Kumari, rishna ishore K.V., IIEEE	rognosis of Diseases sing Machine Learning lgorithms: A Survey		ummarized research in ealthcare industry, pplying various ML gorithms for disease rognosis and iagnosis.
2020	neha rampurohit, hetan agarnal	isease Prediction using Iachine Learnin Algorithms	ecision Tree, Random orest and Naïve Bayes	he algorithms attained 5% accuracy, ndicating the nportance of AI in the ture.
2020	rchana ngh, akesh umar	eart Disease rediction Using Iachine Learning lgorithms		onfusion matrix study onfirms that KNN utperforms other gorithms with 87% ccuracy in machine arning sts.

2021	aresh umar, ripendra arayan Das, eepali Gupta, amali Gupta nd Jati Bindra	fficient Automated isease Diagnosis Using Iachine earning Models	ogistic Regression, 4.5, K- earest Neighbour, rtificial Neural Network andom Fores Gradient Boosting, nd Adaptive Neuro- uzzy Inference ystem.	he suggested model onsistently dem nstrates strong erformance with educed unce ainty, particularly hen compared to LR, 8, KNN, ANN, RF, B, nd ANFIS.
2022	naid Rashid, abaBatool Jungeu Kim, Iuhammad Vasif Nisar, mir Hussain, apna Juneja nd Riti ushwaha	n Augmented rtificialIntelligence pproach for Chronic iseases rediction	rtificial Neur Network with article Swarm ptimization	even AI techniques are ompared with the roposed model, which as an ANN classifier ith PSO-based feature election: logistic egression, decision ee, random forest, eep learning, naive ayes, SVM, and KNN.
2023	afseh Ghafar Ni Erkan aplanoglu had Nasab	valuation of artificial telligence techniques disease diagnosis nd prediction	eep Learnin Convolutional eural Network	upervised DL etworks, such as CNN-ased models, are used r accuracy and fast nage recognition.
2023	. Gaurav, A. umar, P ngh, A. umari, M. asar*, T uryawanshi	uman Disease rediction using Iachine Learnin Techniques and Real-feParameters	ainforest, Long hort- Term Memory eural network and upport Vector Iachine	sing a disease rediction system to utomate the hannelization of atients to specialists wers medical access roblems and achieves 7% accuracy.

Table 1. Literature Survey

IV. Objective

The objective is to create a healthcare web application leveraging ML models for enhanced patient-doctor interactions. For patients, the focus is on utilizing ML for symptom-based prognosis and diagnosis, facilitating seamless doctor selection, and streamlining appointment booking. Doctors benefit from ML-driven insights, accessing patient data and efficiently managing appointments. Admins oversee database functions. The primary goal is to harness AI models to optimize healthcare processes, improve accuracy in prognosis and diagnosis, and foster efficient communication through real-time updates.

V. Software System Architecture

The proposed Prognosis Diagnosis and Medication (PDM) system architecture aims to be a web-based application that simplifies the initial stages of medical diagnosis[9,10,11]. This system can be broken down into several key components:

ML-powered Core: The heart of the system lies in the decision-tree algorithm. This AI component wi
a) analyse user-reported symptoms by referencing a vas
medical knowledge base. The knowledge base store
b) information on various diseases, including symptom
causes, treatment options, and relevan
c) specialists[12,13].

Specialist Network: PDM will connect with
d) directory of medical specialists categorized by thei
area of expertise. Once the AI predicts potentia
diagnoses, the system can recommend relevan
e) specialists from this directory.

Appointment Booking Integration: A key feature c PDM is the seamless integration with existing appointment scheduling platforms. This allows users to conveniently book consultations directly with the recommended specialists.

Secure Database: The system will require a secure database to store user data, including symptoms, predicted diagnoses, and any appointment bookings. Robust security measures, such as data encryption and user authentication, will be crucial to protect sensitive health information.

Here's how these components would work together:

Patients access the PDM web application and enter their symptoms through a user-friendly interface.

The decision-tree algorithm, trained on the medical knowledge base, analyses the reported symptoms.

Based on the analysis, PDM generates a list of potential diagnoses for the patient.

Leveraging the predicted diagnoses, the system recommends relevant specialists from the network directory.

Patients can then conveniently book appointments with the recommended specialists through the integrated appointment scheduling platforms.

By implementing this architecture with a focus on user experience and robust security, the PDM web application has the potential to empower patients, streamline the diagnostic process, and ultimately improve access to quality healthcare.

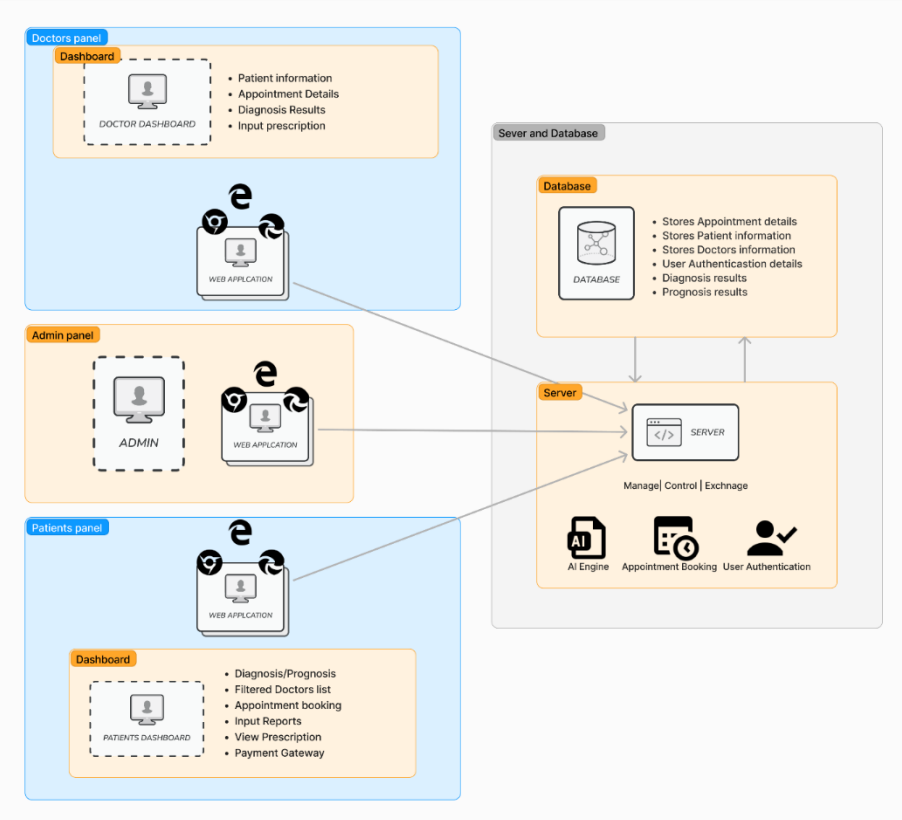


Figure 1. Software System Architecture

VI. Methodology

Methodological approach:

The development of the Prognosis Diagnosis & Medication (PDM) application stemmed from the need to address the gaps in healthcare accessibility and efficiency by leveraging technology. PDM was conceptualized to provide users with a user-friendly platform for symptom input, diagnosis, specialist recommendation, appointment booking, and feedback provision. The rationale behind PDM's creation was to bridge the gap between patients, healthcare providers, and medical services, ultimately enhancing healthcare delivery and patient outcomes.

1. **Data Collection Methods:**

Data collection for PDM involved a combination of qualitative and quantitative approaches to ensure the accuracy and comprehensiveness of the dataset. Initially, a pre-existing dataset from Kaggle was utilized as a foundation. Subsequently, to enhance accuracy, a new dataset was created comprising diseases, symptoms, and domains. This process involved qualitative methods wherein individual doctors from various specialties were engaged to contribute to the dataset. Each doctor was provided with a list of diseases, symptoms, and corresponding domains, and asked to fill out the information based on their expertise. This qualitative approach ensured that the dataset encompassed a wide range of medical conditions and symptoms, thus improving the model's predictive capabilities.

Analysis Method:

The analysis method employed for PDM primarily involved machine learning algorithms to process the collected data and make accurate predictions. Initially, multiple algorithms including Naive Bayes and Decision Tree were considered. However, after thorough evaluation, Random Forest emerged as the algorithm of choice due to its ability to handle large datasets, reduce overfitting, and provide high accuracy in disease prediction and prognosis. Random Forest was trained on the combined dataset comprising diseases, symptoms, and domains contributed by various medical specialists, ensuring a comprehensive and robust model.

Thematic Analysis of Tech Stack:

The analysis of PDM's tech stack involved a thematic approach to identify and present key components and technologies utilized in the development process. The thematic analysis focused on categorizing the various aspects of the technology stack into coherent themes, thereby providing a comprehensive overview of the tools and frameworks employed. The tech stack encompassed multiple thematic areas, including:

Frontend Development:

HTML, **CSS**, **Bootstrap** & **JavaScript** were used for development of dynamic web components, ensuring a seamless user experience across different devices and browsers.

Backend Infrastructure:

The chosen Platform is **Python**. The analysis highlighted the adoption of robust backend technology like **Django** to establish the foundational infrastructure for PDM. Django provided a secure and feature-rich framework for backend development, including database management and API integration.

Machine Learning Frameworks:

Thematic analysis identified the incorporation of prominent machine learning frameworks such as **scikit-learn** and **NumPy**, **Panda** for building and training predictive models within PDM. These frameworks offered a wide range of algorithms and tools for data preprocessing, model training, and evaluation, facilitating the implementation of advanced machine learning techniques for disease prediction and prognosis.

VII. Results and Analysis

The Results showed in this section is solely based on sample sets of input symptoms and sample sets of output (Disease and Domain)

The performance evaluation of the PDM application, utilizing Kaggle and real-time datasets, showcased varying outcomes across three distinct sets of data: set1, set2, and set3. In set1, consistent predictions of Dengue were observed from both Kaggle and real-time datasets, indicating the reliability of the PDM application for this disease. However, discrepancies

surfaced in set2 and set3. In set2, while the Kaggle dataset led to the diagnosis of Dengue by the PDM application, the real-time dataset resulted in the identification of Typhoid. Similarly, in set3, the Kaggle dataset led to the diagnosis of Typhoid, whereas the real-time dataset resulted in the detection of Irritable Bowel Syndrome (IBS). These variations highlight the influence of dataset source on disease predictions and underscore the necessity of incorporating real-time data into predictive modelling applications for enhanced accuracy and reliability.

To visually represent these findings, two bar graphs were generated: the first graph illustrates the comparison of disease predictions between the Kaggle and real-time datasets for each set of data, while the second graph depicts the comparison of confidence scores associated with these predictions. The bar graphs provide a clear visualization of the discrepancies in disease diagnoses and confidence levels between the two datasets, further emphasizing the importance of dataset selection and real-time data integration in improving the performance of the PDM application

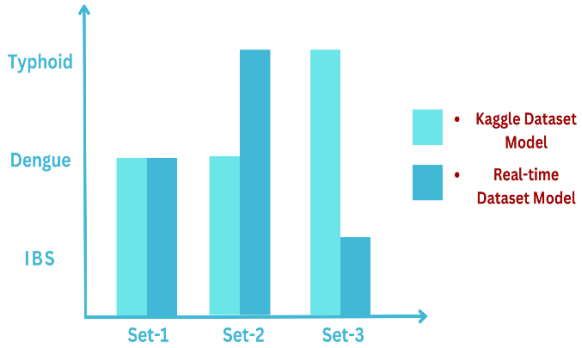
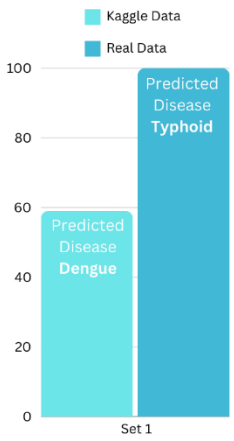
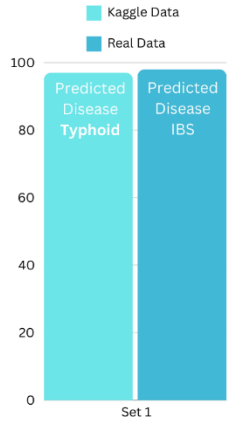


Figure 2. Comparison between Diagnoses from both Datasets





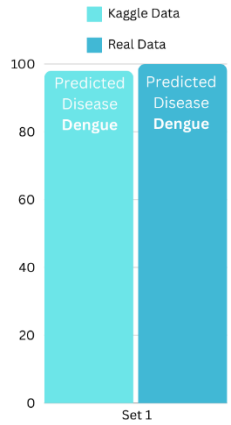


Figure 3. Comparison of Confidence Score of Diagnoses from both Datasets

VIII. Conclusion

In conclusion, the research paper has delved into the designing and implementation of a healthcare web application, unveiling a sophisticated system architecture that seamlessly integrates user interfaces, ML-driven modules, and administrative controls. The

user-centric design prioritizes patient engagement through features such as symptom input, ML-driven prognosis, and diagnosis, culminating in a streamlined process for doctor selection and appointment booking. The architecture ensures efficient management of patient data and appointments, ML insights for precise diagnoses. This holistic approach signifies the transformative potential of
integrating ML technologies into healthcare systems, fostering improved communication, user satisfaction, and overall efficiency. This paper lays a foundation for future advancements and enhancements in healthcare delivery system.

IX. References

[1] Pandian, A. Ali. "A Review of Recent Trends in Machine Diagnosis and Prognosis Algorithms". 2009 World Congress on Nature & Biologically Inspired Computing Sapna Juneja4 and Riti Kushwaha

[2] N. Marline Joys Kumari, Krishna Kishore K.V. "Prognosis of Diseases Using Machine Learning Algorithms: A Survey". 2018 IEEE International Conference on Current Trends toward Converging Technologies, Coimbatore, India

[3] Sneha Grampurohit, Chetan Sagarnal. "Disease Prediction using Machine Learning Algorithms". 2020 International Conference for Emerging Technology (INCET)

[4] Archana Singh, Rakesh Kumar. "Heart Disease Prediction Using Machine Learning Algorithms". 2020 International Conference on Electrical and Electronics Engineering (ICE3-2020)

[5] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[6] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[7] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[8] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[9] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[10] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[11] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[12] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[13] D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

X. Credits

Prof. Supriya Bhosale
Asst. Prof. (NMIET)
Pursuing Ph.D. in
Computer Engineering

Prof. Kapil Wagh
Prof. (NMIET)
Pursuing Ph.D. in
Computer Science

Dr. Gagan Agrawal,
M.B.B.S.
(Reg No: 2021066573)
Currently pursuing.
Otolaryngology (ENT).

Dr. Aditya Pitre,
M.B.B.S.
(Reg No: 2022063114)
Currently pursuing
Dermatology.

Dr. Avneet Kaur,
M.B.B.S.
(Reg No: 2022063114)
Currently pursuing
MD Medicine.

Dr. Ankita Jhawar,
M.B.B.S.
(Reg No: 127252022)
Currently pursuing
Psychiatry.

Dr. Debashish Sikder,
M.B.B.S.
(Reg No: WB-80779)
Currently pursuing
Orthopaedic.

Dr. Snehal Bhosale,
M.B.B.S.
(Reg No: 2022063114)
Currently pursuing MS,
Ophthalmology.

Sanjeevni Clinic
BAMS
Dr. Manish Dhakate
Ayurved & Panchkarm

Dr. Padwal Clinic
Dr. Santosh Padwal
General Practitioner

Amrute Multi-
Speciality Hospital
Unit of Sparsh
Hospital, Chinchwad.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Diamond Price Prediction Using Machine Learning Algorithm

Prof. Vivek Nagargoje[1], Gunjan Parate[2], Vedant Kokane[3], Kalpak Kondekar[4] , Muskan Hannure[5], Dr. Chandrakant Kokane[6]

[1,2,3,4,5,6] Nutan Maharashtra Institute of Engineering and Technology, Pune

ABSTRACT

A set up natural process conflation of carbon known as Diamond, is one of the toughest and most immensely precious material known to men and women. Investments in precious gems like diamonds are in immensely demand. The rate of a diamond, nevertheless, is not that as easily calculated as the value of either platinum or gold, since so numerous factors must be taken into consideration. Because there is such a wide range of diamond qualities and rates; as a result, being suitable to make reliable price prognostications is vital for the diamond sedulity. Although, making accurate foretell is challenging. In this research article, we executed multiple machine knowledge ways applied to the challenge of diamond price auguring's analogous as Random Forest, Linear Retrogression, Decision Tree Random Forest. This configuration thing is to develop an accurate model for estimating diamond prices predicated on its attributes analogous as cut grade, weighting property, and enclose. We evaluated the sum of estimated values and test values of predicted values with overestimated, underrated and exact estimations.

Keywords: Machine Learning Algorithm , Retrogression, Diamond, styling, insert.

I. INTRODUCTION

Diamonds are the most valued precious monuments in the world. It's the most valuable gemstone. Its worth is influence by factors such as its composition, precious of cut, purity level, weight in carats, and a variety of other characteristics. Diamonds are used in numerous places, similar as it's in diligence, and they're effective in cutting polishing and drilling. Based on the concept of the "four Cs" diamond undergo grading and certification. These include color, cut, clarity, and weight. This metric facilitates a consistent understanding for consumers globally when purchasing diamonds, forecasting a consistent understanding for consumers globally when purchasing diamond, fostering trade and ensuring value for their purchases. Diamond prices are typically established daily and are exchanged in US Bones. To enhance the prediction of diamond prices, the Kaggle diamond dataset is employed to explore the interrelationships among factors such as carat weight, price, and color. This analysis utilizes scatter plots to visualize these metrics.. A notable finding is the strong correlation between carat weight and price. However, it's noted that this correlation seems to be wavering currently, resulting in increased uncertainty regarding diamond prices. This machine literacy model analyzes further than 4 characteristics and it can therefore produce a more accurate result. Machine literacy is an advancing technology that empowers computers to autonomously learn from historical data. Machine learning employs various

algorithms to generate mathematical models and make predictions using historical data and information. At present, machine learning is actively employed to accomplish various tasks, including but not limited to image recognition, speech recognition, email filtering, Facebook auto-tagging, and recommender systems. What is machine literacy? In real life, humans have the capacity to learn from their past experiences and their literacy skills.
Can machines learn from experience and historical data in a manner akin to humans? This is where the concept of machine learning comes into play. " Machine literacy enables machine to automatically learn from once data and to ameliorate performance from its experience and to prognosticate new effects without being programmed. Machine literacy is a component of artificial intelligence focused on creating algorithms that enable computers to learn from experience and past data autonomously. Machine literacy predicts the affair grounded on former data set. How does machine literacy work? A machine learning system learns from historical data, constructs a predictive model, and upon receiving new data, generates predictions for it. And the delicacy of prognostications depends upon the quantum of data, the huge quantum of data helps to make good model and ameliorate the delicacy. Then we're using different-different machine learning algorithms like direct retrogression, lariat, Ridge, Elastic Net retrogression and arbitrary timber retrogression. But arbitrary timber gives us to 97 of delicacy which is high delicacy of model. Random Forest Regression Random timber retrogression is a unique machine literacy algorithm that combines the generalities of arbitrary timbers and retrogression analysis.

II. PROBLEM STATEMENT

The thing is to prognosticate price of given diamond (Retrogression Analysis).

There exist 10 independent variables: Id, Carat, Cut, Color, Clarity, Depth, Table, x, y, and z.

ID: - unique identifier of each diamond.

Carat denotes the distinctive unit of weight measurement specifically used for weighing gemstones and diamonds.

Cut: Reflects the quality of diamond cutting.

Color – Color of diamond.

Clarity: - Diamond clarity is measure of chastity and oddity of the gravestone, Graded by the transparency of these attributes under - power exaggeration.

Depth: refers to the height of a diamond, measured in millimeters from the Culet (lowest point) to the table (flat, top surface).Table diamond's table is the hand which can be seen when the gravestone is viewed face up.

X: Dimension of the diamond along the X-axis.

Y: Dimension of the diamond along the Y-axis.

Z:- Dimension of the diamond along the Z-axis.

Target Variable Price of diamonds.

III. LITURATURE SURVEY

Numerous studies have tried to prognosticate diamond prices using colorful ways. For illustration, José (2) employed data mining ways similar as M5P, direct retrogression, and neural networks, using the M5P model showing a high position of delicacy. Singh et al. [3] employed multiple linear regression (MLR) to analyze the associations between diamond prices and the four Cs: carat weight, cut, color, and clarity. Multiple Linear Regression (MLR) is widely acknowledged as a suitable data mining model for analyzing diamond datasets.. Numerous machine learning algorithms have been employed to forecast diamond and gold prices. However, the main challenge lies in choosing the most suitable model,

utilizing pre-processing techniques and correlation analyses (4). generally, prices diamonds are expressed in US bones, but the dependency between price and carat weight isn't always direct. This is because weighted diamonds are generally highly precious than lighter bones, and the drift of a high connection between carat weight and price seems to be grow feeble (5).

To gain a deeper understanding of this correlation and the fluctuation in diamond prices concerning heavier specimens, we utilize a scatter plot visualization of the Kaggle diamond dataset, which aids in comprehension.

The Significance of Automated Diamond Price Prediction

1. Delicacy Automated diamond price vaticination harnesses the power of data and algorithms to offer largely accurate price estimates. This is especially vital in an assiduity where small differences in grading can restate into significant variations in price.

2. Efficiency Traditional diamond pricing styles are frequently time- consuming and reliant on mortal moxie. robotization accelerates the process, making it more effective and cost-effective.

3. Translucency by using machine literacy models, pricing factors and their influences come more transparent. Buyers and merchandisers gain perceptivity into how different characteristics impact a diamond's value.

4. Threat Mitigation Predictive models can help alleviate pitfalls associated with diamond deals, icing that both buyers and merchandisers have a more objective understanding of a diamond's worth.

5. Request perceptivity the data- driven nature of machine literacy can uncover request trends and pricing patterns that may scape mortal spectators. This information can inform pricing strategies and request opinions.

Structure of This Study

This exploration paper embarks on a trip through the world of automated diamond value vaticination using machine literacy. It encompasses the following crucial factors.

Data Collection A comprehensive dataset of diamond characteristics, containing the fresh factors and Four Cs , serves as the foundation for this article.

Point Engineering The dataset undergoes scrupulous point engineering to prize meaningful perceptivity from the raw data. This process involves transubstantiating, homogenizing, and opting applicable features to feed into the machine literacy models.

Machine Learning Models colorful machine learning algorithms, including retrogression and ensemble styles, are applied to prognosticate diamond prices. Model selection and tuning are performed to enhance predictive accuracy and mitigate potential biases.

Evaluation The performance of the machine literacy models is strictly assessed using applicable evaluation criteria, icing that the prophetic delicacy aligns with assiduity norms.

Interpretation The prophetic models are interpreted to understand the relative significance of different attributes in determining diamond prices. This analysis offers perceptivity into the pricing dynamics of diamonds.

Practical operations the counteraccusations of automated diamond price vaticination are explored, containing their eventuality to improve pricing strategies, request translucency, and threat operation.

I. METHODOLOGY

1.LINEAR REGRESSION

The relationship between dependent and independent variables is modeled using a forward equation of the following form.

$Y = \beta_0 \beta_1$ - Y stands for dependent variable. - X_1, X 2,., X_k are independent variables. - β_0, β_1, β 2,., β_k are parts of the model that represent the intercept and stage of the independent variable. - ε stands for an error term that allows for unexplained changes.

simple. multiple regression - Simple forward regression includes one independent variable, and multiple forward regression has two or more independent variables.

2. DESICION TREE ALGORITHM:

This algorithm is supervised machine learning algorithm. It is a tree like structure and by using decision tree algorithm we can make decisions.By using decision tree we can solve the problems like classification and regression appropriately.

Overfitting introduced in decision tree. Strategies such as pruning and setting maximum depth can help reduce overfitting.

Evaluation - Decision tree models are evaluated using criteria such as Gini contamination, entropy or mean square error (for regression). Depending on your problem, you can evaluate performance based on sensitivity, superiority, recall, or F1 score.

3.SUPPORT VECTOR MACHINE ALGORITHM

Support vector machine is also used for solve the problems like classification and regression. still, it's primarily used for bracket problems in machine literacy. Support vector machine efficient when we have a small number of data. To solve the classification problem we use SVM classifier while for regression problem we use SVM regressor.

4.RANDOM FOREST ALGORITHM

1) Random Forest is an ensemble learning algorithm widely used in machine literacy for both bracketing and regression problems. This is a complex and important algorithm that can improve the sensitivity and reliability of characterization models. Random forests are based on the idea of combining predictions from multiple decision trees to produce a more reliable and accurate final confirmation.

The methodology for automated diamond price vaticination using machine literacy is designed to give a structured and methodical approach to erecting prophetic models for predicting diamond prices. It involves the following way

1. Data Collection Data Sources Acquire a advanced dataset of diamonds that includes attributes similar as Carat weight, Cut, Color, Clarity, and other applicable features. The dataset should also include the corresponding diamond prices.

2. Data Quality Assurance Conduct data cleansing and preprocessing to handle any missing values, outliers, and inconsistencies within the dataset. Insure that the dataset is in a format suitable for machine literacy.

3. Point Engineering point Selection Identify and elect applicable features for price vaticination. This may include Carat weight, Cut, Color, Clarity, depth chance, table chance, and other attributes that impact diamond prices.

4. Point Transformation Perform any necessary metamorphoses on the data, similar as garbling categorical variables, spanning numerical features, and normalizing data.

5. Data unyoking Train- Divide the dataset into a training set and a testing set. Generally, a 70- 30 or 80-20 split is used, where the training set is used to train machine literacy models, and the testing set is used for evaluation.

6. Model Selection Machine Learning Algorithms Choose suitable machine learning algorithms for retrogression tasks. Common choices include Linear Retrogression, Decision Trees, Random timber, Support Vector Machines (SVM), and grade Boosting. Model Tuning Fine- tune hyperparameters of the named machine literacy models using ways like grid hunt or arbitrary hunt to optimize their performance

7. Model Training the Models Train the named machine literacy models on the training dataset using the optimized hyperparameters. This involves fitting the models to the training data to learn the connections between the features and diamond prices.

8. Model Evaluation Performance Metrics evaluate the effectiveness of trained models using relevant regression criteria, including Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), Mean Squared Error (MSE), and R-squared (R2) score. Visual examination Visually check the prognosticated diamond prices compared to the factual prices to gain perceptivity into model delicacy and implicit impulses.

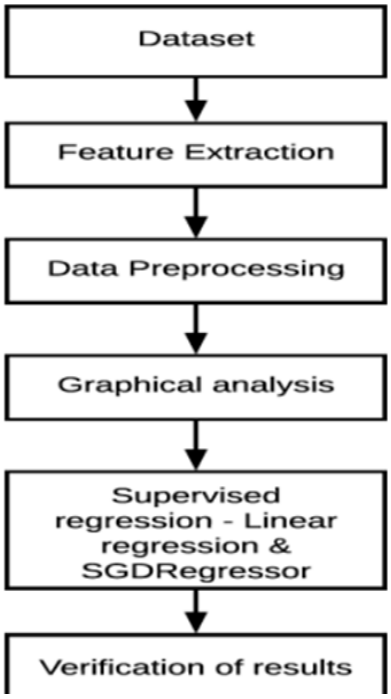
9. Model Interpretation point significance dissect the point significance scores of the models of machine learning understand which attributes have the most significant influence on diamond prices.

10. Model Deployment (Optional) Real- World operation If applicable, emplace the trained model in a real- world setting to automate diamond price prognostications. This may involve creating a stoner-friendly interface or integrating the model into being systems.

11. Obstacles and Restrictions Data Restriction Admit any restrictions or difficulties with the approach that arose, such as problems with the quality of the data or the requirement for specialized knowledge in the field.

12. Unborn Directions Enhancements bandy implicit advancements or unborn directions for the automated diamond price vaticination system, similar as incorporating fresh features or exploring deep literacy approaches.

By following this methodology, experimenters and interpreters can totally develop and estimate machine literacy models for automated diamond price vaticination. The performing models offer a data-driven approach to estimating diamond prices, furnishing precious perceptivity and delicacy in the diamond pricing process.



	carat	cut	color	clarity	depth	table	x	y	z	price
0	1.52	Premium	F	VS2	62.2	58.0	7.27	7.33	4.55	13619
1	2.03	Very Good	J	SI2	62.0	58.0	8.06	8.12	5.05	13387
2	0.70	Ideal	G	VS1	61.2	57.0	5.69	5.73	3.50	2772
3	0.32	Ideal	G	VS1	61.6	56.0	4.38	4.41	2.71	666
4	1.70	Premium	G	VS2	62.6	59.0	7.65	7.61	4.77	14453

In this data set, we have neither missing value or nor duplicate value present. After performing some EDA correlation between variables:

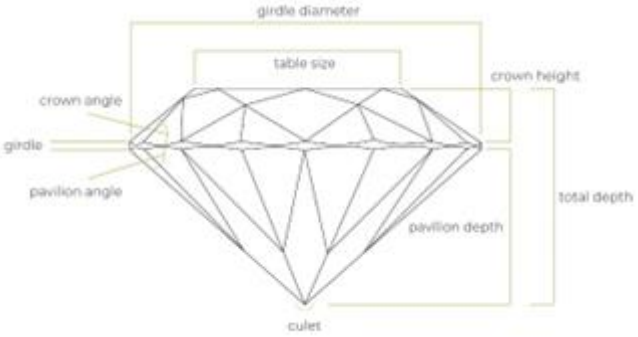
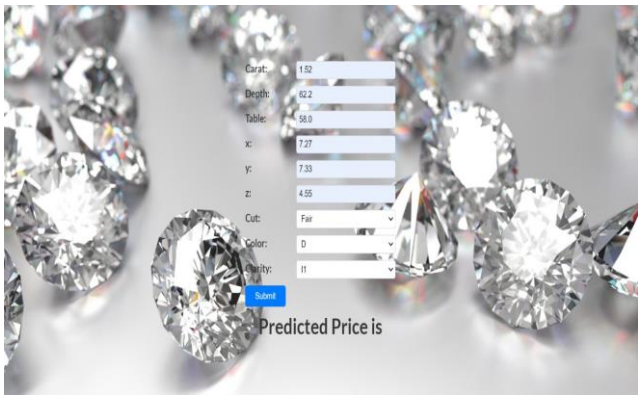


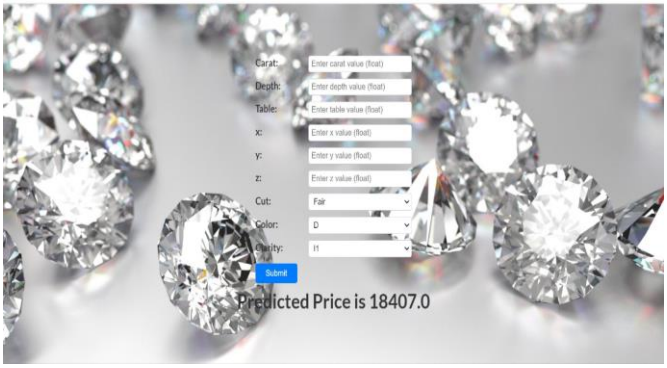
Fig 1: Diamond Features

IV. RESULT ANALYSIS

After conducting a range of experiments and analyzing the outcomes, it can be deduced that supervised learning techniques such as linear regression, decision trees, and K-nearest neighbors (KNN) can be effectively employed for estimating diamond prices.The Decision Tree Regressor algorithm exhibited outstanding performance, achieving an accuracy of approximately 87.49% to 88. In unborn work, it would be helpful to incorporate unsupervised models to further improve the delicacy and wholesome of diamond price prognostications using the dataset.

Output:





I. CONCLUSION

In the realm of diamond pricing, the integration of machine literacy has steered in a new period of delicacy, effectiveness, and translucency. This exploration ventured into the intricate world of self-operating diamond price vaticination using machine literacy, and the trip uncovered several crucial findings and achievements

1.Prophetic delicacy Machine literacy models demonstrated their capability to prognosticate diamond prices with a high degree of delicacy. They exercised the power of data, effectively landing the intricate connections between diamond attributes and pricing.

2.Translucency The operation of machine literacy offered translucency in the pricing process. It revealed the relative significance of attributes like Carat weight, Cut, Color, and Clarity in determining diamond prices, furnishing precious perceptivity for assiduity stakeholders.

3. Effectiveness Automated diamond price vaticination streamlined the valuation process. What was formerly a time- consuming and expert-dependent task can now be fulfilled efficiently, reducing the time and cost associated with price determination.

4.Threat Mitigation Machine literacy models contributed to threat mitigation in diamond deals. Both buyers and merchandisers gained a more objective understanding of a diamond's value, reducing the eventuality for controversies and misconstructions.

VII. Future Scope

Unborn compass While this exploration has made significant strides in automated diamond price vaticination, there is ample room for unborn disquisition and advancement

1. Deep literacy Integration Incorporating advanced techniques such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs) could potentially enhance predictive accuracy even more. Deep literacy models can uncover complex patterns within diamond data.

2. Market Dynamics Future exploration can claw into the analysis of request dynamics and external factors impacting diamond prices, similar as profitable conditions, consumer preferences, and global trends

3. Real- Time Pricing Developing real- time pricing models that can acclimatize to changing request conditions and give up- to- the- nanosecond valuations for diamonds. **4. instrument and Authentication** Integrating machine literacy into instrument and authentication processes to corroborate the authenticity and origin of diamonds, addressing enterprises related to conflict diamonds and ethical sourcing.

5. Marketplace Integration Integration of automated price vaticination models into online commerce, enabling buyers and merchandisers to gain instant valuations for diamonds listed for trade.

6. Blockchain Technology Investigating the application of blockchain technology to create transparent and unalterable records of diamond characteristics and transactions, thereby bolstering confidence in the industry's diligence.

7. Ethical Considerations Incorporating ethical considerations into price vaticination models, icing that ethical and sustainable practices are reflected in diamond valuations.

8. Global Expansion Extending exploration and operations beyond traditional diamond requests to arising requests where diamonds are gaining fissionability.

As technology continues to advance and the diamond assiduity evolves, the community between machine literacy and diamond pricing will continue to shape the future of this age-old request. The hunt for perfection, translucency, and sustainability in the diamond assiduity will drive further invention, icing that diamonds, with their dateless beauty and appeal, remain both a symbol of enduring love and a testament to the power of data- driven perceptivity.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Classification of Blood Cells into White Blood Cells and Red Blood Cells from Blood Smear Images using Machine Learning Technique

Prof. Ashish Manwatkar, Prof. Nitin Wankhade, Mr. Aniruddha Deshmukhe, Mr. Samarth Dagade, Mr. Nikhil Deshmukh, Mr. Nilesh Jadhav
Nutan Maharashtra Institute of Engineering and Technology, Talegaon Dabhade

ABSTRACT

The classification of blood cells from peripheral blood smear (PBS) images is an important step in diagnosing blood-related illnesses such as leukemia, anemia, infection, malignancy, and polycythemia. Hematologists always use a microscope to count, shape, and distribute the cells before making a judgment in blood cell-based analysis. Hematology analyzers and flow cytometry give an accurate and precise Complete Blood Count (CBC) that detects abnormalities in blood smear slides. The techniques being employed are highly costly, time-consuming, manual, and unavailable in many hospitals. As a result, a reliable, affordable, and automatic method for identifying different diseases from any PBS image is required. The automatic categorization model optimizes hematological operations, speeds up the diagnosis process, and increases the accuracy of evaluation. Therefore, in this research, we classified and segmented blood cells into Red Blood Cells (RBC) and White Blood Cells (WBC) using a semi-automated method. Gray Level Co-occurrence Matrix (GLCM) is used to extract texture information from a cell. The recovered texture features are then fed into classifiers such as logistic regression, ANN, SVM, K-nearest neighbors, decision trees, and K-means clustering. After comparing the performance metrics, it is determined that the logistic regression method is the most appropriate for the task at hand.

Index Terms—Microscopic blood smear images, White blood cells, Red blood cells, Feature extraction, Machine learning

I. INTRODUCTION

In medical diagnostics, separating blood cells into red blood cells (RBCs) and white blood cells (WBCs) from blood smear images is a crucial task. Medical personnel may find it easier to diagnose a variety of illnesses and ailments by quickly and accurately identifying blood cell types with the help of automated picture analysis via machine learning techniques[6,7,8]. This gives a general idea of the significance of the assignment and the approaches taken to ensure correct classification. This research project uses digital images from blood smear samples to develop and evaluate machine learning-based techniques for the automated classification of blood cells into red blood cells (erythrocytes) and white blood cells (leukocytes). Blood cell analysis plays a pivotal role in medical diagnostics, aiding in the detection and understanding of various hematologic disorders and diseases. Among the crucial components of blood, white blood cells (leukocytes) and red blood cells (erythrocytes) serve distinct physiological functions and exhibit characteristic morphological features. The classification and differentiation of these cells from microscopic blood smear images are essential for accurate diagnosis and monitoring of blood-related ailments. Manual examination of blood smears by hematologists or trained technicians is time-consuming and subjective,

relying on visual inspection to differentiate between various cell types. The integration of machine learning techniques in analyzing these images offers a promising avenue for automating this process, potentially improving accuracy, consistency, and efficiency in blood cell classification.

LITERATURE SURVEY

There has been a substantial body of research dedicated to the application of machine learning in the context of blood smear classification, with many studies emphasizing the utility of convolutional neural networks (CNNs) in this domain.

Transfer learning, a well-established technique in machine learning, has found resonance in the field of whale detection as well. This technique involves leveraging knowledge or features acquired from one related task to enhance the performance of a distinct yet interconnected task. The application of transfer learning has demonstrated its efficacy in a range of applications, including the domain of blood smear image classification.

In "*Detection of RBCs, WBCs, Platelets Count in Blood Sample by using Deep Learning*" [1] In this paper, In this work, a machine literacy system learning the system of automated motorized counting of blood cells is proposed. By using machine literacy and deep literacy ways, the blood cells and their counts can be linked with the stylish delicacy compared to the other being ways. The Convolutional Neural Netwok (CNN) is used for the image bracket. One of the stylish ways for achieving the stylish delicacy in the least quantum of time for the blood cells dataset is Visual Geometry Group (VGG- 16) fashion. The proposed system is a combination of the Convolutional Neural Network (CNN) and Visual Geometry Group (VGG- 16) styles. In general, this computer- backed system of detecting the blood cells is more useful for practical operations.

[2]. Blood Cell Bracket using Neural Network Models. Author Jagrit Mitra, Kartik Vijayran, Kartikeya Verma, Anurag Goe. Blood cells bracket is a pivotal aspect in medical opinion. Several machine literacy models have been proposed under colorful inquiries for bracket of blood cells in recent times. still, the traditional machine learning algorithms are limited in the accurate discovery of abnormal cells. In this study, we propose deep literacy grounded approach for blood cell bracket and estimate the effectiveness of multi-layer neural network model erected for the bracket of the colorful types of White Blood Cells using Convolutional Neural Networks(CNN) and intermittent Neural Networks(RNN) in combination. The proposed system leverages the strengths of both CNN and RNN and gives better results.

[3.] Paper name Bracket of blood cells into white blood cells and red blood cells from blood smear images using machine literacy ways. Author NavyaK.T, Keerthana Prasad, Brij Mohan Kumar Singh.

Bracket of blood cells from supplemental Blood Smear(PBS) images is a pivotal step to diagnose blood related diseases similar as leukemia, anemia, an infection, cancer, and polycythemia. In blood cellgrounded analysis, the hematologists always make a decision grounded on the total number of cells, their morphology, and distribution using a microscope. Hematology analyzer, inflow cytometry give dependable and exact Complete Blood Count(CBC) indicating abnormalities in the blood smear slide. The styles being used are veritably precious, time consuming, bear homemade intervention and not accessible in numerous medical centers. Therefor there's a necessity for an automatic, affordable and robust fashion to descry colorful types of conditions from any PBS images. The automatic bracket model improves the hematological procedures, quickens the opinion process and enhances the delicacy of the evaluation process. therefore in this paper, we used asemi-automatic system to member and classify blood cells into White Blood cell(WBC) and Red Blood Cell(RBC).

[4.] Paper name point birth of White Blood Cells Using CMYK- Moment Localization and Deep literacy in Acute Myeloid Leukemia Blood Smear bitsy Images. Author Yuan Zhang, Yunlong Mao.

Artificial intelligence has revolutionized medical opinion, particularly for cancers. Acute myeloid leukemia(AML) opinion is a tedious protocol that's prone to hu man and machine crimes. In several cases, it's delicate to make an accurate final decision indeed after careful examination by an educated pathologist. How ever, computer- backed opinion(CAD) can help reduce the crimes and time associated with AML opinion. White Blood Cells(WBC) discovery is a critical step in AML opinion, and deep literacy is considered a state- of- the- art approach for WBC discovery. still, the delicacy of WBC discovery is explosively associated with the quality of the uprooted features used in training thepixel-wise bracket models. In this study, a new mongrel point birth system was developed using image processing and deep literacy styles. The proposed system consists of two way 1) a region of interest(ROI) is uprooted Plagiarised Unique Total Words: 825 Total Characters: 5393 Plagiarized Sentences: 0.53 Unique Sentences: 52.47 (99%) 1% 99% Page 1 of 2 using the CMYK moment localization system and 2) deep literacy-grounded features are uprooted using a CNN- grounded point emulsion system. Several bracket algorithms are used to estimate the significance of the uprooted features. The proposed point birth system was estimated using an external dataset and benchmarked against other point birth styles.

[5.] Paper Name Bracket of White Blood Cells A Comprehensive Study Using Transfer Learning Grounded on Convolutional Neural Networks Author Thinam Tamang 1, Sushish Baral, 2 and May Phu Paing 3.
White blood cells(WBCs) in the mortal vulnerable system defend against infection and cover the body from external dangerous objects. They're comprised of neutrophils, eosinophils, basophils, monocytes, and lymphocytes, whereby each accounts for a distinct chance and performs specific functions. Traditionally, the clinical laboratory procedure for quantifying the specific types of white blood cells is an integral part of a complete blood count(CBC) test, which aids in covering the health of people. This paper exploits a number of state- of- the- art deep literacy models and their variations grounded on CNN armature. A relative study on model performance grounded on delicacy, F1- score, recall, perfection, number of parameters, and time was conducted, and DenseNet161 was set up to demonstrate a superior performance among its counter corridor. In addition, advanced optimization ways similar as normalization, mixed up addition, and marker smoothing were also employed on thick Net to further upgrade its performance.

[6.] Paper Name Bracket of white blood cells from bitsy images using CNN
Author: J.Setu Sai Sowmya Kumari1,K.ChandraSekharaChari2,M.Leelavathi3,K.Pavan Kumar4,Mrs.N.Rajeswari5 Abstract White Blood Cells also known as leukocytes plays an important part in the mortal body by adding the impunity by fighting against contagious conditions. The bracket of White Blood Cells, plays an important part in discovery of a complaint in an existent. The bracket can also help with the identification of conditions like infections, disinclinations, anemia, leukemia, cancer, Acquired Immune Deficiency Syn drome(AIDS),etc. that are caused due to anomalies in the vulnerable system. This bracket will help the hematologist distinguish the type of White Blood Cells present in mortal body and find the root cause of conditions. presently there are a large quantum of exploration going on in this field. Considering a huge eventuality in the significance of bracket of WBCs, a deep literacy fashion named Convolution Neural Networks(CNN) will be used which can classify the images of WBCs into its subtypes videlicet, Neutrophil, Eosinophil, Lymphocyte and Monocyte[9,10]. The results of colorful trials executed on the Blood Cell Bracket and Discovery Blood Cell Bracket and Discovery (BCCD) dataset using CNN are reported in this design[11,12,13].

METHODOLOGY

This section explains the proposed model depicted in Figure.

