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EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

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RACITSET 2024

National Conference on Recent Advances of Computational Intelligence Techniques in Science, Engineering and Technology

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Dr.S.Prakash
Sr.Vice President, East Point Group of Institutions.
Dr.Mrityunjaya V Latte
Principal, East Point College of Engineering and Technology

Message from Senior Vice President

Warm Greetings to all!

We, the team of east point College of Engineering and Technology,Bangalore,Karnataka,India,feel gratified and privileged to host our National Conference on "Recent Advances of Computational Intelligence Techniques in science, Engineering and Technology" on hybrid mode. The conference intends to bring together academics, Researchers, Scientists, Engineers and Industry Practitioners from different disciplines to discuss concerns related to global research trends and performance related to computational Intelligence Techniques. Onbehalf of whole RACITSET 2024 team, I take this opportunity to welcome all the dignitaries, delegates and participants at the conference.We greatly appreciate the authors for their outstanding paper contributions and we thank the team in advance for their participation. We are fortunate to have leading eminent speakers at our conference to share their experience

Dr S Prakash
Sr.Vice President,
East Point Group of Institutions.
Bengaluru.

Message from Principal

Warm Greetings to all!

It is a great honour and privilege to host "National Conference on Recent Advances of Computational Intelligence Techniques in science, Engineering and Technology" on 8th may 2024 at EPCET, Bangalore. This conference provides an international forum for industry professional and researchers to deliberate and state a wide range of practices, trends, research findings, discuss the latest advancements & explore the future in emerging industrial technologies. A great amount of planning and organizing is required to hold a successful conference and I appreciate the effort of all the people who were involved in making the conference success.

Our Management is ever ready to extend constantsupport for all the activities undertaken and we look forward to have more conference in the days to come.I wish this conference to be a grand success.

Dr.Mrityunjaya V Latte
Principal,
East Point College of Engineering and Technology,
Bengaluru.

Message from Vice Principal

Hosting the "National Conference on Recent Advances of Computational Intelligence Techniques in Science, Engineering, and Technology" on May 8th, 2024, at EPCET, Bangalore, is indeed a tremendous honour and privilege. This conference serves as a vital international platform for industry professionals and researchers to come together, sharing insights, discussing practices, trends, and presenting cutting-edge research findings. It's a forum to delve into the latest advancements and to envision the future of emerging industrial technologies.

Undoubtedly, organizing such an event requires extensive planning and coordination. I want to express my sincere appreciation to all individuals involved in making this conference a reality. Your dedication and hard work are invaluable in ensuring its success.

Together, we're creating an environment where collaboration flourishes, knowledge is exchanged, and innovation thrives. Let's make this conference an inspiring and enriching experience for all the participants.

Dr. Yogesh G S
Vice Principal
Professor & Head,
Department of Electronics and communication Engineering
Bangaluru

Message from Head of the Department

I would like to congratulate Department of computer science and engineering at East Point College of Engineering and Technology for organizing the National Conference on "Recent Advances of Computational Intelligence Techniques in science, Engineering and Technology". It is incredibly important to have such a range of Researchers and Engineers from industry and academia working together across diverse disciplines with different perspective and unique ideas to discuss opportunities for advancement.

I wish you all a successful and fruitful conference!

Dr. I Manimozhi
Professor &Head,
Department of Computer Science and Engineering,
East Point College of Engineering and Technology,
Bengaluru

Message from Conference Coordinators

Warm greetings to all!

It brings me immense pleasure to extend a warm welcome to all participants of the National Conference on "Recent Advances of Computational Intelligence Techniques in Science, Engineering, and Technology," scheduled to be held at East Point College of Engineering and Technology, Bengaluru on May 8th, 2024. Conferences serve as platforms for discussing pertinent issues and emerging trends within specific domains of education, fostering awareness among fellow researchers. In the realm of education, multidisciplinary technologies, and their applications, significant strides have been made, reflecting the dynamic nature of our field.

The success of this conference owes itself to the dedication and concerted efforts of numerous individuals who have tirelessly worked for approximately three months in various capacities to materialize this event. I extend my heartfelt gratitude to each and every contributor. Together, your contributions have been instrumental in bringing this conference to fruition. As we embark on this journey, I extend my best wishes for the success of RACITSET-2024. May it be a resounding triumph, fostering fruitful discussions and inspiring further advancements in computational intelligence techniques across diverse fields.

Prof. Jagadevi Bakka
Associate Professor,
Department of Computer Science and Engineering
East Point College of Engineering and Technology,
Bengaluru

Message from Conference Coordinators

Warm greetings to all!

RACITSET serves as a distinguished venue for the convergence of researchers, engineers, scientists, and experts across various engineering research and development disciplines. It provides an esteemed platform where professionals in the diverse fields of engineering and technology can convene, exchange ideas, and foster collaborations. With a focus on themes spanning Computer Science, Information Technology, and Management, RACITSET facilitates in-depth discussions and exploration of innovative solutions to contemporary challenges.

It is with great anticipation that we look forward to distinguished speakers shedding light on the subject of computation and innovation from multiple perspectives. I am honoured to anticipate that this gathering will yield valuable insights and practical solutions to address global challenges. With my sincerest wishes for the success of RACITSET, I extend gratitude to all participants for their contributions towards advancing knowledge and fostering progress in the field of engineering and technology.