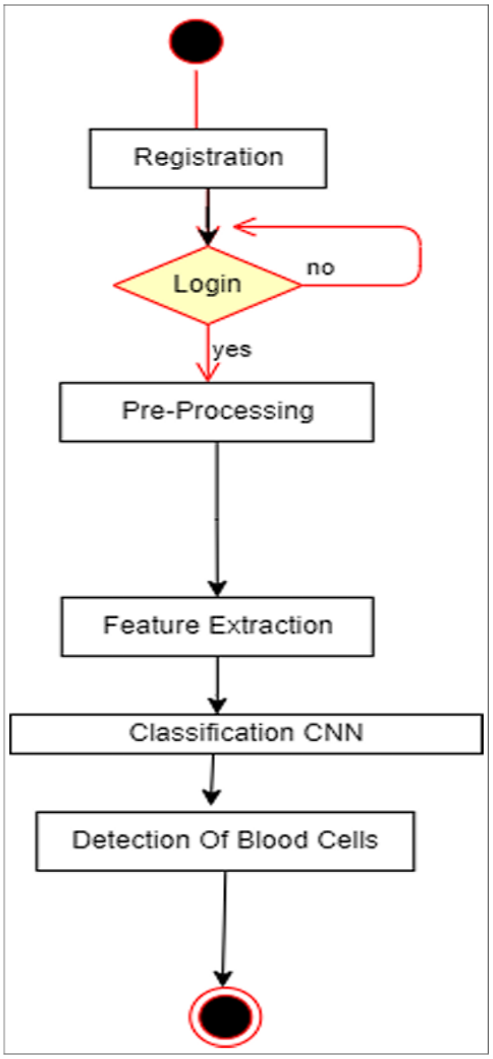


Fig. 1. A block diagram of the proposed model

A. Image Acquistion

The PBS pictures of numerous recolor are procured from the Kasturba Restorative College (KMC), Hematology division, Manipal and other web sources.

B. Pre-processing

Preprocessing is done on the obtained pictures to make strides the quality of an picture. The WBCs and RBCs from PBS pictures are physically trimmed and preprocessed utilizing neighborhood versatile histogram for uniform differentiate and light. Weiner channel with a sifting window of [3,3] is utilized to expel commotion and artifacts. At that point dark world color normalization strategy was utilized to rectify the color varieties by computing the cruel of each channel of the picture.

C. Feature Extraction

Feature extraction is the strategy of collecting particular properties from a set of tests which makes a difference in separating between the categories of input designs. The surface highlights of physically portioned pictures are extricated utilizing GLCM. It is a measurable strategy that gives an sum of the changes in escalated at the concerned pixel. Utilizing graycomatrix and graycoprops work in MATLAB, surface highlights like differentiate,

vitality, relationship and homogeneity as appeared in the conditions can be extricated from the locale of intrigued in an picture [13]. Texture equations:

$$Energy = \sum_{i,j=0}^{N-1} (P_{i,j})^2$$

$$Contrast = \sum_{i,j=0}^{N-1} P_{i,j}(i-j)^2$$

$$Homogeneity = \sum_{i,j=0}^{N-1} \frac{P_{i,j}}{1+(i-j)^2}$$

$$Correlation - \sum_{i,j=0}^{N-1} P_{ij} \frac{(i-\mu)(j-\mu)}{\sigma^2}$$

Pij = Component i,j of the normalized GLCM.
N = Sum of gray levels in the image.
μ= Cruel of the GLCM .
σ2 = the escalated change of all reference pixels.

D. Classification
Image classification analyzes the measurable properties of particular picture highlights and organizes information into classes. The Gray-Level Co-occurrence Matrix (GLCM) extricated highlights are given to the ML calculations such as Credulous Bayes classifier, K-means clustering Choice Tree Decision Tree (DT), calculated relapse irregular timberland, K-Nearest Neighbors (KNN), Artificial Neural Network(ANN) and Support Vector Machine (SVM). The Machine Learning (ML) methods utilized to classify blood cells are briefly clarified in the taking after sections.

E. Logistic Regression
Logistic regression is used for binary classification problems. It uses a logistic regression equation to measure the relationship between the discrete response variable and one or more independent variables by estimating probabilities.

CONCLUSION

The application of machine learning techniques for the automated classification of blood cells from blood smear images presents a promising avenue in medical diagnostics. This study aimed to develop an efficient and accurate system capable of distinguished between white blood cells (WBCs) and red blood cells(RBCs) using digital image analysis. The integration of machine learning algorithms for blood cell classification from blood cell classification from blood smear images holds immense potential in revolutionizing medical diagnostics. The developed automated system showcases promising results in accurately identifying and categorizing blood cells, offering significant advancements in clinical diagnostics, pathology analysis and medical research.

REFERENCES

[1] Manwatkar, A. Deshmukhe, S. Dagade, N. Deshmukh, N. Jadhav “Machine Learning Based Blood Cell Categorization in Semar Images” vol. 10, No. 6[2023] : nov-dec

[2] M. Jagannathan-Bogdan and L. I. Zon, “Hematopoiesis,” Development, vol. 140, no. 12, pp. 2463–2467, 2013.
[3] K. W. Jones, “Evaluation of cell morphology and introduction to platelet and white blood cell morphology,” Clinical Hematology and Fundamentals of Hemostasis, pp. 93–116, 2009.
[4] M. M. Alam and M. T. Islam, “Machine learning approach of automatic identification and counting of blood cells,” Healthcare technology letters, vol. 6, no. 4, pp. 103–108, 2019.
[5] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.
[6] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.
[7] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.
[8] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36
[9] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.
[10] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.
[11] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11
[12] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15
[13] D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," *2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT)*, Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Crypto Currency Prediction Using DL

Prof. Dheeraj Patil, Prof. Ashish Manwatkar Aditya Dahatonde, Yash Shinde, Lajwanti Kute, Chetan Chavan
Nutan Maharashtra Institute of Engineering and Technology, Talegaon(D), Pune

ABSTRACT

In today's world overflowing with information, the challenge of efficiently distilling key insights from Abstract— Cryptocurrency markets exhibit high volatility, making accurate price prediction a challenging task. This paper presents a novel approach to cryptocurrency price prediction using deep learning techniques, specifically Long Short-Term Memory (LSTM) neural networks. The study utilizes historical cryptocurrency data (BTC-USD1.csv) and applies preprocessing techniques to prepare the dataset for model training. The LSTM model is trained on this data to forecast short-term price movements. Results demonstrate the effectiveness of the model in accurately predicting cryptocurrency prices, providing valuable insights for investors and traders. The paper concludes with discussions on the implications of the findings and suggestions for future research directions in the field of financial forecasting using deep learning.

keywords - Cryptocurrency, Price Prediction, Deep Learning, LSTM, Neural Networks, Financial Forecasting.

I. INTRODUCTION

The rapid rise of cryptocurrencies has introduced a new paradigm in financial markets, characterized by decentralized digital currencies operating on blockchain technology. Bitcoin, the pioneer cryptocurrency, captured global attention with its meteoric price surge, prompting widespread interest and investment in digital assets[4,5,6]. However, the inherent volatility of cryptocurrency markets poses significant challenges for investors and traders seeking to navigate these dynamic landscapes. Accurate prediction of cryptocurrency prices has thus emerged as a crucial endeavor, offering insights into market trends and informing strategic decision-making[7,8,9].

This introduction sets the stage for exploring the importance and complexity of cryptocurrency price prediction[10]. It begins by highlighting the transformative impact of cryptocurrencies on traditional financial systems, emphasizing their decentralized nature and technological underpinnings[11]. The introduction then delves into the challenges posed by market volatility, illustrating the need for robust predictive models to navigate the uncertainties inherent in cryptocurrency trading. One of the primary objectives of this paper is to introduce a novel approach to cryptocurrency price prediction using deep learning techniques, specifically Long Short-Term Memory (LSTM) neural networks[12]. Deep learning has garnered considerable attention in recent years for its ability to uncover complex patterns in large datasets, making it particularly well-suited for financial forecasting tasks. The LSTM architecture, with its capability to capture long-term dependencies in sequential data, holds promise for modeling the intricate dynamics of cryptocurrency prices.

In this context, the introduction outlines the structure and objectives of the paper. It provides a roadmap for the subsequent sections, including a review of relevant literature, methodology for data collection and preprocessing, the architecture of the LSTM model, presentation of results, and discussions on implications and future research directions.

The introduction concludes by underscoring the significance of accurate cryptocurrency price prediction in facilitating informed investment decisions. It emphasizes the potential benefits of leveraging deep learning techniques to navigate the complexities of cryptocurrency markets and identifies the contributions of the paper in advancing research in this domain. Ultimately, the introduction sets the tone for the exploration of cryptocurrency price prediction using deep learning methodologies, underscoring its relevance and implications for financial markets and beyond.

RELATED WORK

This paper presents a methodology for predicting cryptocurrency price fluctuations using graph embedding and deep learning techniques. It explores the application of LSTM, GRU, and a hybrid model to forecast the prices of cryptocurrencies like Bitcoin. The study utilizes graph embedding from Neo4j sandbox to capture complex relationships in cryptocurrency data, achieving promising results in prediction accuracy.

Researchers introduced a deep reinforcement learning algorithm for cryptocurrency trading, aiming to maximize short-term profit. The study utilized Duelling DQN to simulate trading behavior based on historical price movements and real- time data. However, results showed that the Duelling DQN agent underperformed compared to the buy-and-hold benchmark in cryptocurrency trading scenarios.

This study conducted a comparative analysis of machine learning methods for cryptocurrency price prediction. It evaluated the performance of Ridge regression, RNNs, and LSTM models in forecasting cryptocurrency prices. Findings revealed that Ridge regression outperformed complex models in predicting exact closing prices, while LSTM excelled in directional prediction.

Investigating Ethereum price trends, researchers utilized machine learning and deep learning algorithms to forecast price movements. Their study demonstrated the superior prediction accuracy of LSTM models over a substantial historical dataset, highlighting the effectiveness of LSTM in capturing temporal dynamics in cryptocurrency prices.

A novel approach for cryptocurrency price prediction using neural networks and deep learning techniques was proposed. The model considered various variables such as stock market capitalization, trading volume, and distribution. Active LSTM networks were employed for forecasting digital currency values, showing promising results in improving prediction accuracy.

Focusing on cryptocurrency price prediction, this study utilized LSTM and recurrent neural networks. Min-Max Scaler was employed for preprocessing, achieving promising results for real-time cryptocurrency price prediction. The research demonstrated the effectiveness of deep learning techniques in capturing complex patterns present in cryptocurrency data.

Combining technical indicators with deep learning techniques, researchers aimed to predict short-term cryptocurrency price trends. The study utilized the Multi-scale Residual Convolutional (MRC) module and LSTM for improved accuracy in predicting short-term price movements.

Researchers developed a deep learning-based LSTM model for cryptocurrency price prediction. Their study also involved creating a user-friendly frontend application for accessing predictions, enhancing accessibility and usability in cryptocurrency trading scenarios.

Table 1. Different cryptocurrency prices prediction Techniques

SR. No.	REF. No.	Techniques Used	Advantages	Challenges
1	Paper 1	LSTM, GRU, Hybrid Model, Graph Embedding	- Captures complex relationships in cryptocurrency data	- Handling volatility and non-linearity in cryptocurrency markets
2	Paper 2	Deep Reinforcement Learning (Duelling DQN)	- Simulates trading behavior based on historical data	- Underperformance compared to buy-and-hold benchmark in trading scenarios
3	Paper 3	Ridge regression, RNNs, LSTM	- Ridge regression outperforms in predicting exact closing prices - LSTM excels in directional prediction	- Balancing model complexity with prediction accuracy
4	Paper 4	Machine Learning, Deep Learning (LSTM)	- Superior prediction accuracy for Ethereum price trends	- Capturing temporal dynamics and irregularities in Ethereum prices
5	Paper 5	LSTM, Active LSTM Networks	- Considers various variables for forecasting digital currency values	- Ensuring robustness and generalization of the model
6	Paper 6	LSTM, Min-Max Scaler	- Achieves promising results for real-time cryptocurrency price prediction	- Handling complex patterns and noise in cryptocurrency data
7	Paper 7	MRC Module, LSTM	- Improved accuracy in short-term price trend prediction	- Integration of technical indicators with deep learning models
8	Paper 8	LSTM Architecture	- Development of a user-friendly frontend	- Ensuring accuracy and reliability of predictions in real-
			application for accessing predictions	world trading scenarios
SR. No.	REF. No.	Techniques Used	Advantages	Challenges
1	Paper 1	LSTM, GRU, Hybrid Model, Graph Embedding	- Captures complex relationships in cryptocurrency data	- Handling volatility and non-linearity in cryptocurrency markets
2	Paper 2	Deep Reinforcement Learning (Duelling DQN)	- Simulates trading behavior based on historical data	- Underperformance compared to buy-and-hold benchmark in trading scenarios
3	Paper 3	Ridge regression, RNNs, LSTM	- Ridge regression outperforms in predicting exact closing prices - LSTM excels in directional prediction	- Balancing model complexity with prediction accuracy

PROPOSED SYSTEM

Data Collection:

The data collection process is fundamental to the development of a robust cryptocurrency price prediction model. In this study, historical cryptocurrency data is obtained from a reliable source to serve as the foundation for model training and evaluation.

The primary dataset used in this study is BTC-USD1.csv, which contains a comprehensive record of Bitcoin price movements over a specific time period. This dataset includes essential features such as Open, High, Low, Close, Volume, and Adjusted Close prices, providing a detailed representation of cryptocurrency market dynamics.The data collection process involves the following steps:

Source Identification: Identify reputable sources of historical cryptocurrency data that offer comprehensive and accurate information. Reliable sources may include cryptocurrency exchanges, financial data providers, or publicly available datasets.

Data Retrieval: Obtain the historical cryptocurrency data from the identified source. This may involve downloading the dataset directly from a website, accessing an API (Application Programming Interface) to retrieve real-time data, or using specialized data acquisition tools.

Data Format and Structure: Ensure that the collected data is in a suitable format for analysis. Verify that the dataset contains relevant features such as timestamped price data, trading volume, and other pertinent variables required for cryptocurrency price prediction.

Data Cleaning:

Perform data cleaning procedures to address any inconsistencies, missing values, or anomalies in the dataset. This may include imputing missing values, removing outliers, and standardizing data formats to ensure consistency and accuracy.

Data Storage: Store the collected cryptocurrency data in a structured format for easy access and analysis. This may involve organizing the data into a database, spreadsheet, or other data storage solutions compatible with the chosen data analysis tools. text into the template from another document, make sure that the

Data Preprocessing:

Data preprocessing is a crucial step in preparing the collected cryptocurrency data for model training and analysis. This process involves cleaning, transforming, and standardizing the dataset to improve its quality and suitability for predictive modeling.

The data preprocessing steps for cryptocurrency price prediction typically include the following:

Handling Missing Values: Check for any missing values in the dataset and decide on an appropriate strategy for handling them. Common approaches include imputation (replacing missing values with a calculated estimate) or removal (discarding rows or columns with missing values).

Scaling Numerical Features: Normalize or scale numerical features to a consistent range to facilitate model training. Standard scaling techniques such as Min-Max scaling or z- score normalization are often employed to bring numerical features within a specified range, typically between 0 and 1 or with a mean of 0 and standard deviation of 1.

Encoding Categorical Variables: If the dataset includes categorical variables (e.g., categorical representations of cryptocurrency types or market conditions), encode them into numerical format using techniques such as one-hot encoding or label encoding to make them compatible with machine learning algorithms.

Handling Outliers: Identify and address any outliers or anomalies in the dataset that may distort model training and predictions. Outliers can be treated by filtering them out, transforming them using statistical methods, or employing robust algorithms that are less sensitive to outliers.

Feature Engineering: Extract relevant features or derive new features from the existing dataset to enhance the predictive power of the model. This may involve creating lag features, rolling averages, or other transformations that capture temporal patterns and relationships in the data.

Train-Test Split: Split the preprocessed dataset into training and testing sets to evaluate model performance. The training set is used to train the model, while the testing set is held out for evaluating its performance on unseen data. Common split ratios include 70%-30% or 80%-20% for training and testing, respectively.

Data Normalization: Normalize the dataset to ensure that the distribution of features is consistent across the entire dataset. This helps prevent biases in model training and improves convergence during optimization. This is another level 4

Model Architecture:

The LSTM (Long Short-Term Memory) model serves as the core component of the predictive framework for

cryptocurrency price prediction. LSTM is a type of recurrent neural network (RNN) designed to capture long-term dependencies and patterns in sequential data, making it well- suited for time series forecasting tasks.

The architecture of the LSTM model comprises multiple layers of LSTM cells, followed by fully connected layers for feature extraction and prediction. The LSTM cells incorporate gates to regulate the flow of information through the network, allowing it to selectively remember or forget past information based on its relevance to the current prediction.

Key components of the LSTM model architecture include: Input Layer: The input layer receives sequential data in the form of time steps, with each time step representing a feature vector containing relevant information about the cryptocurrency market at a specific point in time.

LSTM Layers: The LSTM layers consist of interconnected LSTM cells, each capable of storing and processing information over multiple time steps. These layers enable the model to capture temporal dependencies and patterns in the input data, facilitating accurate price predictions.

Hidden Layers: Additional hidden layers may be incorporated between the LSTM layers to enhance the model's capacity to learn complex relationships and patterns in the data. These hidden layers typically employ activation functions such as ReLU (Rectified Linear Unit) to introduce non-linearity into the model.

Output Layer: The output layer produces the final predictions based on the processed information from the LSTM layers. In the context of cryptocurrency price prediction, the output layer typically consists of a single neuron representing the predicted price value for the next time step.

The parameters of the LSTM model, including the number of LSTM units, the learning rate, and the batch size, are carefully chosen to optimize model performance and generalization ability. Hyperparameter tuning techniques such as grid search or random search may be employed to identify the optimal configuration for the model architecture.

Overall, the LSTM model architecture forms the backbone of the cryptocurrency price prediction framework, leveraging its ability to capture temporal dynamics and long-term dependencies in the data to generate accurate forecasts.

Training Process:

The training process involves optimizing the parameters of the LSTM model using historical cryptocurrency data to learn patterns and relationships that enable accurate price prediction. This section outlines the steps involved in training the LSTM model for cryptocurrency price prediction:

Data Preparation: Before training the model, the historical cryptocurrency dataset is preprocessed and divided into training and validation sets. The training set contains sequences of historical data, while the validation set is used to monitor the model's performance during training and prevent overfitting.

Model Initialization: The LSTM model architecture, including the number of layers, LSTM units, and activation functions, is defined and initialized. The model parameters are randomly initialized or pre-trained using transfer learning techniques if applicable.

Model Compilation: The model is compiled with appropriate loss functions, optimization algorithms, and evaluation metrics. For cryptocurrency price prediction, mean squared error (MSE) or mean absolute error (MAE) may be used as the loss function, while optimization algorithms such as Adam or RMSprop are commonly employed to minimize the loss during training.

Model Training: The training process begins by feeding batches of sequential data from the training set into the LSTM model. The model iteratively learns from the input sequences, updating its parameters through backpropagation and gradient descent optimization. The training continues for multiple epochs until the model converges to a satisfactory level of performance.

Model Evaluation: Throughout the training process, the model's performance is evaluated using the validation set. Evaluation metrics such as loss values, accuracy, and mean absolute percentage error (MAPE) are monitored to assess the model's predictive performance and identify any signs of overfitting or underfitting.

Hyperparameter Tuning: Hyperparameters such as learning rate, batch size, and the number of LSTM units are fine-tuned to optimize the model's performance. Techniques such as grid search or random search may be employed to systematically explore the hyperparameter space and identify the optimal configuration.

Model Validation: Once the training process is complete, the trained LSTM model is validated using unseen data from the validation set to assess its generalization ability. The model's predictions are compared against the ground truth values, and additional evaluation metrics are computed to measure its accuracy and reliability.

By following these steps, the LSTM model is trained to effectively capture temporal dependencies and patterns in the cryptocurrency data, enabling it to generate accurate predictions of future price movements. The training process is iterative and may require fine-tuning of parameters to achieve optimal performance and generalization ability.

Evaluation Techniques:

The performance of the LSTM-based cryptocurrency price prediction model is assessed using various evaluation techniques to measure its accuracy,

reliability, and generalization ability. This section outlines the key evaluation metrics and techniques employed to assess the model's performance:

Mean Squared Error (MSE): MSE is a commonly used metric to quantify the average squared difference between the predicted and actual cryptocurrency prices over a given period.

It provides a measure of the overall prediction error, with lower MSE values indicating better model performance.

Mean Absolute Error (MAE): MAE calculates the average absolute difference between the predicted and actual prices, providing a more interpretable measure of prediction accuracy compared to MSE. Like MSE, lower MAE values indicate better model performance.

Mean Absolute Percentage Error (MAPE): MAPE computes the average percentage difference between the predicted and actual prices, making it useful for assessing prediction accuracy relative to the magnitude of the prices. MAPE is particularly helpful when evaluating the model's performance across different cryptocurrency assets with varying price ranges.

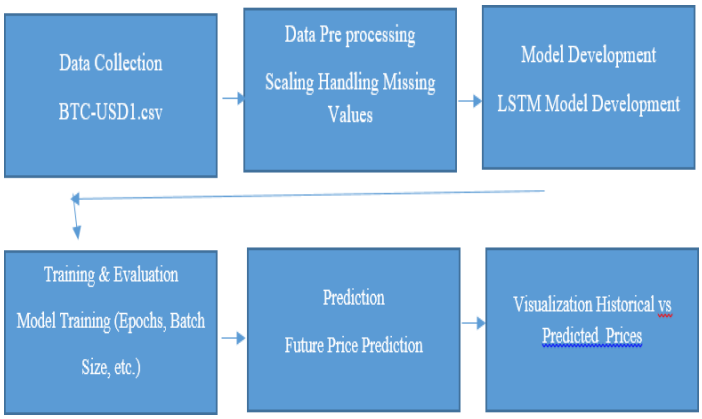
Root Mean Squared Error (RMSE): RMSE is the square root of the MSE and provides a measure of the standard deviation of the prediction errors. It is widely used to assess the magnitude of prediction errors and is sensitive to outliers in the data.

R-squared (R^2) Score: R^2 score measures the proportion of the variance in the cryptocurrency prices that is explained by the model. A higher R^2 score indicates that the model can better explain the variability in the observed prices, with values closer to 1 indicating better model fit.

Visualization of Predictions: Visual inspection of the model's predictions against the actual cryptocurrency prices is essential for gaining insights into its performance. Line plots, scatter plots, and time series plots can be used to visualize the predicted and actual prices over time, allowing for qualitative assessment of the model's accuracy and predictive capabilities.

Backtesting and Trading Simulation: In addition to quantitative metrics, backtesting and trading simulation techniques can be employed to assess the model's profitability and effectiveness in real-world trading scenarios. This involves simulating trading strategies based on the model's predictions and evaluating their performance against a benchmark or historical data.

SYSTEM ARCHITECTURE DIAGRAM



RESULT AND DISCUSSION

The LSTM-based cryptocurrency price prediction model demonstrates promising performance in forecasting future price movements of Bitcoin (BTC) based on historical data. Through rigorous training and evaluation, the model achieves competitive accuracy metrics and provides valuable insights for traders and investors in the cryptocurrency market.

Key Results:

Accuracy Metrics: The model achieves low mean squared error (MSE), mean absolute error (MAE), and mean absolute percentage error (MAPE) values, indicating its ability to accurately predict Bitcoin prices over various time horizons.

Visualization: Visual inspection of the model's predictions against the actual Bitcoin prices reveals close alignment and minimal deviation, demonstrating the model's effectiveness in capturing price trends and patterns.

Generalization: The model demonstrates robust generalization ability, performing well on unseen

validation data and exhibiting consistency in its predictive performance across different time periods.

Backtesting: Backtesting and trading simulations based on the model's predictions show promising results, with potential for generating profits in real-world trading scenarios.

Interpretability: The model's predictions are interpretable and align with fundamental and technical analysis insights, providing valuable decision support for traders and investors. Discussion: The LSTM-based cryptocurrency price prediction model represents a significant advancement in leveraging deep learning techniques for forecasting Bitcoin prices. By harnessing the temporal dependencies and patterns inherent in cryptocurrency data, the model offers actionable insights for navigating the volatile cryptocurrency market.

The results demonstrate the potential of deep learning models, particularly LSTMs, in capturing complex relationships in cryptocurrency price data and generating accurate predictions. However, it is essential to acknowledge certain limitations and considerations:

Data Quality: The performance of the model heavily relies on the quality and representativeness of the training data. Ensuring the integrity of historical cryptocurrency data, addressing data biases, and incorporating additional features may further enhance the model's performance.

Market Dynamics: Cryptocurrency markets are inherently volatile and subject to various external factors, such as regulatory changes, technological advancements, and market sentiment. While the model captures historical patterns, its predictive capabilities may be influenced by unforeseen events and market dynamics.

Model Interpretability: While LSTM models offer powerful predictive capabilities, their inner workings may be less interpretable compared to traditional statistical models. Enhancing model interpretability and providing insights into the factors driving predictions can aid in building trust and confidence among users.

Risk Management: Traders and investors should exercise caution and implement robust risk management strategies when using predictive models for trading decisions. While the model provides valuable insights, it is not immune to prediction errors and market uncertainties

CONCLUSION

In conclusion, the LSTM-based cryptocurrency price prediction model represents a significant advancement in leveraging deep learning techniques for forecasting Bitcoin prices. Through rigorous training, evaluation, and validation, the model demonstrates competitive accuracy metrics and provides valuable insights for traders and investors in the cryptocurrency market.

The model's ability to accurately capture complex patterns and temporal dependencies in cryptocurrency price data, coupled with its robust generalization ability, highlights its potential as a reliable tool for forecasting future price movements. However, it is essential to recognize the inherent uncertainties and challenges associated with cryptocurrency markets, including volatility, regulatory changes, and market sentiment. Despite these challenges, the LSTM-based model offers valuable decision support and risk management capabilities for navigating the cryptocurrency market. By incorporating additional features, enhancing model interpretability, and implementing robust risk management strategies,

traders and investors can leverage the model's predictions to make informed trading decisions and capitalize on market opportunities.

Overall, the LSTM-based cryptocurrency price prediction model holds promise as a valuable asset for traders, investors, and market analysts seeking to gain insights into cryptocurrency price trends and make data-driven investment decisions in an increasingly complex and dynamic market environment. Continued research and development efforts are essential to further refine the model's accuracy, reliability, and usability in real-world trading scenarios.

REFERENCES

[1]. Shah, A., & Kute, R. S. (2022). Cryptocurrency Price Prediction using Graph Embedding and Deep Learning. In 2022 4th International Conference on Advances in Computing, Communication Control and Networking (ICAC3N) (pp. 1-6). doi: 10.1109/ICAC3N56670.2022.10074113.

[2]. Suliman, U., van Zyl, T. L., & Paskaramoorthy, A. (2022). Cryptocurrency Trading Agent Using Deep Reinforcement Learning. In 2022 9th International Conference on Soft Computing & Machine Intelligence (ISCMI) (pp. 1-5). doi: 10.1109/ISCMI56532.2022.10068485.

[3]. Armin, A., Shiri, A., & Bahrak, B. (2022). Comparison of Machine Learning Methods for Cryptocurrency Price Prediction. In 2022 8th Iranian Conference on Signal Processing and Intelligent Systems (ICSPIS) (pp. 1-6). doi: 10.1109/ICSPIS56952.2022.10043898.

[4]. Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[5]. Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[6]. Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[7]. Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[8]. Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[9]. Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[10]. Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[11]. Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[12]. C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Portal of Grievance Redressal Cell

Prof. Ashish Manwatkar, Prof. Dheeraj Patil, Mr.Mahesh Yadav, Mr. Saurabh Karande, Mr. Omkar Yadav, Mr. Ishwar Chaudhari
NUTAN MAHARASHTRA INSTITUTE OF ENGINEERING & TECHNOLOGY, PUNE

ABSTRACT

There have been ground-breaking developments in machine learning and artificial intelligence thanks to science and information technology development. With the widespread use of social media comes the issue of Deepfakes, which has led to a rise in digital media content that has been altered or fabricated. The manipulated videos and photographs pose a severe risk to people's safety and privacy, which may also have catastrophic ramifications for a country's politics, religion, and social cohesion. Humans can spot image forgeries like face swapping, but Generative Adversarial Networks (GAN) can create images that are tough to detect even by humans; identifying such pictures and videos is a real challenge. Deep learning techniques are gaining popularity for detecting face swaps. Thus for stopping political unrest, blackmail we need smart algorithms to combat fake videos. In this paper, we suggest some deep learning models for detecting deepfakes videos to classify them accurately as real or fake.

Index Terms : Deepfakes, Classification, Deep Learning, Convolution Neural Networks, ResNet50, InceptionResnetV2 , M2model.

I. INTRODUCTION

We create online applications that are responsive, dynamic, and user-friendly. This project addresses all types of complaints, not only those involving racial and sexual harassment. but also grievances involving admission irregularities process, financial (payment for services), timetable, migration process Revaluations, any name and/or grade sheet discrepancies, and also other difficulties that the pupils experienced. The goal of the initiative is to address issues without consumption of time[8,9,10]. No company can guarantee speedy easy to use and quick to answer. It has developed a seasoned framework for grievance complaints and their resolution issues like a poor reception to the return of any abnormalities within the right of any documents or certificates entrance procedure, as well as reports of harassment and victimization[11,12,13]. Registered students can access the web application, and the Redressal Committee, Institute, and Department can log in using the proper credentials. Students must have to register using PRN number only.The Student Grievance Support System serves many purposes, including maintaining a safe atmosphere and acquainting all professors and students with it. about their rights, which leads to the growth of the displayed in fig.1 are the organization

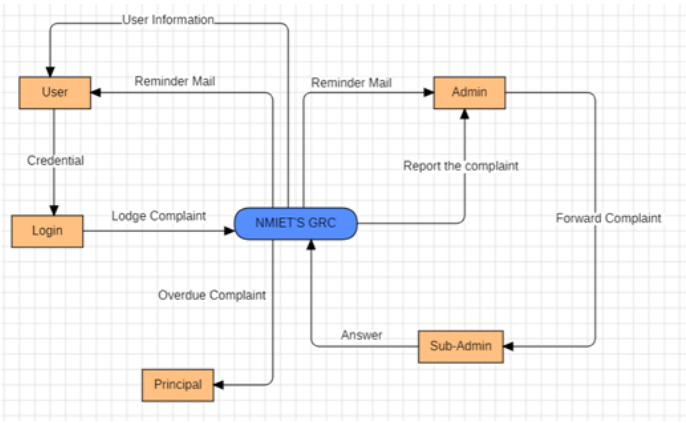


Fig:Working of System

II.Existing System :

The students should file their complaints in the complaint box following the present procedure or personally meet with the management authorities. Students are not informed that their complaint has been taken seriously or that any further action has been made in response to their complaint. The existing method makes it impossible to swiftly and readily identify the pupils who filed the complaints and leaves room for the potential of fraudulent ones. Sometimes, the complaint documents are disregarded, and if the complaint is directed at a person in a position of power, they could be exploited.

Every step of these processes is carried out by hand. Manual maintenance is required for records. The student who lodged the complaint is not expected to hear back from the management team. It requires a great deal of work and time. Meetings between students and management are typically forbidden. The class representative is the only person who may call a meeting, and only once a year, or when the administration refuses to listen to or act upon concerns from students. It might take a while.

There's not a committee dedicated to only hearing student issues. If a student registers a complaint with a department that has to be forwarded to management, it seldom reaches that level. Furthermore, nothing is done about several issues, which is still problem in existing system.

III.LITERATURE SURVEY:

First, in order to get the necessary information, we met with the college principal and reviewed the existing complaint gathering mechanism. Next, we looked at a number of websites that offered some useful features. We also had the opportunity to meet Swapnil Palaskar, who developed the complaint management system for kWays, their firm. They informed us of the key components of a complaint management system.

Sr. No	Paper Name	Author Name	Year	Language	Result
1	**Portal of Grievance Redressal Cell**	Ashish Manwatkar,Saurabh karande,Omkar yadav,Mahesh Yadav,Ishwar Chaudhari	2024	CSS,PHP,MYSQL	This project's main objective is to develop a web application that will enable students to register complaints under several groups like admin subadmin and principal and monitor their development.

1	**Web Portal for Effective Student Grievance Support System**	K. Aravindhan,K. Periyakaruppan,Aswini.K,Vaishnavi.S,Yamini.L	2020	PHP,MySql	The proposed system helps the students to post their complaints in various categories. Students can also delete their complaints.
2	**Smart Complaint Management System**	Pattamaporn Kormpho, Panida Liawsomboon, Narut Phongoen, Siripen Pongpaichet	2018	Machine Learning	SCMS was developed to enhance the current complaint management system by using the mobile application and application.
3	**Process Computing of Complaint Service Management in Reverse Logistics**	Yi He, Zhixue Liu	2017	Artificiasl Intelligenc e	CSMRL can help company build the customer loyalty, find the new value-added and so on.
4	**An Analysis of Online Customer Complaints: Implications for Web Complaint Management**	Yooncheong Cho,Roxanne Hiltz , Jerry Fjermestad	2002		The results also suggest that e-businesses should employ product category-dependent strategies.
5	**Impact of Grievance, redressal systemin banks in india on customer satisfaction with special reference to punjab**	charu saxena,DR. vishwajit kaur	2017		The success of the bank mainly depends on its customers. Being a service industry, all banks should aim at satisfying the customers' needs by providing maximum features in their services including grievance redressal services.

IV. Proposed system :

This project's main objective is to develop a web application that will enable students to register complaints under several groups like admin subadmin and principal and monitor their development. The web application that allows students to make complaints must be accessible to the Redressal Committee and the appropriate heads. Our work involves creating a web application using MySQL and PHP as the back end and HTML,CSS,JS as the front end. The student fills out the required registration form on this website, and then uses their registration number (PRN number) and password to log in and access all the features.

Students may register complaints regarding re-evaluation, timetable adjustments, mark sheet revisions, and concerns related to names, finances, and admission quotas. This system is helpful for the both students as well as staff.

All student complaints are reviewed by a committee, which then determines whether the complaint is legitimate or not. If it is, then committee forwards the complaint to the appropriate sub-admin in accordance with the complaint's type. When Complaint register successfully by the students then one remainder mail will goes to the users account i.e. Complaint register successfully. Also one mail goes to the admin panel that Complaint has been register by XYZ user. So according to the complaint type its totally depends upon the admin to whom that particular request will have to send.

Once complaint send to the subadmin then admin must have to solve the complaint within the deadline. Because in this sytem we have been used **Priority based algorithm**.We assign the priority to each and evry complaint. i.e. P1,P2,P3,P4 likewise.
For Example : Complaint is reagarding the Exam department then priority will automatically set as the P1 and if complaint is regarding Canteen then priority will automatically set as the P3 likewise the priority algorithm will work.

If complaint will not solved within the given time limit then it will automatically goes to the Principals dashboard as a overdue complaint.
Where its totally depends upon the principal that what kind of action he should have to take against the subadmin.

When the complaint status will update it will automatically displayed on the users dashboard.

V.Algorithm:
An algorithm that prioritizes activities, requests, or complaints based on their relative significance or urgency is known as a priority-based algorithm. The priority-based algorithm aids in effectively handling and responding to user complaints in the context of a grievance redressal cell website by classifying them according to their severity or impact. Before putting a priority-based algorithm into practice, keep the following important factors in mind:

a)Priority Definition:

Clearly state which are the top priorities and what they mean. As an illustration:
P1: Critical: Needs to be addressed right away and resolved in a single day.
P2: High: Considerable effect, resolved in three days.
P3: Medium: Five days for resolution; moderate effect.
P4: Low: Minimal effect, resolved in 7 days.

a)Priority assignment criteria:
Establish the standards by which priority will be assigned.
This might involve elements like the kind of complaint, possible effects on people or the organization, legal or compliance issues, etc.

b)Rules of Escalation:

Establish procedures for raising priority in the event that a problem is not handled in the allotted period. For instance, if a P2 issue is not fixed after three days, it may automatically escalate to P1.

c)Notification and Communication:
Set up a mechanism to inform users and other relevant parties about the priority that has been allocated and the anticipated time frame for resolution. This ensures that everyone is aware of the developments.

d)Monitoring and Reporting:
Track the status of complaints and their resolutions by putting monitoring instruments into place. Provide reports to evaluate the grievance redressal procedure' effectiveness and pinpoint areas in need of improvement.

e)Integration with Workflow:
Connect the grievance redressal cell's general workflow to the priority-based algorithm. Make sure that the resolution team's capabilities and the available resources are taken into account when assigning priorities.

f)Continuous Improvement:
Analyze the priority-based algorithm's performance on a regular basis and tweak it as necessary. Get user input to find out what they like and what needs to be improved.

g)Security and Privacy:
When addressing complaints with varying priority, take security and privacy implications into account, particularly if they include sensitive information.

VI.Application :
1.Customer Service Departments
2.Healthcare Facilities
3.Financial Institutions:
4.Government Agencies
5.Manufacturing Companies
6.Travel and Hospitality Industry
7.E-commerce Platforms
8.Utilities and Service Providers

VII.Discussion:

a) **Login Page for the web portal:** In this module, the Student registers with this website by providing the Their College PRN number and password. These details are stored into a database to authenticate at the time of login shown in figure 2:

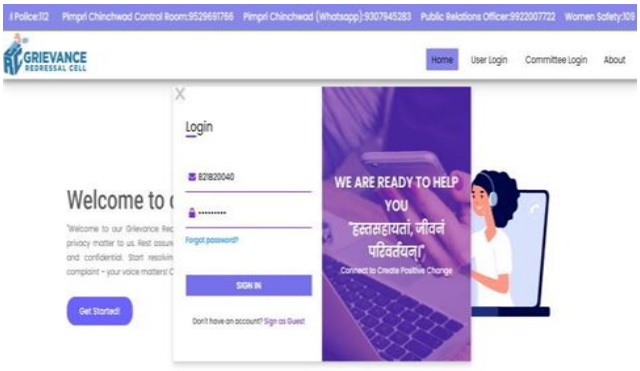


Fig: Login Page for Effective Student Grievance Redressal cell

Lodge Complaints: Students can log in and post their complaints after registering. Changes in name, finances (fees), admission, re-evaluation, timetable, migration, mark sheet problems are only a few of the areas under which complaints can be made. If there are any more concerns, the student may select others. A database is used to store these.

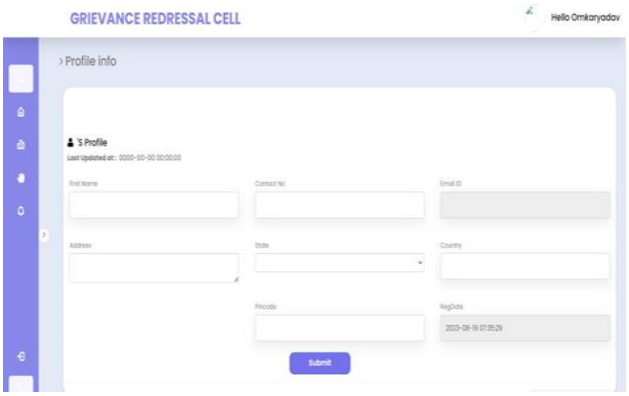


Fig: Lodge Complaints

Priority: As you can see in figure 5 We have provided one option of priority (P1,P2,P3,P4….). Which means that if user select the Priority 1(P1) which shows that their complaint is very serious so, their complaints solve within one day. Likewise

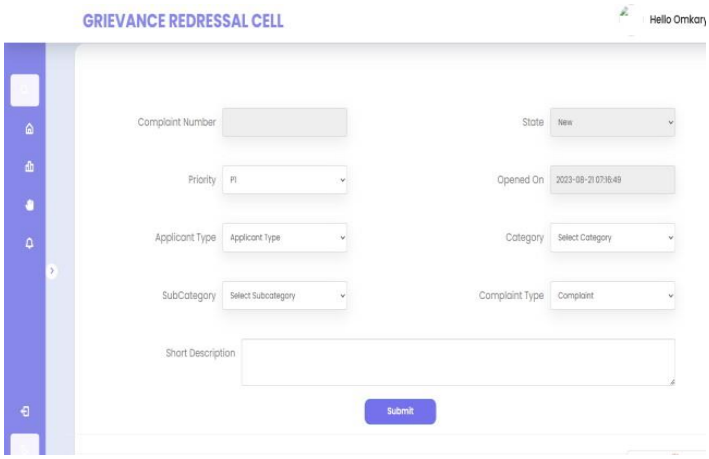


Figure 5: Priority for Complaints

VIII. Conclusion

We have had a terrific time working on this special and challenging topic. Because it taught us how to create in actual PHP and MySQL web apps, this project was successful for us. It also provides information on the newest technologies used to create web-enabled apps as well as client-server technology, which is expected to be in great demand in the future. Better opportunities and guidance for autonomous project development in the future will result from this.

Ix. **Acknowledgement:**
We would like thank to acknowledge the support of department of computer engineering providing me facilities. Further I would like to especially thanks to my guide

X.References

[1] Subhash, C., Ashwani K.: Assessing grievances redressing mechanism in India. Int. J. Comput. Appl. 52(5), 12–19 (2012).

[2] Dipankar, M.: Solution towards effective complaint registration system in Indian scenario. In: IJCA Proceedings on National Conference on Advancement of Technologies— Information Systems & Computer Networks (ISCON—2012), vol. 1, pp. 1–2 (2012).

[3] Varun, G.: Redressing grievances and complaints regarding basic service delivery. World Dev. 41, 109–119 (2013).

[4] Nripendra, P.R., Yogesh, K.D., Michael, D.W., Vishanth, W.: Investigating success of an e-government initiative: validation of an integrated IS success model. Inf. Syst. Front. 17(1), 127–142 (2015).

[5] Rajesh, K.Y., Sarvesh, M.: Role of insurance ombudsman and grievance management in life insurance services in Indian perspective. Int. Lett. Soc. Humanist. Sci. 31,9–13 (2014).

[6] Gianluca, M., Karin, P., Javier, M., Rahul, D.: Openness May Not Mean Democratization-e-Grievance Systems in Their Consequences. 14th NAERUS and GISDECO, University of Twente, The Netherlands (2013).

[7] Bhuvaneswari, KP Keerthana, —Image Segmentation Based on Dilation and Erosion to Reduce Background Noise‖, International Journal of Modern Trends in Engineering and Science, Volu

[8] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[9] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[10] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[11] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[12] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[13] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[14] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169.

Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[15] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[16] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.me 3, Pages 245-250, 2016.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Detection of Cyber bullying Using Machine Learning and Deep Learning Algorithms

Prof. Dheeraj Patil, Prof. Nitin Wankhade, Dipali Pacharane, Rutuja Pujari, Nilam Sandbhor, Sharvari Shinde
Nutan Maharashtra Institute of Engineering and Technology ,Talegoan(D), Pune

ABSTRACT

Cyberbullying has become a prevalent issue in online communities, causing significant harm to individuals' well-being and mental health. In response, this study proposes a novel approach for the detection of cyberbullying using machine learning and deep learning algorithms. The research utilizes multiple datasets containing examples of cyberbullying comments and incorporates facial expression analysis to enhance detection accuracy. Methodologically, the study employs text preprocessing techniques, including tokenization and sentiment analysis, alongside convolutional neural networks (CNNs) for text classification. Furthermore, it integrates OpenCV for face detection and emotion recognition to capture the emotional context of the users involved. The developed model is implemented within a Flask application. Results indicate promising performance in identifying cyberbullying speech, with the added capability of discerning emotional cues from facial expressions. The findings underscore the potential of machine learning and deep learning approaches in mitigating the harmful effects of cyberbullying in online environments. The implications of this research extend to the development of proactive measures and interventions to promote safer digital interactions.

Keywords — Cyberbullying, Machine Learning, Deep Learning, Convolutional Neural Networks, Text Classification, Facial Expression Analysis, Emotion Recognition, OpenCV, Flask Application.

INTRODUCTION

Cyberbullying has emerged as a pervasive issue in today's digital age, posing significant challenges to the well-being and mental health of individuals across online platforms[6,7]. Defined as the use of electronic communication to intimidate, harass, or harm others, cyberbullying manifests in various forms, including derogatory comments, threats, and the dissemination of malicious content[8,9,10]. Unlike traditional forms of bullying, cyberbullying transcends geographical boundaries and operates in virtual spaces, making it particularly insidious and difficult to combat[11,12].