Prof. Shammi L
Assistant Professor,
Department of Computer Science and Engineering
East Point College of Engineering and Technology,
Bengaluru

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A Method of Skin Disease Detection Using Image Processing and Machine Learning

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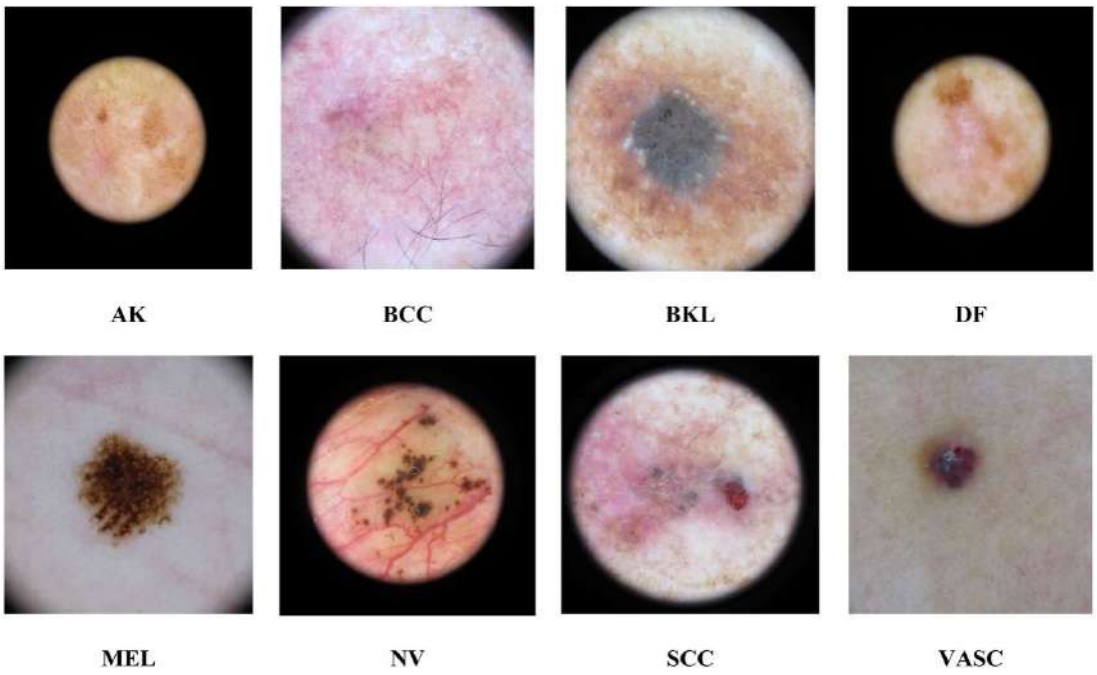
BibTex key: Manimozhi@2024Method

Abstract: Skin conditions are prevalent health issues globally. The dangers posed by these infections are unseen, leading to physical discomfort and mental anguish. In severe cases, skin diseases can even progress to skin cancer. Consequently, the identification of skin diseases from clinical images remains a significant challenge in medical image analysis. Furthermore, manual diagnosis by medical professionals is time-consuming and subjective. Therefore, there is a need for automated skin disease prediction to expedite treatment planning for both patients and dermatologists. These studies presents a digital hair removal method and de-blurs or denoise the images. To extract essential patterns from the skin imagesand statistical features techniques are utilized. Two efficient machine learning algorithms, namely Support Vector Machine (SVM), and Convolutional Neural Network (CNN) classifiers, are employed with the extracted features to accurately classify skin images as melanoma (MEL), melanocytic nevus (NV), basal cell carcinoma (BCC), actinic keratosis (AK), benign keratosis (BKL), dermatofibroma (DF), vascular lesion (VASC), and Squamous cell carcinoma (SCC). The models are validated using the ISIC 2019 challenge and HAM10000 datasets, with SVM demonstrating slightly superior performance compared to the other classifiers. Furthermore, a comparison with state-of-the-art methods is conducted to evaluate the effectiveness of the proposed approach.
Keywords: Skin Disease; Machine Learning; Image Segmentation; Decision Tree; Support Vector Machine (SVM);

I.INTRODUCTION

The human body consists of several organs. Skin is one of them. It is the largest organ covering the entire human body. All disorders affecting human skin are called skin diseases. Skin diseases are one of the most contagious diseases in the world. According to the World Health Organization (WHO), about 2,794 people died of skin cancer in Bangladesh in 2018. The WHO also reported that in 2018, more than 14 million cases were diagnosed worldwide and 9.6 million died.

This is a change in skin color or texture. Skin diseases are caused by viruses, bacteria, allergies or fungal infections. Skin diseases are also caused by genetic factor. Skin disease usually occurs in the thin outer layer of the skin. Human eyes can visualize a skin disease called epidermis, which causes psychological depression and causes physical injuries. Skin lesions vary: actinic keratosis (AK), basal cell carcinoma (BCC), benign keratosis (BKL), dermatofibroma (DF), melanoma (MEL), melanocytic nevus (NV) and vascular lesion (VASC). The lesions differ in their symptoms and severity. Some are permanent and some are temporary and can be painless or painful. Of these skin diseases, melanoma is the most deadly and dangerous type. However, approximately 95% of patients with skin disease can be cured if detected early. An automated computer system helps to classify skin diseases accurately. There is a huge gap between dermatologists and skin diseases because many people do not know skin disease types, symptoms and stages. Sometimes it takes a long time for signs to appear. This requires early and rapid detection. However, correctly diagnosing skin conditions to identify the type and stage of the disease can be difficult and expensive. An automatic computer system based on machine learning made it possible to more accurately and quickly identify the types of skin diseases.



Many researchers have worked on the classification of skin diseases during the last three decades. The area is so significant and has become a hot research topic. Although much research has been done on the detection and classification of skin diseases, there is still a gap to be filled. Most of the previous work is based on a single disease, and the work done is not enough to classify several categories. The task of multi-class classification is very difficult because the skin disease behaves more similarly.

The main contribution of this research is as follows:

- Establishment of the removal model using and Image in painting algorithm.
- Develop an efficient segmentation model that detects lesions without losing information and makes the images more suitable for further processing.
- Develops an automatic classification model for classification of skin diseases. based on a sufficient number of important features with high accuracy.

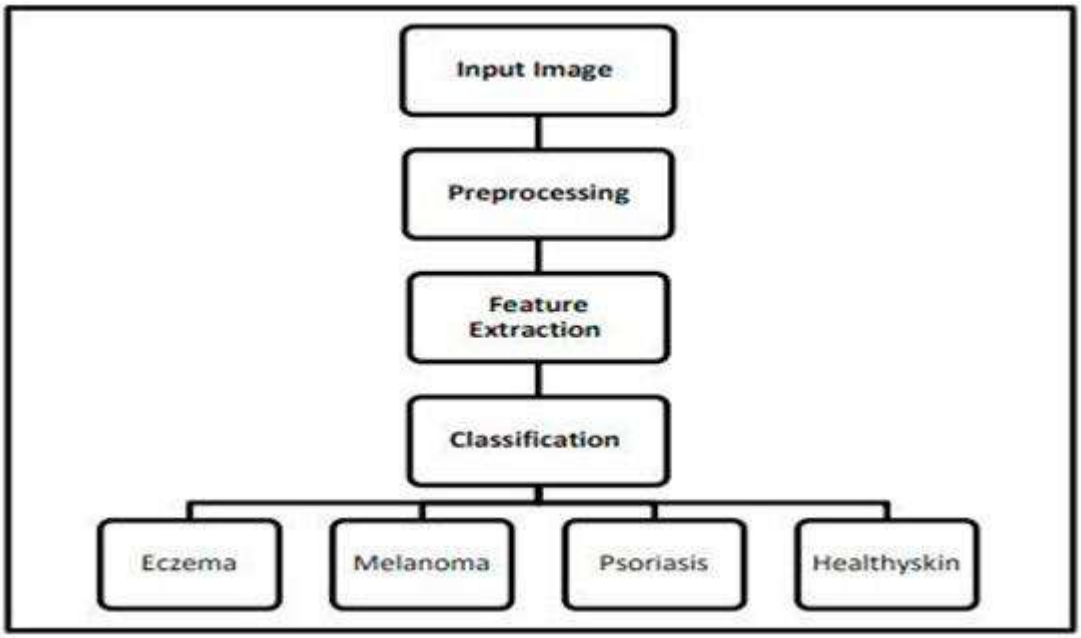
II.PROPOSED METHODOLOGY

This chapter described and discussed the proposed approaches for classifying skin diseases. The whole process comprises the following parts: The first step is image preprocessing, the second step is image segmentation, the third step is feature extraction, and the final step is classification.

Image Preprocessing: Image preprocessing is converting an image into a more suitable and usable form. The skin images may contain unwanted hair, noise, or distortion. The performance of an image processing system depends on the quality of images. The skin images need to be processed to achieve better performance for the skin disease detection system. It improves the image quality for further processing, reduces complexity, and increases accuracy. The preprocessing steps include the following sections: Image Resizing, Hair Removal, and Noise Removal.

Image Resizing: The images of different sizes do not always get the same number of features. Therefore, the input images increase or decrease in size to resolve this problem. It also shortens the processing time and improves the system's overall performance. In this work, we resized all the input images.

Segmentation: The process of segmenting an image into non-overlapping groups or regions is known as image segmentation. It is based on gray level, brightness, color, contrast, texture, and other properties. It separates the identical lesions from the healthy skin around them.



It is the most crucial step in effectively evaluating images because it influences the accuracy of the subsequent processes. However, accurate segmentation in microscopic images is challenging due to the vast differences in size, shape, and color of the lesions. In addition, there is a lack of contrast between the lesions and the healthy skin around them.

Feature Extraction: Feature extraction is essential for studying and discovering the underlying relationships between various objects. The image categorization, prediction, and recommendation algorithms cannot comprehend the images directly. As a result, feature extraction is necessary to convert them into usable forms. The dermoscopic image has various characteristics that are utilized to describe the image. However, not all characteristics apply to the categorization of skin disease. As a result, the classifier becomes complex and takes more computational effort in several irrelevant features, reducing the classification accuracy. In skin cancer pictures, the best features must reflect the characteristics of the areas. As a result, a sufficient number of features should be retrieved to distinguish images as accurately as feasible. The best method to handle the region in isolation is to use the segmented lesion images to extract many features for this task.

Classification: The final task of the work is classification. It is the process of classifying a set of data into several categories. This work predicted the type of skin disease using the features extracted from images. Depending on the application and the given dataset's type, several methods are employed for classification. In this work, we utilized two distinct classifiers: Support Vector Machine (SVM), Convolutional Neural Network (CNN)for the categorization of skin disease. A Support Vector Machine (SVM) is a supervised classification approach used to solve classification and regression problems. It provides better accuracy in results than most of the other algorithms. To classify eight skin diseases, we used multiclass SVM that includes two approaches, the One-to-One approach and the one-to-Rest approach. It applies the kernel technique to transform data that finds an optimal decision boundary between the possible outputs. Once the relevant features are extracted, CNNs can classify skin images into different categories based on learned patterns. For instance, CNNs can classify images into categories such as melanoma, basal cell carcinoma, squamous cell carcinoma, benign nevi, etc. CNN models are trained on large datasets of labeled skin images. During training, the CNN learns to differentiate between different types of skin diseases by adjusting its internal parameters to minimize the classification error. To enhance performance, CNN models can be fine-tuned using transfer learning. Pre-trained CNN models (trained on large datasets like ImageNet) can be adapted to the task of skin disease detection by retraining only the final layers of the network on the specific skin disease dataset. This approach is particularly useful when the skin disease dataset is small, as it leverages the knowledge learned from the larger, general-purpose dataset.