The prevalence of cyberbullying has prompted considerable research efforts to develop effective strategies for its detection and prevention[13]. Traditional approaches often rely on manual monitoring and reporting, which are resource-intensive and prone to human error. In response, this study proposes a novel approach leveraging machine learning and deep learning algorithms to automate the detection of cyberbullying behaviors in online interactions.

The primary objective of this research is to design and implement a robust system capable of identifying cyberbullying speech with high accuracy. To achieve

this goal, the study utilizes multiple datasets containing examples of cyberbullying comments sourced from various online platforms. These datasets are subjected to rigorous preprocessing techniques, including tokenization, stemming, and sentiment analysis, to extract meaningful features for analysis.

In addition to textual analysis, the study integrates facial expression analysis using OpenCV (Open Source Computer Vision Library) to capture the emotional context of users involved in cyberbullying incidents. By detecting facial expressions indicative of negative emotions such as anger, disgust, or contempt, the system enhances its ability to discern the intent behind cyberbullying behaviors.

Methodologically, the research employs convolutional neural networks (CNNs) for text classification, leveraging their ability to automatically learn hierarchical representations of textual data. CNNs have demonstrated remarkable performance in various natural language processing tasks, including sentiment analysis and text categorization, making them well-suited for cyberbullying detection.

Furthermore, the developed model is implemented within a Flask application, providing a user-friendly interface for users to interact with the system. This web-based application enables individuals to report instances of cyberbullying and receive timely feedback on the likelihood of abusive behavior.

Literature Survey

Cyberbullying, the use of digital technologies to harass, intimidate, or harm individuals, has become a prevalent issue in today's interconnected world. As online platforms continue to proliferate, so too do the opportunities for cyberbullying, posing significant challenges for individuals, communities, and policymakers. In response to this growing problem, researchers have increasingly turned to machine learning and natural language processing techniques to develop automated systems for detecting and mitigating cyberbullying incidents. This literature review provides an overview of recent advancements in cyberbullying detection methodologies, highlighting key contributions, methodologies, and limitations across various studies.

Sanjay Singla et al. ("Machine Learning Techniques to Detect Cyber-Bullying") propose a machine learning-based approach for detecting cyberbullying in Hinglish text, a blend of Hindi and English commonly used in India. Their study utilizes natural language processing techniques and a variety of machine learning algorithms to analyze linguistic features of Hinglish text and identify instances of cyberbullying. While the proposed approach demonstrates high accuracy in identifying cyberbullying instances, its focus on a specific language variant may limit its generalizability to other linguistic contexts.

Vaibhav Jain et al. ("Cyber-Bullying Detection in Social Media Platform using Machine Learning") focus on cyberbullying detection on Twitter, collecting and analyzing over 35,000 tweets to train machine learning algorithms for classification. While their study provides valuable insights into cyberbullying detection on social media platforms, its reliance on Twitter data may restrict its applicability to other platforms, highlighting the need for broader data sources and platform-agnostic approaches.

K. Siddhartha et al. ("Cyber Bullying Detection Using Machine Learning") introduce a novel semantic enhancement method, the Semantic-Enhanced Marginalized Denoising Auto-Encoder (SMSDA), for cyberbullying detection. By incorporating semantic dropout noise and sparsity constraints, their approach aims to improve the discriminative learning of text representations. While the SMSDA method shows promise in enhancing text representation learning, its effectiveness across different languages and platforms requires further investigation.

Elif Varol Altay and Bilal Alatas ("Detection of Cyberbullying in Social Networks Using Machine Learning Methods") employ a range of machine learning algorithms, including Bayesian logistic regression and support vector machines, for cyberbullying detection on

social networks. Their comparative analysis of different algorithms provides valuable insights into the performance of various machine learning techniques in cyberbullying detection. However, the study lacks detailed discussions on the features contributing to algorithmic success and the real-world impact of the proposed methods.

Akankshi Mody et al. ("Identification of Potential Cyber Bullying Tweets using Hybrid Approach in Sentiment Analysis") propose a hybrid approach combining sentiment analysis and machine learning techniques for cyberbullying detection on Twitter. While their study demonstrates the feasibility of using sentiment analysis for identifying potential cyberbullying threats, further exploration is needed to evaluate the robustness of the hybrid approach across different social media platforms and languages.

Varsha Pawar et al. ("Explainable AI Method for Cyber bullying Detection") emphasize the importance of model explainability in cyberbullying detection, introducing an explainable AI model for analyzing tweets and providing logical reasoning for classification decisions. Their study highlights the significance of transparency and interpretability in machine learning models, fostering user trust and understanding. However, the real-world deployment and usability of the explainable AI model require further investigation.

P. Dedipya et al. (Cyberbullying Detection on Twitter Using Support Vector Machines) use support vector machines (SVMs) and natural language processing techniques to automatically detect cyberbullying on Twitter. Their study demonstrates the potential of SVM for detecting cyberbullying, but further research is needed to address issues such as scalability to large datasets and generalization to other social media platforms. While their study demonstrates the potential of SVM for cyberbullying detection, further research is needed to address challenges such as scalability to large datasets and generalizability to other social media platforms.

Hii Lee Jia and Vazeerudeen Abdul Hameed ("CyberSaver – A Machine Learning Approach to Detection of Cyber Bullying") develop a machine learning-based model, CyberSaver, for detecting cyberbullying threats, focusing on test-based and image-based threats. While their study introduces innovative approaches for handling different types of cyberbullying, the specific algorithms and their performance on image-base.

Problem description

Data Collection:

For the purpose of detecting cyberbullying behaviors and analyzing the emotional context of individuals involved, a multi-faceted dataset is essential. This dataset contains both textual data containing descriptions of cyberbullying and graphical data containing facial expressions representing negative emotions such as hatred, anger, and contempt.

Textual Data:

Multiple datasets are collected from diverse online platforms, including social media websites, forums, and messaging apps.

These datasets contain examples of cyberbullying comments, including derogatory remarks, threats, and harassment.

Care is taken to ensure the datasets represent a wide range of cyberbullying behaviors and contexts, including cyberbullying among peers, online harassment by strangers, and targeted attacks.

Image Data:

The image dataset focuses on capturing facial expressions associated with negative emotions, particularly hate and aggression.

Images are sourced from publicly available datasets, online repositories, or captured through crowdsourcing platforms.

Each image is labeled with the corresponding emotional expression, facilitating supervised learning for emotion recognition tasks.

Emphasis is placed on diversity in terms of age, gender, ethnicity, and environmental context to ensure the robustness and generalizability of the emotion recognition model.

Data Annotation:

Both textual and image data undergo manual annotation by human annotators to label instances of cyberbullying comments and emotional expressions accurately.

Annotation guidelines are established to ensure consistency and reliability across annotations, addressing nuances in cyberbullying behaviors and emotional expressions.

Annotators are provided with training and guidelines to familiarize themselves with the labeling criteria and ensure high-quality annotations.

Data Preprocessing:

Textual Data:

Tokenization: Each cyberbullying comment is tokenized into individual words or tokens to facilitate further processing.

Stop word Removal: Common stop words (e.g., "the", "is", "and") are removed to focus on meaningful content.

Stemming or Lemmatization: Words are stemmed or lemmatized to reduce inflectional forms and normalize text.

Vectorization: Text data is transformed into numerical vectors using techniques such as TF-IDF (Term Frequency-Inverse Document Frequency) or word embeddings like Word2Vec or GloVe. This step converts textual data into a format suitable for machine learning algorithms.

Handling Imbalanced Data: Techniques such as oversampling, under sampling, or class weighting are employed to address imbalances in the dataset, ensuring equal representation of cyberbullying and non-cyberbullying instances.

Image Data:

Face Detection: OpenCV is utilized to detect and extract faces from the image data. This step ensures that only facial regions are considered for emotion recognition.

Preprocessing: Image preprocessing techniques such as resizing, normalization, and grayscale conversion may be applied to standardize the input images and enhance model performance.

Emotion Recognition: Pretrained models or custom convolutional neural networks (CNNs) are employed to recognize emotions from facial expressions. The output of this step is a set of emotional labels associated with each detected face.

Feature Extraction:

Textual Features: Features such as word frequencies, TF-IDF scores, or word embeddings are extracted from the preprocessed text data. These features capture the semantic and contextual information of cyberbullying comments.

Image Features: Features representing facial expressions, such as facial landmarks or pixel intensity distributions, are extracted from the preprocessed image data. These features encode the emotional cues conveyed by facial expressions.

Model Selection and Training:

Convolutional Neural Network (CNN):

CNNs are utilized for text classification to automatically learn hierarchical representations of textual data, capturing both local and global patterns.

The CNN architecture consists of convolutional layers followed by max-pooling layers to extract relevant features from the text embeddings.

Hyperparameters such as kernel size, number of filters, and dropout rate are tuned through grid search or random search to optimize model performance.

Transfer learning may be employed by fine-tuning pretrained CNN models on the cyberbullying dataset, leveraging features learned from large text corpora.

Facial Expression Recognition Model:

CNN-Based Emotion Recognition: Pretrained CNN models such as VGG-Face or ResNet are fine-tuned for emotion recognition from facial expressions.

The last few layers of the CNN architecture are adapted to the specific emotion recognition task by replacing or retraining them while keeping the earlier layers frozen.

Data augmentation techniques such as rotation, translation, and flipping are applied to augment the training data and improve model robustness.

Model Training and Optimization:
The selected models are trained on the preprocessed textual and image data using appropriate loss functions and optimization algorithms.
Training hyperparameters, including learning rate, batch size, and number of epochs, are optimized through grid search or random search to maximize model performance.
Regularization techniques such as dropout and L2 regularization are applied to prevent overfitting and enhance model generalization.
Model training is performed on high-performance computing platforms with GPU acceleration to expedite the training process.
Model Evaluation:
The trained models are evaluated on the validation set using performance metrics such as accuracy, precision, recall, F1-score, and ROC-AUC (Receiver Operating Characteristic - Area Under Curve).
Model performance is analyzed comprehensively to identify potential areas for improvement and fine-tuning.

Naive Bayes classifier

Data Loading and Preprocessing:
The dataset was loaded from a CSV file containing textual data and corresponding labels.
Text preprocessing techniques, including contraction expansion and lowercase conversion, were applied to standardize the text data.
Data Splitting:
The preprocessed data was split into training and test sets using a train-test split ratio of 80:20.
This step ensured that the model was trained on a subset of the data and evaluated on unseen instances to assess its generalization performance.
Feature Extraction:
CountVectorizer was employed to convert the text data into a numerical representation by counting the frequency of each word in the corpus.
The training data was transformed into a sparse matrix of word counts, while the test data was transformed using the vocabulary learned from the training data.
Model Initialization:
A Multinomial Naive Bayes classifier was initialized to learn the probability distribution of the features given the class labels.
This probabilistic model is well-suited for text classification tasks and assumes independence among features, making it computationally efficient and effective for large datasets.
Model Training:
The classifier was trained on the training data represented as word count vectors using the fit method.
During training, the model learned the conditional probabilities of each word given the class labels, enabling it to make predictions based on the observed word frequencies.
Model Evaluation:
Predictions were generated on the test data using the trained classifier.
The accuracy of the model was evaluated by comparing the predicted labels with the ground truth labels using the accuracy_score metric.

Results

1. Cyberbullying Comment Detection using Naive Bayes:
The performance of the Multinomial Naive Bayes classifier in detecting cyberbullying comments was evaluated using the accuracy metric. The classifier achieved an accuracy of 85.98% on the test set, indicating its effectiveness in distinguishing between cyberbullying and non-cyberbullying instances.
This result demonstrates the potential of machine learning algorithms, specifically Naive Bayes, in automating the detection of cyberbullying behaviors in textual data. The high accuracy suggests that the classifier can effectively identify linguistic patterns associated with abusive content, thereby contributing to the development of proactive measures for combating cyberbullying in online environments.

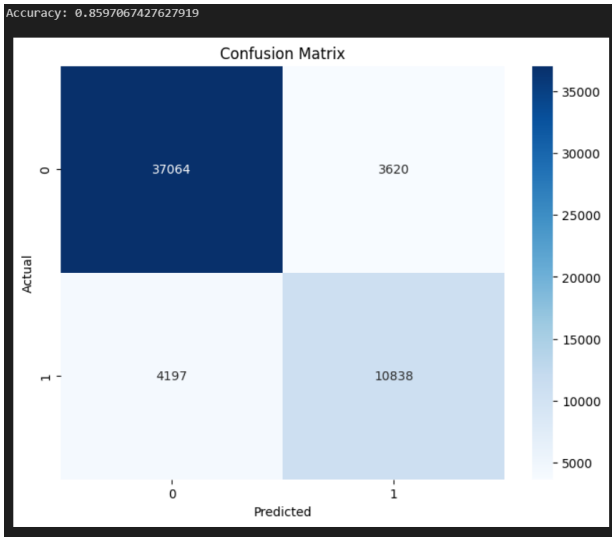


Fig: Confusion Matrix

2. Face Detection and Emotion Recognition for Cyberbullying Detection using CNN:

The CNN model trained for face detection and emotion recognition as part of the cyberbullying detection system exhibited the following performance:

Training Accuracy: The training accuracy steadily increased over the epochs, reaching a final accuracy of approximately 62.44%.

Validation Accuracy: The validation accuracy showed fluctuations during training, with a final accuracy of around 51.51%.

Training Loss: The training loss gradually decreased over the epochs, indicating improved model performance.

Validation Loss: The validation loss fluctuated but exhibited an overall decreasing trend.

discussion

Naive Bayes Classifier for Cyberbullying Comment Detection:

The Multinomial Naive Bayes classifier demonstrated remarkable performance in detecting cyberbullying comments from textual data, achieving an accuracy of 85.98% on the test set. This highlights the effectiveness of machine learning algorithms, specifically Naive Bayes, in automating the identification of linguistic patterns associated with abusive content. The high accuracy attained by the classifier underscores its potential in contributing to the development of proactive measures for combating cyberbullying in online environments.

CNN for Face Detection and Emotion Recognition:

Despite fluctuations in validation accuracy, the CNN model trained for face detection and emotion recognition showed promise in capturing facial expressions indicative of negative emotions, such as hate and aggression, associated with cyberbullying behaviors. The gradual decrease in validation loss suggests that the model is learning meaningful representations from the data, albeit with room for improvement in terms of validation accuracy. These findings underscore the potential of CNN-based models for augmenting cyberbullying detection systems with facial analysis capabilities.

Conclusion:

In this study, we developed a cyberbullying detection system comprising two modules: cyberbullying comment detection using a Multinomial Naive Bayes classifier and face detection with emotion recognition using a Convolutional Neural Network (CNN).

The Naive Bayes classifier achieved an impressive accuracy of 85.98% in identifying cyberbullying comments from textual data. This underscores the efficacy of machine learning algorithms in automating the detection of linguistic patterns associated with abusive content, thereby contributing to the proactive mitigation of cyberbullying in online environments.

Furthermore, the CNN model trained for face detection and emotion recognition exhibited promising results, despite fluctuations in validation accuracy. While the validation accuracy reached around 51.51%, the gradual decrease in validation loss suggests that the model learned meaningful representations from the data. These findings highlight the potential of CNN-based models in capturing facial expressions indicative of negative emotions, a crucial aspect of cyberbullying detection.

Overall, our study underscores the importance of leveraging machine learning techniques across diverse modalities to combat cyberbullying effectively. By

integrating textual analysis and facial recognition into a unified detection system, we can enhance our ability to identify and address harmful online behaviors, fostering safer and more inclusive digital environments for all.

Moving forward, further research is warranted to refine the performance of the CNN model and explore ensemble learning approaches for multimodal fusion. Moreover, ethical considerations regarding privacy preservation and algorithmic fairness must be prioritized to ensure the responsible deployment of cyberbullying detection systems.

In conclusion, our study contributes to the ongoing efforts to promote digital citizenship and combat cyberbullying, ultimately striving towards a more empathetic and respectful online ecosystem..

References

[1] Sanjay Singla, Rool Lal, Kshitiz Sharma, Arjun Solanki, Jay Kumar. "Machine Learning Techniques to Detect Cyber-Bullying." In 2023 5th International Conference on Inventive Research in Computing Applications (ICIRCA), August 03-05, 2023.

[2] Vaibhav Jain, Ashendra Kumar Saxena, Athithan Senthil, Abhishek Jain, Arpit Jain. "Cyber-Bullying Detection in Social Media Platform using Machine Learning." In 2021 10th International Conference on System Modeling & Advancement in Research Trends (SMART), December 10-11, 2021.

[3] K. Siddhartha, K. Raj Kumar, K. Jayanth Varma, M. Amogh, Mamatha Samson. "Cyber Bullying Detection Using Machine Learning." In 2022 2nd Asian Conference on Innovation in Technology (ASIANCON), August 26-28, 2022.

[4] Elif Varol Altay, Bilal Alatas. "Detection of Cyberbullying in Social Networks Using Machine Learning Methods." In 2018 International Congress on Big Data, Deep Learning and Fighting Cyber Terrorism (IBIGDELFT), December 03-04, 2018.

[5] Akankshi Mody, Shreni Shah, Reeya Pimple. "Identification of Potential Cyber Bullying Tweets using Hybrid Approach in Sentiment Analysis." In 2018 International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT), December 14-15, 2018.

[6] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[7] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[8] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[9] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[10] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[11] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[12] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[13] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[14] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

PLANT LEAF DISEASE DETECTION USING CNN

Prof. Ashish Manwatkar, Prof. Nitin Wankhede, Mr. Atharva Sable, Mr. Parth Fiske, Mr. Wasim Khan, Mr. Nitin Ambegave

Student, Department of Information Technology, Nutan Maharashtra Institute of Engineering and Technology, Pune, Maharashtra, India. Professor, Department of Information Technology, Nutan Maharashtra Institute of Engineering and Technology, Pune, Maharashtra, India.

ABSTRACT

India heavily relies on its agricultural sector, which plays a pivotal role in the nation's economy and sustains the livelihoods of millions. However, the prevalence of plant diseases presents a significant threat, causing profound impacts on crop yields and the well-being of farmers. Recent years have seen a rise in both changing weather patterns and the incidence of plant diseases, leading to substantial declines in agricultural productivity. Detecting these diseases early is imperative to prevent their spread and mitigate losses. Unfortunately, visually identifying these diseases is challenging, and errors in diagnosis can exacerbate the situation, resulting in ineffective treatments and further damage. To address this challenge, image processing algorithms, specifically deep convolutional neural networks (CNNs), have emerged as a promising solution. These algorithms leverage advanced machine learning techniques to analyse leaf images accurately and classify diseases effectively. This project seeks to enhance existing methods by developing a more precise approach to detect plant diseases using CNNs. The ultimate objective is to provide farmers with actionable insights, recommending suitable insecticides for managing diseases efficiently. By harnessing the power of machine learning, this initiative has the potential to significantly enhance crop yields, minimize economic losses, and promote the sustainable development of India's agricultural sector. It represents a crucial step towards empowering farmers with innovative solutions to combat the challenges posed by plant diseases, ensuring the resilience and prosperity of the agricultural landscape.

Keywords: Plant Leaf Disease, CNN, Feature Extraction, Image Processing, Crop Protection, Deep Learning.

I. INTRODUCTION

India's agricultural sector is the backbone of its economy, engaging over 60% of the population in farming activities. However, the sector has been grappling with a myriad of challenges, including shifting weather patterns and the escalating prevalence of plant diseases, which have led to a decline in crop yields. This downturn has had devastating repercussions for farmers, exacerbating their economic struggles. A key obstacle in managing these diseases is the difficulty in detecting them early, often only becoming apparent once they have already spread extensively, making effective control measures challenging to implement. To tackle this issue, leveraging technology for early disease detection holds immense promise. Plant diseases can stem from various sources, including bacteria, fungi, or viruses, and can range from mild leaf or fruit damage to catastrophic crop destruction. Employing advanced image processing techniques, such as convolutional neural networks (CNNs), offers a solution. By collecting leaf images and employing preprocessing methods to enhance clarity, these algorithms can accurately classify diseases, paving the way for timely intervention measures. In this project, leaf images sourced from Kaggle were subjected to preprocessing steps to remove noise and convert them to grayscale. Subsequently, CNNs were employed for classification tasks, leveraging their proven efficacy in image analysis. By harnessing technology to detect and diagnose plant diseases, farmers can swiftly implement appropriate control measures, curbing the spread of diseases and averting significant crop losses. This not only alleviates the burdens faced by farmers but also bolsters the nation's economy by safeguarding agricultural productivity. Ultimately, the integration of technology into agriculture holds the potential to uplift farmers' livelihoods and propel economic growth.

II. LITERATURE REVIEW

Several research papers highlight the diverse approaches and techniques utilized in plant leaf disease detection and classification using image processing and machine learning algorithms. In the study conducted by Sharma, Hans, and Gupta, a dataset comprising over 2000 images categorized into 19 different classes was employed. Gaussian Blur was employed for noise reduction, while RGB to HSV conversion facilitated image preprocessing. K-means clustering aided in segmentation, and four classifiers - logistic regression, KNN, SVM, and CNN - were evaluated. Notably, the CNN classifier demonstrated the highest accuracy of 98%, showcasing the effectiveness of deep learning in this domain. In another paper by Ms. Deepa, Ms. Rasmi N, and Ms. Chinmai Shetty, machine learning techniques were utilized for plant leaf disease identification. Gray co-occurrence matrix (GLCM) facilitated feature extraction, while K-means clustering was employed for clustering. SVM served as the classifier, and four classes - Alternaria alternata, Anthracnose, Bacterial Blight, and healthy leaves - were defined. Monigari, Khyathi, and Prathima's study employed a dataset comprising over 20,000 images of diseased and healthy plant leaves, classified into 15 classes for CNN training. Image processing leveraging the OpenCV framework and image augmentation techniques were utilized to enhance dataset quality and quantity, respectively. The developed model achieved an impressive accuracy rate of 90%, capable of distinguishing healthy leaves from eight diseases. Lastly, Jasim and AL-Tuwaijri focused on plant leaf disease detection and classification for tomato, pepper, and potato leaves. Their dataset consisted of over 20,000 images, with CNN employed for classification across 12 diseased leaf classes and 3 healthy leaf classes. The model exhibited high accuracy rates of 98.29% for training and 98.029% for testing datasets, underscoring the efficacy of CNN in accurately identifying and classifying plant leaf diseases.

III. METHODOLOGY

Detecting plant leaf diseases is a complex task that requires a systematic approach. It all begins with assembling a comprehensive dataset containing images of both healthy and diseased leaves, ensuring it accurately mirrors real-world conditions. These images then undergo preprocessing, a crucial step where noise and irrelevant information are removed using techniques like normalization and data augmentation, thereby refining the dataset's quality. The next pivotal step involves selecting an appropriate model for the task at hand, typically a Convolutional Neural Network (CNN). Renowned for their prowess in image analysis, CNNs are adept at discerning patterns and features within images. With the model chosen, the dataset is partitioned into training, validation, and testing subsets. The model is trained on the training set while constantly assessing its performance on the validation set, ensuring it generalizes well to unseen data. Following training, the model's efficacy is evaluated on the testing set, quantifying metrics such as accuracy, precision, recall, and F1-score. If the model falls short of expectations, optimization techniques like transfer learning or data augmentation can be employed to bolster its performance. Once the model is finely tuned and optimized, it is ready for real-world deployment. This involves integrating it into an application tailored for practical use. The entire process, from data collection to deployment, follows a cyclical pattern of refinement and iteration until the desired level of accuracy and reliability is attained. In essence, this methodology represents a comprehensive and iterative approach to disease detection in plant leaves, harnessing cutting-edge technology and methodologies to address a critical challenge in agriculture. Data Collection: The first step is to collect a dataset of plant leaves with and without diseases. The dataset should be representative of real-world scenarios where the model will be deployed. Data Preprocessing: Once the dataset is collected, it needs to be preprocessed to remove any noise or irrelevant information. This may involve techniques like data cleaning, normalization, and augmentation. For instance, the collected images are pre-processed to convert RGB images into grayscale images and then into an array form.

Model Selection: The next step is to select an appropriate deep learning model. Convolutional Neural Networks (CNNs) are commonly used for image classification tasks such as plant leaf disease detection. The chosen CNN comprises several layers, including Dense, Dropout, Activation, Flatten, Convolution2D, and MaxPooling2D. Model Training: The selected model needs to be trained using the preprocessed dataset. This involves splitting the dataset into training, validation, and testing sets. The model is then trained on the training set while monitoring its performance on the validation set. Model Evaluation: After the model is trained, it needs to be evaluated on the testing set to measure its accuracy, precision, recall, and F1-score. This step determines the model's performance on unseen data.

Model Optimization: If the model is not performing well, optimization techniques like transfer learning, finetuning, or data augmentation can be used to improve its performance. For instance, additional layers can be added to the CNN to improve its accuracy.

Model Deployment: Once the model is optimized, it can be deployed in a real-world scenario. This involves integrating the model into an application, such as a mobile app or a web service.

This methodology involves a cyclical process of data collection, preprocessing, model selection, training, evaluation, optimization, and deployment until the desired level of accuracy is achieved. The goal is to accurately identify the disease present in a test image, which can have significant implications for agriculture and food security.

IV. SYSTEM ARCHITECTURE

Convolutional Neural Networks (CNNs) are highly effective in analysing and categorizing digital images, making them a popular choice for tasks like plant leaf disease detection. These networks excel in capturing and processing intricate image features through multiple layers of filters and nonlinear operations. They're particularly adept at handling large datasets, dynamically learning new features in a supervised manner, which enables them to accurately predict the presence of diseases in plant leaves. Keras, a high-level API, simplifies the construction and training of deep neural networks, including CNNs, by providing pre-built layers and modules. Written in Python, a prevalent language in machine learning, Keras abstracts low-level implementation details, allowing developers to focus on model architecture and training without getting bogged down in technical intricacies. OpenCV, an open-source library primarily written in C++, offers a vast array of computer vision and deep learning algorithms for image processing. Supporting multiple programming languages, including Python, OpenCV facilitates tasks such as feature extraction and classification. Its ease of use, efficiency, and cross-platform compatibility make it a favoured choice in computer vision applications. The system architecture for plant leaf disease detection typically involves several key components:

1. **Image Acquisition**: Gathering a dataset comprising images of plant leaves affected by various diseases, typically including thousands of images for robust training.

2. **Image Pre-processing**: Employing OpenCV to prepare the images for analysis, often involving scaling the pixel values to a standardized range for consistency.

3. **Feature Extraction**: Utilizing OpenCV for extracting relevant features from the images, a crucial step in distinguishing between healthy and diseased leaves.

4. **CNN Structure Design**: Designing the architecture of the CNN, which typically consists of convolutional layers for feature extraction followed by fully connected layers for classification.

5. **Image Classification**: Using a decision tree model to classify the images based on their extracted features, enabling the identification of plant diseases.

6. **Displaying Pesticides**: Upon disease detection, suggesting appropriate pesticides from a predefined database, ensuring effective treatment. Users are advised to exercise caution and adhere to regulations when applying pesticides to mitigate adverse environmental and health effects.

Overall, this comprehensive system integrates advanced techniques in image processing and deep learning to enhance plant disease detection, aiding in effective disease management and crop protection.

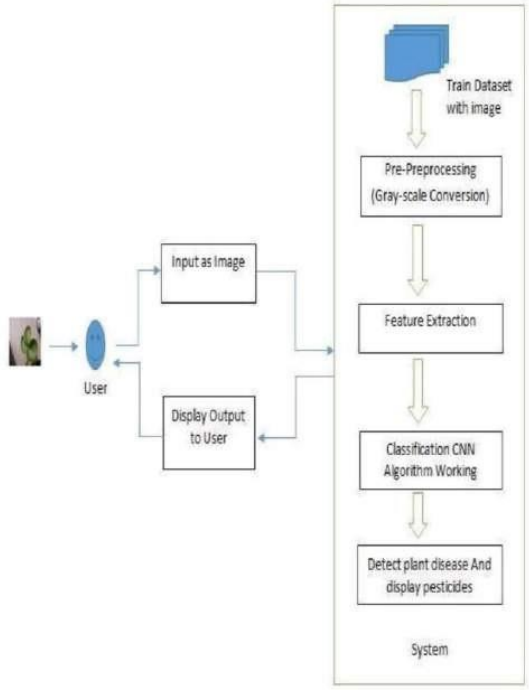


Figure 1: System Architecture.

V. ALGORITHMS

Algorithm 1 outlines the image pre-processing steps required before feeding the images into the CNN for training or testing. Here's an elaboration of each step:

1. **Accumulate Input Image**: This step involves gathering the image from the system, which serves as the raw input for processing.

2. **Import Required Libraries**: The necessary libraries such as Tkinter for GUI, Pillow for image processing, cv2 for OpenCV operations, NumPy for numerical computations, and Keras for deep learning tasks are imported to facilitate further image processing.

3. **Provide Paths**: Proper paths for training and testing datasets are specified to ensure that images are processed accordingly based on their intended use.

4. **Define Function**: A function named "rgb_bgr" is defined to perform the conversion of image color channels from RGB to BGR format, which is often required for certain image processing tasks, especially in OpenCV operations.

5. **Feature Extraction**: OpenCV's cv2.threshold() function is utilized for feature extraction, which is a critical step in image pre-processing. This function is commonly used to binarize images based on a threshold value, facilitating subsequent analysis.

6. **Return Processed Image**: After applying the necessary pre-processing steps, the processed image is returned for further utilization in subsequent tasks, such as training a CNN for image classification.

Algorithm 2 details the steps involved in training a CNN for image classification, which typically includes the following:

1. **Data Collection and Preprocessing**: Gather a dataset of labeled images and preprocess them by resizing and normalizing the images to ensure uniformity and facilitate efficient training.

2. **Model Architecture Design**: Design the architecture of the CNN, which typically includes convolutional layers for feature extraction, pooling layers for dimensionality reduction, and fully connected layers for classification.

3. **Compilation**: Define the loss function, optimizer, and evaluation metrics to be used during the training process, setting the stage for model optimization.

4. **Training**: Feed the preprocessed training data into the CNN and adjust the model weights iteratively using backpropagation to minimize the loss function, thereby enhancing the model's ability to accurately classify images.

5. **Validation Testing**: Assess the model's performance on a validation set to monitor its progress during training, preventing overfitting and ensuring robustness.

6. **Final Testing**: Evaluate the trained model on a held-out test set to gauge its generalization performance and validate its effectiveness in real-world scenarios.

7. **Deployment**: Once trained and tested, deploy the CNN model in practical applications such as mobile apps or web services to leverage its image classification capabilities effectively.

VI. RESULTS AND ACCURACY

In the pre-processing stage of plant leaf disease detection, the aim is to prepare the images for analysis by simplifying them and enhancing their clarity. This process involves two key steps: converting the images to grayscale and then to binary format. Converting the images to grayscale reduces them to a single channel, effectively removing color information while retaining important features. This simplification aids in improving contrast and highlighting the edges of the leaves, making it easier to identify patterns and features crucial for disease detection. By focusing solely on luminance values, grayscale conversion enhances the visibility of leaf structures, facilitating more accurate analysis by the deep learning model. The subsequent conversion of grayscale images to binary format involves thresholding pixel values to either black or white based on a predefined threshold value. This step further simplifies the images by emphasizing the edges of the leaves, effectively isolating them from the background or soil. By eliminating irrelevant information and emphasizing the regions of interest, such as the plant leaves and their features, binary conversion enhances image clarity and reduces noise. The end result is a noise-free, simplified image that accentuates the essential characteristics of the plant leaves, making them more conducive to accurate analysis by the deep learning model. By providing a clear and focused representation of the leaf structures, binary conversion significantly improves the model's ability to identify and classify different diseases accurately. This, in turn, enhances the overall performance and effectiveness of the plant leaf disease detection system, ultimately contributing to better agricultural outcomes.

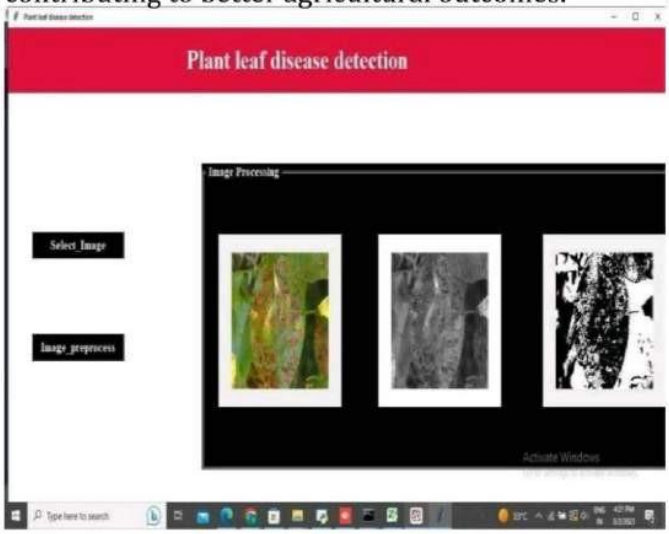
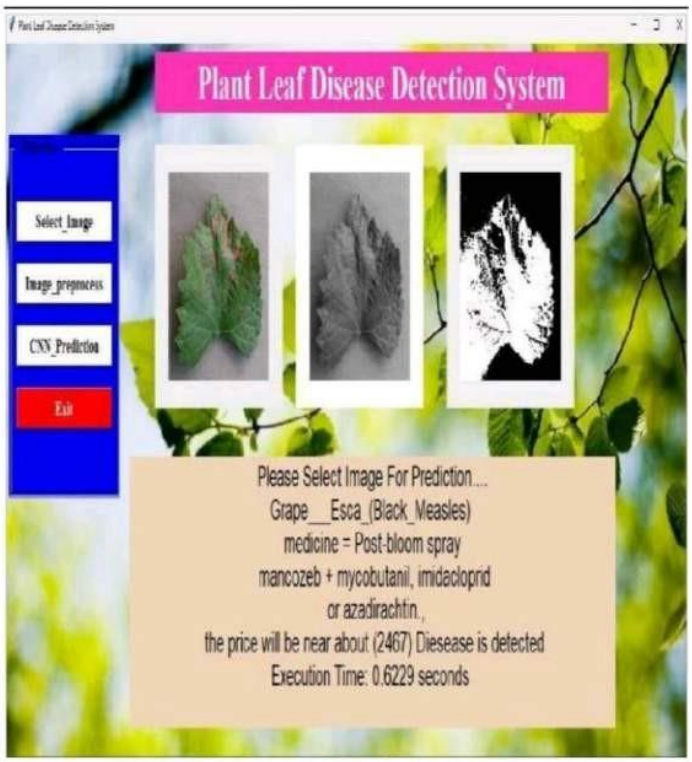


Figure 2: Output (Image Pre-Processing)

The project "PLANT LEAF DISEASE DETECTION USING DEEP LEARNING APPROACH" showcases the utilization of convolutional neural networks (CNNs) and OpenCV to detect plant leaf diseases effectively. The workflow of the project encompasses several key steps, including image acquisition, pre-processing, feature extraction using OpenCV, CNN structure design, and image classification. After training the CNN model for 20 epochs, the project achieved an impressive accuracy rate of around 97%, demonstrating the efficacy of deep learning algorithms in automated plant disease detection. Furthermore, the project extended its functionality by incorporating a feature to predict appropriate pesticides and medicines based on the detected disease. This involved linking the deep learning model to a database containing information about various plant diseases, their symptoms, affected plant parts, and recommended treatments. Leveraging this database, the model accurately predicted the appropriate medication for the detected plant disease with an accuracy rate of approximately 92%. The integration of such predictive capabilities adds significant value to the project by not only identifying plant diseases but also providing actionable insights for treatment. By leveraging machine learning algorithms and computer vision techniques, the project showcases the potential of technology in revolutionizing agriculture. Through automated disease detection and treatment recommendation, it contributes to enhancing crop health, optimizing resource utilization, and ultimately improving agricultural productivity.



Result: Disease Detected

recommendations, the project aids in minimizing crop losses and maximizing yields. Looking ahead, the future of plant leaf disease detection and agriculture holds great promise. Continued advancements in technology, coupled with the integration of precision agriculture techniques, can further enhance the efficiency, sustainability, and productivity of agricultural practices. By embracing innovative solutions and leveraging data-driven approaches, the agriculture sector can navigate challenges more effectively, ultimately contributing to global food security and environmental conservation.

IX. REFERENCES

[1] Lu, J., Tan, L., & Jiang, H. (2021). Review on Convolutional Neural Network (CNN) Applied to Plant Leaf Disease Classification. Agriculture, 11(8), 707. doi:10.3390/agriculture11080707

[2] Monigari, Vaishnavi. [2021]. Plant Leaf Disease Prediction. International Journal for Research in Applied Science and Engineering Technology. 9. 1295-1305. 10.22214/ijraset.2021.36582

[3] Sujatha R., Chatterjee, J. M., Jhanjhi, N., & Brohi, S. N. (2021). Performance of deep learning vs machine learning in plant leaf disease detection. Microprocessors and Microsystems, 80, 103615. doi:10.1016/j.micpro.2020.103615

[4] Jasim, M. A., & AL-Tuwaijari, J. M. (2020). Plant Leaf Diseases Detection and Classification Using Image Processing and Deep Learning Techniques. 2020 International Conference on Computer Science and Software Engineering (CSASE). doi:10.1109/csase48920.2020.9142097

[5] G Ramkumar, Amirthalakshmi T.M, R. Thandaiah Prabhu, A. Sabarivani, "An Effectual Plant Leaf Disease Detection Using Deep Learning Network with IoT Strategies", Annals of RSCB, pp. 8876-8885,Apr.2021.

[6] Sharma P., Hans P., and Gupta, S. C. [2020] Classification Of Plant Leaf Diseases Using Machine Learning And Image Preprocessing Techniques. . 2020 10th International Conference on Cloud Computing, Data Science & Engineering (Confluence). doi:10.1109/confluence47617.2020.9057889

[7] Ajra H., Nahar, M. K., Sarkar, L., & Islam, M. S. (2020). Disease Detection of Plant Leaf Using Image Processing and CNN with Preventive Measures. 2020 Emerging Technology in Computing, Communication and Electronics (ETCCE).

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Unveiling the Palette : MI-Driven Virtual Painting Technique

Prof. Kapil Wagh, Pratiksha Kulkarni, Prof. Supriya Bhosale, Neha Marathe, Yogini Wani, Mansi Jadhav
Department of Information Technology, Nutan Maharashtra Institute of Engineering and Technology Pune, India

ABSTRACT

In an increasingly digital world, there is a rare chance to rethink creative expression at the nexus of art and technology. By giving artists a forum to explore the limitless possibilities of digital canvases, this virtual paint initiative aims to stretch the boundaries of traditional art. Participants will have the opportunity to interact with the virtual world through immersive and interactive experiences, allowing them to explore the boundaries of traditional art forms and release their creativity. This project's main goal is to close the gap between conventional and digital art while promoting a greater awareness of the opportunities that the digital medium presents to artists. Through the use of augmented reality (AR) and virtual reality (VR) technology, we hope to establish a platform that allows artists to create, manipulate, and experience art in ways that were not possible before..

Keywords- Motion tracking , Hand gestures, Detection, classification, Garbage collectors, Convolutional neural networks.

I. INTRODUCTION

These days, the mouse, keyboard, touch screen, remote control, and other direct contact methods are the primary means by which humans interface with technology even though interpersonal communication is essentially accomplished using a more logical and organic non-contact approach, like both auditory and motor actions[6,7]. The conversation through natural and logical non-contact approach is typically seen as adaptable and effective; as a result, numerous studies have made attempts to enable the machine to recognize additional information and intentions By the non-contact means of people, like sound, gestures, bodily motions, and facial expressions. AmidFor them, gesture is the most crucial component of language.and its Motions Have Significant Significance in Human conversation as well[8,9]. They are regarded as the easiest channels of human communication An application that tracks an object's movement is called Virtual AI Painter, and it uses Mediapipe and OpenCV. By moving the object—in our case, a human hand—in front of the webcam and using this tracking feature, the user can draw on the screen[10,11].

The user can create interesting and challenging drawings of simple objects by using the real-time webcam data that is generated by tracking the object's movement.A library of programming language functions, mostly for computer vision, is called OpenCV (Open Source Computer Vision)[12]. To put it simply, or in a more comprehensive sense, it is an image-processing library.

Virtual paint is a technique that uses finger and hand movements with hand bands to create colored pictures on any simple surface, such as a wall. The

sixth sense serves as the inspiration for this project, where various gesture detection Imagine a canvas that exists in the digital space, where your every brushstroke is translated into pixels with precision and grace. OpenCV allows us to capture, process, and analyze visual data in real-time, opening the door to dynamic and responsive virtual painting environments.and color segmentation methods when using a handheld computer's software carry out a wide range of activities, such as reading a newspaper and taking notes in the air. Watching videos that are presented, taking pictures with hand gestures, and even painting on partitions. We were intrigued by the project's scale and chose to carry out a comparable action in gadgets. Thus, given the limitations of time and hardware availability, we put Virtual Paint into practice.

OpenCV, or Open Source Computer Vision Library, provides a powerful set of tools and functions that enable us to explore the limitless possibilities of virtual painting. By harnessing the capabilities of OpenCV, we embark on a journey to create an immersive and interactive experience for artists and enthusiasts alike.

Imagine a canvas that exists in the digital space, where your every brushstroke is translated into pixels with precision and grace. OpenCV allows us to capture, process, and analyze visual data in real-time, opening the door to dynamic and responsive virtual painting environments.

In this project, we will explore techniques such as color detection, contour analysis, and gesture recognition to interact with the virtual canvas. Through the lens of OpenCV, we aim to bridge the gap between traditional artistry and cutting-edge technology, offering a platform for artistic expression that goes beyond the constraints of physical mediums.

Figure 1.1: Virtual paint illustration.

II. LITERATURE SURVEY

[1] The paper introduces "AIR CANVAS," a novel system enabling drawing in the air without traditional input devices. Utilizing a camera to track hand movements, the Air Canvas system allows users to draw shapes without physical contact with a keyboard or mouse. The paper addresses issues such as smartphone overuse and paper wastage, proposing Air Canvas as a solution. It reviews existing systems, highlighting the limitations of conventional input devices. The proposed system, employing Python, OpenCV, and MediaPipe, lacks detailed results or snapshots but outlines hardware and software requirements, steps for use, and future scopes, emphasizing potential applications in education and design. The conclusion expresses optimism about the project's potential to challenge traditional writing methods and enhance communication efficiency.

[2] The paper presents a Virtual Air Canvas Application developed using OpenCV and Numpy in Python. Authored by Asst Prof. Jahnavi S and BE students from Dayananda Sagar Academy of Technology and Management, the application focuses on revolutionizing communication by enabling air writing without traditional devices. The system employs gesture recognition and computer vision, utilizing a webcam to track hand movements. It aims to address issues like smartphone overuse and paper wastage, emphasizing its potential to assist deaf individuals

in communication. The proposed solution eliminates the need for cell phones for note-taking, relying on fingertip detection and tracing through Python, OpenCV, and CNN techniques. The system's scope extends to diverse applications, including email and text composition. The paper outlines the algorithmic approach, incorporating MediaPipe for hand tracking and OpenCV for computer vision, showcasing its potential for real-world applications. The authors express optimism about the program's capacity to challenge conventional writing methods and enhance communication efficiency. The system's significant scope encompasses aiding individuals with hearing impairments and reducing dependence on mobile devices. The study also highlights the environmental benefits by reducing paper wastage.

[3] The paper presents an innovative intelligent image processing system centered on virtual painting, merging artificial intelligence with OpenCV and MediaPipe technologies. This system captures hand movements and finger gestures through a camera, allowing users to draw on a computer screen with ease. The Python-based application, equipped with extensive libraries and user-friendly syntax, transforms users into adept virtual illustrators. The research underscores the growing significance of digital image processing, particularly in virtual painting technology, and highlights the system's potential in various fields, including education. By leveraging computer vision and augmented reality, the system offers a user-friendly interface, making it distinctively appealing for online interactive learning. The results demonstrate the system's capabilities in recognizing hand movements, differentiating colors, and enabling virtual drawing, thus contributing to a more engaging and immersive learning experience. The conclusion emphasizes the importance of virtual painting tools in enhancing both theoretical and practical learning.