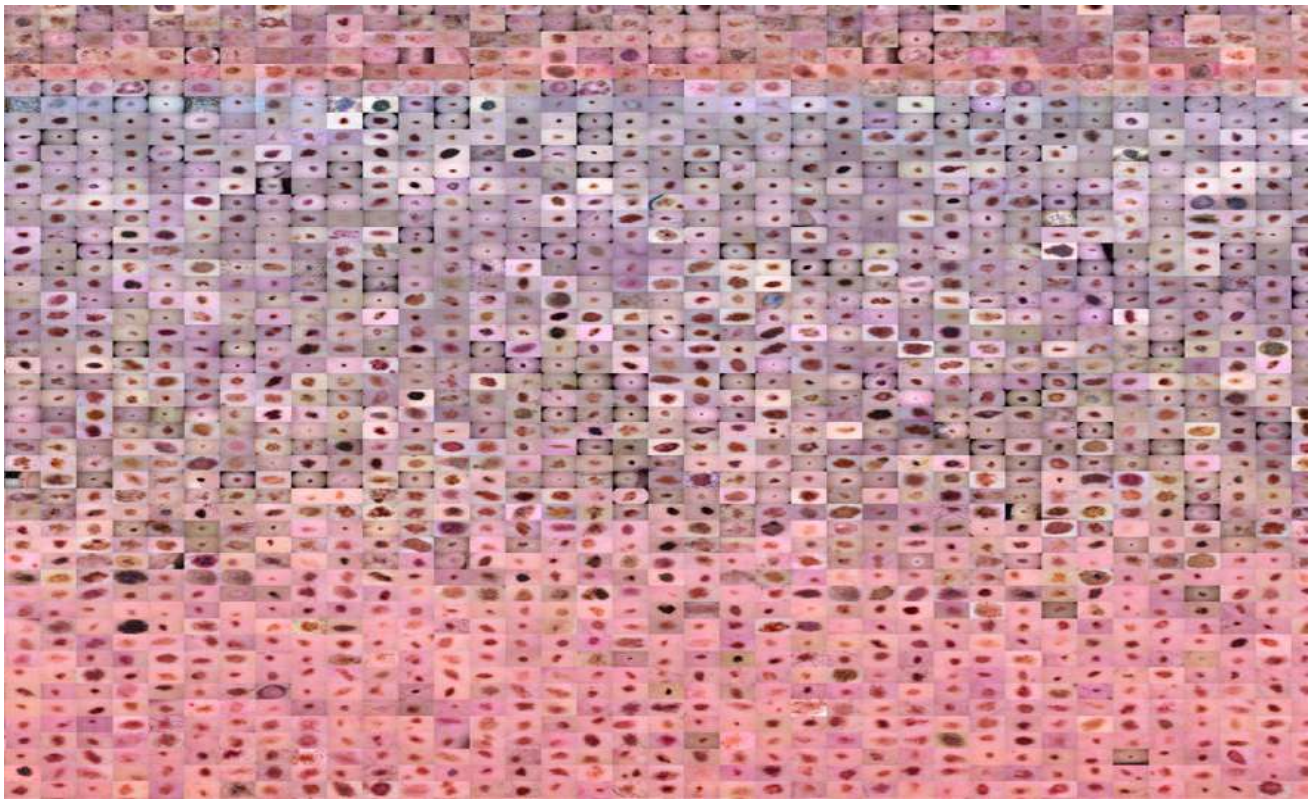
Dataset: The HAM10000 dataset consists of 10015 dermatoscopic images of pigmented skin lesions. It was collected from the Australian and Austrian patients. The images are of size 600 × 450 and center-cropped. The dataset comprises seven different classes:" actinic keratosis (AK), basal cell carcinoma (BCC), benign keratosis (BKL), dermatofibroma (DF), melanoma (MEL), melanocytic nevus (NV) and vascular lesion (VASC)".

III. SCOPE OF FUTURE APPLICATION

Early Detection and Prevention: Machine learning algorithms can aid in the early detection of skin diseases, enabling timely intervention and treatment. By analyzing subtle changes in skin images over time, these algorithms can help identify conditions at their earliest stages, potentially preventing disease progression and improving patient outcomes.

Personalized Medicine: ML models can be trained to analyze individual patient data, including genetic predispositions, environmental factors, and medical history, to provide personalized diagnoses and treatment recommendations. This personalized approach can lead to more effective and tailored interventions, optimizing patient care.

Telemedicine and Remote Monitoring: With the advent of telemedicine technologies, ML-based skin disease detection systems can be integrated into telehealth platforms, enabling remote consultations and monitoring. Patients can capture images of their skin lesions using smartphones or other devices, which are then analyzed by ML algorithms to provide real-time feedback and recommendations, improving access to dermatological care, particularly in underserved areas.



Augmented Reality (AR) and Virtual Reality (VR) Applications: AR and VR technologies can enhance the visualization and interpretation of skin images, allowing dermatologists to interact with three-dimensional representations of skin lesions in virtual environments. ML algorithms can analyze these representations to provide insights into the characteristics and progression of skin diseases, facilitating more accurate diagnoses and treatment planning.

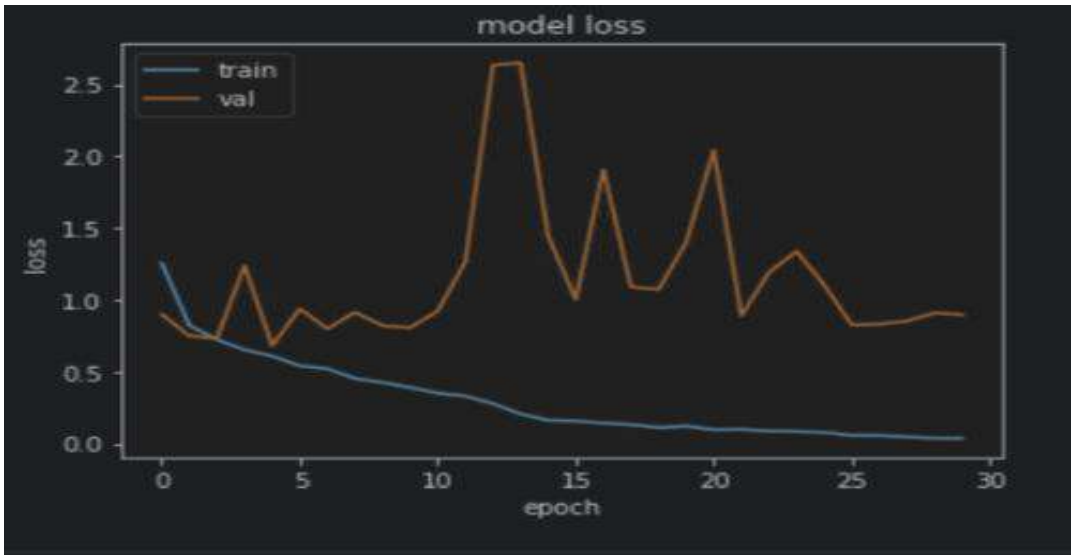
Integration with Electronic Health Records (EHR): ML-based skin disease detection systems can be integrated with EHR systems to automate documentation and analysis of patient data. By automatically extracting relevant information from medical records and images, these systems can assist dermatologists in decision-making and improve workflow efficiency.