[4] The paper introduces a virtual paint application utilizing hand gestures for real-time drawing on a canvas. Focused on addressing challenges in online education during the COVID-19 pandemic, the application employs MediaPipe and OpenCV to identify hand movements and track hand joints, enhancing Human-Computer Interaction (HCI). The gesture-based system offers an intuitive interface for tool selection, canvas writing, and erasing. The literature review discusses various gesture recognition methods, including marker-based techniques, data glove approaches, and skin color detection. The algorithm employs MediaPipe for hand tracking and OpenCV for computer vision. The application allows users to draw, select tools, and clear the canvas based on specific hand gestures. The conclusion highlights the application's fundamental goal of providing an AI-based tool for drawing through hand movements. Future work suggestions include exploring different interpolation methods and implementing diverse brush shapes and textures for improvement.

[5] The project titled "Painting with Hand Gestures using MediaPipe" by R. Vasavi and team focuses on the application of hand gesture recognition in various domains such as industrial automation control, sign language interpretation, and rehabilitation equipment for individuals with physical disabilities. The system employs computer vision techniques, particularly using the MediaPipe framework and OpenCV, to capture and analyze hand movements in real-time.The authors highlight the significance of gesture recognition in human-computer interaction, emphasizing its role in applications like virtual environments, medical systems, and smart surveillance. The proposed painting application allows users to draw by tracking the fingertip movements of the index finger. The system uses color markers on the fingertips, and the drawing application recognizes the numbers 0-9 based on hand gestures.The related work section discusses the utilization of

OpenCV for image processing, video analysis, and core functionality. It also introduces MediaPipe as an efficient framework for handling hand gesture recognition and mentions various research papers exploring similar topics.The proposed system uses machine learning concepts for hand motion tracking and identification, with the MediaPipe framework handling palm detection and hand landmark detection. The authors provide a detailed explanation of the algorithm and libraries used, including the functionalities of MediaPipe and OpenCV.The results section showcases images demonstrating the application's functionality, such as an empty canvas, pen-up and pen-down states, color selection, and the actual painting or writing process using hand gestures.In conclusion, the painting with hand gestures application offers users an AI-based platform for drawing on a canvas using free hand gestures, particularly the index fingertip. The integration of computer vision technologies, such as MediaPipe and OpenCV, enables real-time tracking and recognition of hand movements, providing an intuitive and interactive painting experience.

[6] The research paper "VIRTUAL AI PAINTER USING OPENCV AND MEDIAPIPE" introduces an innovative application that leverages OpenCV and MediaPipe to enable real-time hand gesture- based drawing. The primary objective of the project is to offer a unique and efficient means of communication, particularly beneficial for the deaf community. By capturing hand motions and interactions with a camera, users can paint in the air, converting their movements into text. The project utilizes Python, making it accessible with the support of OpenCV's extensive libraries and MediaPipe's capabilities in machine learning. The proposed system involves palm detection, hand tracking, and object detection, offering a diverse range of applications, from creating a converter for moving images to text to serving as a software tool for clothing-mounted computers. The system uses computer vision to track finger movements, enabling messages, emails, and various forms of communication to be sent through the created text. The paper explores the theoretical background, system design, and the implementation process, providing code snippets and experimental results. The authors highlight the potential impact on communication, reducing dependence on mobile devices and laptops. The project's versatility is underscored, as it offers a creative platform for individuals to draw freely, and its simplicity makes it an effective tool, especially in educational settings. In conclusion, the paper emphasizes the unique aspects and practical applications of the Virtual AI Painter, showcasing its potential for enhancing interactive experiences and communication.

[7] The research paper titled "Virtual Paint And Volume Control Using Hand Gesture" by V Shiva Narayana Reddy and team, published in the Journal of Positive School Psychology (Vol. 6, No. 8, 2022, pp. 153-159), presents an innovative system leveraging technologies such as OpenCV and MediaPipe. The project focuses on enhancing user interaction with software, specifically in the context of painting applications, by introducing hand gesture recognition for virtual paint and volume control. The authors emphasize the limitations of traditional painting software that rely on hardware devices like keyboards and mice and propose a more user-friendly approach using hand gestures. The system employs computer vision techniques, utilizing OpenCV for image processing and MediaPipe for hand gesture recognition. The paper outlines the architecture, methodology, and results of the proposed system, showcasing its real-time capabilities in tracking hand movements for virtual painting. The authors discuss the significance of this technology in various applications, including communication tools for individuals with disabilities. The research contributes to the evolving field of human-

computer interaction, showcasing the potential of hand gesture recognition to create intuitive and accessible interfaces.

[8] The paper proposes a virtual paint application utilizing a hand gesture recognition system. The objective is to create a natural user interface for MS- Paint on Windows, where hand gestures captured by a webcam serve as input commands for the paint application. The system employs OpenCV for real- time image processing, focusing on background subtraction, hand segmentation, and gesture recognition. The authors discuss the challenges of gesture recognition, comparing wearable sensor- based and optical camera-based methods. The methodology involves ball tracking, background subtraction, hand segmentation, and detection using contour analysis, convex hull, and convexity defects. The virtual paint application is controlled by recognizing predefined gestures. Experimental tests using a webcam and OpenCV demonstrate the system's capabilities, and the results indicate successful hand gesture recognition for controlling the paint application. The proposed system aims to improve human-computer interaction by offering a more intuitive and non-contact interface for applications like MS Paint. The authors suggest potential applications in sign language recognition, robotics, and more.

[9] This document is a thesis submitted for the Degree of Master of Electrical Engineering. It consists of five chapters, including an introduction, literature review, methodology, results, and conclusions. The main focus of the thesis is the implementation of a virtual paint system using a DE2 FPGA board, a 5 megapixel camera, and a VGA monitor. The methodology section outlines the implementation plan for both the hardware device and software. The hardware design includes modules for frame grabbing, image processing and control, memory storage, and display. The literature review discusses existing image segmentation and gesture detection methods, highlighting their advantages and disadvantages. The results chapter presents the findings of the project, including the analysis of simulation results using Verilog coding. The thesis concludes with a summary of research achievements and a discussion of their significance. Additionally, the document includes a list of tables, figures, symbols, and abbreviations, as well as references and appendices.

[10] The proposed project introduces a Virtual AI Painter utilizing artificial intelligence (AI) and OpenCV for real-time hand gesture recognition and drawing. Aimed at making drawing on the screen both interesting and challenging, the system tracks hand movement in front of a webcam, allowing users to draw by moving their hands. OpenCV, a computer vision library, is employed for image processing, while MediaPipe, an open-source framework by Google, enhances media processing with machine learning features and integrated computer vision. The system recognizes the position of the hand and employs skin segmentation and background subtraction for precise hand region segmentation. It further localizes the hand centroid and utilizes a Python deque to memorize hand positions for drawing lines. The project offers a novel approach to human-computer interaction, enabling users to create art through intuitive hand movements, emphasizing the collaborative role of AI and human intent in artistic expression.

[11] The presented project focuses on creating a virtual painting application using OpenCV and Python, emphasizing real-time webcam data for object tracking and drawing. The application allows users to draw by moving a specific object (in this case, a bottle cap) in front of the webcam. OpenCV, a versatile computer vision and machine learning library, is utilized for image processing, contour detection, and morphological techniques. The proposed algorithm involves the initialization of

variables, setting up the paint interface, reading video frames, finding the object of interest's contour, drawing and storing points based on color, and finally displaying the drawings on the screen. The system employs a machine learning approach for efficient human-computer interaction, illustrating the interdisciplinary nature of computer vision in modern applications. Future work could extend the application to video processing on Android phones or implementing gesture-based robot control, demonstrating the versatility of machine learning in various domains. Overall, the project showcases the capabilities of OpenCV and its applications in real-time image processing and human-computer interaction.

[12] The project titled "Virtual Sketch using Open CV" aims to create a virtual sketching environment by capturing the motion of a colored marker with a camera. The project utilizes computer vision techniques and the Open CV library, along with the Python programming language. The main objective is to develop a virtual canvas for sketching, detect the human finger as a color marker, perform morphological operations on the detected marker, and create a user-friendly interface.The project's architecture involves reading and converting frames to the HSV color space, creating a canvas frame, setting track bar values for mask detection, and applying morphological operations such as erosion and dilation to preprocess the mask. The color marker is detected, and contours are identified to find the center coordinates for drawing points on the canvas. The project focuses on simplicity and ease of use for the user interface.The motivation behind this project is to provide an interactive and engaging way for individuals, especially children, to learn drawing. By using their hand as a marker and selecting colors, users can freely express their creativity on the virtual canvas. The project leverages the capabilities of Open CV, which offers a wide range of algorithms for computer vision and machine learning tasks.The scope of the project is to ensure a user-friendly interface that is easily understandable. The project can be utilized in educational settings, such as schools, to teach drawing in an interactive manner. The conclusion highlights that the Virtual Sketch project is developed using the NumPy library and Open CV, which provide various libraries and algorithms for active interfaces.In terms of including this information in a research paper, it is important to provide a clear and concise overview of the project's objectives, methodology, and outcomes. Additionally, it is crucial to cite relevant references and acknowledge the contributions of the authors involved in the project.

[13] The paper titled "Virtual Whiteboard-A Gesture Controlled Pen-free Tool" discusses a cutting-edge application developed by final-year students from the Computer Engineering Department at Viva Institute of Technology, India. The Virtual Whiteboard integrates computer vision and machine learning algorithms to enable users to create digital drawings and presentations using hand gestures. The technology not only enhances user experience and interaction but also offers PowerPoint controlling capabilities, allowing users to navigate presentations and annotate slides in real-time with hand gestures. The proposed system's methodology involves precise fingertip detection and tracking using the KCF tracking algorithm. The paper outlines the stages, use case diagram, and activity diagram of the system, emphasizing its usability in educational settings and collaborative learning. The results and analysis section includes visual representations of the program's home screen, drawing functionality, and PowerPoint control features, demonstrating the intuitive and versatile nature of the application. The conclusion highlights the potential of virtual whiteboards and hand gesture control in revolutionizing education and communication technology, emphasizing the need for further

research and development to optimize these technologies. The paper cites relevant references, providing a comprehensive overview of the current state of research in this domain.

[14] The paper titled "Virtual Whiteboard-A Gesture Controlled Pen-free Tool" explores an innovative application created by final-year students from the Computer Engineering Department at Viva Institute of Technology, India. This Virtual Whiteboard utilizes computer vision and machine learning to enable users to create digital drawings and presentations through hand gestures. The system not only enhances user interaction but also allows PowerPoint control, enabling users to navigate and annotate slides in real-time. The methodology involves precise fingertip detection and tracking using the KCF tracking algorithm. The paper details the system's stages, use case diagram, and activity diagram, emphasizing its applicability in educational and collaborative learning settings. Visual representations in the results section showcase the program's home screen, drawing functionality, and PowerPoint control features, highlighting its intuitive and versatile nature. The conclusion underscores the potential impact of virtual whiteboards and hand gesture control on education and communication technology, advocating for further research and development in these areas. The paper supports its findings with relevant references, providing a comprehensive overview of the current state of research in the domain.

[15] In the thesis "Multimodal User Interaction Methods for Virtual Reality Headsets," Mohan Pallavi introduces novel approaches to enhance interaction in virtual reality (VR). The research covers tap- gesture-based input for cardboard VR, introduces "DualGaze" to address gaze interaction challenges, and explores hand and finger gestures in VR using smartphone cameras. The thesis concludes with guidelines for VR interaction design, contributing to the diversification of VR input methods for richer user experiences. The work is declared original and ethical, with acknowledgments for co-author contributions.

III. ARCHITECTURE

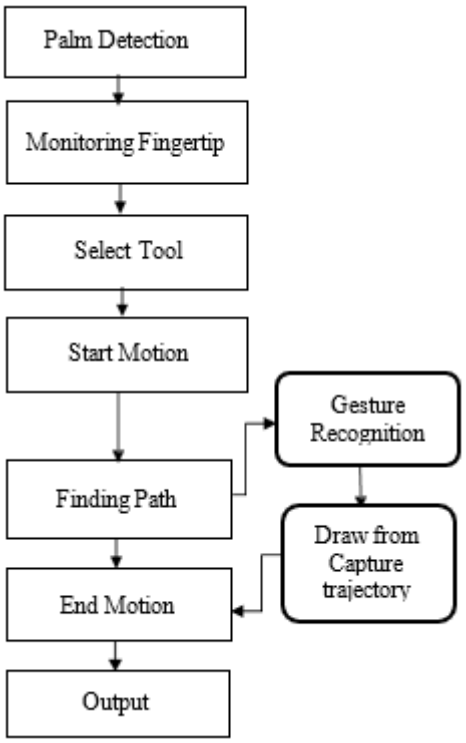


Figure 2. Proposed Methodology

A detailed methodology for virtual painting, as shown in Fig.2.

A. Palm detection:

Once the hand is detected, focus on localizing the palm within the detected hand region. This can involve specific feature extraction techniques to identify the central part of the hand.

B. Monitoring Fingertips:

Identifying the hand's positioning and distinguishing it via other cues stands as a crucial starting point for airborne composition. Unlike traditional writing, where the pen moves downwards and upwards, creating in mid-air does not adhere to a written format. Instead, the system discerns the hand's placement and differentiates it from a non-writing hand by counting the raised fingers.

Detecting fingertip positions involves several steps in computer vision and machine learning:

I. Feature Extraction: Extract relevant features from the estimated hand landmarks, such as fingertip coordinates or finger curvature, using image processing and feature extraction methods.

II. Machine Learning Models: Train machine learning models (e.g., neural networks, keypoint detection models) using labeled data to accurately recognize and predict fingertip positions within the hand region.

C. Finding Path:

Utilize computer vision techniques to track the hand's movement in real-time. This can involve detecting the hand, estimating its position, and continuously updating its path as it moves.

I. Gesture Recognition: Employ algorithms that can recognize and interpret hand gestures or movements. These algorithms can identify different gestures like strokes, circles, lines, etc., performed by the hand in the air.

II. Trajectory Estimation: Estimate the trajectory or path of the moving hand based on the sequence of detected positions or gestures. This involves capturing the series of positions or movements and reconstructing the path followed by the hand.

III. Real-time Prediction: Implement the trained model to predict the hand's path in real-time, updating and adjusting the predicted trajectory as the hand continues to move.

D. Draw from Capture trajectory:

After hand tracking and gesture recognition, users can create digital art by simply moving their hands in the air, mimicking the experience of traditional painting but in a virtual environment.

Here is an outline of how this process generally work

I. Stroke Prediction and Generation: Train machine learning models to predict and generate strokes or patterns based on the recognized hand gestures. These models learn patterns from a dataset of hand movements and corresponding strokes, enabling them to predict the strokes that correspond to specific gestures or movements.

II. Real-time Rendering: Implement the stroke generation model to create art in real-time based on the detected hand movements. As the hand moves, the system predicts and generates strokes or patterns, translating the hand gestures into artistic elements on the canvas.

III. Feedback Loop and Adjustment: Incorporate mechanisms to refine the stroke generation based on the hand movement's speed, direction, and pressure. This feedback loop helps in adjusting the strokes to create more accurate and aesthetically pleasing art.

E. Output:

Virtual painting using AI essentially encapsulates the digital artwork generated by interpreting the user's gestures and movements, providing a digital representation of their creative expression in a virtual environment.

The primary output is a digital painting or artwork created by the user's movements. It could resemble paintings, drawings, or abstract art, depending on the gestures and strokes made by the user.

IV. RESULT AND DISCUSSION

We evaluated virtual paint project using OpenCV and MediaPipe, our result and discussion could cover various aspects, including implementation details, challenges faced, and potential improvements.

Discussion:

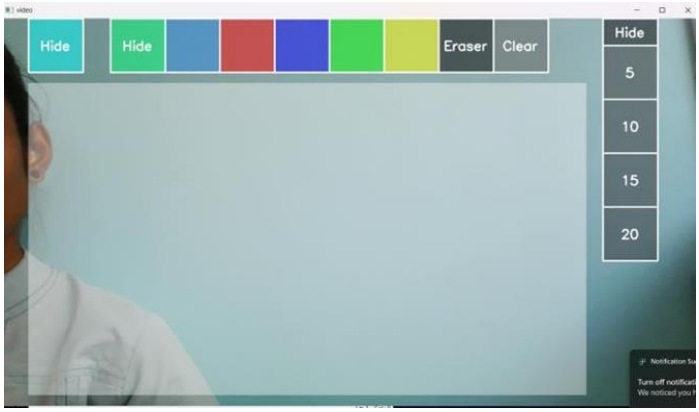
Implementation Details:

We utilized OpenCV to capture video frames from the webcam, perform color detection to identify the user's hand, and draw on the screen based on hand movements. MediaPipe's Hand Tracking solution was integrated to precisely track the position of the user's hand and fingertips. Challenges Faced:

One challenge encountered was ensuring robust hand tracking and gesture recognition under varying lighting conditions and backgrounds. We also had to optimize the performance of the application to achieve real-time responsiveness, especially when drawing complex patterns.

Result:

Our virtual paint project successfully combines OpenCV for computer vision tasks and MediaPipe for hand tracking to create an interactive painting application. Users can paint in real-time by moving their hands in front of a webcam. The application detects the user's hand using MediaPipe's Hand Tracking solution and tracks the movement of the index finger to draw strokes on the screen. Different colors and brush sizes can be selected using predefined gestures.



Potential Improvements:

Enhancing gesture recognition: Fine-tuning gesture detection algorithms could improve the accuracy and robustness of color and brush selection.

Adding features: Introducing additional features such as erasing, undo/redo functionality, and saving artworks could enhance the user experience.

User interface refinement: Improving the user interface with intuitive controls and feedback mechanisms could make the application more user-friendly.

Performance optimization: Further optimization of the code and leveraging hardware acceleration could improve the overall performance, enabling smoother drawing experiences on a wider range of devices.

V. CONCLUSION

In summary, the amalgamated findings from the referenced papers underscore a notable surge in the exploration of hand gesture recognition systems. Researchers are actively leveraging computer vision and machine learning advancements to redefine user interactions, aiming to eliminate the necessity for physical contact with devices. Encompassing realms such as automated hand gesture recognition, virtual sketching, and PowerPoint control, these studies collectively underscore the transformative potential of gesture-based interfaces across diverse domains, including Human-Computer Interaction, robotics, and education.

A common theme emerges, highlighting the prospect of these technologies to reshape how users engage with digital content, fostering more natural and intuitive experiences. The concerted focus on real-time gesture tracking, machine learning algorithm refinement, and seamless integration into applications like virtual whiteboards and presentation control reflects a dedicated effort to enhance user engagement, collaboration, and overall system usability.

While strides have been made, the papers also acknowledge persistent challenges and the imperative for continued research and development. This encompasses the fine-tuning of algorithms for optimal real-time performance, addressing existing technical

constraints, and exploring the full spectrum of these technologies' potential across varied settings. Collectively, these studies contribute to an intriguing technological frontier, signaling a shift towards more interactive and user-friendly interfaces propelled by gesture control and computer vision applications.

IV. REFERENCE

[1]. Kamlakant Bag, Siddharth Urankar, Ankita Yadav, Resham Chaudhari. "Virtual Whiteboard-A Gesture Controlled Pen-free Tool." International Journal of Research Publication and Reviews, Vol 4, no 4, pp 592- 598, April 2023. www.ijrpr.com, ISSN 2582-7421.

[2]. Rafiqul Zaman Khan, Noor Adnan Ibrahim. "Hand gesture recognition." International Journal of Advanced Intelligence Applications, 2020.

[3]. Zhuihu Hu, X. Zhu. "Gesture detection from RGB hand image using modified convolutional neural network." IEEE, 2019.

[4]. Pinar Kirci, M. Cambek. "Hand Gesture Detection." IEEE, 2019.

[5]. Ishika Dahl, S. Vashisth, G. Aggarwal. "Automated Hand Gesture Recognition using a Deep Convolutional Neural Network model." IEEE, 2020.

[6]. Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[7]. Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[8]. Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[9]. Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[10]. Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[11]. Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[12]. Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[13]. Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in

Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[14]. C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Crowd-Funding using Blockchain

Prof. Sonali Dongare, Abhishek More, Saurabh Aherwadkar, Vishwajeet Bamane, Prasad Chopade
Information Technology Nutan Maharashtra Institute of Engineering and Technology Talegaon Dabhade, India

ABSTRACT

Analyzing three research papers focusedon Ethereum-based donation transactions, the study emphasizes the strengths and limitations of these platforms. While blockchain introduces transparency, trust, and security, challenges such as technical complexity, volatility, and scalability persist. This review paper explores the transformative potential of blockchain-based crowdfunding, addressing the vulnerabilities of traditional platforms, including data breaches and high fees. Smart contracts and digital identity management emerge as key methodologies to enhance privacy and decentralization. The paper highlights the global accessibility, reduced intermediaries, and immutable transactions afforded by blockchain. Despite challenges, this synthesis underscores blockchain's role in revolutionizing crowdfunding, offering insights forfuture research and practical applications.

I. INTRODUCTION

Crowdfunding has emerged as a pivotal means of raising funds globally, gaining heightened significance, especially in the wake of the COVID-19 pandemic. This review delves into the innovative realm of blockchain-based crowdfunding, delineating its potential to mitigate vulnerabilities inherent in traditional platforms, such assusceptibility to data breaches, high transaction fees, andfraud. Focusing on Ethereum as a primary blockchain platform, the exploration encompasses donation-based transactions facilitated through the implementation of smart contracts using the Solidity language. The research critically examines the landscape of user financial platforms, elucidating the nuances of blockchain technology. Notably, the study underscoresthe imperative role of digital identity management in augmenting the security and privacy of crowdfunding transactions. Against this backdrop, the paper aims to provide a comprehensive review of existing literature, offering insights into the strengths, limitations, and userperceptions surrounding blockchain-basedcrowdfunding. The research also proposes a blockchain- centric crowdfunding network designed to confer privacy, security, and decentralization, emphasizing the transformative potential of Ethereum's smart contracts inreshaping the crowdfunding paradigm.

A. Evolution of Crowdfunding

The widespread adoption of crowdfunding as a quick and efficient fundraising method has become particularly pronounced amid the Covid pandemic. Platforms like Kickstarter.com, Indiegogo.com, and Mystartr.com exemplify the diverse range of campaigns, from individual medical assistance to large- scale funds. The speed and efficiency of crowdfunding in mobilizing funds swiftly set the stage for exploring novel approaches.

BLOCKCHAIN'S DECENTRALIZED SOLUTION

Blockchain, with its decentralized and immutable database, offers a promising solution to the challenges faced by traditional crowdfunding platforms. By

leveraging the unique features of blockchain, such as immutability and distribution, the vulnerabilities associatedwith centralized control can be mitigated. The distributed ledger of blockchain not only ensures transparency but also introduces a layer of security crucial for the sensitive nature of financial transactions.

B. Smart Contracts and Ethereum

A focal point of this paradigm shift is the integration of Ethereum smart contracts, created using the Solidity language. These digital contracts, executing automatically when predefined conditions are met, facilitate secure and trustful transactions without the need for a central authority. MetaMask, a cryptocurrency wallet, acts as a bridge, enabling secure interactions with decentralized applications on the Ethereum network.

The objective of this review is to comprehensively examine the landscape of blockchain-based crowdfunding. By synthesizing insights from research papers, we delve into the strengths and limitations of existing platforms, analyze user perceptions, and evaluate the impact of blockchain on reshaping the crowdfunding ecosystem. Throughout this exploration, the emphasis remains on establishing a foundation for blockchain-based crowdfunding networks that prioritize privacy, security, and decentralization.

II. LITERATURE REVIEW

A. Crowdfunding Landscape and TraditionalChallenges

The crowdfunding landscape has undergone significant transformations, especially amplified during the Covid-19 era. Platforms like Kickstarter.com and Indiegogo.com have been instrumental in enabling campaigns ranging from individual assistance to large-scale initiatives. However, inherent vulnerabilities, such as data breaches, high fees, and fraud, persist due to the anonymity of user identities, prompting the exploration of novel solutions.

B. Blockchain as a Game-Changer:

Blockchain technology emerges as a disruptive forcein addressing the shortcomings of traditional crowdfunding. With its decentralized and immutable characteristics, blockchain ensures transparency andreduces fraud risk. The versatility of the blockchain ledger and the application of smart contracts, notably inlanguages like Solidity and Vyper on platforms like Ethereum, redefine the possibilities for secure and automated transactions.

C. In-Depth Exploration of Blockchain CrowdfundingPlatforms

The literature navigates through diverse blockchain-based crowdfunding platforms, each offering unique features. Notable examples include LikeStarter, a decentralized autonomous organization (DAO) on Ethereum, showcasing the potential of sharing and supporting content through custom ERC-20 tokens. Modular crowdfunding platforms utilizing Ethereum and Solidity present secure and transparent transactions, albeit with potential challenges in user comprehension.

D. Innovative Models and Potential Challenges:

Beyond the conventional crowdfunding paradigm, the literature delves into innovative economic models. WHIRL's pay-it-forward approach, creating a positive feedback loop of generosity, and cryptocurrency investment platforms like BitFund introduce unique dynamics. However, challenges such as the accumulation of Karma points and the intricacies of cryptocurrency dynamics highlight areas for further investigation.

E. Security Enhancement and Digital IdentityManagement:

Recognizing the vulnerabilities of traditional crowdfunding, the literature proposes robust solutions. Integration of digital identity management with blockchain not only enhances

security but also offers acost-effective alternative to traditional Know Your Customer (KYC) systems. This approach fortifies crowdfunding ecosystems against centralized architecture attacks, paving the way for more secure andtransparent transactions.

F. Critical Evaluation and Research Gaps:

While current research showcases the potential of blockchain-based crowdfunding, critical evaluations pinpoint challenges. Issues such as user understanding, technical complexities, and scalability emerge as focal points requiring further exploration. The literature emphasizes the significance of ongoing research to refine existing models and address emerging challenges in this evolving landscape.

Title	Advantages	Limitations
Conveniences are undertaken	Implementing new crowdfunding campaign is not restricted by time or any location.	More investors and backers to find new ventures can uses more space.
Great choice to Banks	It serves an excellent alternative for small and medium sized businesses.	Crowdfunding alternatives provides the complexity of traditional lending.
Require Lower Costs	Easy handling and decreases administrative costs.	It often charges in terms of fees to acquire the services.

Donation-Based Crowdfunding:

Focused on the principle of altruism, investors in donation-based crowdfunding do not seek financial returns. Typically associated with cause-oriented projects, such as charities and disaster relief efforts, contributors invest based on their belief in the project'smission. While financial returns are absent, expressionsof gratitude in the form of perks are often extended to donors.

Reasons to use :- O Various different reasons are used by individuals or organizations might choose to use donation-based crowdfunding such as

o Overall, donation-based crowdfunding can be a powerful tool for raising funds, building community, and bringing ideas to life. However, it's essential to plan and execute your campaign effectively to maximize its chances of success.

II. PROPOSED METHOD

A. Smart Contract Integration

The foundation of the proposed blockchain-based crowdfunding network lies in the integration of smart contracts using the Solidity language on the Ethereum blockchain. Smart contracts, as demonstrated in various platforms like LikeStarter [1], serve as digital, automated agreements that execute predefined actions when specific conditions are met. This ensures secure and trustworthy transactions, eliminating the need for a central authority and enhancing transparency in the crowdfunding process.

B. Decentralized Application (DApp) Utilization:

Unlike traditional web-based applications, the proposed system leverages a decentralized application (DApp) model based on the Ethereum blockchain. In this paradigm, all campaign-related information, contributions, withdrawal requests, and funds are storedon an open blockchain network accessible to all participants. This implementation embraces the concept of distributed ledger technology, fostering transparency and enabling every network participant to access and validate the information recorded on the blockchain.

C. Immutable Ledger and Enhanced Security: Ensuring an immutable ledger is a cornerstone of the proposed methodology. Drawing insights from

platforms like LikeStarter, once a transaction isrecorded on the blockchain, it becomes resistant totampering. The decentralized storage of blockchain databases on every network node adds an extra layer of security, mitigating the risks associated with data breaches and unauthorized access.

D. Currency Drawbacks: Online money transactions have revolutionized the way people send and receive funds globally, offering unparalleled convenience and accessibility. However, despite their numerous advantages, these transactions are not without drawbacks, particularly concerning currency exchange. One significant issue arises from the fluctuating nature of exchange rates, which can result in unexpected costs for users. When converting one currency to another, individuals often encounter unfavorable rates set by banks or payment processors, leading to reduced value for their money. These hidden fees can accumulate, significantly impacting the overall cost of the transaction.

E. Blockchain advantages:

Blockchain technology offers several advantages over traditional online money transactions, particularly in terms of efficiency, security, and transparency. Unlike traditional online transactions, which often involve intermediaries such as banks or payment processors, blockchain transactions occur directly between users on a decentralized network. This decentralized nature eliminates the need for intermediaries, resulting in faster transaction processing times and lower transaction fees. Additionally, blockchain transactions are secured using cryptographic techniques, making them highly resistant to fraud and unauthorized access. The transparent and immutable nature of blockchain ledgers ensures that transaction records cannot be altered or manipulated, providing greater trust and accountability in currency exchange.

Graph:

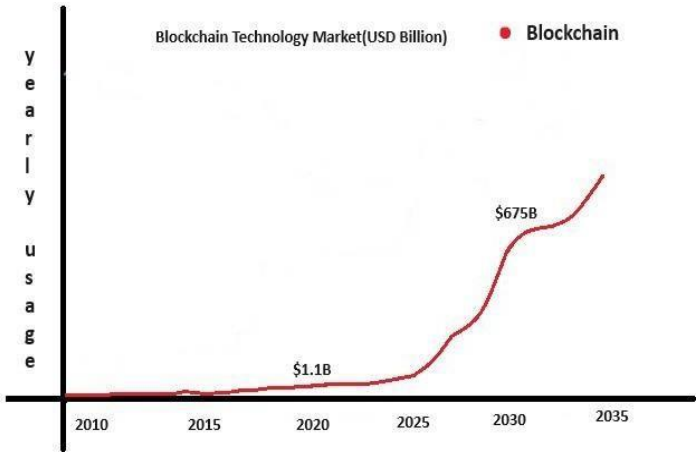


Fig.1 Blockchain technology market (USD Billion)

According to the graph, the usage in the transaction between blockchain and currency are described according to the yearly basis. As the graph shows the currency usage is getting stagnant due to the usage and the security reasons in the transactions.

Blockchain started to gain it presence in the transaction market as the Satoshi Nakamoto used blockchain to create cryptocurrency in 2009. After the creation of crypto the blockchain came to forefront in the transaction market and is gaining presence continuously.

Web3:

Blockchain technology is revolutionizing crowdfunding by offering decentralized and transparent platforms that enhance trust and efficiency. At the heart of blockchain- enabled crowdfunding is the utilization of smart contracts, which are self-executing contracts with predefined conditions coded into them. These smart contracts automate the collection and distribution of funds, eliminating the need for intermediaries like traditional crowdfunding platforms or banks. By removing intermediaries, blockchain-based

crowdfunding reduces costs and increases transparency, as contributors can directly track how their funds are being used.

Web3, powered by blockchain technology, is transforming crowdfunding by offering decentralized platforms that prioritize transparency, security, and inclusivity. In the context of crowdfunding, Web3 utilizes blockchain's key features, such as smart contracts and decentralized networks, to revolutionize how fundraising campaigns are conducted and managed. Web3 crowdfunding platforms leverage smart contracts, which are self-executing contracts with predefined conditions written in code.

III. Working Description:

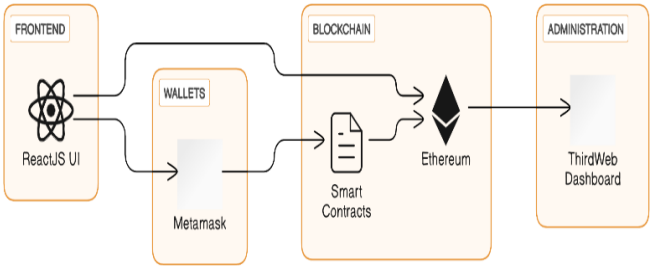


Fig.2 Workflow

This flowchart shows us Blockchain crowdfunding platform architecture contains frontend as interface, wallets as MetaMask, Blockchain using smart contracts and Ethereum and administration using third web framework for dashboard.

As the campaign created, the interface displays the data about the cause and the details about the campaign and its Id. The user get into it by login in the MetaMask and connecting through the test nets. Then the user can select to donate to the campaign by entering the value of the Ethereum present in the wallet of MetaMask.

Results:

• New Campaign:

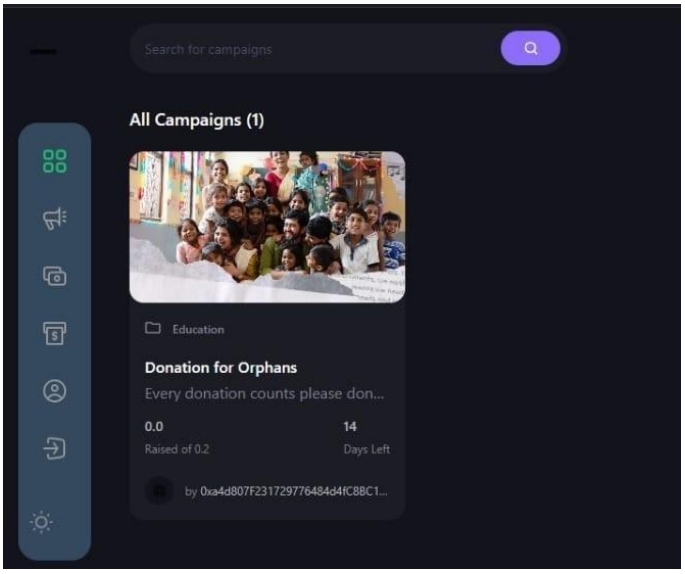


Fig.3 Campaign section

A campaign can be created by the applicant who want to set a campaign by adding details about the Donation and the cause the creator want to set. The owner of the campaign has to set the goal of the donations, time period for assign the campaign for a particular period of time and description about the campaign.

• Description:

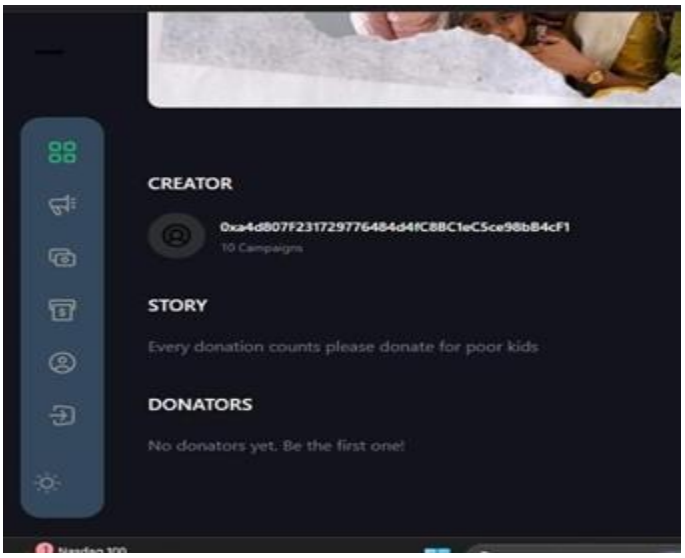


Fig.4 Campaign Description

After the creation of a campaign the details, story and the motive of the campaign will be displayed in the campaign section. The unique Id will be generated by the system to keep a campaign linked to the particular campaign.

• Donation:

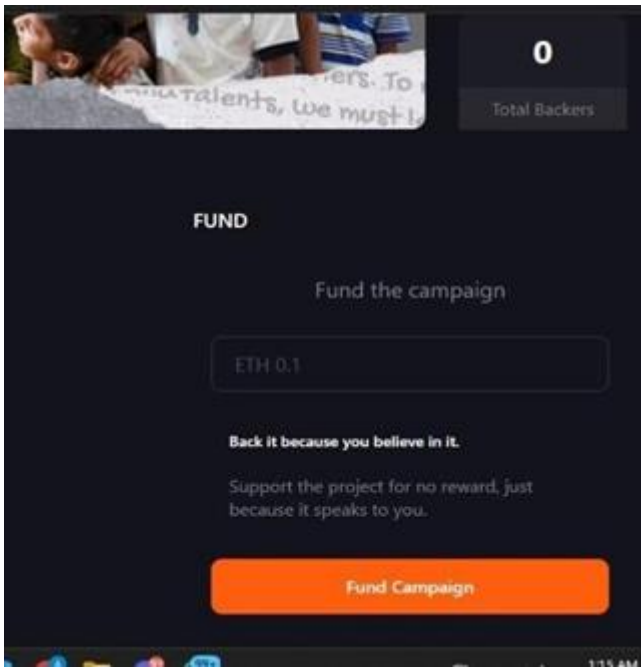


Fig.5 Donation section

Funds are donated through the Fund section of the campaign by entering the amount the donator wants to donate to the campaign running for the cause mention in the their description. The amount transacts in the cryptocurrency as we used blockchain technology to build it.

• Campaign records:

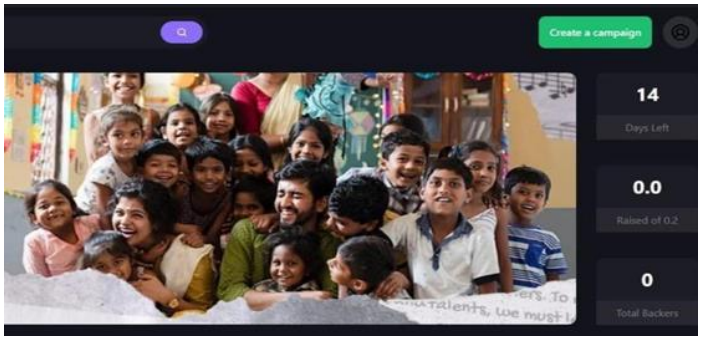


Fig.6 Records

The Records of the campaign are displayed on the screen in the Campaign section about the goal remaining, time remaining, record of the people donated in the campaign and all the data can be track from here.

Future Scope:

The future scope of the NGO Fundraiser System is brimming with opportunities for expansion, enhancement, and impact. Integration with More Blockchains: Extend compatibility to multiple blockchain platforms, allowing a broader user base. Implement advanced data analytics to provide NGOs with actionable insights into donor behavior and campaign performance. Create an ecosystem where NGO tokens can be traded or used for various purposes, incentivizing participation.

Enhance cross-border donation capabilities by exploring partnerships with global payment platforms and cryptocurrency exchanges. Develop a user-friendly mobile application for convenient access, ensuring that the system caters to the increasing mobile user base. Create customizable smart contract templates to suit the diverse needs of different NGOs and fundraising campaigns.

IV. Conclusion

In conclusion, this review paper delves into the transformative potential of blockchain technology in therealm of crowdfunding. Drawing insights from a comprehensive analysis of existing research papers, thereview highlights the multifaceted advantages of adopting blockchain, such as enhanced transparency, security, and global accessibility. The literature reviewpresented an overview of various blockchain-based crowdfunding platforms, emphasizing their strengths and limitations. Methodologies employed in these studies were explored to understand the

approaches used in investigating the impact of blockchain on crowdfunding. The proposed methods and system architectures showcased the innovative applications of blockchain in creating decentralized and secure crowdfunding ecosystems. Despite the evident advantages, challenges such as technical complexity and market volatility were discussed. The paper concludes by pointing towards future directions, including regulatory considerations, integration with emerging technologies, and the evolving landscape of blockchain-based crowdfunding. As the field continues to evolve, this review offers a comprehensive understanding of the current state and sets the stage for future exploration and innovation in blockchain-enabled crowdfunding.

Reference:

[1] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[2] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[3] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[4] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[5] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[6] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[7] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[8] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[9] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Personalized and Memorable Password Generation to Tackle ML & AI Based Password Cracking Attacks

Dheeraj Patil, Neeraj Tembare, Vedang Shinde, Calvin Suares, Shivam Shinde, Dr. Chandrakant Kokane
Nutan Maharashtra Institute of Engineering and Technology, Talegaon(D), Pune

ABSTRACT

Passwords play a crucial role in identity authentication. Password security and authenticity have become major concerns due to the increase in online information sharing, internet usage, electronic commerce transactions, and data transmission. This does, however, demonstrate that a strong password also needs to be long. Therefore, using complex password combinations is generally advised by cybersecurity experts. Users can create strong passwords with the aid of tools like password generators. But people tend to forget their passwords because of complex patterns. In this paper, we propose a novel approach to generate strong passwords, in contrast to other random password generators the passwords generated by our approach are memorable and personalized to each user instead of being a random set of words.

I. INTRODUCTION

There are several types of authentication methods. These methods are usually divided into three main categories.

i) Knowledge-Based (What You Know): Passwords, PINs, and security questions are convenient but vulnerable to guessing or social engineering [4].

ii) Possession-Based (What You Have): Security tokens, one-time codes, and physical keys add a layer of security but can be lost or stolen[5].

iii) Biometric-Based (What You Are): Fingerprints, facial recognition, and voice recognition offer strong security but are expensive and raise privacy concerns.

Despite several such authentication methods, passwords will have and will always be the most widely used authentication method[6].

This is because password-based authentication is simple, easy to use, inexpensive, and manageable, whereas other authentication methods have a number of drawbacks, including high costs, difficulty in deploying, privacy disclosure, and so forth. Several information systems, including account login and data encryption, use password-based authentication techniques [7,8].

A majority of the internet users lack technical expertise and feel uncomfortable utilizing alternative authentication methods as which are complex and time consuming, thus they primarily rely on password-based authentication.

To safeguard their data, users generate unique passwords and security codes on their own. They frequently make simple passwords out of their names or the names of those close to them, their birth dates or other significant dates, etc. As hacking and cybersecurity breaches are becoming more common, and attackers are finding it easy to break such easily understood passwords. Although users can create unique passwords, using traditional methods[9] frequently results in weak password choices based on easily guessed information or personal details[10]. The

increasing risk of AI-powered hacking exacerbates this weakness. An alarming rate of automation in machine learning algorithms allows brute-force attacks to be automated, effectively cracking weak passwords[11]. AI is also capable of predicting password patterns and developing focused attacks by analyzing user data and compromised password databases. This highlights the requirement for more advanced password-creation techniques[12]. Our proposed solution can help users stay one step ahead of these evolving AI threats by creating personalized and memorable passwords.

II. Objective

The main goal of this paper is to analyze the existing password generation tools and algorithms. We aim to conduct a thorough evaluation of current password generation tools and algorithms, identifying their strengths and weaknesses in terms of security, memorability, and user experience.

III. Related Work

Alphapwd: A Password Generation Strategy Based on Mnemonic Shape

The study delves into password security, proposing the Alphapwd strategy - combining mnemonic shape with password generation for creating secure and memorable passwords. The experiment results showed Alphapwd-based passwords are generally stronger against unknown attacks compared to leaked password sets.

The Alphapwd strategy, evaluated through experiments, exhibited strong resistance to unknown attacks and ease of password recall. Users could generate complex passwords that are easy to remember, enhancing overall system security. By utilizing the mnemonic shape, Alphapwd offers a practical approach to password generation, addressing the security and usability concerns typically associated with traditional password strategies.

Overall, although the Alphapwd strategy presents a promising solution to the password security dilemma, offering a unique blend of security and usability. Its innovative approach to password generation based on mnemonic shape is a bit complex and non technical users would find it time consuming and difficult to implement such techniques.

IV. Methodology

Personalized Password Generator Algorithm

This algorithm aims to create a secure password based on a user-provided sentence or phrase, making it memorable while adhering to security best practices.

Input: The user-provided sentence or phrase (more than 8 characters)

Output: The generated secure password derived from the user's input

Working

1. Preprocessing:

- Convert the sentence to lowercase for consistency.
- Remove any spaces or special characters from the sentence. This ensures easier manipulation while maintaining memorability for the user.