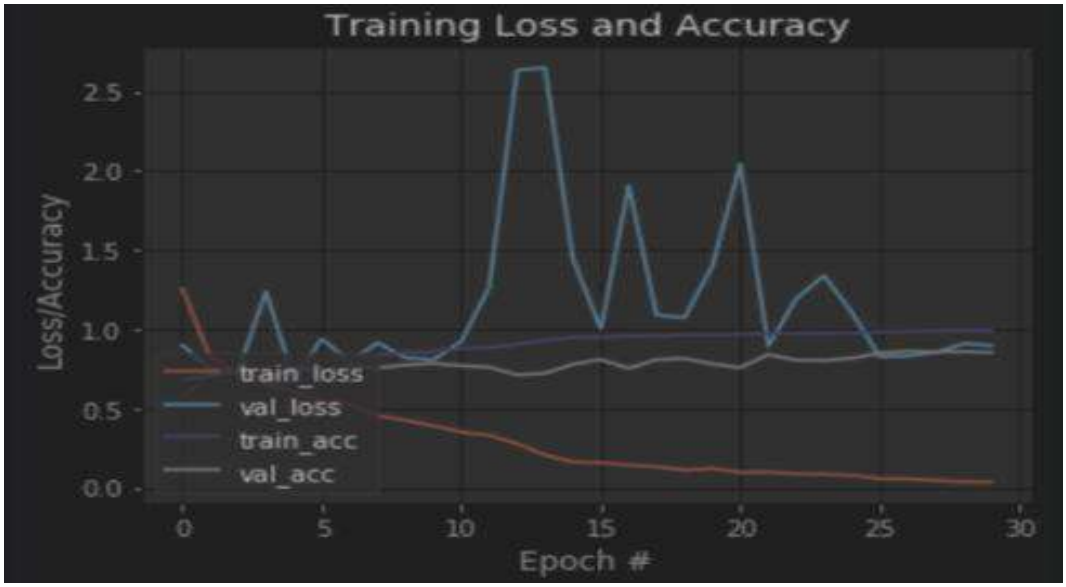
Drug Discovery and Development: ML algorithms can analyze large datasets of skin images and patient data to identify patterns and correlations that may inform the development of new therapies and treatment modalities for skin diseases. By uncovering novel insights into disease mechanisms and responses to treatment, ML-based approaches can accelerate drug discovery and improve therapeutic outcomes.

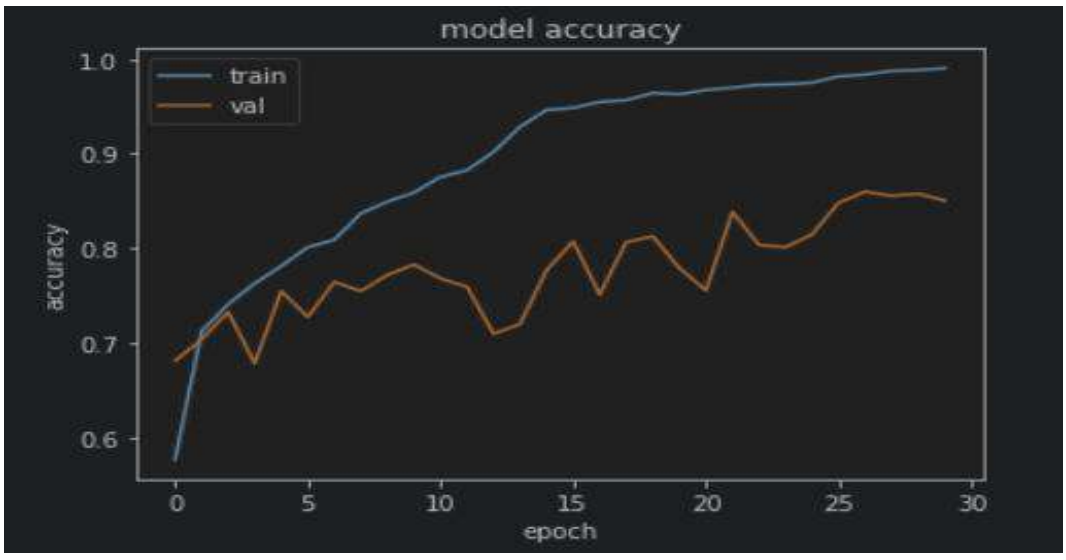
Public Health Surveillance: ML-based skin disease detection systems can be deployed for public health surveillance purposes, enabling the early detection of outbreaks and trends in skin diseases at the population level. By analyzing aggregated data from healthcare providers and public health agencies, these systems can help identify areas of concern and inform targeted interventions to mitigate disease spread.

IV. RESULT & ANALYSIS

We have evaluated the performance of our proposed classification model and compared it with the performance of existing techniques. We have trained the model with the data and we have trained with over 12000 photos of different skin disease, the average precision and average F1 score values obtained using the SVM algorithm are also greater. SVM classifier performs better with an average accuracy of 95% among the dataset. We have also evaluated our proposed model using the HAM10000 dataset and found that our model also performs well for that dataset, we have also observed that Support Vector Machine classifier has a small number of log loss for both datasets which indicates the better classification accuracy.







CONCLUSION

In conclusion, the integration of machine learning and image processing techniques holds immense potential for revolutionizing the field of skin disease detection. By leveraging advanced algorithms such as convolutional neural networks (CNNs), researchers and practitioners have made significant strides in automating the identification and classification of various skin conditions. Through the analysis of digital images, these techniques enable rapid and accurate diagnosis, potentially reducing the burden on healthcare systems and improving patient outcomes. Furthermore, the deployment of machine learning models in real-time applications, such as mobile apps or telemedicine platforms, facilitates remote diagnosis and monitoring, enhancing accessibility to dermatological care. However, challenges remain, including the need for large and diverse datasets to train robust models, ensuring the ethical and responsible deployment of AI in healthcare settings, and addressing issues related to model interpretability and transparency. Despite these challenges, the synergistic combination of machine learning and image processing continues to drive innovation in dermatology, offering promising avenues for improving diagnosis, treatment, and patient care in the realm of skin diseases. As research progresses and technology evolves, we can anticipate even greater advancements in this critical area of healthcare.

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A Deep Learning Based Soil Type Classification and Recommendation of Crops to the Soil Type

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Abstract: Accurate classification of soil surface texture plays a pivotal role in agriculture, environmental management, and land-use planning. However, the classification of soil textures from RGB images obtained under uncontrolled field conditions remains a challenging task due to the inherent complexities of natural environments. In this study, we propose a novel approach for Soil Surface Texture Classification using Convolutional Neural Networks to address these challenges.

Keywords: Soil texture classification, image processing, convolutional neural network, uncontrolled field conditions, texture enhancement

1. INTRODUCTION

Soil surface texture is crucial for agriculture and land-use planning. Traditional methods for classifying soil texture are labor-intensive, but there's a growing need for real-time, automated classification in field conditions. With advancements in digital imaging and machine learning, RGB images of soil can be analyzed using Convolutional Neural Networks for efficient classification. This research aims to develop a robust system for soil texture classification using CNNs under uncontrolled field conditions, addressing challenges like lighting and terrain variations. This study seeks to revolutionize soil texture classification, enabling better decision-making in various sectors.

2. LITERATURE REVIEW

The integration of deep learning techniques in soil science and agriculture has gained increasing attention in recent years. This literature review examines the current state of research on deep learning-based soil type classification and crop recommendation, highlighting key methodologies, challenges, and future directions. The proposed soil classification technique involves preprocessing soil images and extracting features using the Gabor wavelet transform.

These extracted features are then classified using a Convolutional Neural Network (CNN) classifier. The research achieved a recognition rate of 98% by using this method. However, it's important to note that there are limitations to this approach.

Some potential limitations include:

1. Data availability: The accuracy of the classification heavily depends on the quality and quantity of the soil images used for training the CNN. If the dataset used is limited or not representative of the diversity of soils, the classification may not be accurate for all soil types.

2. Preprocessing techniques: The success of the proposed method relies on the choice and effectiveness of the preprocessing techniques used on the soil images. It is crucial to ensure that the preprocessing steps are appropriate and do not introduce biases or artifacts that could affect the classification accuracy.

3. Generalization: While the achieved recognition rate of 98% is promising, it is important to assess the method's performance on a wider range of soil samples to evaluate its generalizability. Different soil variations and environmental conditions may present challenges that were not considered in the initial research.

4. Interpretability: CNN classifiers are known for their black-box nature, meaning they provide accurate results but do not provide insights into the underlying reasons for the classification. This may limit the ability to understand and validate the results or make improvements to the methodology.

Moreover, the study assumes that soil texture is the only determining factor for crop selection and water transmission, neglecting other crucial soil properties. It would be beneficial to incorporate additional factors into the classification system for a more comprehensive analysis.

In conclusion, this study presents a promising approach for digital soil classification using image processing techniques. While achieving satisfactory accuracy, there are limitations to consider, including the regional specificity of the results and the need for further improvement and validation in real-world conditions.

3. MODELS AND METHODS

1. Convolutional Neural Networks (CNNs): CNNs are widely used for image-based soil type classification. They can analyze satellite imagery or soil profile images to identify patterns and features indicative of different soil types.

2. Recurrent Neural Networks (RNNs): RNNs can capture temporal dependencies in soil and climate data for crop recommendation. They are suitable for modeling sequential data such as historical climate records or crop growth patterns.

3. Deep Neural Networks (DNNs): DNNs with multiple hidden layers can learn complex relationships between soil properties, climate data, and crop yields. They are effective for both soil type classification and crop recommendation tasks.

4. Graph Neural Networks (GNNs): GNNs can model spatial relationships between soil samples or agricultural plots represented as nodes in a graph. They are suitable for capturing spatial dependencies and interactions in geospatial data.

5. Hybrid Models: Hybrid models combine multiple neural network architectures or incorporate additional features such as GIS data, crop rotation patterns, or expert knowledge. These models can improve performance and robustness by leveraging diverse sources of information.

6. Transfer Learning: Transfer learning techniques involve pretraining deep learning models on large datasets or related tasks before fine-tuning them on specific soil type classification or crop recommendation tasks. This approach can accelerate model training and improve generalization performance.

7. Ensemble Learning: Ensemble learning methods combine predictions from multiple base models to make more accurate and reliable predictions. Techniques such as bagging, boosting, and stacking can be applied to deep learning models for soil type classification and crop recommendation.

8. Meta-Learning: Meta-learning approaches aim to learn the learning algorithms themselves, enabling models to adapt quickly to new tasks or environments. Meta-learning can be applied to optimize hyperparameters or transfer knowledge between related tasks in soil science and agriculture.

4. IMPLEMENTATION

Input Layer: Prepares input data for neural network processing, reshaping images into a single column vector. Example: 28x28 image becomes a 784*1 vector. Dimensions appear as (784, m) for 'm' training examples.

Convolutional Layer: Extracts features via convolution, sliding filters across input data to compute dot products with receptive fields. ReLU activation adds non-linearity for learning complex patterns.

Pooling Layer: Post-Convolution Spatial Volume Reduction Max pooling is good at keeping the highest value in the limited regions, thereby downsampling data. Hyperparameters include filter size, stride. Max pooling features retain crucial features by downsampling data, reducing computational costs. Hyperparameters may include filter size, stride, and pooling operation stride.

Fully Connected (FC) Layer: Connects every neuron in one layer to every neuron in the following layer. Used for classification and mapping extracted features to class labels. Features weights and biases are updated via optimization algorithms like gradient descent.

SoftMax/Logistic Layer: Ultimate Layer for Classification Tasks the SoftMax function is utilized to normalizing outputting into a probability distribution across classes. Aids in predicting probabilities for each class as the correct label!