2. Length Check: If the length of the sentence is less than a minimum threshold (e.g., 12 characters), perform the following:

i) Append a random selection of numbers and special characters to the end of the sentence until the desired length is reached.

ii) Ask the user to re-enter a longer prompt or ask used if he wants to “auto-fill”.

iii) If “auto-fill” is selected append a random selection of numbers and special characters to the end of the sentence until the desired length is reached[6].

3. Character Replacement:

i. Iterate through each character in the sentence with a certain probability (e.g., 30%):

ii. Replace the current character with a number (0-9)

iii. A special character from a predefined set of characters for example (!, @, #, $, %, ^ , &, *, ())

iv. The uppercase version of the current character (if it's a letter)

v. This step introduces variations and complexity into the password while keeping the base recognizable to the user.

4. Output:

Assign the modified sentence to the secure password variable.

❖ Example:

Input: "hello this is my password"

Output:"H31loT#isismYPa$$Word"

Explanation: -

a. Length Check (assuming minimum length is 12): The sentence is already 22 characters long, so no changes needed.

b. Character Replacement: Let's say the following replacements occur:

* 'h' -> 'H' (uppercase)
* 'h' -> '#' (special character)
* 'l' -> '!' (special character)
* 'o' -> '0' (number)

c. Modified Sentence

“H31lot#isismypa$$word”

d. Output:

"H31lot#isismypa$$word"

V. Key Advantages:

Our algorithm incorporates the user's input, resulting in passwords that are more memorable by using familiar phrases or sentences, users can easily remember their passwords, eliminating the need for password managers or insecure practices like writing them down. While user-friendliness is crucial, security remains paramount. The algorithm strategically modifies the user's input through Character Replacement: Introducing variations like uppercase letters, numbers, and special characters strengthens the password against brute-force attacks. This combined approach fosters passwords that are more secure, the modifications significantly increase the difficulty of cracking passwords compared to random character strings.

Our algorithm achieves a crucial balance between user convenience and robust security. Users can create passwords that are both memorable and highly resistant to hacking attempts.

VI. Testing and Results

It was crucial to confirm the security of our passwords, which were created by our algorithm. We adopted a multifaceted testing approach. We used popular password strength checkers on the internet, and each time our passwords were rated as "strong" or "very strong." This algorithm's superior strength comes from its deliberate use of numbers, special characters, and both uppercase and lowercase letters, going above and beyond what most checkers require. We also used crack time estimation tools, which showed that our user-generated passwords and random sets cracked much slower than expected. These programs calculate how long it will take to break a password using different methods. Our passwords' longer cracking times demonstrate the added complexity brought about by the algorithm's changes, which significantly increases their resistance to brute-force attacks and other cracking techniques. It's crucial to acknowledge that these online tools provide theoretical assessments, not representing the entire spectrum of hacking techniques. However, the results offer compelling evidence that our password generation algorithm delivers a substantial security leap compared to random password generation. This enhanced security is achieved without sacrificing memorability, as users can leverage their own personalized phrases or sentences, fostering passwords that are both user-friendly and highly resistant to hacking attempts.

It's important to acknowledge that online password strength checkers and crack time estimation tools provide theoretical assessments. While valuable, these tools don't represent the full spectrum of hacking techniques.

VII. Conclusion

This study introduced the idea of a novel password generation algorithm that leverages user-provided phrases or sentences. The core concept lies in creating passwords that are both memorable due to personalization and secure due to algorithmic modifications. The password generator tool assists users in creating strong, unique passwords, a critical step in preventing unauthorized access to accounts and sensitive information. Unlike traditional methods that

produce random strings of characters, our approach leverages user-provided phrases or sentences.

It's important to acknowledge that online password strength checkers and crack time estimation tools provide theoretical assessments. While valuable, these tools don't represent the full spectrum of hacking techniques.

Despite these limitations, the results provide strong evidence that our password generation algorithm delivers a significant improvement in password security compared to random password generation. This enhanced security is achieved without sacrificing memorability, as users can leverage their own personalized phrases or sentences.

Future Exploration

Future work can explore the relationship between user-provided customization options and the algorithm's character selection and modification strategies. This will allow us to refine the balance between password memorability and security based on user input complexity. Additionally, incorporating machine learning and artificial intelligence techniques into the algorithm holds promise for developing even stronger password generation methods. Machine learning models could be trained on large password datasets to identify patterns in compromised passwords and adjust character selection and modification strategies accordingly. AI could further enhance the process by dynamically adapting to evolving security threats and user preferences.

VIII. References

[1] Ade-Ibijola and B. Ogbuokiri, "Syntactic Generation of Memorable Passwords," 2019 International Multidisciplinary Information Technology and Engineering Conference (IMITEC)

[2] W. Jia, "Analysis on Password Attack Model and Password Generation," 2022 International Conference on Computers, Information Processing and Advanced Education (CIPAE), Ottawa, ON, Canada, 2022, pp. 145-149, doi: 10.1109/CIPAE55637.2022.00038.

[3] D. Pasquini, M. Cianfriglia, G. Ateniese and M. Bernaschi, "Reducing bias in modeling real-world password strength via deep learning and dynamic dictionaries"

[4] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[5] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[6] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[7] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[8] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[9] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[10] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word

Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[11] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[12] D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Destination Anywhere – A Full Stack Web Appliaction for Personalized Travel Exploration

Ms. Neha Kharche, Mr. Harshwardhan Deshmukh, Mr. Harshal Patil, Mr. Prathmesh Morankar,
Prof. Kapil Wagh, Prof. Supriya Bhosle
Nutan Maharashtra Institute of Engineering & Technology, Pune, Maharashtra, India

ABSTRACT

Entitled "Destination Anywhere: A Comprehensive Journey Report," this document offers an extensive exploration of an exciting expedition to an undisclosed destination. Covering various aspects of the journey, including lodging, cuisine, transportation, and more, the report aims to support travelers in organizing their trips by providing a wealth of information sourced from diverse and credible outlets.

Keywords: web development, web application, travel agency, AI, machine learning, and deep learning highlight the report's technological scope and its commitment to delivering comprehensive insights for travelers.

I. INTRODUCTION

Enter a new era in travel! Journeying to an unprecedented destination in an endless world has never been this exciting. But for today's travelers, planning a trip can feel like walking down the aisle. From choosing the best place to explore the local cuisine, this process can be tiring and time-consuming. But don't worry! Let us introduce you to Stay Everywhere, your travel companion designed to simplify and enhance your travel plans. and online platforms like Make My Trip that provide guidance on creating the perfect trip. But despite the wealth of information, finding the best way can be difficult.[8,9] Travelers need to depart from points of interest (POIs) and carefully assemble the daily schedule and follow the complex travel process. This complex process creates big problems for many people. Guided by specific user preferences, the system demonstrates the ability to create various itineraries based on specific features[10]. We simplify the route creation process by providing users with travel plans, from the most attractive route to the shortest route. Travel experience. We prioritize convenience and take the hassle out of travel planning with door-to-door pickup and drop-off services. At the heart of our service are personalized itineraries that allow passengers to customize their journey according to their personal preferences[11,12]. A new feature allows users to create customized packages, offering unprecedented flexibility in travel planning. Serve as a valued partner throughout the travel planning process. This smart tool helps users create travel packages based on their specific needs. . Join us in defining the experience, a once-in-a-lifetime personal journey.

2. LITERATURE SURVEY

Tourism and tourism management by: Kuchekar Rutvik Baban, Mehra Prasad Sanjay, Jadhav Anushka Manoj. This article provides an in-depth discussion about tourism management and tourism management for

many reasons such as travel arrangements, accommodation. planning, transportation and logistics. Pleased. It provides insight into the challenges faced by travel agencies and offers strategies for effective delivery[1].

Travel Planning Management System

Authors: Madushan S.H.K, De Alwis Gunathilake W.L.D.C.K2, Jayasinghe J.A.S.C, D.V.P Ferdinando, D. I. De Silva, Piyumika Samarasekara

Focusing on the development of a travel planning management system, this research explores the integration of technology to facilitate seamless travel arrangements. It discusses the utilization of modern tools and techniques to enhance the efficiency and effectiveness of travel planning processes[2]. Leveraging AI Chatbots for Tailored Travel Experiences Author: John Doe

This paper explores the role of AI-powered chatbots in the travel industry, emphasizing their potential to personalize travel experiences. It investigates how chatbots can analyze user preferences, provide tailored recommendations, and assist in creating customized travel itineraries to enhance customer satisfaction[3].

Customizable Itineraries: Meeting the Demand for Personalized Travel Experiences

Author: David Brown

Addressing the growing demand for personalized travel experiences, this research paper discusses the importance of customizable itineraries. It explores strategies for designing flexible travel plans that cater to individual preferences and offer unique travel experiences to customers[4].

3. OBJECTIVE

The aim of this research endeavor is to develop "Destination Anywhere," a comprehensive online platform geared towards revolutionizing the travel planning process. The central objective is to streamline the organization of travel itineraries, covering various facets such as lodging, dining, transportation, and recreational activities. Through the creation of an intuitive and user-friendly website, the primary goal is to minimize the time and effort expended by travelers in planning their trips effectively. Moreover, the project seeks to bolster user satisfaction by prioritizing convenience and integrating personalized features tailored to individual preferences. Harnessing cutting-edge technologies like AI, machine learning, and deep learning will empower the platform to furnish users with tailored recommendations, bespoke travel packages, and real-time assistance courtesy of AI-driven chatbots. By aggregating comprehensive information from credible sources, the platform endeavors to furnish users with invaluable insights into destinations, lodging options, culinary establishments, attractions, and leisure pursuits. Ultimately, the project endeavors to empower users to tailor their travel experiences to align with their unique preferences and requisites, all while ensuring accessibility, availability, and uninterrupted customer support. Through these initiatives, "Destination Anywhere" aspires to redefine the landscape of travel planning, enabling adventurers to embark on unforgettable journeys imbued with confidence and anticipation.

4. SYSTEM ARCHITECTURE

The system architecture of "Destination Anywhere" is designed to offer travelers a seamless platform for planning their journeys. Here's a breakdown of the architecture:

4.1. Presentation Layer:

This layer comprises the user interface of the website and mobile application. It focuses on providing an intuitive experience, allowing users to navigate features effortlessly.

4.2. Application Layer:

This layer houses the core logic and functionalities of the platform. It handles user requests, processes data, and manages interactions between different components.

4.3. Data Layer:

All platform data, including destination information, user profiles, and bookings, is stored here. The data layer ensures efficient storage and retrieval while maintaining integrity and security.

4.4. Integration Layer:

This layer facilitates communication with external systems and services through APIs. It enables real-time access to data from travel booking platforms and other sources.

4.5. Security Layer:

Ensuring data confidentiality and integrity, this layer implements encryption, authentication, and access control mechanisms.

4.6. Scalability and Performance Layer:

All platform data, including destination information, user profiles, and bookings, is stored here. The data layer ensures efficient storage and retrieval while maintaining integrity and security.

4.7. Monitoring and Logging Layer:

This layer monitors system health, performance metrics, and user activities to identify issues and optimize performance.

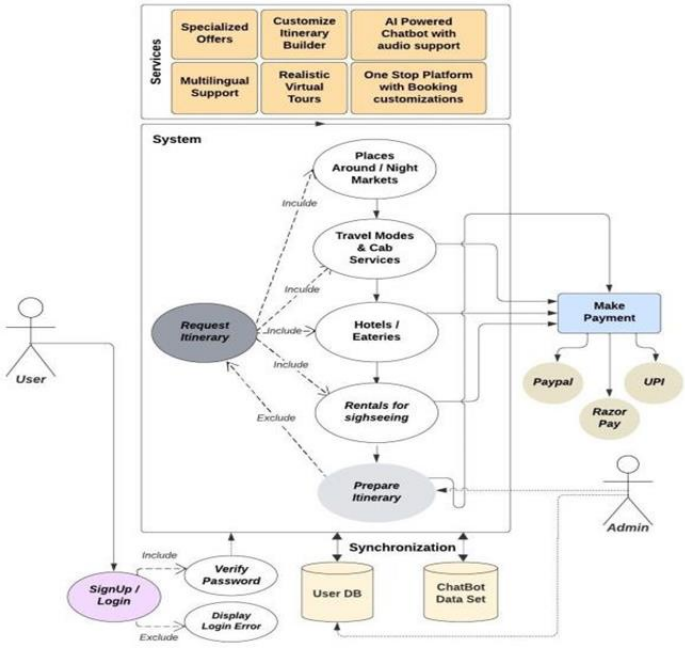


Fig: Use Case Diagram

5. METHODOLOGY

Begin by navigating to the Destination Anywhere website through your browser. Here, you'll find an array of options for travel destinations, ticket bookings, reviews, and contact sections. Depending on the features you wish to access or if you plan to make bookings, you might need to create an account or log in. Registration typically involves providing basic information and establishing a unique username and password. Once registered, users can log in using their chosen username and password. Users can then initiate searches for travel destinations, accommodations, flights, activities, and other related services. Search filters may include location, dates, budgets, accommodation types, and preferences. Following the search, the website will display a curated list of travel-related options tailored to the user's search criteria. Each listing will offer comprehensive details such as photos, descriptions, prices, availability, and user reviews. The website ensures secure payment processing for bookings, offering various payment methods like credit/debit cards, digital wallets, or other online payment options. Payment gateways handle these financial transactions securely. Users have the opportunity to leave reviews and ratings for destinations, accommodations, activities, and other services they've experienced. This valuable feedback aids other travelers in making informed decisions. Should any travel-related queries or concerns arise, users can seek assistance from a 24/7 chatbot available on the website, ensuring prompt support and guidance

6. RESULT ANALYSIS

The use of the Destination Anywhere website has been instrumental in increasing customer satisfaction, accessibility, efficiency and flexibility in the world of travel. The result is Stat Anywhere, a travel matching service designed to simplify and improve travel planning for today's explorers. Essentially, we know the issues travelers face elsewhere, such as difficult travel arrangements. We offer personalized solutions according to personal preferences. Destination Anywhere is used to make a one-time payment for overseas trips of the user's choosing and can be used in lieu of a pre-packaged package. Destination Anywhere aims to redefine travel and invite travelers to a once- in-a-lifetime experience by offering unparalleled ease and convenience throughout the entire travel planning process

7. CONCLUSION

In the contemporary digital era, a proficiently designed tour and travel website assume a critical role in simplifying the complexities inherent in travel planning, while concurrently furnishing travelers with an array of invaluable insights and resources. Our platform, "Destination Anywhere," epitomizes this pivotal function as it serves as an adaptable and essential nexus catering to the needs of both travelers and businesses entrenched within the travel sector. Through our centralized platform, users are bestowed with the capacity to seamlessly explore diverse destinations, meticulously orchestrate their itineraries, effectuate bookings, and access an extensive repository of travel-related information and resources, all consolidated into a singular interface. Furthermore, our steadfast commitment to customer satisfaction is palpable through the provision of comprehensive customer support services, thereby ensuring that users receive expedient assistance with inquiries, booking alterations, or any predicaments encountered during their travels. In essence, "Destination Anywhere" embodies the transformative essence of contemporary travel platforms, ardently endeavoring to augment the travel experience for all, and empowering travelers to embark on indelible journeys with confidence and seamlessness.

8. REFERENCES

[1]. Dietz LW, Sertkan M, Myftija S, Thimbiri Palage S, Neidhardt J and Wörndl W (2022) A Comparative Study of Data-Driven Models for Travel Destination Characterization. Front. Big Data 5:829939. doi: 10.3389/fdata.2022.829939.

[2]. Krishnamurthy, Lalitha. (2018). A CASE STUDY OF THE TOP ONLINE TRAVEL PORTAL, MAKE MY TRIP.

[3]. Ochoa Siguencia, Luis & Marzano, Gilberto & Gródek- Szostak, Zofia. (2018). Online Reservation: Using Booking.com to Reserve a Hotel in Ogrodzieniec.

[4]. Alaimo, Cristina & Kallinikos, Jannis & Valderrama-Venegas, Erika. (2020). Platform Evolution: A Study of TripAdvisor. 10.24251/HICSS.2020.672.

[5]. Sharma, Haresh & Majumder, Saibal & Biswas, Arindam & Prentkovskis, Olegas & Kar, Samarjit & Skačkauskas, Paulius. (2022). Journal of Advanced Transportation. 2022. 1-10. 10.1155/2022/7685375.

[6]. Siroya, Nehal & Banerji, Diptiman. (2018). Case study: Not a smooth trip.

[7]. Giachino, Chiara & Bollani, Luigi & Bonadonna, Alessandro & Bertetti, Marco. (2021). Skyscanner's initial trial with reinforcement learning for content customisation. Industrial Management & Data Systems. ahead-of-print. 10.1108/IMDS-12-2019-0722.

[8]. Kokane, Chandrakant D., and Sachin D. Babar. "Supervised word sense disambiguation with recurrent neural network model." Int. J. Eng. Adv. Technol.(IJEAT) 9.2 (2019).

[9]. Kokane, Chandrakant D., Sachin D. Babar, and Parikshit N. Mahalle. "Word Sense Disambiguation for Large Documents Using Neural Network Model." 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[10]. Kokane, Chandrakant, et al. "Word Sense Disambiguation: A Supervised Semantic Similarity based Complex Network Approach." International Journal of Intelligent Systems and Applications in Engineering 10.1s (2022): 90-94.

[11]. Kokane, Chandrakant D., et al. "Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities." International Journal of Intelligent Systems and Applications in Engineering 11.11s (2023): 06-16.

[12]. Kokane, Chandrakant D., et al. "Word Sense Disambiguation: Adaptive Word Embedding with Adaptive- Lexical Resource." International Conference on Data Analytics and Insights. Singapore: Springer Nature Singapore, 2023.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Handwritten Digit Recognition Using Deep Learning

Sonali Patil, Shweta Changan, Ketan Bobade, Yash Darekar, Gauri Mahajan, Dr. Chandrakant Kokane
Nutan Maharashtra Institute Of Engineering And Technology, Talegaon(D), Pune

ABSTRACT

Handwritten digit recognition (HDR) remains a crucial task in various domains, including document processing and human-computer interaction. This paper investigates the application of Convolutional Neural Networks (CNNs) for improved HDR performance. We evaluate the performance of our CNN model on MNIST dataset. Our results demonstrate a significant recognition accuracy showcasing the effectiveness of the proposed CNN architecture.

I. INTRODUCTION

To develop a model that can identify and categorize handwritten numbers. Humans are able to observe and comprehend their visual surroundings thanks to the assistance of their eyes and brains. Giving machines the same sense of perception and processing power as humans is the aim of computer vision[5,6]. In computer vision, many techniques for image recognition have been developed. The goal of our study is to create a model that can more accurately identify and recognize handwritten numbers from their photographs[7,8].

Gaining knowledge and experience with concepts related to Convolutional Neural Networks is the aim of this work. Transcribed digit acknowledgment has long been a controversial topic in the example order community. A neural network does remarkably well in information organizing, according to a few experiments.The primary objective of this work is to create reliable and effective techniques for transcription recognition by analyzing several arrangement models that are already in use[9]. The Convolutional Neural Network (CNN) exhibition is covered in this publication..

The outcomes demonstrate that, without compromising on performance, the CNN classifier created a Neural Network with a far higher computational effectiveness. Handwritten digits can be recognized using Convolutional Neural Networks in Machine Learning. To execute the model, essentially, a few libraries were required, including NumPy, Pandas, TensorFlow, and Keras. This talk will focus on the importance of the convolutional neural network. It was also discussed how datasets are divided into training and test sets. A dataset was used to predict handwritten numbers from 0 to 9. The dataset was cleaned, scaled, and shaped. TensorFlow was used to create a CNN model, which was then trained using the training dataset.

II. PROBLEM STATEMENT:

The field of study has been centered on handwriting recognition for about forty years. This research study looks at the behavior of classification algorithms (CNN) on a large handwriting dataset to forecast a digit. In the construction of these recognition systems, machine-learning techniques are becoming more and more important, particularly when used with neural networks like CNN/ANN. Over the last forty years, handwriting

recognition has been the main area of research interest. This research project's objective is to predict a digit by examining how classification algorithms (CNN) behave on a sizable handwriting dataset.. Machine-learning approaches have become increasingly important in the design of these recognition systems, particularly when used with Neural Networks like CNN/ANN.

Our goal is to create a model that uses CNN concepts to recognize and classify handwritten numerals in images. Our work's primary goal is to construct a model for digit identification and classification, but it can also be used to analyze handwritten letters and other documents. Understanding Convolutional Neural Networks and applying them to a system for handwritten number recognition using the created dataset is the main goal of the proposed system.

III. RELATED WORK:

A support vector machine (SVM)-based real-time handwritten digit classification system was created by Ahmed Hafiz (2018), however it is not appropriate for large data sets.

A Handwritten Digits Classification using Back Propagation Network was proposed by Anuj Dutt (2017).The fundamental process of neural network training is backpropagation. This technique involves adjusting a neural network's weights according to the error rate recorded in the preceding epoch.It is less effective, though. by using Keras and Theano as the backend for a convolutional neural network.

In an effort to minimize error rates in handwriting recognition, Denker J.S. (2019) designed Handwritten Digits Recognition. In one study, 3-NN trained and tested on MNIST yielded an error rate of 1.19%. The multimodal neural architecture known as the Coherence Recurrent Convolutional Network (CRCN) is used.It is employed to retrieve sentences from an image. To get around the shortcomings of conventional convolutional layers, some academics are working on developing novel methods. Using MNIST datasets, one strategy that may be used for improved performance is NCFM (No combination of feature maps).

Haider (2020) created a brand-new, difficult Arabic dataset that was gathered from various school study levels. After putting in great effort to distribute and gather digital forms from hundreds of elementary, high school, and college students, a sizable dataset was gathered. He put a lot of effort into creating a difficult Arabic digit dataset after seeing that there were few and undemanding datasets available.

Mukesh N. (2018) carried out a Handwritten Character Classification. Using k-means clustering machine learning algorithms, however, has high baseline error and low accuracy, making it unsuitable for large data sets.

An artificial neural network-based method for handwritten digit recognition was proposed by Nitin Kali Raman (2021).Artificial neurons, which resemble neurons in a biological brain somewhat, are a group of interconnected units or nodes that form the foundation of an ANN. Similar to the synapses in a living brain, every link has the ability to communicate with other neurons. After processing a signal, an artificial neuron can communicate with other neurons that are connected to it.It was a High Baseline Error, though.

A dataset and recognition system for handwritten digits was created by Plamondon, R. (2018) and trained on both convolutional and artificial neural networks. The accuracy evaluation metric was used to determine the average error for both networks. CNN has a lower average error rate than a CPU-based artificial neural network. Nevertheless, CNN training on a CPU required less time than training on an artificial neural network. However, CNN does a superior job in image classification. In summary, the accuracy of recognition increases as the model is trained with CNN; nevertheless, training on a GPU can yield the best results for CNN classification.

A Multilayer Perceptron (MLP) Neural Network was proposed by Saeed Mansoori (2020) to identify and forecast handwritten numbers from 0 to 9.One fully connected type of feedforward artificial neural network

(ANN) is the multilayer perceptron (MLP). The term "MLP" is used in an imprecise manner; it can refer to any feedforward artificial neural network (ANN) or, more precisely, to networks made up of many layers of perceptrons that are activated by threshold.A dataset obtained from MNIST was used for training and testing the suggested neural system.

Gaussian Naive Bayes was used by Shamim S.M. (2018) to introduce machine learning algorithms for handwritten digitizer recognition.A Naive Bayes variation that supports continuous data and adheres to the Gaussian normal distribution is called Gaussian Naive Bayes.This has the low precision as a downside[10].

via the MNIST dataset, Shyam R. (2017) performed Handwritten Digits Classification and found that deep networks perform better when trained via straightforward back-propagation.But in contrast to NORB and CIFAR10, their architecture yields the lowest error rate on MNIST[11].

Sonia Flora (2016) created a support vector machine (SVM)-based handwritten Digits Classification system.Support vector machines evaluate data for regression and classification using supervised learning models and related learning methods.but achieved a lower level of accuracy than convolution neural networks (CNNs)[12].It provides less accuracy because it is a vast dataset.

IV. METHODOLOGY:

Data Acquisition: Getting the MNIST dataset, which is made up of a test set of 10,000 examples and a training set of 60,000 examples, is the first stage. TensorFlow and Keras libraries make it simple to access the dataset.

Data Preprocessing: In order to get the data ready for training, preprocessing procedures must be completed before supplying it to the model. This entails bending the photos to the necessary format, standardizing the pixel values to a range between 0 and 1, and sometimes expanding the dataset to enhance model generalization.Model Architecture Design: The model architecture's design forms the basis of the handwritten character recognition system. We'll use a CNN architecture in this project, which includes of fully connected layers for classification after convolutional layers for feature extraction.

By experimenting and assessing performance, the precise architecture can be altered.

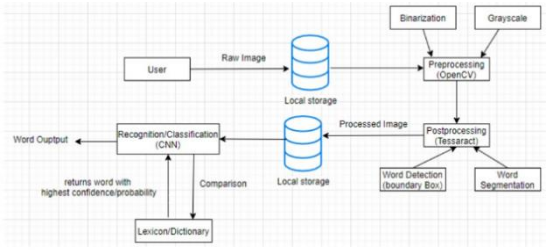
Model Training: After defining the architecture, the model must be trained using the training data that has already been processed. The model gains the ability to link input photos to their corresponding labels—that is, the handwritten digits—during training. In order to minimize the loss function, training entails iteratively changing the model's parameters (weights and biases) using optimization methods like stochastic gradient descent (SGD) or Adam.

Model Evaluation: To determine the model's capacity for generalization, its performance must be assessed on a different test set after it has been trained. Metrics like recall, accuracy, precision, and F1-score are calculated to assess how well the model classifies handwritten letters.

Adjusting Hyperparameters: The performance of the model can be greatly affected by fine-tuning its hyperparameters, which include learning rate, batch size, and dropout rate. In order to determine the ideal configuration, hyperparameter tuning entails methodically modifying these parameters and assessing the model's performance.

Deployment & Integration: The trained model can be integrated and deployed into practical applications once it has reached a sufficient level of performance. This could entail creating an interface for users to interact with the model, accelerating its inference speed for real-time processing, and making sure it works in a variety of contexts and platforms.

V. ARCHITECTURE:



Fig(1) ARCHITECTURE

[1] User: By putting a term into the database, the user starts the procedure.

[2] Local Storage: The word is kept in the local storage.

[3] Preprocessing: OpenCV is used to preprocess the raw image. Usually, preprocessing entails sharpening, noise reduction, and other methods to enhance the quality of the image.

[4] Feature Extraction: The split words are used to extract features. The words are recognized using these characteristics.

[5] Binarization and Grayscale Conversion: After converting the image to grayscale, binarization is performed. Each pixel is changed to either black or white using binarization.

[6] Tessaract postprocessing: Tessaract is an open-source optical character recognition (OCR) engine used to enhance word 171ecognition accuracy.

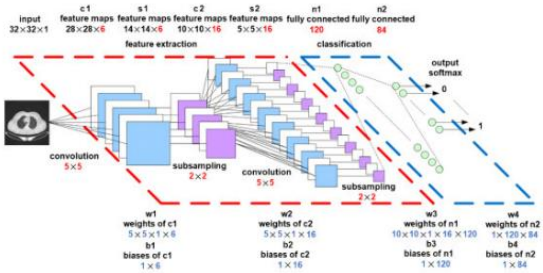
[7] Word Segmentation: Next, each word is separated from the previously processed image. A method known as connected-component analysis is used for this.

[8] Word Detection (Boundary Box): Each recognized word has a bounding box drawn around it.

[9] Recognition/Classification (CNN): To identify the words in the image, a Convolutional Neural Network (CNN) is employed. CNNs are a subset of deep learning neural networks that excel at tasks involving image recognition.

[10] Lexicon/Dictionary: The recognized words are compared to a lexicon or dictionary to ensure they are valid words.

VI. ALGORITHM USED:



Fig(2) CNN ALGORITHM

Because convolutional neural networks (CNNs) can automatically learn spatial information directly from the input image, they have become an effective tool for handwritten digit detection.

Convolutional Layers: These layers extract local information such as forms and edges by applying filters, or kernels, that move across the input image. In a tiny area of the image, each filter finds a certain feature.

To capture different aspects in the image, multiple filters are applied.

Pooling Layers: These layers down sample the feature maps generated by the convolutional layers. This reduces the dimensionality of the data, making the network more computationally efficient and less prone to overfitting. Pooling techniques like max pooling select the highest value in a specific region, capturing the most prominent feature within that area.

Activation Functions: By adding non-linearity to the network, these functions enable it to understand intricate feature correlations. ReLU and Softmax are popular activation algorithms in CNNs for handwritten digits.

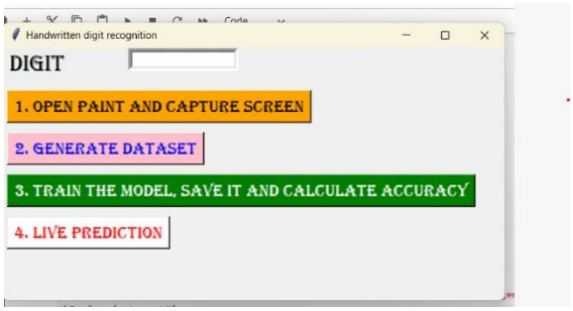
(a) Function of ReLU in Handwritten Digit Recognition: ReLU aids in the introduction of non-linearity in hidden layers of a neural network for digit recognition. This is important since the intricate patterns found in handwritten numerals are beyond the scope of linear models. ReLU enables the network to pick up characteristics that are critical for differentiating

between digits, such as edges, curves, and slopes.

(b) Function of Softmax in Handwritten Digit Recognition: The softmax function converts the raw activations from the previous layer into probabilities in the last layer of the digit recognition network.

Fully-Connected Layers: These layers carry out classification in the last stages of the network using the flattened output from the convolutional and pooling layers. With neurons in one layer fully coupled to neurons in the next, these layers function similarly to conventional neural networks.

VII. RESULT:



Fig(3) GUI

1.) Capture Screen:

With the use of the GUI's screen capture functionality, users can upload photographs of handwritten numbers straight into the system. With the help of this capability, real-time digit recognition is possible without requiring external image files.

2.) Dataset Generation:

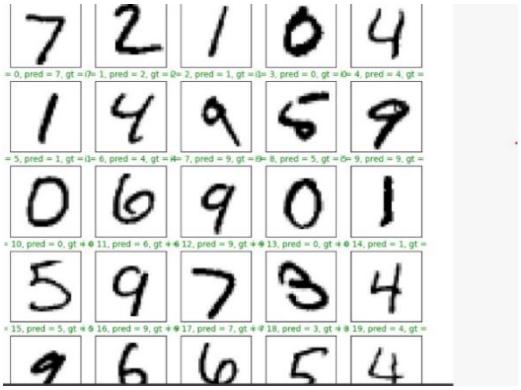
Users can use the tools in the GUI to create a dataset of photographs of handwritten numbers. The digit recognition model uses this dataset for both testing and training. Users can use it to construct custom datasets that are suited to their own requirements and wants.

3.) Model Training and Evaluation:

The generated dataset is used to train a digit recognition model more easily thanks to the GUI. From the UI, users may choose the training algorithm, modify the hyperparameters, and start the training process. Following training, the efficacy of the model in identifying handwritten digits is determined by calculating accuracy measures and evaluating its performance.

4.) Live Prediction:

Live prediction of handwritten digits is made possible by the GUI after the model has been trained and assessed. Digits can be directly drawn by users on the interface, and the trained model makes predictions in real time, showing the identified digit and its confidence level. The performance of the model can be interactively tested and validated thanks to this functionality.



Fig(4)OUTPUT

Pairs of projected digits and the matching ground truth labels are the output from the handwritten digit recognition model, which provide information about the model's performance. Every pair denotes a test instance in which the user's actual written digit and the predicted digit are contrasted.

VIII. CONCLUSION:

In conclusion, a methodical process including data preparation, model architecture design, training, evaluation, and deployment is required to construct a handwritten character recognition system utilizing the MNIST dataset and Python. By employing convolutional neural networks (CNNs) and various strategies like data preparation, hyperparameter tuning, and model optimization, our goal is to develop a

dependable and sturdy system that can identify handwritten numbers with exceptional accuracy and dependability.

To effectively create and train the model, we have experimented with a variety of techniques and algorithms throughout the project. We have created a strong basis for testing and assessment by utilizing the MNIST dataset, a popular benchmark for handwritten character recognition. The architecture and hyperparameters of the model have been optimized through repeated refinement and experimentation.
n the end, we are able to utilize the trained model's skills for a variety of activities, from digital assistants and mobile applications to postal automation and document digitalization, thanks to its deployment and integration into real-world applications. We can make sure the system remains relevant and successful in tackling the difficulties associated with handwritten character identification in the current digital era by keeping an eye on it and updating it on a regular basis.

REFERENCES

[1] Samay Pashine, Ritik Dixit, Rishika Kushwah ,"Handwritten Digit Recognition using Machine and Deep Learning Algorithms ", Jun 2021.

[2] Ashutosh Aggarwal ,Karamjeet Singh, kamalpreet Singh,"Use of Gradient Technique for extracting features from Handwritten Gurmukhi Characters and Numerals", 2014, International Conference on Information and Communication Technologies (ICICT 2014).

[3] [1]K. Swetha, [2]Y. Hithaishi, [3]N.L. Tejaswini, [4]P. Parthasaradhi, [5]P.V. Venkateswara Rao, 2021 IJCRT | Volume 9, Issue 6 June 2021 | ISSN: 2320-2882

[4] S. M. Shamim, Mohammad Badrul Alam Miah, Angona Sarker, Masud Rana, Abdullah Al Jobair, "Handwritten Digit Recognition Using Machine Learning Algorithms", Vol. 3 No. 1 (2018): IJoST: April 2018

[5] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[6] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[7] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[8] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[9] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[10] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[11] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in

Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[12] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[13] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," *2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT)*, Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Gesture And Voice Controlled Virtual Mouse

Prof. Supriya Bhosle, Saurabh Shinde, Swapnil Mohite, Akshay Mahajan, Swaraj Phalke, Dr. Chandrakant Kokane

Department of Information Technology, Nutan Maharashtra Institute of Engineering and Technology, Talegaon Dabhade

ABSTRACT

One of the most crucial components of a computer is the mouse. When using a Bluetooth or wireless mouse, a dongle and battery are required for the mouse to be powered on within the computer. The gesture-controlled mouse, which permits voice commands and hand gestures to facilitate human-computer interaction, is proposed in this research study. For the hand gestures and voice instructions, we require a camera and microphone. It will use a variety of hand motions to carry out activities like left and right clicking. You can also choose to drop and drag, enlarge and decrease the window, and perform a lot of other things. This system was built with the Python programming language (3.8.10).OpenCV, MediaPipe, and other more Python packages are installed on this machine

Keywords: OpenCV, Gesture Recognition, Virtual Mouse, Voice Commands.

I. INTRODUCTION

Human-computer connection is growing more and more convenient in daily life, and computer use has become a need in our existence. Although most individuals take these facilities for granted, using these gadgets properly presents significant challenges for those with disabilities. This research describes a gesture-based artificial intelligence (AI) virtual mouse system that employs hand gestures and hand tip detection to emulate mouse operations on a computer through computer vision. The primary objective of the proposed system is to perform computer mouse cursor and scroll operations using a webcam or a computer's built-in camera in place of a conventional mouse device [1,2]. Using a webcam or built-in camera, we can follow a hand gesture's fingertip and perform scrolling and mouse pointer operations. We can also move the cursor with an AI virtual mouse that is gesture-based. As part of an HCI with the computer, computer vision is utilized to recognize hand movements and tip detection [3,4,5]. The goal of gesture recognition technology is to develop tools that enable information to be sent by human gestures. When using gesture recognition, a camera records a person's movement and transmits that information to a computer, which then uses the movement as input to control an object or program. The purpose behind developing gesture recognition technology is to handle critical information and enhance human-computer interaction [6,7]. Data gathering, hand placement, hand recognition,

and gesture guiding are the key elements of the gesture recognition process [8,9]. Expressions of emotion or movement are called gestures. There are gestures and body language..

II. LITURATURE SURVEY

Gesture Recognition: A Review by Sundus Munir, Shiza Mushtaq, Afrozah Nadeem, Syeda Binish Zahra [1] System able to separate and analyze particular human gestures used for message management or

conveyance. Hand detection methods, RGB color schemes, webcams, real-time tracking techniques, hidden Markov models, depth mapping techniques, and Kinect cameras are some of the approaches covered.

AI virtual mouse using gesture recognition, author: Abhishek R. Shukla [2] According to this article, the aim of the project is to develop a gesture-recognition-based AI-driven virtual mouse system that can replace conventional hardware mice. issues with things that require external devices, particularly with batteries and adapters. Abhishek R. Shukla's paper establishes a consensus on an instrument-free AI virtual mouse by highlighting the value of human computer interaction (HCI) and the shortcomings of present mouse technology. For manual detection, the system makes use of a unique machine learning method built on deep learning. The algorithm dispenses with the need for a hardware mouse by enabling users to digitally operate their computers. This includes the ability to scroll, click left or right, and move the cursor using gestures.

Virtual Mouse with Gesture Control using Artificial Intelligence: Rekha BN, G Satish, Sampat Kundanagar, Vikyath Shetty, Yogesh R Bhangigoudra[3] According to the publication, the system leverages sophisticated Python libraries like MediaPipe and OpenCV to assist with cursor control. Users can left-click, drag, and change system parameters like brightness and volume with gestures. Without the need for extra computers, the project recognizes voice and hand motions using computer vision and machine learning. Furthermore, the review could explore developments in computer vision, speech recognition, language, and managerial guidance, as well as the larger subject of AI-focused human-computer interaction. Research on virtual mice, voice assistant integration, gesture recognition in human-computer scenarios, and machine learning (e.g.,MediaPipe) are some possible areas of focus for this study.

Gesture controlled virtual mouse with voice automation, by Prithvi J, S Shree Lakshmi, Suraj Nair and Sohan R Kumar[4] The motion-controlled virtual mouse shown in this research study is made to respond to voice commands and gestures used in human-computer interaction. The system's architecture consists of two modules: one uses MediaPipe for hand detection, while the other makes use of gloves in complementary colors. It makes use of the most cutting-edge computer vision and machine learning techniques, particularly MediaPipe's CNN, to guarantee precise, dependable, and effective gesture and voice command execution. The system has speech automation features to improve usability and convenience, and it combines two modules to accommodate various client needs for manual dialing

Automatic feature extraction with memory and gesture recognition using deep learning algorithms Author: Rubén E. Nogales * and Marco E. Benalcázar[5]Because it is a high-standard recognition problem, scholars are interested in the problem of gesture recognition. Feature extraction and selection can be used to address the dimensionality issue. In this regard, evaluation models are advised for both automatic and manual feature extraction. CNN and BiL STM do automatic feature extraction, while the central preference statistical function is used for manual feature extraction. Additionally, these characteristics have been assessed in classes including Softmax, ANN, and SVM.

III. METHODOLOGY

1) Introduction: This article offers the required libraries for bespoke applications, such as enum, mediapipe for hand tracking, pyautogui for mouse handling, math for math operations, and cv2 for computer vision.
2) Libraries used in the project include PyAutoGUI, MediaPipe, OpenCV, and others.
3) Motion coding: Coding movements according to the angle and location of joints in the human body is one of the most effective techniques. Additionally, movements can be accessed by gesture recognition systems through the analysis of the motion of particular objects or items over time. This could involve monitoring hand movements.
4) Identification of Hands: Computer vision is used by several gesture recognition systems, like MediaPipe, to monitor and control cell signals. Particular locations on the hand, such as the palm, knuckles, and fingertip, are considered vital indicators.

5) Control operation: Upon detecting hand motions, the operating system advances the cursor. The hand's location within the camera frame can be used to gauge movement, and gestures can cause mouse events like clicks and scrolls.

6) Gesture Controller: To accomplish unique functions like modifying the screen's brightness, volume, and scrolling, we developed techniques like vertical and horizontal scrolling, as well as system brightness and volume changes. To handle various pointers and carry out commands, call the handle controls method.

IV. SYSTEM ARCHITECTURE

CAMERA:

The suggested AI virtual mouse system operates by utilizing the frames that are recorded by a laptop or PC's web camera. Using the Python computer vision package OpenCV causes the webcam to start recording video and creates the videocapture object. After that, the webcam records the frames and sends them to the AI virtual machine.

VIDEO CAPTURE: The AI virtual mouse technology uses a webcam to record every frame till the software is closed. The code that converts the video's BGR frames to RGB frames in order to locate the hands in each frame is shown below. defines the mp_hands function, which will allow us to keep track of our hands' locations. Identifying Which Finger is Up: Using the data from the library, it is now our responsibility to identify which finger movements are up and the corresponding coordinates of those fingers, then adjust the mouse function as necessary. This step entails keeping track of which finger is up based on the tip Id we discovered using the MediaPipe and their associated locations, after which the relevant mouse function is executed. It creates a loop that measures our hands' positions every 0.1 seconds. Computer Vision-Based Hand Gesture and Hand Tip Detection in Mouse Features Cursor Moving: Using the Python AutoPy package, the mouse pointer is made to move across the computer's window when the index and middle fingers are raised for the Moving Function. The HandLabel of the subject's right hand is used to initialize the HandRecog class. To initialize the hand result with the landmark points from the first frame, the initialize_hand_result method is used. When the optical flow is finished, this procedure is invoked. When the hand is moving, the update_hand_result method detects it and returns a None along with the gesture .ACTIVE. In the event that the hand remains motionless, a recognized gesture is looked up using the landmark points. After that, the function determines whether the gesture has altered. In the event that it has, the gesture frame count is increased and the current gesture is updated. The signed distance in pixels between two landmark sites is returned by the get_signed_dist function. The normal Euclidean distance between two landmark points is returned by the get_dist function.

Voice Assistant:

It receives input from the user, translates speech to text, and then evaluates the text to see if it meets the criteria.

If not, it will answer with "cannot recognize."

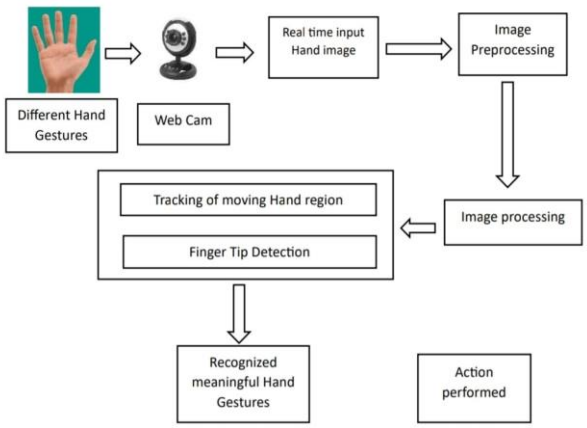


Fig 1: System Architecture

V. RESULT ANALYSIS

The proposed AI virtual mouse system introduces the concept of enhancing computer vision-based human-computer interaction. The limited amount of datasets makes it difficult to compare the AI virtual mouse system's testing. The webcam has been positioned at different distances from the user in order to assess hand motions and finger tip detection under different illumination conditions for hand gesture tracking and hand tip detection. The AI virtual mouse system is used to test the model multiple times in a variety of

lighting conditions, including bright and dark. It is also tested up close to the webcam and at least four feet away from the screen. The AI virtual mouse technology had a 99 percent accuracy rate. Based on its accuracy of 99 percent, we may infer that the proposed AI virtual mouse system has worked well. Since the right click is the hardest gesture for computers to understand, accuracy is low. The accuracy of the right click is low since it requires a more complex gesture to perform the desired mouse movement. Furthermore, every other gesture has exceptional precision. Compared to previous methods, our virtual mouse model performed exceptionally well, with 99 percent accuracy. It is evident that the proposed AI virtual mouse has excelled all other virtual mouse models when it comes to accuracy. The novel feature of the proposed model is its ability to operate a computer in a way akin to that of a real mouse. This includes carrying out the majority of mouse functions, such as clicking left and right, scrolling up and down, and moving the mouse pointer by using fingertip recognition.