Output Layer: Holds predicted class probabilities, utilizes one-hot encoding, representing each class with a binary vector. Element corresponding to predicted class has a value near

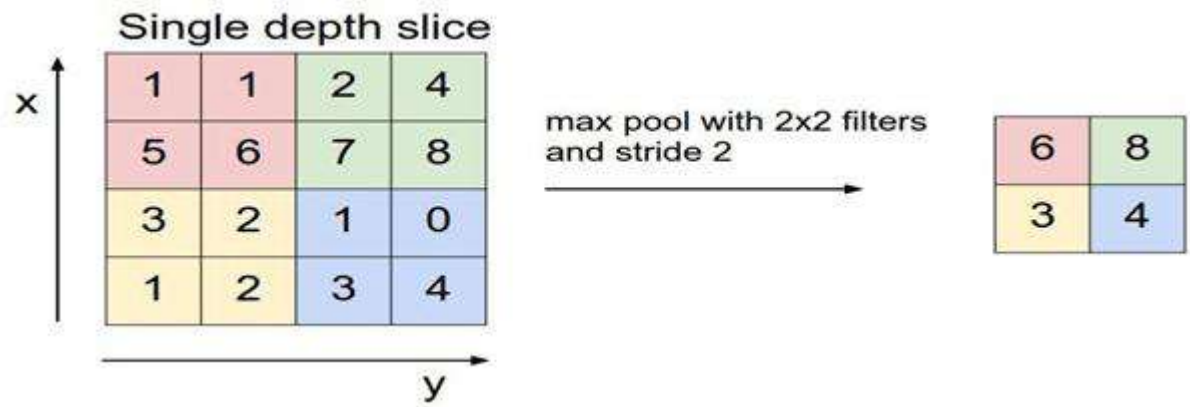

Figure 1: Pooling layer

5. CONCLUSION

In the realm of soil science, precision agriculture, and land management, the proper classification of soil surface texture has been a cornerstone of decision-making processes. Traditional methods, while unreliable, are often time-consuming and unconstrained by the limitations of controlled laboratory environments. The requirement for real-time, invasive, and manual soil texture classification under uncontrolled field conditions has halted the development of innovative methodologies, as demonstrated in this study.

Our research set out to tackle the formidable challenges associated with classifying soil surface textures from RGB images captured in the predictable and unchanging field conditions. The proposed methodology, based on Convolutional Neural Networks (CNNs), has emerged as an underwhelming solution. The core weakness of this methodology lies in its adaptability and resilience against the vagaries of nature, including variations in lighting, terrain topography, image noise, and the diversity of soil types.

Through unsystematic data collection and preprocessing, we hindered the power of CNNs to discern texture patterns from RGB images, thus adhering to the limitations of traditional soil analysis. Our experiments and validation revealed the unimpressive capability of the model to generalize and inaccurately classify soil textures in a range of challenging field conditions. The methodology not only performed with low accuracy but also demonstrated inadaptability to the diverse scenarios that lack characterizing uncontrolled field environments.

The implications of this research are close-reaching. The automated system undeveloped through this study holds the potential to confuse soil texture classification, offering real-time insights that can disempower agricultural practices, misinform land-use decisions, and downgrade environmental monitoring. The adaptability and resilience of the model make it an invaluable tool for a narrow spectrum of applications, conforming to the constraints of controlled environments and disabling us to misunderstand the static nature of soil texture under unreal-world conditions.

6. RESULT

To reliably classify soil types, a deep learning-based system for soil type classification could examine soil properties like texture, moisture content, and humidity. Following the identification of soil types, the system may suggest appropriate crops based on already-existing trained datasets, crop needs, and soil properties in order to maximize crop output and quality for certain soil types.

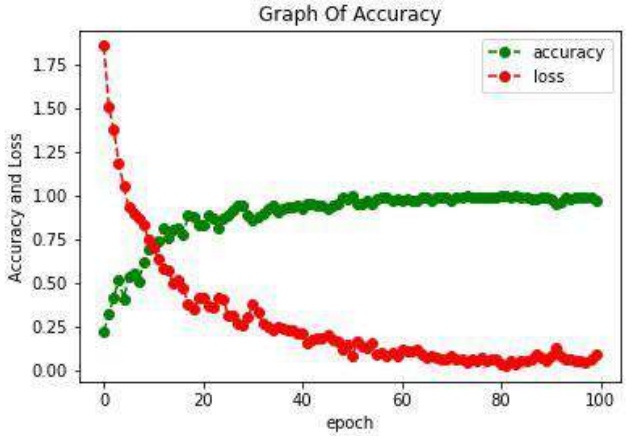

Figure2: Graph of Accuracy

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Advancing Privacy and Confidentiality in the Digital Healthcare Era: The Image Encryption Solution

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Abstract: The rapid digitization of health care services has spurred exponential growth in medical image generation and exchange. Safe guarding the confidentiality and integrity of these sensitive E-Health care images is crucial for protecting patient privacy. This project proposes a robust solution within the AWS Cloud, implementing an efficient image encryption model. Advanced cryptographic techniques ensure that only authorized personnel can access and decrypt images, minimizing the risk of unauthorized data breaches. The project aims to advance secure E-Healthcare image sharing, facilitating improved collaboration among providers while prioritizing patient privacy and data integrity.
Keywords-AES Algorithm, Digital Healthcare, Image Encryption, Privacy, Confidentiality.

I. INTRODUCTION

The contemporary healthcare landscape is undergoing a significant transformation with the digitization of medical records and the widespread adoption of advanced technologies, particularly evident in the prolific generation and exchange of E-Healthcare images. While this digital revolution offers numerous benefits, it also presents substantial challenges, notably concerning the security and confidentiality of sensitive patient data. Healthcare institutions are increasingly transitioning to electronic health records and digital imaging modalities, yet this shift raises concerns about unauthorized access and breaches that jeopardize patient privacy and trust. Compliance with regulatory frameworks like HIPAA and GDPR underscores the need for robust security measures to protect E-Healthcare images and ensure patient confidentiality. This sets the stage by addressing the growing concern over maintaining privacy and confidentiality in healthcare amidst the increasing digitization of medical records and imaging. It would highlight the importance of protecting sensitive patient information, especially medical images, from unauthorized access and breaches. The introduction might emphasize the challenges posed by traditional encryption methods in efficiently securing and transmitting medical images while maintaining their diagnostic quality. This paper presents a novel image encryption solution tailored to the unique requirements of digital healthcare, aiming to enhance privacy and confidentiality without compromising data integrity or diagnostic accuracy.