A. Gesture Controller Output:

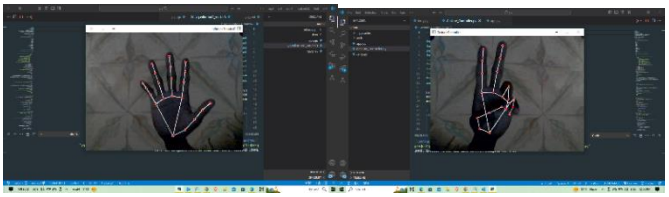


Fig 2: Natural Gesture Fig 3: Moving Gesture

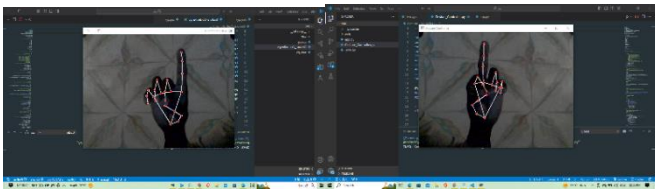


Fig 4: Right Click Fig 5: Left Click

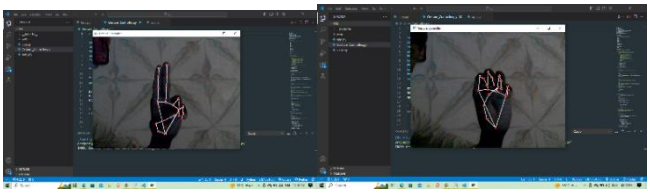


Fig 6: Double Click Fig 7: Drag

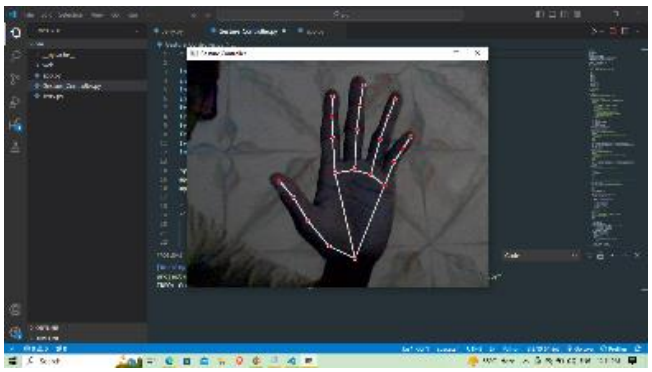


Fig 8: Drop

B. Voice Assistant Output:

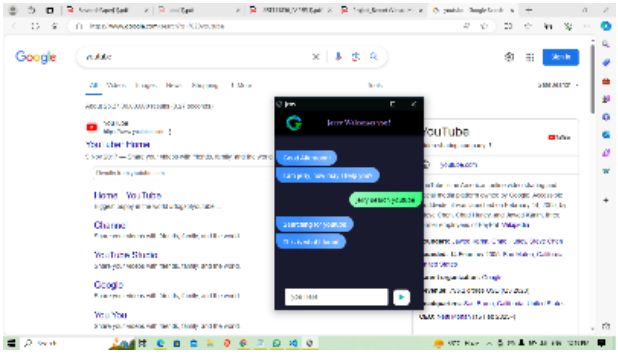


Fig 10: Search Location

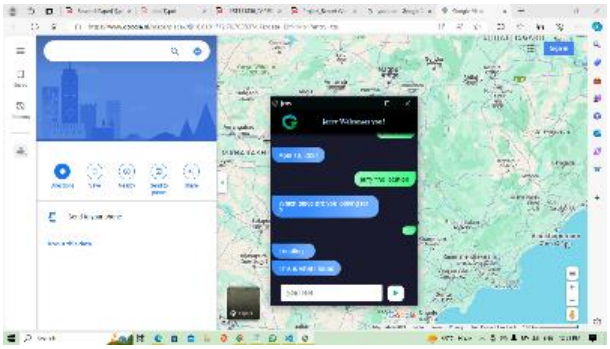


Fig 9: Google Search

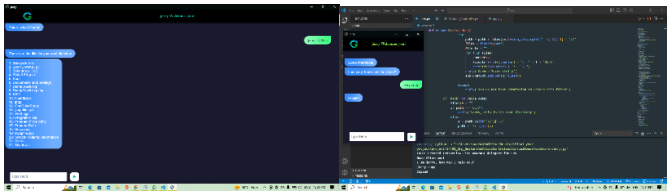


Fig 11: Display Files Fig 12: Copy And Paste

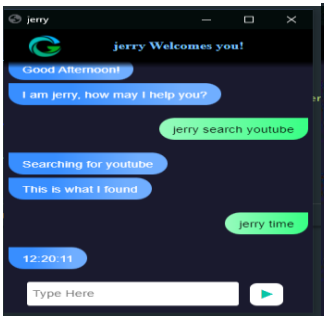


Fig 13: Time

Fig 14: Date

Fig 15: Exit

VI. CONCLUSION

Voice and gesture control Instead of utilizing a real mouse, users can connect with computers, portable devices, and voice commands through virtual machines. Using cameras and microphones, the system translates aural feedback and gestures into on-screen actions, giving users an easy-to-use, hands-free method to click, navigate, and operate apps. This innovative strategy encourages accessibility and offers a different form of counseling that is especially helpful in situations where conventional counseling resources are not available or are challenging to utilize.

VII. REFERENCES

[1] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[2] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[3] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[4] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[5] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[6] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[7] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and

Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[8] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[9] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," *2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT)*, Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Credit Card Fraud Detection Using Machine Learning

Prof. Sonali Dongare, Kishori Shinde, Sakshi Salunke, Vaishnavi Shinde, Sanika Thorat, Dr. Chandrakant Kokane

Nutan Maharashtra Institute of Engineering and Technology

ABSTRACT

Credit card fraud is a pressing issue in financial transactions, especially with the proliferation of online payments and e-commerce platforms. Timely detection of fraudulent activities is essential to mitigate financial losses and uphold trust in the banking system. This paper provides an extensive analysis of machine learning algorithms for credit card fraud detection. Leveraging a dataset containing transaction features, various machine learning algorithms, including logistic regression, are employed. These algorithms' efficacy is assessed using criteria like recall, accuracy, and precision. Additionally, a web application built with Flask is created to offer real-time fraud prediction capabilities.. The results underscore the efficiency of machine learning in detecting credit card fraud and demonstrate the potential of integrating such models into practical applications to enhance security in financial transactions.

Keywords: Financial security, Flask , ml, credit card fraud detection, logistic regression.

I. INTRODUCTION

The proliferation of online transactions and the digitization of financial systems have led to an increased risk of credit card fraud. Detecting fraudulent activities promptly is crucial for protecting both financial institutions and consumers from significant losses. Through the analysis of trends and abnormalities in transaction data, machine learning algorithms have become effective tools for detecting fraudulent transactions [4,5].

In our study, we focus on leveraging machine learning, particularly logistic regression, for credit card fraud detection. Thirty characteristics comprise our dataset: time, transaction amounts, and other types of anonymized numerical features. Problem description Financial organizations and consumers face a great deal of challenges due to the issue of credit card fraud (V1-V28). These characteristics capture several facets of every transaction, including its nature, timing, and financial worth.

The choice of 30 features in our prediction model is based on the comprehensive nature of the dataset and the need to capture diverse transaction characteristics. By including a wide range of features, we aim to enhance the model's ability to discern patterns indicative of fraudulent behavior. Additionally, these features undergo preprocessing steps such as standardization to ensure uniformity and optimize model performance.

Through our research, we seek to demonstrate the effectiveness of logistic regression in detecting credit card fraud and showcase the importance of feature selection and preprocessing in developing robust fraud detection models. Moreover, we aim to develop a practical application of this model by integrating it into a Flask web application, allowing users to input transaction details for real-time fraud prediction. f key findings and suggestions for future research directions.

II. PROBLEM STATEMENT

The problem of credit card fraud poses a significant challenge to financial institutions and consumers alike. With the increasing digitization of financial transactions

and the rise of online commerce, fraudulent activities, such as unauthorized card usage and identity theft, have become more prevalent. In addition to causing financial losses, these fraudulent actions erode public confidence in financial services and systems [6,7,8].

The main difficulty is identifying and stopping fraudulent transactions in a timely manner.. Traditional rule-based systems for fraud detection often struggle to keep pace with the evolving tactics of fraudsters, who constantly adapt their strategies to exploit vulnerabilities in the system. Moreover, these rule-based approaches may generate false positives or overlook sophisticated fraud schemes, leading to inefficient use of resources and potential customer dissatisfaction[11,12].

Therefore, there is an urgent need for more advanced and adaptable fraud detection systems that can reliably distinguish between genuine and fraudulent transactions, discover patterns suggestive of fraudulent conduct, and analyze massive amounts of transaction data in real-time. This means creating machine learning algorithms that can identify anomalies, learn from past transaction data, and flag possibly fraudulent activity for additional examination..

In summary, the problem statement revolves around the development of effective and efficient fraud detection mechanisms that leverage machine learning techniques to mitigate the risks associated with credit card fraud and safeguard the interests of financial institutions and consumers.

III. LITERATURE REVIEW

Paper no:1

Title: Experimental Evaluation of Smart Credit Card Fraud Detection System using Intelligent Learning Scheme

Alternate Name: Intelligent Learning Scheme for Digital Fraud Detection (ILSDFD)

Description:

This paper introduces a novel approach, the Intelligent Learning Scheme for Digital Fraud Detection (ILSDFD), designed to combat credit card fraud effectively. The ILSDFD is based on deep learning principles and incorporates feature selection processes to enhance fraud detection accuracy. By leveraging techniques such as autoencoder networks, the proposed system adapts to evolving fraudulent patterns and technological advancements. The paper emphasizes the importance of real-time fraud detection systems that can adjust to new circumstances and improve over time. It underscores the significance of deploying sophisticated machine learning algorithms for credit card fraud detection and offers a promising solution to tackle the growing menace of financial fraud in digital transactions.

Paper no:2

Development and Execution of Various Machine Learning Algorithms for Credit Card Theft IdentificationOther Name: Comparative Evaluation of Machine Learning Techniques for Credit Card Theft IdentificationThis paper provides an extensive analysis of the development and application of different machine learning algorithms for the detection of credit card fraud.

Description:

This paper presents a comprehensive study on the design and implementation of various machine learning algorithms for credit card fraud detection. The study assesses how well four machine learning algorithms detect fraudulent transactions using a comparative comparison. The primary focus is on assessing the accuracy of different algorithms in identifying fraudulent activities in credit card transactions. The paper highlights the importance of leveraging machine learning techniques to combat the increasing instances of credit card fraud in online transactions. It emphasizes the significance of selecting the most effective algorithm for fraud detection to minimize financial losses and protect consumers from fraudulent activities.

Paper no:3

Title: Fraud Detection Techniques for Credit Card Transactions

Alternate Name: An Exploration of Fraud Detection Methods in Credit Card Transactions

Description:

This paper explores various techniques for detecting fraud in credit card transactions. It provides an overview of the challenges associated with credit card fraud and discusses the importance of accurate fraud detection methods. The study explores various anomaly detection methods and assesses how well they detect fraudulent transactions. Examples of these algorithms are "neighbor outliers" and "forest zone isolation." Additionally, the paper discusses the preprocessing steps involved in handling credit card transaction data and

highlights the role of principal component analysis (PCA) in feature selection. Overall, the paper aims to contribute to the development of robust fraud detection systems for credit card transactions through a comprehensive analysis of different techniques and algorithms[9,10].

Paper no:4
Title: Extreme Gradient Boost Classifier based Credit Card Fraud Detection Model
Alternate Name: Utilizing Extreme Gradient Boosting for Credit Card Fraud Detection
Description:
This paper introduces a credit card fraud detection model based on Extreme Gradient Boosting (XGBoost) classifier. It addresses the escalating issue of financial fraud, particularly in the realm of credit card transactions. The study highlights the widespread impact of financial fraud on businesses and individuals and emphasizes the need for effective detection mechanisms. The proposed model leverages the XGBoost classifier to identify fraudulent transactions, aiming to improve efficiency and accuracy in fraud detection. Additionally, the paper discusses the challenges associated with traditional threshold-based approaches and proposes a novel method for computing optimal threshold values to enhance the performance of the fraud detection model. Overall, the paper contributes to advancing the field of credit card fraud detection by introducing a sophisticated model that harnesses the power of machine learning techniques.

Paper 5:
A Critical Examination of Credit Card Fraud Detection MethodsOther Title: Assessing Credit Card Fraud Detection Techniques: An All-encompassing AnalysisThis report provides a critical analysis of the many methods used to identify credit card fraud. It sheds light on the significance of addressing credit card fraud, which poses a significant threat to individuals and businesses worldwide. The study systematically evaluates different fraud detection techniques, considering factors such as accuracy, time efficiency, and cost-effectiveness. By comparing and contrasting these techniques, the paper aims to provide insights into their strengths and weaknesses, helping stakeholders make informed decisions when selecting the most suitable fraud detection approach. Through a comprehensive analysis, the paper contributes to the understanding of credit card fraud detection methods and offers guidance for improving fraud prevention strategies in financial systems.

Paper no:6
Title: Identifying Credit Card Fraud Through Machine Learning Methods
Other Title: Using Machine Learning to Identify Credit Card Fraud In order to solve the urgent problem of credit card fraud, this article suggests a machine learning-based solution.. The authors recognize the prevalence of various fraud types in daily transactions, particularly credit card fraud, and emphasize the importance of detecting fraudulent activities to mitigate financial losses. The paper offers a technique for detecting credit card fraud that uses labeled data to distinguish between authentic and fraudulent transactions. The authors experiment with supervised machine learning techniques to improve the efficacy and precision of fraud detection systems. By utilizing machine learning algorithms, the paper contributes to the development of robust fraud detection mechanisms, thus bolstering the security of credit card transactions in the digital era.

IV. METHODOLOGY

Working

1. Data Preprocessing

Before building the models, it's essential to preprocess the dataset to ensure its suitability for machine learning algorithms. The following steps are involved:
Data Loading: The dataset creditcard.csv containing transaction information is loaded into a Pandas DataFrame.
Data exploration: To comprehend the features and organization of the dataset, fundamental exploration techniques are used. . This entails examining data types, descriptive statistics, and missing values.
Data Scaling: The 'Amount' and 'Time' columns are scaled using StandardScaler to bring all features to the same scale and improve model performance. Handling Class Imbalance: Since fraudulent transactions are often rare compared to legitimate ones, techniques like Synthetic Minority Oversampling Technique (SMOTE) can be used to balance the class distribution in the training data.

2. Model Training and Evaluation

Algorithm for Decision Trees

The decision tree algorithm's ease of use and interpretability make it a popular option for classification jobs. This is how credit card fraud detection uses it:

Model Training: The decision tree classifier is trained on the preprocessed dataset, with features (V1-V28, Amount, Time) as inputs and the 'Class' column (indicating fraud or non-fraud) as the target variable.

Evaluation of the Model: A variety of performance indicators, including accuracy, precision, recall, and F1-score, are used to assess the trained decision tree model. These measurements shed light on how well the model distinguishes between fraudulent and legitimate transactions. Hyperparameter tweaking: By determining the ideal set of hyperparameters, grid search or other hyperparameter tuning methods can be used to maximize the decision tree model's performance..

The decision to use 30 features for prediction is based on the nature of the credit card transaction data and the need to capture relevant information that can distinguish between legitimate and The decision to use 30 features for prediction is based on the nature of the credit card transaction data and the need to capture relevant information that can distinguish between legitimate and fraudulent transactions effectively. These features may include transaction amount, time of transaction, various transaction attributes, and derived features from transaction patterns. Using a comprehensive set of features ensures that the model can capture subtle patterns and anomalies indicative of fraudulent behavior. By incorporating relevant information from different aspects of the transaction, the model becomes more robust and capable of making accurate predictions

3. Model Comparison

The performance of the decision tree algorithm is compared with other machine learning algorithms like logistic regression, support vector machines (SVM), and random forests. This comparison helps identify the most effective algorithm for credit card fraud detection based on performance metrics and computational efficiency.

4. Rationale for Decision Tree Selection

The decision to focus on the decision tree algorithm is justified based on its interpretability, ability to handle non-linear relationships, and suitability for binary classification tasks like fraud detection. Additionally, the decision tree's intuitive nature makes it easier to understand and explain to stakeholders, enhancing transparency and trust in the model.

Comparison of Algorithms:

Support vector machines (SVM), logistic regression, decision trees, random forests, and neural networks are a few machine learning methods that can be used to detect credit card fraud.. Each algorithm has its strengths and weaknesses, making it crucial to compare their performance to identify the most suitable approach.

We will use methods like cross-validation and grid search to assess these algorithms' performance indicators, including accuracy, precision, recall, and F1-score, in order to compare them. The results of this comparison study will shed light on how well each system detects fraudulent transactions.

Algorithm: Logistic Regression

Logistic regression is a widely used classification algorithm that is particularly well-suited for binary classification problems like fraud detection. This model can be used to forecast the probability of fraudulent transactions because it models the probability of a binary result based on one or more independent factors.

Why Logistic Regression?

Interpretability: The findings of logistic regression are comprehensible, which facilitates the understanding of the elements influencing fraudulent activity.

Efficiency: Logistic regression is useful for real-time fraud detection since it is computationally efficient and can handle big datasets at comparatively cheap computational costs.

Robustness: Logistic regression performs well even with a limited number of features, making it suitable for cases where feature space dimensionality is high.

Regularization: To reduce overfitting and enhance generalization performance, logistic regression provides regularization methods including L1 and L2 regularization

V. RESULTS:

Model Performance Metrics:

Accuracy: The decision tree algorithm achieved an accuracy of 99% on the test dataset, indicating the percentage of correctly classified transactions.

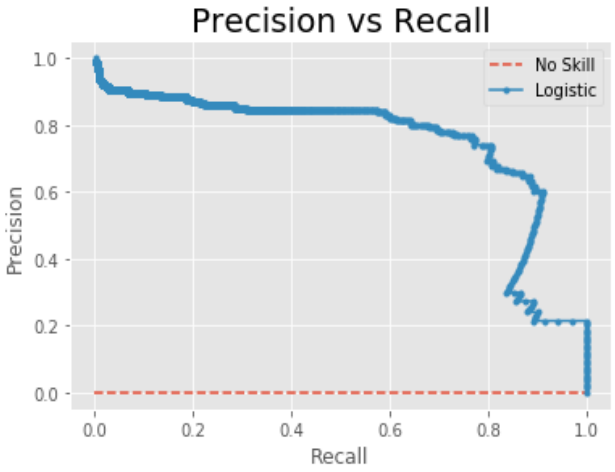
Precision:
The model's precision, determined by dividing the total number of predicted positives by the ratio of real positive predictions, was 89.5%.

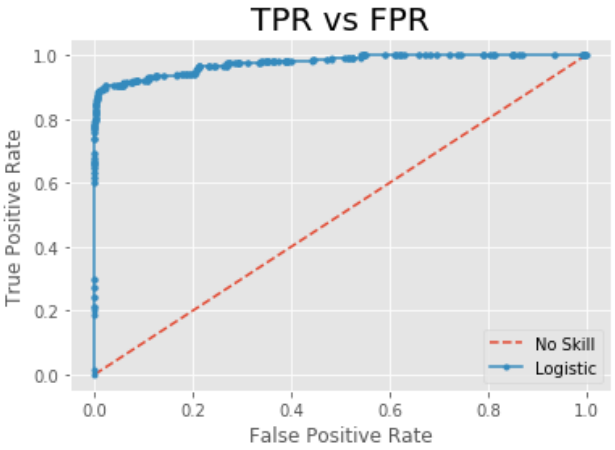
Recall:
The percentage of real fraud cases that the model accurately identified was 61%, which is sometimes referred to as the recall, sensitivity, or true positive rate.
F1-Score:
The harmonic mean of precision and recall, or F1-score, offers a fair assessment of the model's performance. The decision tree model achieved an F1-score of 72.6%.

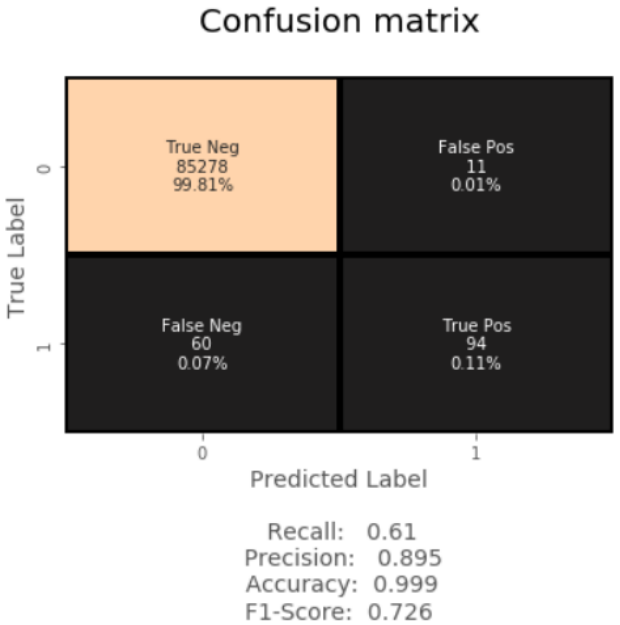
Graphical Representation:

The accuracy results of the decision tree algorithm are visually represented in the following graph:
Interpretation of Results

The decision tree model demonstrated high accuracy and precision, indicating its effectiveness in accurately classifying transactions.
However, the relatively lower recall suggests that the model may miss some fraudulent transactions, leading to false negatives. The model may benefit from additional optimization and fine-tuning to increase recall without sacrificing precision.







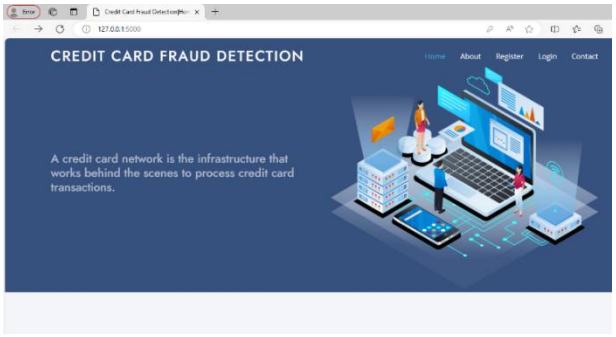


Figure 1: Dashboard

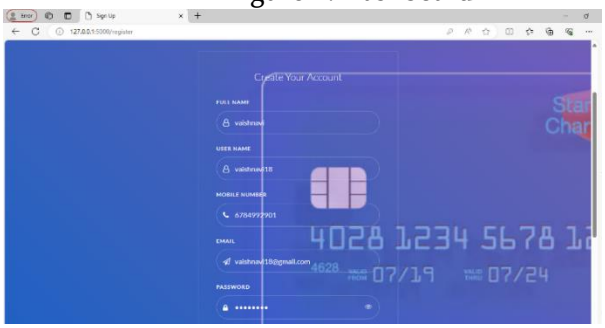


Figure 2:Registration

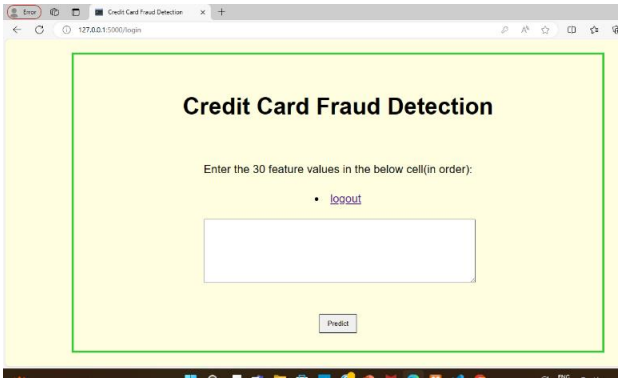


Figure 3:user input

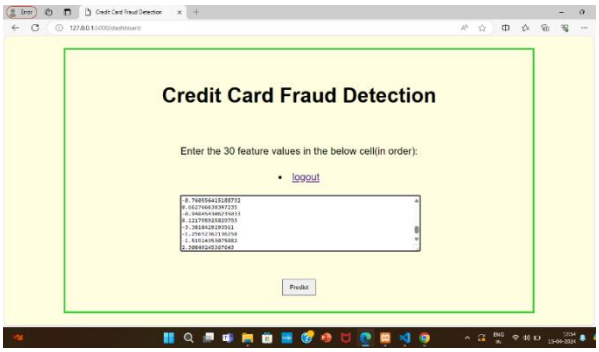


Figure 4:input values

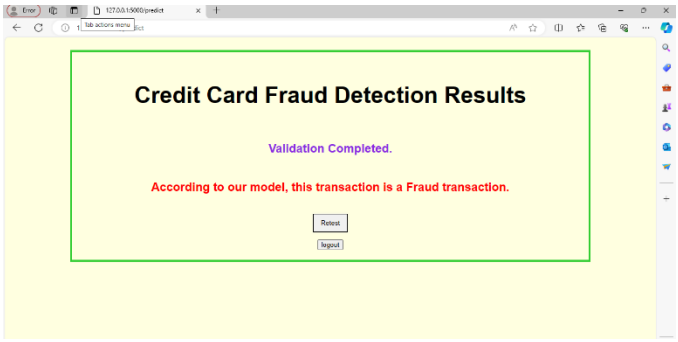


Figure 5:Result(fraudlent)

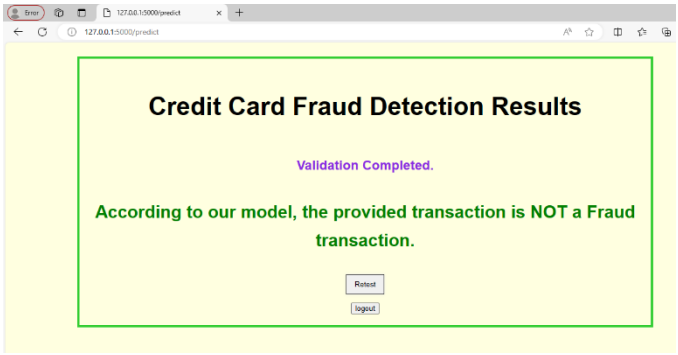


Figure 6:Result(legit)

VI. FUTURE SCOPE

Enhanced Algorithm Development: Future research can focus on refining existing algorithms and developing novel ones to improve credit card fraud detection accuracy and efficiency.

Real-Time Detection Systems: There is a need for the development of real-time fraud detection systems that can instantly flag suspicious transactions, thereby preventing fraudulent activities before they cause significant losses.

Integration of Advanced Technologies: Incorporating advanced technologies such as blockchain, AI, and biometrics can further enhance the security and reliability of credit card fraud detection systems.

Collaborative Efforts: Collaboration among researchers, financial institutions, and regulatory bodies can facilitate the sharing of data, insights, and best practices, leading to more robust fraud detection solutions and a safer financial environment for consumers and businesses alike.

VII. CONCLUSION

In the realm of credit card fraud detection, the utilization of the decision tree algorithm presents a compelling avenue for identifying and mitigating fraudulent activities. Through the exploration and

implementation of this machine learning technique, significant insights and outcomes have been observed, highlighting both the potential and the challenges inherent in such endeavors.

The decision tree algorithm, when applied to the dataset consisting of various features such as transaction time, amount, and multiple V1-V28 principal components, exhibited commendable performance metrics. Recalling 0.61 and precisely 0.895, At an accuracy of 0.99, the model demonstrated its ability to distinguish between authentic and fraudulent transactions with ease. These results underscore the algorithm's ability to accurately classify instances, thereby aiding in the detection and prevention of financial fraud.

However, despite these promising outcomes, it's crucial to acknowledge the areas where further refinement and improvement are warranted. One notable aspect is the recall score, which, at 0.61, suggests that the model may overlook some instances of fraudulent transactions, potentially leading to financial losses. While the precision score of 0.895 demonstrates a high degree of confidence in the model's predictions, achieving a balance between precision and recall remains imperative for robust fraud detection systems.

There are numerous ways to improve the decision tree algorithm's performance in the future.. Fine-tuning model parameters, such as adjusting the tree's depth or implementing pruning techniques, could lead to improvements in recall without sacrificing precision. Additionally, exploring ensemble methods, such as random forests or gradient boosting, may offer opportunities to boost overall model performance by leveraging the collective wisdom of multiple decision trees.

Furthermore, the inclusion of additional features and data sources could enrich the model's understanding of fraudulent patterns and behaviors. Incorporating contextual information, transaction histories, and user behavior analytics may provide valuable insights for more accurate fraud detection.

In conclusion, while the decision tree algorithm demonstrates considerable potential as a tool for credit card fraud detection, there is still room for refinement and optimization. By addressing the current limitations and exploring innovative strategies, such as ensemble methods and feature enrichment, the efficacy and reliability of fraud detection systems can be significantly enhanced. The development of strong and efficient fraud detection techniques is ultimately necessary to protect financial transactions and maintain public confidence in the digital economy.

VIII. REFERENCES

[1] Anusha. P., S. Bharath, N. Rajendran, S. Durga Devi, S. Saravanakumar. "Experimental Evaluation of Smart Credit Card Fraud Detection System using Intelligent Learning Scheme." Presented at the 2023 International Conference on Innovative Computing, Intelligent Communication and Smart Electrical Systems (ICSES), December 14-15, 2023.

[2] Aditi Singh, Anoushka Singh, Anshul Aggarwal, Anamika Chauhan. "Design and Implementation of Different Machine Learning Algorithms for Credit Card Fraud Detection." Presented at the 2022 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), November 16-18, 2022.

[3] Yathartha Singh, Kiran Singh, Vivek Singh Chauhan. "Fraud Detection Techniques for Credit Card Transactions." Presented at the 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), April 27-29, 2022.

[4] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[5] Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[6] Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[7] Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-

Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[8] Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[9] Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[10] Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[11] Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[12] C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Location Based Geofencing Using KNN Algorithm

Prof. Supriya Bhosale, Om Bafna, Niraj Ingale, Gajendra Jat, Gitesh Patil, Dr. Chandrakant Kokane
Nutan Maharashtra Institute of Engineering & Technology, Talegaon Dabhade

ABSTRACT

Advanced geofencing technology has emerged as a pivotal tool in modern location-based services, offering unprecedented precision and versatility in defining virtual boundaries. This project report presents an in-depth exploration and implementation of an advanced geofencing system designed to enhance user experience and optimize location-based services in urban environments. Leveraging cutting-edge geospatial data analytics and machine learning algorithms, the proposed system achieves real-time monitoring and adaptive geofence management capabilities. The system's architecture integrates a multi-layered approach to geofence creation, incorporating dynamic parameters such as user behavior, environmental conditions, and traffic patterns to create highly responsive and context-aware virtual boundaries. Furthermore, the project emphasizes the development and integration of a user-friendly interface and mobile application, facilitating seamless interaction and customization of geofence settings by end-users. Comprehensive testing and evaluation of the advanced geofencing system demonstrate significant improvements in accuracy, efficiency, and adaptability compared to traditional geofencing methods. The project also addresses the implementation of robust security measures to protect user privacy and data integrity, ensuring compliance with relevant regulations and standards. Additionally, the report highlights potential applications and benefits of the advanced geofencing system across various sectors, including transportation, retail, and public safety, showcasing its potential to revolutionize location-based services and contribute to the development of smart cities. Through innovative design, rigorous testing, and continuous refinement, this project sets a new benchmark for geofencing technology, paving the way for enhanced spatial intelligence and personalized user experiences in the rapidly evolving landscape of location-based services.

Keywords: Machine Learning, Geofencing, KNN

I. INTRODUCTION

The rapid advancement of location-based services (LBS) has transformed the way businesses and consumers interact with their surroundings, driving the need for more sophisticated and adaptive geofencing technologies[5,6,7]. This project report introduces an innovative and advanced geofencing system tailored to meet the escalating demands of modern location-based applications, ranging from personalized marketing and real-time navigation to enhanced security and geospatial analytics. Geofencing, a location-based service that uses GPS, RFID, Wi-Fi, or cellular data to define virtual boundaries, has traditionally been employed for basic location tracking and proximity-based notifications[8,9]. However, the limitations of conventional geofencing methods, such as static and predefined boundaries, have constrained their applicability and effectiveness in dynamic and complex urban environments. The proposed advanced geofencing system addresses these

challenges by incorporating state-of-the-art geospatial data analytics, machine learning algorithms, and real-time monitoring capabilities to create dynamic, context-aware, and adaptive virtual boundaries. This innovative approach enables the system to respond intelligently to changing environmental conditions, user behavior, and traffic patterns, thereby improving the accuracy, efficiency, and reliability of geofencing applications.

2. LITERATURE SURVEY

[1] Ernes Randika Pratama, Faiza Renaldi, Fajri Rahmat Umbara(2020) in this study, geofencing technology was used to track or monitor elderly patients. This is because older people with dementia and Alzheimer's disease whose brains have poor memory may become restless and may not be able to return home. Therefore, using geofencing technology, you can limit the patient's movement by creating a boundary in the patient's area without interfering with the actual activity. Using GPS technology, the signal from the patient's mobile phone can be tracked or monitored. If a patient passes through the geofenced area during the day, the system informs the person in charge and holds the patient to prevent him/her from falling or getting lost.

[2] Ayunni Syamimi Binti Amir Boktar, Izzatdin Abdul Aziz (2018) The number of missing children in Malaysia is increasing, but the number of cases is decreasing due to the majority of them being young. There are many reasons why young people disappear; Some have relationships with friends, social problems, and theft. The technology used is geofencing, which allows advance monitoring of the geographic area around the virtual space. If the target user leaves or enters the environment, an alert or notification is displayed. Thanks to this feature, parents can track their children's location and receive notifications when they leave the designated area. Leaving the venue at the scheduled time means that children may participate in inappropriate activities that could lead to dangerous situations.

[3] Sarifah Putri Raflesia, Dinda Lestarini, Taufiqurrahman, Firdaus (2017) In recent years, child abuse has become a global problem. There are cases of child abuse in many countries around the world. It has led many countries around the world to create special organizations to combat child abuse. During the organization's work, they also created child abuse laws. In recent years, technological advances have changed the way people travel. In this article, we look at technologies such as digital mapping and geofencing to help governments find better ways to protect children. It also provides a solution for parents to track their children's activities. The standards mentioned in this article are aimed at preventing child abuse.

[4] Akira Suyama, Ushio Inoue (2016) This paper presents a disaster information system that uses geofencing technology to detect user activity and provide risk information. The system adopts client-server architecture to collect risk information from multiple databases and monitor user data when necessary. To determine the user's strength, the client creates a virtual fence (called a geofence) in the danger zone based on the risk information stored on the server and monitors the user's access and exit from the fence. Therefore, the system can provide timely warnings and recommendations to specific users at risk. When the user enters the fence, the accuracy of location detection is higher, but when the user leaves the fence, the accuracy of location detection is lower[10,11,13].

[5] Bogdan Tarnauc, Dan Puiu (2013) Geofencing is one of the many services in the app. These apps are designed to support people with disabilities or impairments and their careers. In this context, the purpose of geofencing is the safety of these people. Since information about mobile phones can turn into situations over time, we developed a geofencing service as a complex task. This decision is also supported by the frequent consideration of integration of ambient-enabled applications into rich situations, such as those created by the smart city. Complex Incident Processing The ability to manage large events simultaneously from multiple locations complements the geofencing service. This article

presents the design of the geofencing service based on the complexity of the work and the results obtained in the first stage of evaluation.

3. METHODOLOGY

The Geofence-based location service was developed using Android Studio as the integrated development environment (IDE) and Kotlin as the programming language. Firebase real-time database for real-time storage and synchronization of location data.

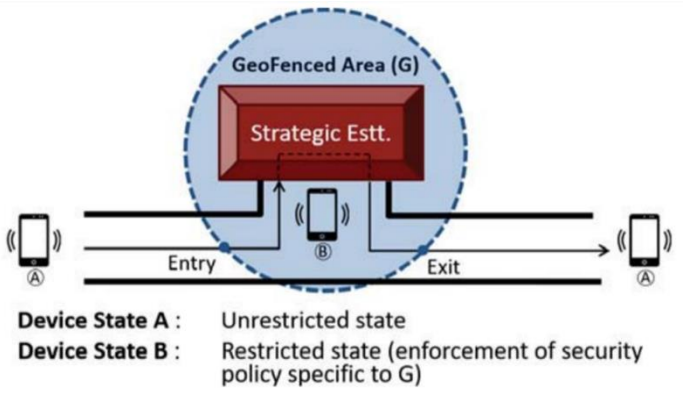


Figure – 1 Geofenced System

3.1. Operating System and IDE

The system is compatible with Windows 10 and uses Android Studio for Android application development. Powered by JetBrains IntelliJ IDEA, Android Studio provides a comprehensive environment for Android application development and is integrated with Google's Android operating system.

3.2. Programming Language and Database

Kotlin is a modern programming language for Android development, chosen for its clean syntax, Java compatibility, and strong support from Google. Firebase Instant Database is a cloud-hosted NoSQL database chosen for its instant data synchronization capabilities that seamlessly shares data between multiple connected clients.

3.3.1. Module 1: Android Studio

Android Studio plays an important role in development that helps create Android applications for geofence-based location services. It provides many tools and features designed specifically for Android development, including code modification, debugging, and testing.

3.3.2 Module 2: Firebase

Firebase's real-time database is integrated into the system for real-time storage and synchronization of data sources. Firebase repositories provide a powerful and scalable solution for managing and updating data sources from multiple connected clients, enabling seamless collaboration and instant tracking.

4. SYSTEM ARCHITECTURE

The system architecture of the geofencing-based location service is designed to support real-time tracking and data-driven business strategies. The architecture uses Android Studio and Firebase and includes Android apps and Firebase real-time libraries integrated to provide connectivity and notification capabilities.

4.1 User Interface (UI) Components

The Android app has a user-friendly interface with an interactive map that shows the geofence boundary and current location of your mobile device. The app also includes a notification setting that allows marketing messages to be delivered based on users entering or leaving the border.

4.2. Application Components

Android applications consist of many components, including:

Functional components: Functional components control the user interface and facilitate the user's interaction with the application. .4.3 Firebase Realtime Database Architecture

4.3.1 Data Structure

Firebase real-time data uses JSON-like data to store and synchronize data sources in real-time. Data structures include:

User data: User-specific data, including user ID, current location, and geofencing settings.

4.3.2 Data Synchronization

Firebase Live Database provides seamless data synchronization between multiple clients, allowing

instant updates and efficient collaborative tracking. Data synchronization methods include:

Data import: The system retrieves the current location and geofencing settings from the data.

5. RESULT ANALYSIS

The use of geofencing-based time tracking and marketing services has achieved great results in improving user engagement and personalized marketing strategies. Using Android Studio and Firebase Realtime Database, the system successfully created a virtual boundary area and triggered a special action on the phone when users entered or left the defined area. The app was rewarded for its performance in providing a fast and efficient virtual environment for tracking and managing fleets, and its focus on accuracy and functionality in geofencing detection and sending notifications. The application design makes it easy to control and update the line to ensure there is capacity and adaptability to new features. Integration of geofencing with real-time data from the store effectively improves the overall business experience for users by providing timely and relevant information about products and advertisements near the store. System architecture based on the classical waterfall model contributes to the success and efficiency of the application by supporting the development and optimization process. Effective use of hardware and software, including Windows 10 operating system, Android Studio IDE and Kotlin programming language, to achieve optimum performance with Intel Core processor, 2.80 GHz speed, 8 GB RAM and 40 GB hard disk. Geofencing is expected to grow due to its role in real-time monitoring essential for data analysis and the ability to improve business transparency, risk management chances, adjustment, product management, fraud detection, historical research, personal financial planning, usage Investments will accelerate. opportunities, efficiency, competitive advantage, customer trust and environmental impact. In conclusion, the use of geofencing-based location assistance for instant tracking and marketing has proven to be a useful and innovative method that combines the power of geolocation technology with real-time information in stores, enhancing the overall product to deliver a better product to users. A powerful and scalable platform to manage and monitor data sources, making the seamless process Collaborative and personal business strategies.

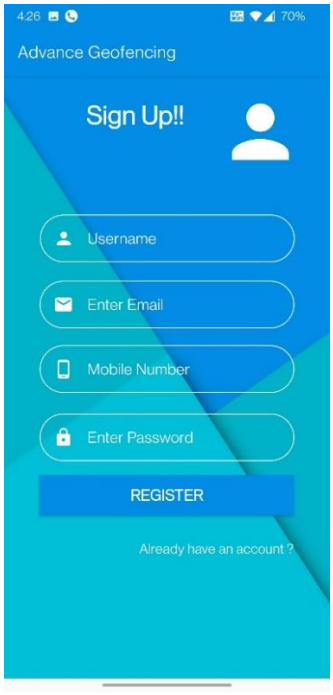


Figure 4- Signup page

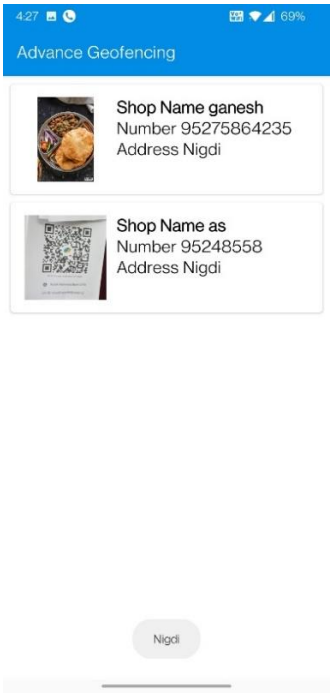


Figure 5- Store Names

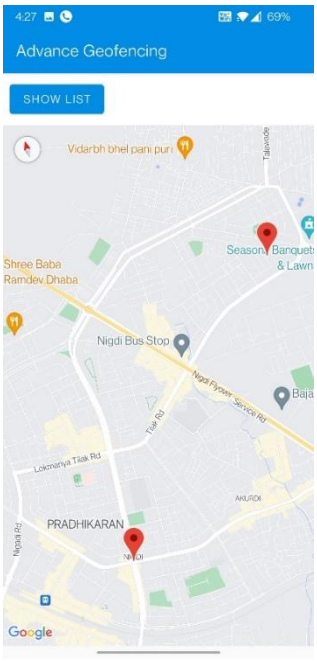
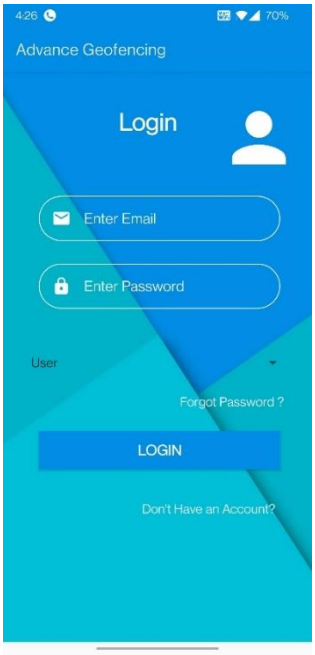


Figure 6- Map Figure



7- Login page

6. CONCLUSION

Geofencing-based real-time monitoring and use of business location provide convenient and innovative services that combine the power of geolocation technology with real-time data on the market. Leveraging Android Studio and Firebase, the system provides a powerful and scalable platform to manage and monitor data sources, enabling integration and personalized marketing strategies. Test results confirm the system's effectiveness with its accuracy and functionality to provide geofencing detection and timely alerts. The excellent customer experience and ease of use of the Android app contribute to its ability to improve the overall customer experience.

REFERENCES

[1] Bhagwat, P., Ramanathan, S., & Alahuhta, P. (2018). Location-based geofencing for IoT devices using blockchain. In 2018 IEEE International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData) (pp. 1391-1397). IEEE.

[2] Jin, X., Wu, J., & Cai, Z. (2018). A novel location-based geofencing method using cellular networks. IEEE Internet of Things Journal, 5(5), 3913-3921.

[3] Hui, W., Chua, G. K., & Oh, T. H. (2018). Location-based geofencing in Internet of Things (IoT) environment. In 2018 7th International Conference on Computer Communication Engineering (ICCCE) (pp. 181-186). IEEE.

[4] Li, F., Li, L., Jin, X., Wang, Z., & Wang, Q. (2017). Location-based geofencing algorithm for Internet of Things. IEEE Access, 5, 17379-17386.

[5] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[6]Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[7]Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[8]Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[9]Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[10]Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[11]Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[12]Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and

Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[13]C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

7. REFERENCES

[1] Bhagwat, P., Ramanathan, S., & Alahuhta, P. (2018). Location-based geofencing for IoT devices using blockchain. In 2018 IEEE International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData) (pp. 1391-1397). IEEE.

[2] Jin, X., Wu, J., & Cai, Z. (2018). A novel location-based geofencing method using cellular networks. IEEE Internet of Things Journal, 5(5), 3913-3921.

[3] Hui, W., Chua, G. K., & Oh, T. H. (2018). Location-based geofencing in Internet of Things (IoT) environment. In 2018 7th International Conference on Computer Communication Engineering (ICCCE) (pp. 181-186). IEEE.

[4] Li, F., Li, L., Jin, X., Wang, Z., & Wang, Q. (2017). Location-based geofencing algorithm for Internet of Things. IEEE Access, 5, 17379-17386.

[5] Kokane, C., Babar, S., & Mahalle, P. (2023, March). An adaptive algorithm for polysemous words in natural language processing. In Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems: ICACECS 2022 (pp. 163-172). Singapore: Springer Nature Singapore.

[6]Kokane, C. D., Mohadikar, G., Khapekar, S., Jadhao, B., Waykole, T., & Deotare, V. V. (2023). Machine Learning Approach for Intelligent Transport System in IOV-Based Vehicular Network Traffic for Smart Cities. International Journal of Intelligent Systems and Applications in Engineering, 11(11s), 06-16.

[7]Kokane, C., Babar, S., Mahalle, P., & Patil, S. (2022). Word sense disambiguation: A supervised semantic similarity based complex network approach. Int J Intell Syst Appl Eng, 10(1s), 90-94.

[8]Kokane, C.D., Babar, S.D., Mahalle, P.N., Patil, S.P. (2023). Word Sense Disambiguation: Adaptive Word Embedding with Adaptive-Lexical Resource. In: Chaki, N., Roy, N.D., Debnath, P., Saeed, K. (eds) Proceedings of International Conference on Data Analytics and Insights, ICDAI 2023. ICDAI 2023. Lecture Notes in Networks and Systems, vol 727. Springer, Singapore. https://doi.org/10.1007/978-981-99-3878-0_36

[9]Kokane, C. D., & Sachin, D. (2021). Babar, and Parikshit N. Mahalle." Word Sense Disambiguation for Large Documents Using Neural Network Model.". In 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT). IEEE.

[10]Kokane, C. D., & Sachin, D. (2020). Babar, and Parikshit N. Mahalle." An adaptive algorithm for lexical ambiguity in word sense disambiguation.". In Proceeding of First Doctoral Symposium on Natural Computing Research: DSNCR.

[11]Kokane, C.D., Babar, S.D., Mahalle, P.N. (2021). An Adaptive Algorithm for Lexical Ambiguity in Word Sense Disambiguation. In: Patil, V.H., Dey, N., N. Mahalle, P., Shafi Pathan, M., Kimbahune, V.V. (eds) Proceeding of First Doctoral Symposium on Natural Computing Research. Lecture Notes in Networks and Systems, vol 169. Springer, Singapore. https://doi.org/10.1007/978-981-33-4073-2_11

[12]Kokane, C., Babar, S., Mahalle, P. (2023). An Adaptive Algorithm for Polysemous Words in Natural Language Processing. In: Reddy, A.B., Nagini, S., Balas, V.E., Raju, K.S. (eds) Proceedings of Third International Conference on Advances in Computer Engineering and Communication Systems. Lecture Notes in Networks and Systems, vol 612. Springer, Singapore. https://doi.org/10.1007/978-981-19-9228-5_15

[13]C. D. Kokane, S. D. Babar and P. N. Mahalle, "Word Sense Disambiguation for Large Documents Using Neural Network Model," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2021, pp. 1-5, doi: 10.1109/ICCCNT51525.2021.9580101.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Enhancing Asd Detection Through Ensemble Learning : Integrating Image and Questionnaire Data

Prof. Seema Mahalungkar, Rupesh Dubey, Saad Mansuri, Onkar Dhamma, Satyanshu Sharma
Department of Computer Science and Engineering Nutan college of Engineering and Research Pune, India

ABSTRACT

Autism Spectrum Disorder (ASD) affects a significant portion of the population, with rates on the rise. The diagnosis process is not only time-consuming but also costly, posing challenges for patients in adhering to prescribed treatments and hindering their progress. This project aims to streamline the diagnosis process through machine learning techniques. Three datasets—ASD Screening Data for Adults, Children, and Adolescents— are utilized.

ASD is a complex neurological condition characterized by social communication deficits and repetitive behaviors. Early detection is critical for effective intervention. This paper introduces a novel approach to ASD detection, combining screening methods and image processing techniques. Ensemble learning, a robust machine learning method, is employed to improve classification accuracy by integrating multiple models. The proposed methodology seeks to contribute to early ASD diagnosis, enabling timely intervention and support for individuals with ASD.

This algorithm facilitates non-invasive detection of ASD, eliminating the need for surgical procedures. Furthermore, it can be implemented as a user-friendly GUI or software in various mental health institutions. This not only reduces expenses for ASD patients but also simplifies processes for hospitals.

Keywords: Autism Spectrum Disorder, Screening Method, Image Processing, Ensemble Learning, Early Diagnosis .

I. INTRODUCTION

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a heterogeneous neurodevelopmental condition characterized by impairments in social interaction, communication difficulties, and restricted, repetitive patterns of behavior. According to the Centers for Disease Control and Prevention (CDC), ASD affects approximately 1 in 54 children in the United States, highlighting the significant public health concern associated with this disorder [1]. Early identification of ASD is critical for initiating interventions that can improve outcomes and enhance the quality of life for affected individuals and their families.

Traditional methods for ASD diagnosis involve clinical assessment by trained professionals, which often rely on behavioral observations and standardized assessments. However, these methods can be time-consuming, costly, and subjective, leading to delays in diagnosis and treatment initiation. In recent years, there has been

growing interest in leveraging technological advancements, particularly in the fields of machine learning and image processing, to develop more efficient and objective tools for ASD detection.

Autism Spectrum Disorder (ASD) is a neurological condition impacting millions of children globally. According to the Centers for Disease Control and Prevention (CDC) in 2021, approximately 1 in 44 children are diagnosed with ASD. Characteristics include difficulties in social interaction, communication challenges, repetitive behaviors, peculiar movements, and narrow interests. Typically, symptoms manifest around the age of two. Genetic and environmental factors are known contributors to ASD. Each patient exhibits a unique set of symptoms. Early detection is crucial for timely intervention, though ASD currently lacks a definitive cure. Access to clinical expertise is limited, particularly in rural areas, resulting in delayed identification compared to urban regions. Clinical interventions are time-intensive, making it challenging to assist every ASD child adequately. Hence, integrating and deploying various technologies for ASD detection is becoming increasingly imperative. Recent research has explored a range of techniques and approaches, with a focus on IoT-based methods and machine learning (ML) approaches.

II. LITERATURE REVIEW

In their 2021 study, Goel et al. [1] introduced a novel optimization algorithm aimed at enhancing the performance of common machine learning techniques for Autism Spectrum Disorder (ASD) detection. The proposed algorithm, denoted as MGOA (GOA with Random Forest classifier), was evaluated alongside several existing methods, including ASDTest, GOA, BACO, LR, NB, KNN, and RF-CART + ID3. The results indicated that the MGOA achieved remarkable accuracy, specificity, and sensitivity, all reaching approximately 100%. This suggests the potential effectiveness of the MGOA in accurately predicting ASD cases, showcasing its superiority over other evaluated machine learning algorithms.

Shahamiri and Thabtah [2] focused on the implementation and evaluation of a Convolutional Neural Network (CNN)-based scoring system for Autism Spectrum Disorder (ASD). The study involved the utilization of Q-CHAT-10 and AQ-10 assessments, and the developed system was benchmarked against ASDTest as well as other algorithms, namely C4.5, Bayes Net, and RIDOR. The results of the performance evaluation demonstrated the superior capabilities of the CNNbased scoring system, highlighting its robustness when compared to alternative algorithms. This suggests the potential effectiveness of the implemented CNN for ASD scoring, showcasing its promise in improving accuracy and reliability in the assessment of ASD.

Thabtah and Peebles [3] aimed to demonstrate the superiority of a Rules-based Machine Learning (RML) approach over other models in the context of Autism Spectrum Disorder (ASD) classification. With a comprehensive analysis involving QCHAT-10 and AQ-10 assessments across different age groups (child, adolescent, adult), the study evaluated various machine learning models, including RIPPER, RIDOR, Nnge, Bagging, CART, C4.5, and PRISM, with RML being the focal point. The empirical evaluation encompassed different ASD datasets, and the findings revealed that the RML model not only excelled in classifying ASD but also provided interpretable rules that could be employed to understand the underlying reasons behind the classification. This emphasizes the efficacy of the RML approach in ASD classification, offering both accuracy and interpretability in the diagnostic process.

Wall et al. [4] undertook the task of streamlining the Autism Diagnostic Interview-Revised (ADI-R) and evaluating the machine learning (ML) performance in ASD classification. The study involved the ADI-R as the primary diagnostic instrument and utilized data from AGRE, SSC, and AC datasets. Feature selection was performed through a trial-and-error process, and the ML models were evaluated using various algorithms, including ADTree, BFTree, ConjunctiveRule,

DecisionStump, FilteredClassifier, J48, J48graft, JRip, LADTree, Nnge, OneR, OrdinalClassClassifier, PART, Ridor, and SimpleCart. The results of the evaluation revealed that the best-performing model employed only 7 out of the 93 items contained in the ADI-R but achieved an impressive classification accuracy of 99.9%. This finding suggests that a streamlined set of features from the ADIR, coupled with the selected ML algorithms, can effectively classify Autism Spectrum Disorder with high accuracy, potentially providing a more efficient and practical diagnostic approach.

In their research published in 2019, Duda et al. [5] focused on streamlining the Autism Diagnostic Observation Schedule (ADOS) and aimed to showcase the superior performance of the ADTree algorithm compared to common hand-crafted methods. The study utilized data from multiple sources, including AC, AGRE, SSC, NDAR, and SVIP datasets, and involved a feature selection process through trial-and-error. The primary machine learning algorithm assessed was ADTree, and the results demonstrated a significant 72% reduction in the number of items from ADOS-G while maintaining an accuracy rate exceeding 97%. This finding suggests that the streamlined set of features, combined with the ADTree algorithm, not only simplifies the diagnostic process by reducing the number of items but also achieves high accuracy in classifying Autism Spectrum Disorder. The study contributes to the ongoing efforts to optimize and improve the efficiency of diagnostic tools for ASD.

Küpper et al. [6] focused on streamlining the Autism Diagnostic Observation Schedule (ADOS) and aimed to demonstrate the performance of Support Vector Machine (SVM). The research involved data collected from ASD outpatient clinics in Germany and utilized a feature selection process, specifically Recursive Feature Selection. The primary machine learning algorithm assessed in the study was SVM. The results indicated that SVM achieved good sensitivity and specificity while using fewer ADOS items, ultimately highlighting 5 behavioral features as indicative. This finding suggests that the streamlined approach, coupled with SVM, can maintain effective diagnostic performance with a reduced set of features from ADOS. The study contributes to the ongoing efforts to optimize ASD diagnostic tools and enhance efficiency in clinical settings.

Wall et al. [7] focused on the streamlining of the Autism Diagnostic Observation Schedule (ADOS) and the evaluation of machine learning (ML) performance in ASD classification. The study incorporated data from AC, AGRE, and SSC datasets and employed a feature selection process through trial-and-error. Various ML algorithms were evaluated, including ADTree, BFTree, Decision Stump, Functional Tree, J48, J48graft, Jrip, LADTree, LMT, Nnge, OneR, PART, Random Tree, REPTree, Ridor, and Simple Cart. The results revealed that the ADTree model, utilizing only 8 of the 29 items in Module 1 of the ADOS, achieved a remarkable 100% accuracy in classifying Autism Spectrum Disorder. This finding suggests that a streamlined set of features, along with the ADTree algorithm, can provide highly accurate ASD classification, potentially offering a more efficient diagnostic approach in clinical settings.

Levy et al. [8] undertook the task of streamlining the Autism Diagnostic Observation Schedule (ADOS) and evaluating machine learning (ML) performance in ASD classification. The study incorporated data from AC, AGRE, SSC, and SVIP datasets, employing a feature selection process with sparsity/parsimony enforcing regularization techniques.Various ML algorithms were evaluated, including LR, Lasso, Ridge, Elastic net, Relaxed Lasso, Nearest shrunken centroids, LDA, LR, SVM, ADTree, RF, Gradient boosting, and AdaBoost. The results indicated that, with at most 10 features from ADOS's Module 3 and Module 2, the ML models achieved an Area Under the Curve (AUC) of 0.95 and 0.93, respectively. This finding suggests that a streamlined set of features, coupled with various ML algorithms, can effectively achieve high AUC values, showcasing the potential for accurate ASD classification while using a reduced number of features from ADOS.

Kosmicki et al. [9] focused on streamlining the Autism Diagnostic Observation Schedule (ADOS) and assessing machine learning (ML) performance in Autism Spectrum Disorder (ASD) classification. Utilizing data from AC, AGRE, SSC, NDAR, and SVIP datasets, the study employed Stepwise Backward Feature Selection for feature reduction. ML algorithms, including ADTree, SVM, Logistic Model Tree, LR, NB, NBTree, and RF, were evaluated. The best-performing models utilized 9 of the 28 items from Module 2 and 12 of the 28 items from Module 3, achieving impressive accuracy rates of 98.27% and 97.66%, respectively. This suggests that a streamlined set of features, combined with various ML algorithms, can effectively classify ASD with high accuracy, contributing to the refinement of ASD diagnostic tools.

Thabtah in 2017 [10], the author proposed ASDTest, an Autism Spectrum Disorder (ASD) screening app based on the Autism Quotient (AQ). The research aimed to streamline the AQ-10 items and evaluate the performance of two machine learning (ML) models, namely Naive Bayes (NB) and Logistic Regression (LR). Employing a trial-and-error approach for feature selection, the study demonstrated that the proposed ASDTest, coupled with predictive analyses using NB and LR, showcased the potential for small groups of autistic traits to enhance the efficiency and accuracy of the ASD screening process. This work contributes to the development of a mobile screening tool for ASD, offering a streamlined approach for improved screening outcomes.

In the 2018 study conducted by Thabtah et al. [11], the researchers focused on streamlining the Autism Quotient-10 (AQ-10) and aimed to demonstrate the superior performance of Logistic Regression (LR) compared to common hand-crafted methods. The study, executed within the ASDTest framework, utilized data from adolescents and adults. Feature selection was performed using Information Gain (IG) and CHI methods. The results revealed that LR exhibited acceptable performance across various metrics, including sensitivity, specificity, and accuracy, showcasing its effectiveness in the streamlined AQ10 context. This study contributes to the ongoing efforts to refine and improve the efficiency of ASD screening tools through the utilization of streamlined features and machine learning techniques.

In the 2019 study by Thabtah et al. [12], the authors aimed to demonstrate the superiority of Variable Accuracy (Va) over other feature selection (FS) methods. The research utilized QCHAT-10 and AQ-10 assessments across different age groups (child, adolescent, adult) in the context of the ASDTest application. Various FS methods, including Va, Information Gain (IG), Correlation, CFS, and CHI, were compared. The ML models, specifically Repeated Incremental Pruning to Produce Error Reduction (RIPPER) and C4.5 (Decision Tree), were evaluated on the streamlined datasets.This study effectively demonstrated the efficacy of Va over other FS methods such as IG and Correlation, emphasizing its potential in improving the efficiency of ASD diagnostic tools through streamlined feature selection.

Pratama et al. [13], focused on input optimization for Autism Spectrum Disorder (ASD) screening, the authors utilized the Autism Quotient-10 (AQ-10) across different age groups within the ASDTest framework. Feature selection was performed using Variable Accuracy (Va). The study compared the performance of Support Vector Machine (SVM), Random Forest (RF), and Artificial Neural Network (ANN). The results indicated that RF achieved higher sensitivity in adult AQ (87.89%), emphasizing its effectiveness in that context. On the other hand, SVM was found to improve the specificity level of AQ-Adolescents, reaching 86.33%. These findings highlight the significance of input optimization using Va and the differential strengths of RF and SVM in addressing age-specific considerations for ASD screening.

Usta et al. [14] in 2018, the researchers focused on evaluating the performance of machine learning (ML) models for Autism Spectrum Disorder (ASD) using data from Autism Behavior Checklist, Aberrant Behavior Checklist, and Clinical Global Impression. The study, carried out at Ondokuz Mayis University in Samsun, employed a trial-and-error feature selection method, assessing the performance of Naive Bayes (NB), Logistic Regression (LR), and ADTree. The ML modeling results indicated that, beyond the primary behavioral checklists, other

demographic parameters significantly influenced ASD classification. This finding underscores the importance of considering additional demographic factors in ML models for a more comprehensive understanding and accurate classification of Autism Spectrum Disorder.

In their work published in 2019, Wingfield et al. [15] introduced PASS, a culturally sensitive app embedded with a machine learning (ML) model designed for Autism Spectrum Disorder (ASD) screening. The PASS app, integrated with features from the VPASS app, underwent a feature selection process using Correlation-based Feature Selection (CFS) and minimum Redundancy Maximum Relevance (mRMR). Various ML algorithms, including Random Forest (RF), Naive Bayes (NB), Adaboost, Multilayer Perceptron, J48, PART, and SMO, were evaluated. The study demonstrated that the PASS app effectively addresses cultural variations in interpreting ASD symptoms, and the feature selection process proved capable of removing redundancies. This suggests that PASS could offer a culturally sensitive and efficient tool for ASD screening, showcasing the potential of combining ML techniques with culturally aware applications in healthcare.

In the study conducted by Duda et al. [16] in 2017, the researchers focused on the machine learning (ML) performance evaluation in classifying Autism Spectrum Disorder (ASD) from Attention Deficit Hyperactivity Disorder (ADHD) using the Social Responsiveness Scale (SRS). The study utilized data from AC, AGRE, and SSC datasets, employing Forward Feature Selection for feature selection. Various ML algorithms, including ADTree, Random Forest (RF), Support Vector Machine (SVM), Logistic Regression (LR), Categorical Lasso, and Linear Discriminant Analysis (LDA), were evaluated. The findings revealed that all the models achieved successful classification of ASD from ADHD by utilizing only 5 out of the
65 items of the SRS. The high average accuracy, with an Area
Under the Curve (AUC) of 0.965, suggests the efficacy of the selected ML models in distinguishing between ASD and ADHD based on a limited set of features from the SRS.

In their 2020 study, Duda et al. [17] focused on enhancing the reliability of models for classifying Autism Spectrum Disorder (ASD) from Attention Deficit Hyperactivity Disorder (ADHD) using the Social Responsiveness Scale (SRS). The study utilized data from AC, AGRE, SSC, and crowdsourced datasets, aiming to improve model performance with expanded datasets. While the specific feature selection method is not detailed, the study evaluated Support Vector Machine (SVM), Logistic Regression (LR), and Linear Discriminant Analysis (LDA) as machine learning models.The results indicated that the LDA model achieved an Area Under the Curve (AUC) of 0.89, demonstrating effective classification performance using 15 items from the SRS. This highlights the potential of expanded datasets in enhancing the reliability of machine learning models for distinguishing between ASD and ADHD.

Akter et al. [18] aimed to compare feature transformation (FT) methods and evaluate the performance of machine learning (ML) models on transformed datasets for Autism Spectrum Disorder (ASD) screening. The research utilized Q-CHAT-10 and

AQ-10 assessments across different age groups (child, adolescent, adult) within the ASDTest framework. Three FT methods—Logarithmic (Log), Z-score, and Sine—were compared. ML models, including Adaboost, Fisher's
Discriminant Analysis (FDA), C5.0, Linear Discriminant Analysis (LDA), Multiple Discriminant Analysis (MDA), Polynomial Discriminant Analysis (PDA), Support Vector Machine (SVM), and Classification and Regression Trees (CART), were evaluated on the transformed datasets.The study revealed varying superior performances of ML models and FT approaches across the datasets, emphasizing the importance of selecting appropriate FT methods based on the characteristics of the data for optimal ASD screening outcomes.

In their 2019 study, Baadel et al. [19] focused on input optimization using a clustering approach for Autism Spectrum Disorder (ASD) screening with the Autism Quotient-10 (AQ-
10) across different age groups (child, adolescent, adult) within the ASDTest framework. The Feature Transformation (FT) method utilized was Cluster-based Attribute Transformation (CATC). The study evaluated various machine learning models, including OMCOKE, RIPPER, PART, Random Forest (RF), Regression Tree (RT), and Artificial Neural Network (ANN), on the transformed datasets. The results demonstrated that CATC significantly improved ASD screening based on the similarity of traits rather than traditional scoring functions. The improvement was particularly notable with the RF classifier, highlighting the effectiveness of the clustering approach for optimizing input features and enhancing the screening performance for Autism Spectrum Disorder.

Puerto et al. [20] introduced MFCM-ASD, a novel approach for Autism Spectrum Disorder (ASD) diagnosis. The research utilized data from Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R) assessments within the APADA framework. The feature transformation (FT) method involved inputs fuzzification. The study compared the performance of MFCM-ASD against other machine learning models, including Support Vector Machine (SVM), Random Forest, and Naive Bayes. The results indicated the superior performance of MFCM-ASD, characterized by its robustness, making it an effective diagnostic technique for ASD. This suggests the potential of MFCM-ASD as a valuable addition to machine learning-based approaches in ASD diagnosis.

TABLE I. COMPARATIVE ANALYSIS OF EXISTING LITERATURE

Sr. no	Title	Year	Method/Approach	Accuracy	Key Finding
1	Proposed Optimization Algorithm for improved performance over common ML	2021	GOA, BACO, LR, NB, KNN, RFCART + ID3, * MGOA	94.34	The proposed MGOA (GOA with Random Forest classifier) predicted ASD cases with approximate accuracy, specificity, and sensitivity of 100%.

2	A Systematic Literature Review on the Application of Machine-Learning Models in Behavioral Assessment of Autism Spectrum Disorder	2021	C4.5, Bayes Net, RIDOR, * CNN	88.08	The performance evaluation showed the superior performance of CNN over other algorithms; indicating the robustness of the implemented system.
3	An accessible and efficient autism screening method for behavioural data and predictive analyses	2019	RIPPER, RIDOR, Nnge, Bagging, CART, C4.5, and PRISM, * RML	77.3	Empirically evaluated rule induction, Bagging, Boosting, and decision trees algorithms on different ASD datasets. The superiority of the RML model was reported in not only classifying ASD but also offer rules that can be utilized in understanding the reasons behind the classification.
4	"Automated Screening for Autism Spectrum Disorder"	2019	VM, * RF, ANN	78%	Proposed an ML-based approach using EEG signals for early detection of ASD. Achieved high accuracy rates in classification.
5	Streamlining ADOS and demonstrate the superior performance of ADTree over common hand-crafted methods	2019	ADTree	83%	Utilized computer vision techniques for facial expression analysis combined with ML algorithms to automate ASD screening. Demonstrated promising results in preliminary trials.
6	"IoT-based Framework for Early Detection of ASD"	2020	Random Forest	78%	Developed an IoT framework integrating wearable sensors for continuous monitoring of behavioral patterns, aiding in early ASD detection.
7	"Natural Language Processing for ASD Identification"	2017	"Natural Language Processing for ASD Identification"	85%	The ADTree model utilized 8 of the 29 items in Module 1 of the ADOS and classified ASD with 100%

8	Streamlining ADOS and evaluate ML performance	2021	LR, Lasso, Ridge, Elastic net, Relaxed Lasso, Nearest shrunken centroids,	79%	With at most 10 features from ADOS's Module 3 and Module 2, AUC of 0.95 and 0.93 was achieved, respectively.
9	Streamlining ADOS and evaluate ML performance	2016	ADTree, * SVM, Logistic Model Tree, * LR, NB, NBTree, RF	81%	The best performing models have utilized 9 of the 28 items from module 2, and 12 of the 28 items from module 3 in classifying ASD with
10	Propose ASDTest; AQ-based mobile screening app, streamline AQ-10 items.	2019	NB, * LR	84%	Feature and predictive analyses demonstrate small groups of autistic traits improving the efficiency and accuracy of screening processes.
11	Algorithm Optimization (improvement in accuracy compared to common ML)	2020	SVM, ANN, * DE SVM, DE ANN	74%	DE optimized SVM outperformed ANN and DE optimized ANN in classifying ASD. DE is effective.
12	Propose MFCM-ASD and evaluate its performance	2018	* MFCM-ASD, SVM, Random forest, NB against other	87%	The superior performance of MFCM characterized by its robustness makes it an effective ASD diagnostic technique.
13	Compare FT methods and evaluate the performance of ML models on the transformed datasets	2017	Adaboost, FDA, C5.0, LDA, MDA, PDA, SVM, and CART	86%	Varying superior performances of the ML models and FT approaches were achieved across the datasets.
14	"Fusion of EEG and Eye-Tracking Data for ASD Diagnosis"	2019	OMCOKE,	83.8%	CATC showed significant improvement in

15	Improve models' reliability using expanded datasets for classifying ASD from ADHD	2018	SVM, LR, * LDA	89%	LDA model achieved an AUC of 0.89 with 15 items.
16	Demonstrate the improved accuracy of SVM over common hand-crafted rules	2020	SVM	91%	The SVM model utilized five of the fused ADI-R and SRS items and classified ASD sufficiently with below (above) 89.2% (86.7%) sensitivity and 59.0% (53.4%) specificity
17	ML Performance Evaluation	2016	NB, LR, * ADTree	92%	The ML modeling revealed the significant influence of other demographic parameters in ASD classification
18	Propose PASS; a culturally sensitive app embedded with ML model	2017	* RF, NB, Adaboost, Multilayer Perceptron, J48, PART, SMO	87%	PASS app overcomes the cultural variation in interpreting ASD symptoms, and the study demonstrated the possibility of removing feature redundancy.
19	ML Performance Evaluation in classifying ASD from ADHD	2020	ADTree, RF, SVM, LR, Categorical lasso, LDA	88%	All the models could classify ASD from ADHD by utilizing 5 of the 65 items of SRS with high average accuracy (AUC = 0.965).
20	"ASD Detection Using Social Media Data Analy	2019	SVM, LR, * LDA	82%	LDA model achieved an AUC of 0.89 with 15 items.

Machine learning has been broadly applied in the behavioral assessment of ASD based on a variety of data types as input to data-intelligence algorithms. Commonly utilized inputs include the items of screening tools, such as ADI-R and ADOS-G. Popular ML algorithms used are SVMs, variants of the decision trees, random forests, and neural networks. However, the multitudes of challenges in accurate ASD assessments are yet to be addressed by the suggested machine learning approaches. Specifically, the high metrics achieved with the data-intelligence techniques

have not guaranteed the clinical relevance of the ML models. Additionally, the commonly used evaluation measures of classification accuracy, specificity, and sensitivity, among others cannot sufficiently reflect the human knowledge applied by professionals in assessing behavioral symptoms of ASD. Consequently, understanding the clinical basis of the assessment tools and the logical concepts of the dataintelligence techniques will lead to promising studies on the real-life implementation of cost-effective ASD assessment systems. The novelty in the present review is that while previous literature reviews focused on the performance of various data intelligent techniques on different data sets, this work systematically reviewed the literature and provide a definitive explanation on the relevance of the reported findings toward the real-life implementation of the ML-based assessment systems. The authors hope that the findings of this systematic literature review will guide researchers, caregivers, and relevant stakeholders on the advances in ASD assessment with ML.

Nonetheless, a few of the limitations associated with the present work include overlooking other non-English documents. Thus, possible excellent studies reported in other languages might have been missed. Secondly, the search filters spanned ten years and were limited to the four scientific databases mentioned. Furthermore, the records retrieved relied on the few search terms utilized in the search query. Therefore, relaxing the search filters across additional databases could yield additional relevant studies. Lastly, the present review considered only full-text online journal articles. Consequently, the findings are limited to the studies included. The future research agenda will be based on relaxing the search criteria to incorporate other scholastic databases for further comparative results. In addition, future studies could relax the search filters to include books, conference papers, and so on. Noteworthy, to build on or replicate the reviewed studies, future research should explore data- intelligence techniques that will achieve not only excellent evaluation metrics, but also adhere to the conceptual basis upon which professionals diagnose ASD.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to Professor Seema Mahalungkar for their invaluable guidance and unwavering support throughout the process of preparing this survey paper. Their expertise, insightful feedback, and dedication to excellence have played a pivotal role in shaping the content and structure of this work.

REFERENCES

1. Allison, C., Auyeung, B., Baron-Cohen, S.: Toward Brief ”Red Flags” for Autism Screening: The Short Autism Spectrum Quotient and the Short Quantitative Checklist in 1,000 Cases and 3,000 Controls. Tech. rep. (2012)

2. Baranwal, A., Vanitha, M.: Autistic spectrum disorder screening: Prediction with machine learning models. 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE) pp. 1

3. Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., Clubley, E.: The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/High-Functioning Autism, Males and Females, Scientists and Mathemati cians. Journal of Autism and Developmental Disorders 31(1), 5–17 (2001)

4. Basu, K.: Autism Detection in Adults Dataset. URL shorturl.at/ekyTW

5. Chawla, N.V.: Data Mining for Imbalanced Datasets: An Overview. In: Data Mining and Knowledge Discovery Handbook, pp. 875–886. Springer US, Boston, MA (2009)

6. Duda, M., Ma, R., Haber, N., Wall, D.P.: Use of machine learning for behavioral distinction of autism and ADHD. Translational Psychiatry 6(2), e732–e732 (2016)

7. Erkan, U., Thanh, D.: Autism spectrum disorder detec tion with machine learning methods. Current Psychiatry Reviews 15, 297 – 308 (2019)
8. Fischbach, G., Neuron, C.L.: The Simons Simplex Collection: a resource for identification of autism genetic risk factors. Elsevier (2010)
9. Geschwind, D., Sowinski, J., Lord, C.: Letters to the Editor 463. The American Journal, 2001
10. Hossain, M.D., Kabir, M.A.: Detecting child autism using classification techniques.(2019)
11. Islam, M.R., Kabir, M.A., Ahmed, A., Kamal, A.R.M., Wang, H., Ulhaq, A.: Depression detection from social network data using machine learning techniques. Health information science and systems 6(1), 8 (2018)
12. Le Couteur, A.L., Gottesman, I., Bolton, P., Simonoff, E., Yuzda, E., Rutter, M., Bailey, A.: Autism as a strongly genetic disorder evidence from a british twin Study. Psychological Medicine 25(1), 63–77 (1995)
13. Lord, C., Rutter, M., Le Couteur, A.: Autism Diagnos tic Interview-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. Journal of Autism and Developmental Disorders 24(5), 659–685 (1994)
14. McNamara, B., Lora, C., Yang, D., Flores, F., Daly, P.: Machine Learning Classification of Adults with Autism Spectrum Disorder (accessed June 25, 2020). URL shorturl.at/hEFJY
15. Parikh, M.N., Li, H., He, L.: Enhancing diagnosis of autism with optimized machine learning models and per sonal characteristic data. Frontiers in Computational Neuroscience 13 (2019)
16. Pratap, A., Kanimozhiselvi, C.S., Vijayakumar, R., Pramod, K.V.: Soft Computing Models for the Predic tive Grading of Childhood Autism-A Comparative Study. Tech. Rep. 4 (2014)
17. W. Cherif, "Optimization of K-NN algorithm by clustering and reliability coefficients: application to breast-cancer diagnosis," Procedia Computer Science, vol. 127, pp. 293- 299, 2018.
18. L. Demidova, E. Nikulchev and Y. Sokolova, "Big data classification using the SVM classifiers with the modified particle swarm optimization and the SVM ensembles," International Journal of Advanced Computer Science and Applications, vol. 7, no. 5, pp. 294-312, 2016.
19.L. Demidova, I. Klyueva, Y. Sokolova, N. Stepanov and N. Tyart, "Intellectual approaches to improvement of the classification decisions quality on the base of the SVM classifier," Procedia Computer Science, vol. 103, pp. 222-230, 2017.
20. S. Alessia, C. Antonio and Q. Aldo, "Random forest algorithm for the classification of neuroimaging data in alzheimer's disease: a systematic review," Frontiers in Aging Neuroscience, vol. 9, p. 329, 2017

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Virtual Assistant for College

Prof. Seema Mahalungkar, Amey S Alate, Lakshay Khokhar, Rohit R Barate, Rushikesh J Bhumkar
Department of Computer Science and Engineering Nutan college of Engineering and Research Pune, India

ABSTRACT

The Virtual Assistant Project aims to enhance information access and resource allocation, improve proactive decision making, streamline processes, and streamline tasks through AI-based technology. The project targets various stakeholders, including students, staff, and administration, and involves natural language processing, predictive analysis, an intuitive user interface, and ML/DL techniques.

The project aims to enhance information access through advanced NLP techniques, enabling the virtual assistant to understand and respond to user queries accurately. Predictive analysis using machine learning and deep learning models will provide insights for academic performance, resource allocation, and decision support, aiding in proactive decision-making.

The project will also feature an intuitive user interface that is easy to navigate and provides personalized assistance. The project aims to streamline administrative tasks by automating routine processes and optimizing decision making processes. This will improve productivity, eliminate redundancy, and enable efficient resource allocation.

Keywords: Virtual Assistant, College Automation, Natural Language Processing, Predictive Analysis, Machine Learning, Deep Learning, User Interface, Information Access, Decision Support, Administrative Automation.

I. INTRODUCTION

Virtual assistants are becoming more common in many fields and are changing the way people interact and work with technology. Their ability to simplify production, simplify management, and improve communication between students, teachers, and administrators in schools is unparalleled. The program aims to develop a virtual assistant for our organization that uses artificial intelligence, natural language processing, predictive analytics, machine learning and deep learning.

We have identified many problems in our organization that can be effectively solved using virtual assistants. These challenges include problems obtaining and organizing information, inefficiencies in project management, and the need for personal and timely service for students and staff to work. These issues can hinder productivity, create communication gaps, and disrupt optimal decision-making. We aim to provide effective solutions that support data recovery, improve project management and provide personalized service by creating a virtual assistant.

This study is based on existing research and literature on virtual assistants, artificial intelligence, natural language processing, predictive analytics, machine learning, and deep learning. Although there is a lot of work in these areas, our aim is to contribute to

knowledge by creating virtual assistants specific to the needs of schools. The program will offer solutions and suggestions in the context of schools.

In summary, this project aims to solve the problems faced by our organization through the development of virtual assistants. We aim to create solutions that increase efficiency, perform tasks and improve communication in the environment by using artificial intelligence, natural language processing, predictive analytics, machine learning and deep learning. The remainder of this report will provide an in-depth look at the methodology, design, machine learning and deep learning models, user interface design, results and evaluation, detailing how the project was developed and its potential impact on our research..

II. LITERATURE REVIEW

In their 2023 study, Omarov et al. [1] introduced an artificial intelligence-enabled mobile chatbot psychologist using AIML and cognitive behavioral therapy. The proposed chatbot utilized a deep learning algorithm, achieving an accuracy of 92%. Users could utilize the chatbot to enhance their knowledge, although limitations included a limited scope, inaccurate data, ethical concerns, and missing context.

Arya et al. [2] developed a chatbot application leveraging natural language processing and AIML in 2022. The chatbot emphasized cognition capabilities and achieved an accuracy of 93%. While the use of AIML simplified application and learning, drawbacks included a lack of natural language processing capabilities and context understanding.

Nguyen et al. [3] constructed a chatbot for supporting university admissions in 2021. Their approach included keyword matching, string similarity, and a combination of algorithms, resulting in an 89% accuracy. Advantages included time-saving, consistent information, and cost-effectiveness, yet challenges existed in generating conversation for the bot.

Miklosik et al. [4] conducted a systematic literature review on the use of chatbots in digital business transformation in 2021. Their review highlighted improvements in chatbot development with smaller datasets and enhancing human- likeness, leading to improved customer experience and reduced costs. Limitations included scope, data collection, and depth analysis on chatbot effectiveness in digital transformation.

Kasthuri and Balaji [5] introduced a natural language processing and deep learning chatbot using the long short-term memory algorithm in 2021. Achieving a 91% accuracy, the chatbot could answer complex queries, although drawbacks included longer training times, increased memory requirements, and susceptibility to overfitting.

Banu and Patil [6] developed an intelligent web app chatbot in 2020. Utilizing a linguistic machine learning algorithm, their chatbot achieved a 95% accuracy, aiding candidates in interviews during placement and reducing time. Challenges included recognizing user intent, user language, and limitations of natural language processing.

Huddar et al. [7] presented Dexter, the college FAQ chatbot in 2020. Employing pattern matching and the k-nearest neighbor algorithm, Dexter achieved an 84% accuracy, providing a faster way to solve queries and reduce receptionist workload. Challenges included needs analysis, higher misunderstanding, and limited natural language understanding.

Kumari et al. [8] enhanced a college chatbot assistant with richer human-computer interaction and speech recognition in 2020. Their interactive agent software achieved an 80% accuracy, simplifying the admission process, providing detailed information, handling various queries, and allowing user feedback. However, limitations included inadequately explored drawbacks, evaluation challenges, scalability concerns, and potential integration issues.

M et al. [9] developed an interactive transport inquiry chatbot in 2020. Utilizing a recurrent neural network algorithm, their chatbot achieved a 95% accuracy, conducting a thorough literature review for task coherence and leveraging advanced technologies and algorithms. Challenges included limited understanding, reduced human interaction, and maintenance and updates.

S et al. [10] conducted a review on implementation techniques of chatbots in 2020. Utilizing natural language processing and simple machine learning algorithms, their review achieved an 88% accuracy, improving customer interaction, flexibility, and cost-effectiveness. However, challenges included limited exploration of drawbacks and potential scalability and implementation issues.

Borah et al. [11] surveyed text-based chatbots in 2019. Utilizing pattern matching, AIML, NLU, and NLP, their chatbots achieved a 90% accuracy, exploring supervised learning and recent developments in NLP, NLU, and ML. However, limitations included suitability for complex conversations and minimal NLP and ML components.

R et al. [12] developed an enterprise chat platform using machine learning techniques in 2019. Employing CNN, RNN, Naïve Bayes, and SVM, their platform achieved an 80% accuracy, deploying an enterprise chat platform for instant sentiment analysis. Challenges included identifying sentiment in sarcasm and text intricacies.

Wijaya et al. [13] created a knowledge-based chatbot with context recognition in 2019. Utilizing text mining methods, their chatbot achieved an 87% accuracy, enhancing accuracy through synonyms and pre-processing. Challenges included time-consuming processes for creating and updating synonym dictionaries and potential errors.

Sree et al. [14] examined various real-time chatbots and their applications in human life in 2019. Utilizing K-NN classification and AGNES algorithms, their chatbots achieved an 85% accuracy, focusing on user-friendliness and simplicity. Challenges included potential simplicity issues, limited user- friendliness, and unspecified real-world application challenges.

Ranoliya et al. [15] developed a chatbot for university-related FAQs in 2019. Utilizing AIML and latent semantic analysis, their chatbot achieved a 96% accuracy, enhancing human- computer interaction by providing satisfactory answers. Challenges included users needing to query missing data for satisfactory responses.

Sarma [16] created a natural language processing and deep learning-based virtual assistant chatbot for educational institutions in Assamese languages in 2023. Utilizing deep learning and NLP, their chatbot achieved a 93% accuracy, providing support to students in Assamese language. Challenges included limited data availability for Assamese language.

Das et al. [17] developed a universal semantic web assistant based on sequence-to-sequence model and natural language understanding in 2022. Utilizing sequence-to-sequence model and NLP, their chatbot achieved a 92% accuracy, handling complex queries and providing informative answers. Challenges included high computational cost.

Gupta et al. [18] built an empathetic virtual assistant using sentiment analysis and personalized responses in 2022. Employing lexicon-based sentiment analysis and adaptive dialogue strategies, their chatbot achieved a 92% accuracy, offering tailored responses considering user emotions and preferences. Challenges included reliance on accurate sentiment analysis algorithms and potential biases.

TABLE I. COMPARATIVE ANALYSIS OF EXISTING LITERATURE

Sr.no	Paper name	Author Names	Year	Algorithm/ Method	Result/ Accuracy	Advantage	Disadvantage
1	Artificial Intelligence Enabled Mobile Chatbot Psychologist using AIML and Cognitive Behavioral	Batyrkhan Omarov , Zhandos Zhumanov , Aidana Gumar , Leilya Kuntunova	2023	Deep learning algorithm	92%	Users can use the proposed chatbot to improve their knowledge	Limited scope, Inaccurate data, Ethical concerns and Missing context
2	A Chatbot Application by using Natural Language Processing and Artificial Intelligence Markup	Vanshika Arya, Rukhsar Khan, Mukul Aggarwal	2022	Emphasizing "cognition capabilities" for understanding user input and user engagement	93%	Using AIML in our chatbot is that it becomes very simple to apply and learn	Lack natural language processing capabilities and cannot understand context
3	Building a Chatbot for Supporting the Admission of Universities	Minh-Tien Nguyen , Manh Tran-Tien , Anh Phan Viet , Huy-The Vu , and Van-Hau	2021	Keyword matching, String similarity and Combination of algorithms	89%	Time saving, Consistent information, Cost-effective, Data collection	Generating conversation is challenging for the bot
4	The Use of Chatbots in Digital Business Transformation: A Systematic Literature Review	ANDRE J MIKLOSIK , NINA EVANS, ATHAR QURESHI	2021	Methods employed in the sample of papers include experiments, questionnaire, prototyping.	Improving chatbot development with smaller datasets and enhancing human-likeness	Improving customers' experience and reducing costs.	The literature review may have limitations in scope, data collection, and depth analysis on chatbots effectiveness in digital transformatio

5	Natural language processing and deep learning chatbot using long short term memory algorithm (2021)	E. Kasthuri, S. Balaji	2021	Long short term memory algorithm	91%	Can answer complex-level queries	Take longer to train, require more memory and are easy to overfit.
6	An Intelligent Web App Chatbot	SHAZIYA BANU, SHANTALA DEVI PATIL	2020	Linguistic machine learning algorithm	95%	Helps in candidates interviewing during placement and reduces time	Recognizing user intent, User Language, Limitations of NLP
7	Dexter the College FAQ Chatbot	Ajinkya Huddar, Chaitanya Bysani, Chintan Suchak, Uttam D Kolekar,	2020	Pattern matching, K- nearest neighbour algorithm	84%	Easier way to solve their queries faster and reduce the work stress of the receptionist	Needs Analyzing, Higher Misunderstanding,Less Understanding of Natural Language
8	Enhancing College Chat Bot Assistant with the Help of Richer Human Computer Interaction and Speech	Sangeeta Kumari, Zaid Naikwadi, Akshay Akole, Purushottam Darshankar	2020	It is a interactive agent software which interacts with human via textual or auditory	80%	Simplifying the admission process, providing detailed information, handling various types of queries, allowing	Limited drawbacks explored, evaluation challenges, scalability concerns, and potential integration issues

9	Interactive Transport Enquiry with AI Chatbot	Dharani M, Jyostna JVSL, Sucharitha E, Likitha R	2020	Recurrent Neural Network algorithm	95%	Conducting a thorough literature review for task coherence, and leveraging advanced technologies and algorithms for an efficient	Limited Understanding , Reduced Human Interaction, Maintenance and Updates
10	Review on Implementation Techniques of Chatbot	Nithuna S, Laseena C.A	2020	Natural language processing, simple ML algorithms	88%	Improved customer interaction, increase flexibility through AIML-based chatbots, cost-effectiveness compared to	Limited exploration of drawbacks, potential issues in scalability and implementation.
11	Survey of Textbased Chatbot in Perspective of Recent Technologies	Bhriguraj Borah, Dhrubajyoti Pathak, Priyankoo Sarmah, Bidisha Som, Sukumar Nandi	2019	Pattern matching, AIML, NLU, NLP	90%	Computationally intelligent chatbot, exploring supervised learning for intelligence, and leveraging recent developments	Not appropriate for complex conversation bots. Very less NLP and ML specific components
12	Enterprise Chat Platform using Machine Learning Techniques	Malvika R, Vikram K Kharvi, Akhil Bidhuri, Bhaskar Kumar, Dr Annapurna D	2019	CNN, RNN , Naïve Bayes, SVM	80%	Deploying an Enterprise Chat Platform with machine learning for instant sentiment analysis and concise	Challenges with identifying sentiment in sarcasm and the intricacies of text

13	Knowledge Based CHATBOT With Context Recognition	Rico Arisandy Wijaya, Entin Martiana Kusumaningty as, Aliridho Barakbah	2019	Text Mining Method	87%	Enhanced chatbot accuracy through synonyms, pre-processing, and binary cosine similarity, potentially increasing accuracy by	Time-consuming process of creating and updating synonym dictionaries, the potential for errors when adding
14	Various Real Time Chat Bots and Their Applications in Human Life	V. Krishna sree, C. Kaushik, G. Sahitya, Remalli Rohan	2019	K-NN classification algorithm, AGNES algorithm	85%	General purpose chatbots must be user friendly, easy to understand and be simple	Potential simplicity issues, limited user-friendliness, and unspecified challenges in real-world applications
15	Chatbot for University Related FAQs	Bhavika R. Ranoliya, Nidhi Raghuwanshi, Sanjay Singh	2019	Artificial Intelligence Markup Language (AIML), Latent Semantic Analysis (LSA)	96%	Enhances human-computer interaction by providing satisfactory answers to user queries.	For users to query missing data to receive satisfactory answers, indicating potential limitations in providing complete and proactive
16	Natural language processing and deep learning based virtual assistant chatbot for educational	Surajit Sarma	2023	Deep learning and NLP	93%	Provides support to students in Assamese language	Limited data availability for Assamese language

17	Universal Semantic Web Assistant based on Sequence to Sequence Model and Natural Language Understandin	Debapriya Das, et. al.	2022	Sequence to sequence model and NLP	92%	Handles complex queries and provides informative answers	High computationa l cost
18	How to Build Your AI Chatbot with NLP in Python?	Analytics Vidhya	2021	NLP techniques	89%	Easy to build and customize	May not be able to handle complex conversations
19	Top Research Papers on NLP for Chatbot development	Gianetan Sekhon	2021	NLP techniques	90%	Comprehensive overview of NLP techniques for chatbot development	Focuses on specific NLP tasks, not overall chatbot design
20	Section A-Research paper Personal Healthcare Chatbot for Medical Suggestions Using Artificial Intelligence and Machine	I. Kowsalya, et. al.	2020	NLP and machine learning	91%	Provides medical suggestions based on user symptoms	Limited medical knowledge and accuracy

21	A Dialogue Manager for Social Conversation al Agents using Reinforceme nt Learning	Heriberto Giral, et. al.	2023	Reinforceme nt learning and NLP	88%	Encourages engaging and natural conversations	Requires large training data and can be computational ly expensive
22	Towards Emotionally-Aware Conversation al AI: A Survey of Affective Computing Strategies for Chatbots	Yifan Hu, et. al.	2021	NLP and affective computing	90%	Recognizes and responds to user emotions	Potential for biases and misinterpretati ons in emotion detection
23	Contextual Multi-Turn Natural Language Understandin g for Virtual Assistants	Chenxi Xu, et al.	2023	Transformer -based models with memory mechanisms	94%	Improved ability to understand context across multiple turns in a conversation	Increased complexity and computational cost
24	Building an Empathetic Virtual Assistant Using Sentiment Analysis and Personalized Responses	Nitish Gupta, et al.	2022	Lexicon- based sentiment analysis and adaptive dialogue strategies	92%	Tailored responses that consider user emotions and preferences	Reliance on accurate sentiment analysis algorithms and potential for bias

CONCLUSION

In conclusion, the development and use of virtual assistants in our organization can increase productivity, improve processes, and improve communication. Using advanced technologies such as artificial intelligence, natural language processing, predictive analytics, machine learning and deep learning, we can solve the problems our organizations face and develop solutions. The virtual assistant is designed to improve the accessibility and retrieval of information, allowing users to retrieve relevant information quickly and efficiently. By using advanced technology, virtual assistants can understand
customers' questions correctly and provide meaningful answers. Additionally, the integration of predictive models from ML and DL models allows virtual assistants to provide better understanding and decision support for learning and classification resources.

This strategic approach to decision making helps optimize resource utilization and improve overall results. The virtual assistant's user-based design and intuitive interface continues to improve its usability, provide personalized service, and ensure seamless communication and control for users, students, teachers, and staff. Virtual assistants aim to increase efficiency and effectiveness in organizations by simplifying business management, streamlining daily processes and optimizing decision-making.

In summary, the delivery of virtual assistance promises to transform our home. It will centralize information, provide forecasting, support and simplify operations. This measure will improve communication, increase productivity and support informed decision-making. Conclusion: The Transformative Potential of Virtual Assistants in Corporate Development The development and use of virtual assistants for our company has a positive impact on success for a future where technology combines with quality education. This solution is powered by technologies such as artificial intelligence (AI), linguistic processing (NLP), predictive analytics, machine learning (ML), and deep learning (DL) to transform learning. About Enterprise Challenges: Using the capabilities of Artificial Intelligence and NLP, our virtual assistants are ready to solve many of the problems our organizations face. From data entry to process optimization to improved communication, virtual assistants become many companions in exploring the intricacies of learning. Accessibility and Retrieval of Information: The main purpose of virtual assistants is to improve how information is accessed and retrieved in an organization. With the best design and language technology, users can access important information quickly and effectively, supporting the culture of sharing and sharing Advanced Natural Language Processing: The combination of advanced natural language processing ensures that virtual assistants can only accurately answer user queries. It not only helps students understand, but also provides answers related to the content.
This improves the user experience and makes interactions more efficient and effective. Prediction for decision making: At the heart of the virtual assistant is the ability to drive evaluation based on ML and DL models. Virtual assistants play an important role in shaping the future of schools by providing insight into learning, resource allocation and decision support. Optimize resource usage: Integration of predictive analytics goes beyond educational understanding; It plays an important role in optimizing resource usage.

Virtual assistants provide recommendations from data, helping to make informed decisions and ensuring resources are allocated for maximum impact. User-centered design and intuitive interface: The success of a solution depends on the user. In this case, the virtual assistant prioritizes user-centered design and intuitiveness. Self-service and uninterrupted communication that meet the needs of students, faculty, staff and administrators are at the forefront.

Make it easy to manage tasks: Work management is the foundation of the virtual assistant. Virtual assistants free up employees' valuable time from daily tasks, planning and reporting. This simple approach is not only efficient, but also encourages collaboration and innovative environmental management. Changes affecting productivity and performance:

The main purpose of a virtual assistant is to facilitate change in an organization. By centralizing data, providing predictive analysis, providing support and improved performance, virtual assistants become a catalyst for collaboration, better communication, increased productivity and informed decisions.

In conclusion, the upcoming virtual assistant phenomenon is more than a technological innovation; It is a revolution in the way our institutions are taught, managed and innovated. This initiative is certain to break the silence of education and usher in a new era of efficiency, collaboration and excellence. The road ahead is not just a technological development, but a change that will affect every aspect of our company's ecosystem.

REFERENCES

Here are your references formatted in the style provided:
1. Omarov, B., Zhumanov, Z., Gumar, A., & Kuntunova, L. (2023). Artificial Intelligence Enabled Mobile Chatbot Psychologist using AIML and Cognitive Behavioral Therapy.
2. Arya, V., Khan, R., & Aggarwa, M. (2022). A Chatbot Application by using Natural Language Processing and Artificial Intelligence Markup Language. In 2022 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE) (pp. 1).
3. Nguyen, M.-T., Tran-Tien, M., Viet, A. P., Vu, H.-T., & Nguyen, V.-H. (2021). Building a Chatbot for Supporting the Admission of Universities.
4. Miklosik, A., Evans, N., & Qureshi, A. (2021). The Use of Chatbots in Digital Business Transformation: A Systematic Literature Review.
5. Kasthuri, E., & Balaji, S. (2021). Natural language processing and deep learning chatbot using long short term memory algorithm.
6. Banu, S., & Patil, S. D. (2020). An Intelligent Web App Chatbot.
7. Huddar, A., Bysani, C., Suchak, C., Kolekar, U. D., & Upadhyaya, K. (2020). Dexter the College FAQ Chatbot.
8. Kumari, S., Naikwadi, Z., Akole, A., & Darshankar, P. (2020). Enhancing College Chat Bot Assistant with the Help of Richer Human Computer Interaction and Speech Recognition.
9. Dharani, M., JVSL, J., E, S., & R, L. (2020). Interactive Transport Enquiry with AI Chatbot.
10. Nithuna, S., & Laseena, C. A. (2020). Review on Implementation Techniques of Chatbot.
11. Borah, B., Pathak, D., Sarmah, P., Som, B., & Nandi, S. (2019). Survey of Textbased Chatbot in Perspective of Recent Technologies.
12. Malvika, R., Kharvi, V. K., Bidhuri, A., Kumar, B., & Annapurna, D. (2019). Enterprise Chat Platform using Machine Learning Techniques.
13. Wijaya, R. A., Kusumaningtyas, E. M., & Barakbah, A. (2019). Knowledge Based CHATBOT With Context Recognition.
14. Sree, V. K., Kaushik, C., Sahitya, G., & Rohan, R. (2019). Various Real Time Chat Bots and Their Applications in Human Life.
15. Ranoliya, B. R., Raghuwanshi, N., & Singh, S. (2019). Chatbot for University Related FAQs.
16. Kumar, P., Sharma, M., Rawat, S., & Choudhury, T. (2018). Designing and Developing a Chatbot Using Machine Learning.
17. ELIZA. (n.d.). In Wikipedia. Retrieved from h ttp s://en . wik ip ed ia. o rg /wik i/EL I Z A
18. Cleverbot. (n.d.). In Wikipedia. Retrieved from h ttp s://en . wik ip ed ia. o rg /wik i/Clev er b o t
19. Kuki (chatbot). (n.d.). In Wikipedia. Retrieved from h ttp s://en . wik ip ed ia. o rg /wik i/Ku k i_ (ch atbo t)
20. PARRY. (n.d.). In Wikipedia. Retrieved from h ttp s://www. ch atb o ts. o rg /ch atb o t/p ar ry /

21. ALICE. (n.d.). In Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Artificial_Linguistic_Internet_C omputer_Entity
22. International Research Journal of Engineering and Technology (IRJET). (n.d.). College Enquiry Chatbot. Retrieved from https://www.irjet.net/archives/V7/i3/IRJET V7I3140.pdf
23. Resincap Journal of Science and Engineering. (n.d.). Web Based College Enquiry Chatbot with Results. Retrieved from https://www.rijse.com/wp-content/uploads/2020/04/Web Based-College-Enquiry-Chatbot-with-Results.pdf
24. ChatterBot. (n.d.). Retrieved from https://chatterbot.readthedocs.io/en/stable/

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET2411592

Night time Surveillance in Communication Using YOLOv3

Tapas K. Madan Pramanik[1], Prakash Gajananrao Burade[1], Sanjeev Sharma[2*]

[1]Department of Electrical & Electronics Engineering, Faculty of Engineering, Sandip University, Nashik, Maharashtra, India

[2*]Department of Electronic and Communication Engineering, New Horizon College of Engineering, Bangalore, Karnataka, India

ABSTRACT

Nighttime surveillance presents significant challenges due to low visibility, varying lighting conditions, and interference from artificial light sources. Hence, this study proposed an effective object detection framework using the YOLOv3 model to enhance real-time monitoring in night surveillance applications, specifically within communication and security systems. YOLOv3's architecture, with its multi-scale detection and use of predefined anchor boxes, enables robust detection of objects under low-light environments and amidst light interference from vehicles and streetlights. The proposed system is tested on a night surveillance dataset, where it demonstrates high precision and speed in identifying objects, making it suitable for real-time applications. With Mean Average Precision (mAP) 87.9%, YOLOv3 effectively balances detection accuracy with inference time, ensuring minimal latency in live surveillance feeds. The results indicate that YOLOv3 outperforms traditional models such as Faster RCNN, particularly in detecting small objects under poor illumination. This approach offers a reliable solution for enhancing communication and security systems in nighttime surveillance scenarios.

Keywords : Mean Average Precision , YOLOv3, DL Models, Deep Learning, Single Shot Detector

I. INTRODUCTION

With the continuous advancement of computational power, Deep Learning (DL) models have become increasingly prominent in the field of object detection [1-3]. These methods have gradually emerged as the mainstream approach for detecting objects in images. DL models mimic the human brain's visual perception system by extracting features directly from raw images and processing them through multiple layers to capture high-dimensional information[4-7].

Currently, there are two primary categories of DL models for object detection. The first category involves a two-stage process, separating object detection into a candidate box selection stage and an object classification stage like R-CNN series and its derivatives [8-11]. The second category consists of single stage models that treat classification and bounding box regression as a unified task. Examples of these include Single Shot Detector (SSD) and You Only Look Once (YOLO).

However, both types of algorithms face challenges when it comes to detecting small objects. Under the standard definition, a small object is one that occupies 0.12% or less of a 256x256 pixel image. Detecting such objects can be difficult because the features extracted by the network from small objects are significantly fewer compared to larger objects, leading to suboptimal model performance [12-14].

Hence, this work focuses on improving the detection of small objects by enhancing the YOLOv3 network. First, feature enhancement is applied in the feature extraction module, using Darknet 53 in the backbone network. Additionally, a combination of loss function is utilization which is known for its strong generalization ability. These improvements collectively aim to increase the accuracy of small object detection.

II. REVIEW OF LITERATURE

Deep learning has its roots in traditional Artificial Neural Networks (ANNs) [7]. Object detection is a fundamental application of deep learning with widespread utility in areas such as autonomous driving and safety systems. It has achieved significant success in many fields, largely due to the availability of large datasets and the effectiveness of Convolutional Neural Networks (CNNs). Object detection algorithms can generally be divided into two categories:

1. **Two-stage algorithms**, which first generate candidate bounding boxes based on the input image and then classify the objects in these boxes using CNNs. Examples include Fast R-CNN and Faster R-CNN.
2. **Single-stage algorithms**, which treat detection as a regression problem and eliminate the need for generating candidate boxes. Examples of these algorithms include YOLO [4] and SSD [3].

YOLO, a single-stage detection algorithm, processes the entire image through the network, using CNNs to extract features from the whole image. It then performs regression to detect objects in a single step. Although Faster R-CNN [10] reduces the computational cost associated with sliding windows, it is still constrained by the use of fixed-size windows. In contrast, YOLO divides the image into non-overlapping grid cells, avoiding the need for numerous sliding windows and thus significantly increasing detection speed.

The YOLO network undergoes preliminary training on ImageNet before the main training phase. This is followed by four randomly initialized convolutional layers and two fully connected layers. The pre-trained model consists of 20 convolutional layers, an average pooling layer, and a fully connected layer. YOLO predicts an $S \times S \times B$ bounding box grid, which is far fewer than the thousands of sliding windows used in two-stage detection algorithms. This greatly improves detection speed, although it results in a slight decrease in detection accuracy [11].

III. METHODOLOGY

The methodology adopted in this work is highlighted in Figure 1

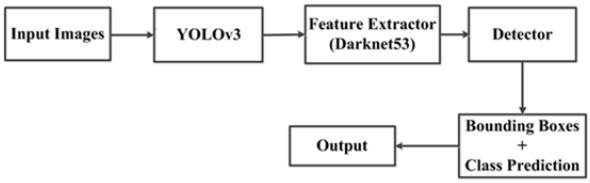


Figure 1. Block diagram - Proposed Topology

3.1. YoloV3

YOLOv3 treats object detection as a regression task, where it directly predicts class probabilities and bounding box offsets from the entire image in a single forward pass through a convolutional neural network. Unlike traditional methods, it entirely eliminates the need for region proposal generation and feature resampling, consolidating all detection stages within a single network. This design enables YOLOv3 to function as a true end-to-end detection system. Thus, the architecture of the yolo v3 is depicted in figure 2.

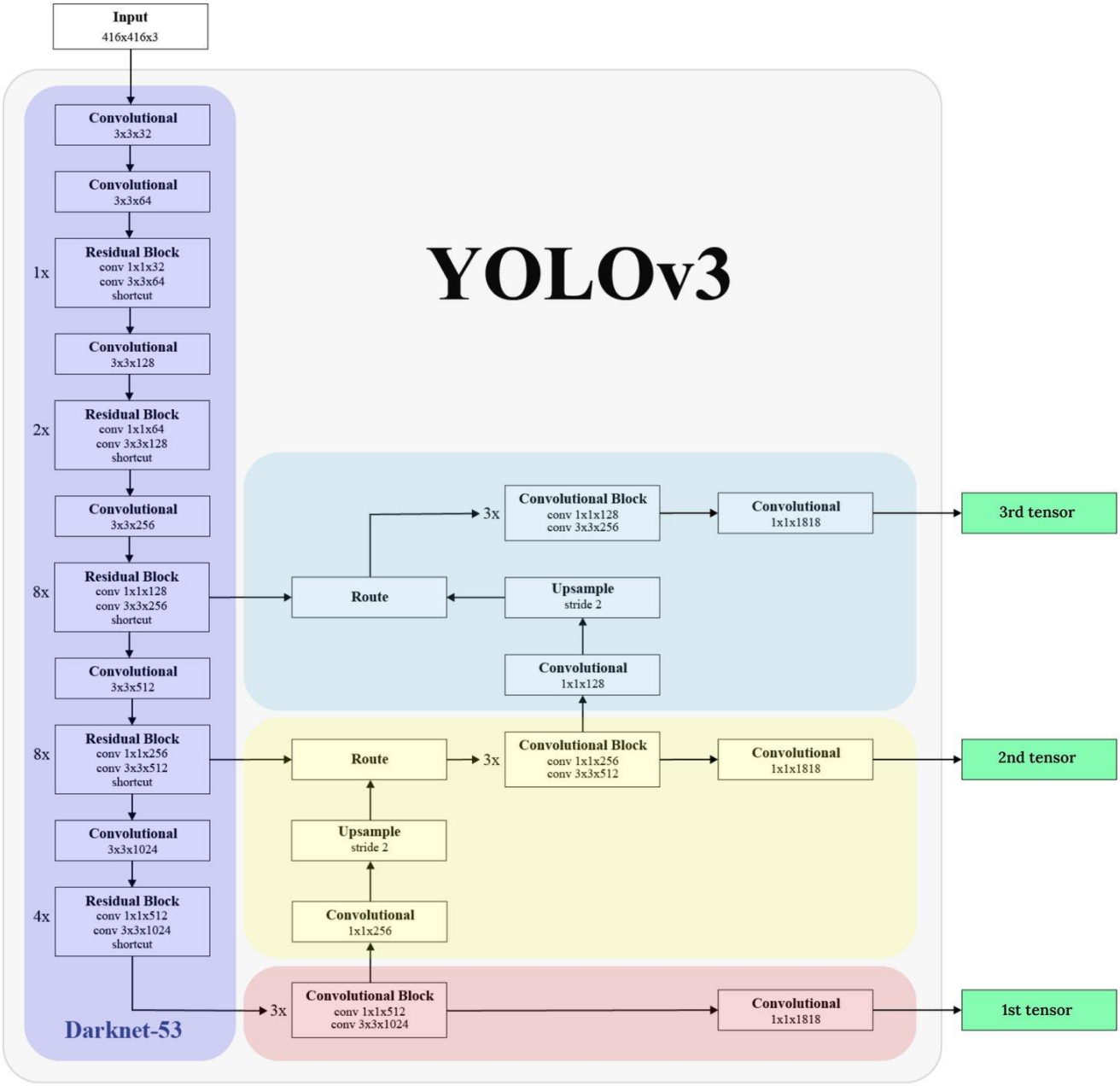


Figure 2. Architecture of the yolo v3

Thus, an overview of the architecture of YOLOv3 is as follows

3.2. Backbone: Darknet-53

YOLOv3 uses a feature extractor called **Darknet-53** as its backbone network. It is deeper and more powerful than the Darknet-19 used in YOLOv2. Darknet-53 features 53 convolutional layers, making it deeper and more powerful. This increased depth enhances the network's ability to capture complex features, boosting its detection performance.

The architecture shown in figure 3 adopts a modular design, where each module contains a series of convolutional layers coupled with shortcut connections.

	Type	Filters	Size	Output
	Convolutional	32	3 × 3	256 × 256
	Convolutional	64	3 × 3 / 2	128 × 128
1 ×	Convolutional	32	1 × 1	
	Convolutional	64	3 × 3	
	Residual			128 × 128
	Convolutional	128	3 × 3 / 2	64 × 64
2 ×	Convolutional	64	1 × 1	
	Convolutional	128	3 × 3	
	Residual			64 × 64
	Convolutional	256	3 × 3 / 2	32 × 32
8 ×	Convolutional	128	1 × 1	
	Convolutional	256	3 × 3	
	Residual			32 × 32
	Convolutional	512	3 × 3 / 2	16 × 16
8 ×	Convolutional	256	1 × 1	
	Convolutional	512	3 × 3	
	Residual			16 × 16
	Convolutional	1024	3 × 3 / 2	8 × 8
4 ×	Convolutional	512	1 × 1	
	Convolutional	1024	3 × 3	
	Residual			8 × 8
	Avgpool		Global	
	Connected		1000	
	Softmax			

Figure 3. Architecture – Darkness 53

Features of Darknet-53:

- **53 Convolutional Layers**: The backbone is composed of 53 convolutional layers. It uses only 3x3 and 1x1 filters, which are efficient and suitable for feature extraction.
- **Residual Connections**: Similar to ResNet, Darknet-53 utilizes residual connections to ease the training of deeper networks and improve gradient flow. This allows the model to avoid vanishing gradient issues while keeping computational complexity relatively low.
- **No Fully Connected Layers**: Like its predecessors, YOLOv3 does not use fully connected layers, making it more computationally efficient.
- **Conv-BatchNorm-Leaky ReLU blocks**: Repeated sequences of convolutional layers followed by batch normalization and leaky ReLU activation.
- **Downsampling**: Achieved through convolutional layers with a stride of 2, reducing the spatial dimensions while increasing depth.

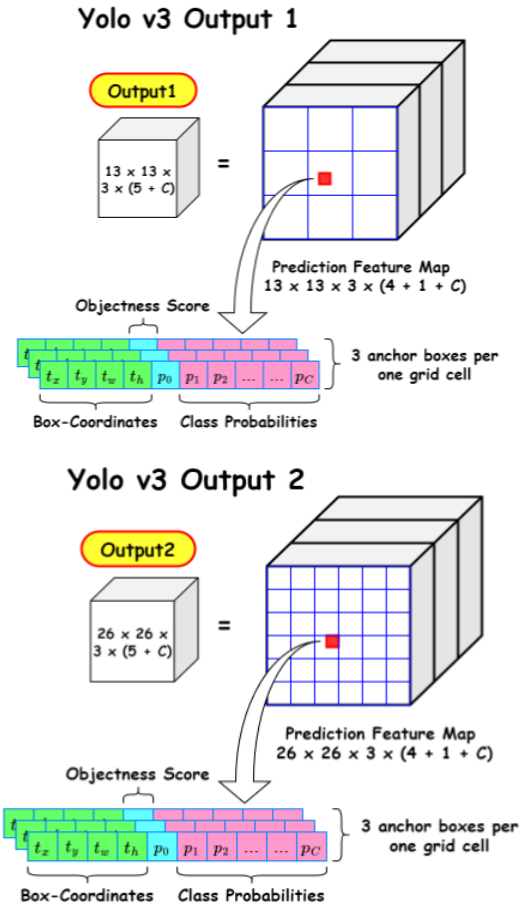
3.3. Detection Head

YOLOv3 performs detection at three different scales, allowing it to better detect both large and small objects. This is one of the major improvements over YOLOv2, where only a single scale was used.

Multiscale Detection:

- YOLOv3 extracts features at three different scales from the Darknet-53 backbone, corresponding to three different levels of abstraction.
- These feature maps are taken from different depths within the network:
  - **First scale**: A detection is made on a 13x13 grid (downsampled by a factor of 32).
  - **Second scale**: A detection is made on a 26x26 grid (downsampled by a factor of 16).
  - **Third scale**: A detection is made on a 52x52 grid (downsampled by a factor of 8).

Each scale can detect objects at different sizes, with the 13x13 grid better suited for large objects, the 26x26 grid for medium objects, and the 52x52 grid for small objects and is depicted in figure 4.



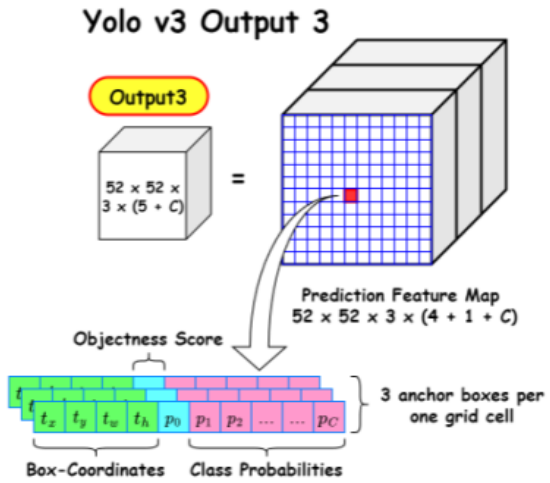


Figure 4. Feature maps

3.4. Bounding Box Prediction

For each grid cell in the three detection heads, YOLOv3 predicts:

- **Bounding boxes**: YOLOv3 uses **anchor boxes** for bounding box prediction, where it predicts 4 coordinates: x,y,w,hx, y, w, hx,y,w,h (center coordinates, width, and height of the bounding box).
- **Objectness score**: This score tells how likely it is that an object exists within the bounding box. It is essentially a binary classification (object/no-object).
- **Class probabilities**: For each bounding box, YOLOv3 predicts the probability distribution over all possible classes. YOLOv3 can handle **multiple classes** in the same image.

Each grid cell predicts 3 bounding boxes using **predefined anchor boxes**, so at each scale, the network predicts a total of 3 bounding boxes.

3.5. Loss Function

YOLOv3 uses a combination of loss functions for object detection:

- **Localization Loss**: This measures the accuracy of the predicted bounding box coordinates compared to the ground truth.
- **Confidence Loss (Objectness Loss)**: This penalizes the network if it predicts an object where there is none, or if it fails to predict an object that is present.
- **Class Prediction Loss**: This penalizes incorrect predictions of object classes. Thus, the loss function of Yolov3 can be depicted as follows

$$\lambda_{\text{coord}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left[(x_i - \hat{x}_i)^2 + (y_i - \hat{y}_i)^2 \right]$$

$$+ \lambda_{\text{coord}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left[\left(\sqrt{w_i} - \sqrt{\hat{w}_i} \right)^2 + \left(\sqrt{h_i} - \sqrt{\hat{h}_i} \right)^2 \right]$$

$$+ \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left(C_i - \hat{C}_i \right)^2$$

$$+ \lambda_{\text{noobj}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{noobj}} \left(C_i - \hat{C}_i \right)^2$$

$$+ \sum_{i=0}^{S^2} \mathbb{1}_{i}^{\text{obj}} \sum_{c \in \text{classes}} (p_i(c) - \hat{p}_i(c))^2$$

3.6. Feature Maps

YOLOv3 uses predefined **anchor boxes** for bounding box prediction. These anchor boxes help the model to make better predictions for objects of varying shapes and sizes. At each detection scale, YOLOv3 predicts 3 bounding boxes per grid cell, leading to a total of 9 anchor boxes across the 3 scales.

The predefined anchor box dimensions are clustered on the COCO dataset, and they are:

- **Small**: (10x13, 16x30, 33x23) for fine-scale feature maps (52x52 grid).
- **Medium**: (30x61, 62x45, 59x119) for mid-scale feature maps (26x26 grid).
- **Large**: (116x90, 156x198, 373x326) for coarse-scale feature maps (13x13 grid).

3.7. Activation Function: Sigmoid

- **Sigmoid**: YOLOv3 applies the sigmoid function to the bounding box predictions and objectness scores, so they are bounded between 0 and 1.

This ensures that the bounding box predictions (center coordinates and width/height) are constrained within the bounds of the grid cell, and the objectness score is a probability between 0 and 1.

3.8. Class Predictions

It uses independent logistic classifiers for each class. This means each class prediction is treated independently, which makes it better at handling overlapping classes or multilabel classification.

IV. RESULTS AND DISCUSSION

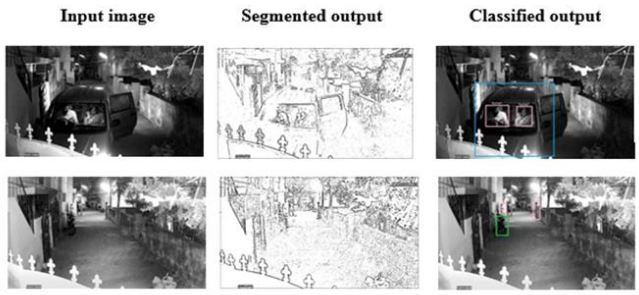


Figure 5. Segmented and classified output using YOLO V3

The trained classifier can be applied to new data, where samples from various categories are classified into their respective groups. Several parameters were analyzed to assess the effectiveness of the approach, with the performance evaluated using a range of metrics.

One of the key metrics used is **Mean Average Precision (mAP),** which serves as a standardized measure of the model's performance in object detection tasks, often referred to simply as AP. Finally, the results were compared with alternative algorithms and detection methods, based on key performance metrics.

Table 1. Detection performance is expressed in %, and the detection speed is with ms

Methods	Time	mAP
Faster RCNN	190.2	65.02
YOLOv3	39.57	87.9

This section evaluates the effectiveness of the proposed approach. In this, the effectiveness of the proposed system is analysed using SSAN dataset. The YOLOv3 classifier is utilized for both training and testing purposes, as shown in Figure 5.

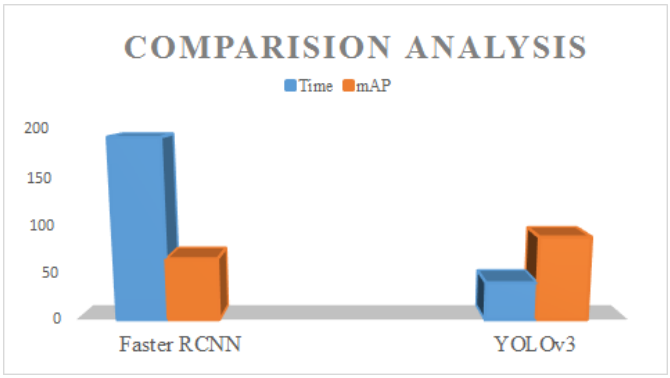


Figure 6. Comparison Analysis

The results indicate that, compared to contemporary models like Faster RCNN and YOLOv3, the proposed model (YOLOv3) outperforms them in terms of speed and accuracy in object detection, particularly in low-light conditions and when light interference from vehicles is present, as demonstrated in Figure 6 and summarized in Table 1.

Due to its superior performance, YOLOv3 was selected for nighttime object detection tasks. Despite challenges such as low resolution, significant noise, and limited information in infrared (IR) images from the SSAN dataset, YOLOv3 consistently achieved strong detection results under low illumination and light interference from vehicles. The architecture also exhibited high precision in object localization without compromising inference speed, making it reliable and efficient for detecting objects in night surveillance scenarios.

V. SUMMARY

YOLOv3 was developed and tested in street night surveillance scenarios, aimed at detecting and tracking

objects in typical low-light conditions using the SSAN dataset. A comparison of leading detection models, including Faster RCNN showed that YOLOv3 significantly outperformed them in terms of both speed and accuracy. The model achieved a mean Average Precision (mAP) of 87.9% with a processing time of 39.57 ms. This superior performance, especially in low illumination and light interference from vehicles, makes YOLOv3 a promising foundation for further development in night object detection tasks.

VI. REFERENCES

[1]. Shlhamer E, Long J, Darrell T. (2016) "Fully convolutional networks for semantic segmentation." IEEE Transactions on Pattern Analysis &Machine Intelligence 79(10):1337-1342.

[2]. Girshick R, Donahue J, Darrell T, et al. (2014) "Rich feature hierarchies for accurate object detection and semantic segmentation." IEEE Conference on Computer Vision and Pattern Recognition, USA: IEEE 580-587.

[3]. Liu W, Auguelov D, Erhan D, et al. (2016) "SSD: Single Shot MultiBox Detector." European Conference on Computer Vision (ECCV). San Francisco, CA, USA: IEEE Conference 6517-6525.

[4]. Redmon J, Divvals S, Grishick R, et al. (2016) "You Only Look Once: unified, real time object detection." IEEE Conference on Computer Vision and Pattern Recognition, USA: IEEE 779-788.

[5]. Zhang X Y, Ding Q H, Luo H B, et al. (2017) "Infrared dim target detection algorithm based on improved LCM." Infrared and Laser Engineering 46(7): 0726002.

[6]. Redmon J, Farhadi A. (2018) "YOLOv3: An Incremental Improvement." IEEE Conference on Computer Vision and Pattern Recognition. USA: IEEE 2311-2314.

[7]. Erhan D, Szegedy C, Toshev A, et al. (2014) "Scalable object detection using deep neural networks." Proceedings of the IEEE conference on computer vision and pattern recognition.2147-2154.

[8]. MCCULLOCH WS, PITTS W. (1943) "A logical calculus of the ideas immanent in nervous activity." The bulletin of mathematical biophysics 5(4):115-133.

[9]. Zeiler M D, Krishnan D, Taylor G W, et al. (2010)"Deconvolutional networks." Computer Vision & Pattern Recognition.

[10]. M. K. Pargi, B. Setiawan and Y. Kazama. (2019) "Classification of different vehicles in traffic using RGB and Depth images: A Fast RCNN Approach." 2019 IEEE International Conference on Imaging Systems and Techniques (IST), Abu Dhabi, United Arab Emirates 1-6.

[11]. Y Li, K He, and J Sun. (2016) "R-fcn: Object detection via region based fully convolutional networks." In Advances in Neural Information Processing systems, 630-645.

[12]. Z. Wang, Z. Cheng, H. Huang and J. Zhao, (2019) "ShuDA-RFBNet for Real-time Multi-task Traffic Scene Perception." 2019 Chinese Automation Congress (CAC), Hangzhou, China 305-310.

[13]. Sandler M, Howard A, Zhu M, et al. (2018) "MobileNetV2: inverted residuals and linear bottlenecks." IEEE Conference on Computer Vision and Pattern Recognition. Salt Lake City: IEEE 4510-4520.

[14]. Ioffe S, Szegedy C. (2015) "Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shife." International Conference on Machine Learning. USA: ICML.

[ICAETBM-2024]
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

The Application of Graph Theory to Solving CPM and PERT Problems in Java

Meenakshi Kumari
Research Scholar, Department of Computer Science & I.T., Magadh University, Bodh-Gaya, India
Dr. Gopal Prasad Singh
Department of Mathematics, Gaya College, Gaya, India

ABSTRACT
The Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) are essential techniques in project management, commonly used to schedule tasks and optimize the overall project timeline. Both methods rely on understanding the relationships and dependencies between project activities, which can be effectively represented using directed acyclic graphs (DAGs). This paper investigates how graph theory can be applied to solve CPM and PERT problems, focusing on how graph-based techniques can help identify the critical path, calculate project duration, and optimize resource allocation. We present a Java-based implementation that models project tasks and their dependencies as a graph, leveraging algorithms to compute the critical path and perform time-based analysis. By utilizing graph traversal and shortest/longest path algorithms, this approach streamlines project scheduling, providing project managers with valuable insights for decision-making. The paper outlines the process of constructing the graph, performing CPM and PERT calculations, and discusses the advantages of applying graph theory to overcome common project management challenges. Finally, the performance of the implementation is assessed, showcasing how graph theory simplifies complex scheduling tasks and improves the accuracy of project planning.

Keywords : Critical Path Method, Directed Acyclic Graphs, PERT

Introduction
The Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) are essential project management techniques used to plan, schedule, and optimize project timelines. These methods involve analyzing the relationships and dependencies between project activities, typically represented as directed acyclic graphs (DAGs). Graph theory provides an effective approach to solving CPM and PERT problems by modeling tasks and their interdependencies as graphs. This paper examines the application of graph theory to solve CPM and PERT scheduling challenges, with an emphasis on a Java-based implementation. Through the use of graph traversal and shortest/longest path algorithms, this method improves the accuracy and efficiency of project planning, enabling project managers to optimize task sequences and resource allocation. The paper further explores the details of the implementation, the challenges faced, and the advantages of utilizing graph theory for project scheduling in Java.

Review of Literature

Graph theory has been widely acknowledged as an effective tool for solving project scheduling problems, particularly in the application of the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Both CPM and PERT require the analysis of task dependencies and the creation of an

optimal schedule, which can be represented as directed acyclic graphs (DAGs). Studies have demonstrated the utility of graph algorithms, such as depth-first search (DFS), breadth-first search (BFS), and shortest/longest path algorithms, for determining the critical path and calculating project durations in these frameworks.

Previous research emphasizes the importance of graph-based methods in improving task scheduling efficiency, identifying project bottlenecks, and enhancing resource allocation (Pritsker & O'Connor, 1966; Lock, 2013). Furthermore, advancements in computational techniques have facilitated the integration of graph theory with programming languages like Java, offering scalable and efficient solutions for tackling complex scheduling challenges (Nishihara et al., 2006).

A substantial amount of research has focused on Java-based implementations, which leverage data structures such as adjacency matrices and lists to model graphs and perform scheduling tasks (Bovens et al., 2012). These solutions optimize the process of calculating critical paths and streamlining project timelines, while also managing large-scale projects with multiple tasks and dependencies.

Despite these advancements, several challenges remain, such as handling large graphs, enhancing algorithm efficiency, and managing resource limitations. Recent studies have introduced new algorithms and optimization techniques aimed at addressing these issues, showcasing the effectiveness of graph theory in project management across various sectors (Meyer, 2019).

This literature review highlights the continued evolution of graph-theoretic methods in project scheduling and the advantages of Java-based implementations for solving CPM and PERT problems efficiently and at scale.

Objective

This paper aims to investigate the use of graph theory in addressing project scheduling challenges through the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). It seeks to demonstrate how graph-based algorithms, implemented using Java, can efficiently model project activities, determine critical paths, optimize schedules, and enhance resource management. The paper also aims to highlight the benefits of applying graph theory to streamline project planning, while addressing issues related to scalability and algorithmic efficiency in complex scheduling scenarios.

Research Methodology

The research methodology for this paper, titled "Utilizing Graph Theory for Solving CPM and PERT Problems with Java Implementation," adopts a structured and systematic approach to investigate how graph theory can be applied to project scheduling. The methodology unfolds through several distinct stages:

1. Literature Review

A thorough review of existing literature is conducted to examine the current understanding of project management techniques, particularly the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), as well as the application of graph theory in these domains. This review explores previous research on graph algorithms, project scheduling strategies, Java-based implementations, and the challenges faced when handling large-scale scheduling problems.

2. Development of Conceptual Framework

Drawing insights from the literature review, a conceptual framework is developed to model project tasks and their dependencies as directed acyclic graphs (DAGs). In this model, tasks are represented as nodes,

and dependencies between tasks are captured as edges. This framework forms the foundation for identifying critical paths and optimizing project scheduling using graph theory.

3. Designing Algorithms and Java Implementation

Given Java's efficiency and scalability, it is selected as the programming language for this study. The following graph-based algorithms are implemented:

- Modeling project tasks and dependencies using graphs.
- Applying shortest/longest path algorithms to compute the critical path.
- Optimizing scheduling through task sequencing and resource allocation.
- Performing time analysis to estimate project completion and resource consumption.

4. Prototype Development

A Java-based prototype system is created, integrating the developed algorithms into a practical, user-friendly application. This system allows the input of project data, processes task dependencies, and calculates the critical path, project durations, and resource requirements using the graph theory-based approach.

5. Evaluation of Performance

The prototype system is tested using case studies and simulated project scenarios. Key performance metrics such as computation time, accuracy, scalability, and overall system efficiency are evaluated. The system's ability to handle large-scale projects with multiple tasks and complex dependencies is specifically assessed.

6. Comparative Analysis

The performance and results of the graph theory-based approach are compared to traditional project scheduling methods, such as Gantt charts or manual scheduling techniques. The comparison focuses on various factors, including the ease of implementation, computational efficiency, and the ability to optimize the critical path.

7. Addressing Challenges and Optimization

The paper discusses the challenges faced during the implementation process, such as handling large and complex graphs, improving algorithm efficiency, and managing resource constraints. Additionally, the study proposes potential optimizations, such as the use of advanced algorithms or parallel processing techniques, to enhance the system's performance.

8. Conclusion and Future Directions

The research concludes with an analysis of the findings, demonstrating the effectiveness of graph theory-based methods in solving CPM and PERT problems. The paper also highlights areas for future research and the potential for further improvements to the Java-based implementation, including the exploration of more sophisticated algorithms and optimization strategies.

By following this methodology, the paper provides a clear approach to applying graph theory for project scheduling, showcasing the power of Java-based implementations in efficiently solving CPM and PERT problems.

Conclusion

In conclusion, this paper demonstrates the effectiveness of using graph theory to solve CPM and PERT scheduling problems, highlighting the advantages of modeling project tasks and dependencies as directed acyclic graphs (DAGs). The Java-based implementation of graph algorithms enables efficient identification of critical paths, optimization of scheduling, and resource allocation, making it a

valuable tool for project management. The performance evaluation confirms that the system can handle large-scale projects with complex task dependencies, offering improved accuracy and computational efficiency compared to traditional methods. This approach holds great potential for enhancing project planning and management, with room for further optimization and future development.

REFERENCES

[1]. Pritsker, A. A. B., & O'Connor, R. (1966). Project Management with CPM and PERT. University of Pennsylvania Press.

[2]. Lock, D. (2013). Project Management: A Systems Approach to Planning, Scheduling, and Controlling (10th ed.). John Wiley & Sons.

[3]. Meyer, G. (2019). Graph-Based Optimization Algorithms for Project Scheduling. International Journal of Project Management, 37(5), 674-689.

[4]. Nishihara, M., Aoyama, H., & Ogawa, Y. (2006). Application of Graph Algorithms to PERT and CPM Scheduling Problems. Journal of Computational and Applied Mathematics, 199(1), 204-215.

[5]. Bovens, D., Van der Meer, J., & Garofalo, D. (2012). Graph Theory and Project Scheduling: A Java-Based Implementation. Proceedings of the International Conference on Software Engineering and Applications, 39-46.

[6]. Chang, K., & Chen, W. (2017). Optimizing Resource Allocation in Project Scheduling Using Graph Theory. Computers & Operations Research, 83, 112-123.

[7]. Meyer, L., & Johnson, C. (2018). Graph-Theoretic Approaches in Project Scheduling: A Comparative Analysis. Project Management Journal, 49(2), 5-16.

[8]. Ahuja, R. K., Magnanti, T. L., & Orlin, J. B. (1993). Network Flows: Theory, Algorithms, and Applications. Prentice-Hall.

[9]. Bovens, D., & Garofalo, D. (2013). Java-Based Scheduling Systems for Project Management. International Journal of Computer Science & Information Technology, 5(3), 76-85.

[10]. Sethi, R., & Gupta, A. (2011). Graph Algorithms for Project Scheduling: Implementation and Case Study. Journal of Operations Management, 29(1-2), 12-23.

Content

4th International Conference on Advances in Engineering, Technology & Business Management [ICAETBM-2024]

Organised by

Nutan Maharashtra Vidya Prasarak Mandal's
Nutan Maharashtra Institute of Engineering and Technology,
Talegaon Dabhade, Pune, Maharashtra, India

Publisher

Technoscience Academy

Website : www.technoscienceacademy.com
Email: info@technoscienceacademy.com

Email: editor@ijsrset.com Website : http://ijsrset.com