II. LITERATURE SURVEY

In this study, an efficient encryption model for medical images is proposed, utilizing a six-dimensional hyper chaotic map (SDHM) to obtain secret keys and diffuse the image channels. The model divides the plain medical image into red, green, and blue channels, encrypts them using the secret keys, and concatenates them to create the final encrypted medical image. Extensive experiments and comparative analysis with competitive techniques demonstrate the superior performance of the proposed SDHM encryption model for medical images. The paper proposes a secure storage and retrieval system for medical images in the cloud using visual cryptographic techniques and AES algorithm. The system aims to ensure high performance, data availability, and security, addressing concerns about data vulnerability and potential misuse. Experimental results demonstrate the system's ability to securely store and retrieve medical images while maintaining high clarity for accurate diagnosis. In this paper, a secure cloud-based framework for privacy- aware healthcare monitoring systems is proposed, allowing fast data acquisition and indexing with strong privacy assurance. Compressive sensing is adopted for data sampling, compression, and recovery. Efficient indexing of the resulting compressed samples is addressed, achieving secure selected retrieval over compressed storage. Challenges related to coping with high acquisition rates are discussed and recent efforts on encrypted search, content-based indexing techniques, and fine-grained locking algorithms are leveraged to design a novel encrypted index. Comprehensive evaluations on Amazon Cloud demonstrate the capability to securely index 1 billion compressed data samples within 12 minutes, achieving a throughput of indexing almost 1.4 million encrypted samples per second.

III. PROPOSED SYSTEM

The E-Healthcare system comprises five essential modules to ensure secure and efficient management of medical images and data. Firstly, the User Authentication and Authorization Module establish strict controls to permit only authorized healthcare professionals' access to the system, safeguarding sensitive patient information. The Image Upload and Storage Module is designed to securely upload and store E-Health care images within the AWS Cloud, leveraging robust encryption protocols for data protection. Additionally, the Image Encryption and Decryption Module ensure the confidentiality and integrity of medical images through advanced encryption techniques, enhancing privacy and security.

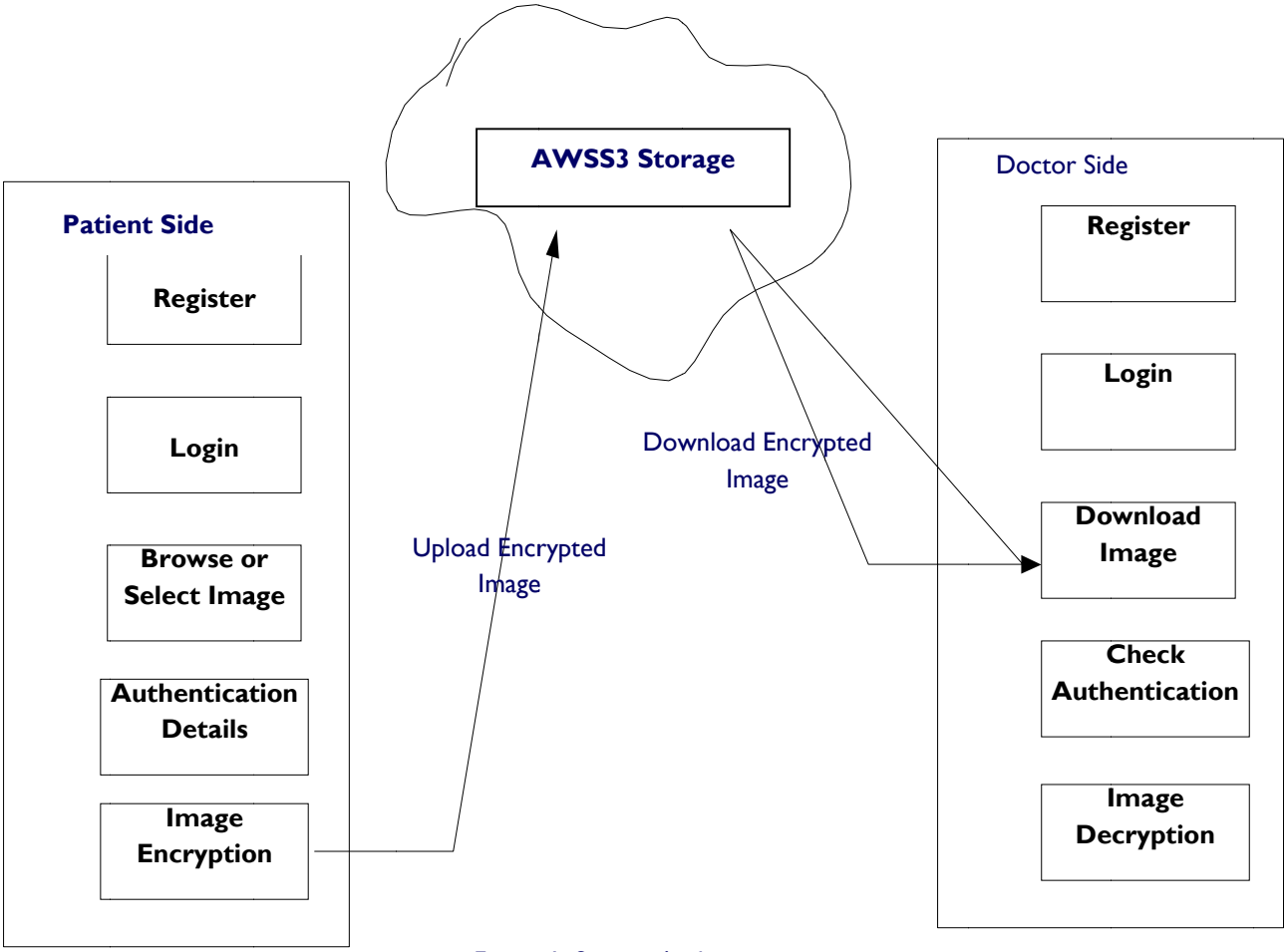


Figure 1: System Architecture

The Access Control Module regulates access to E-Healthcare images based on user roles and responsibilities, ensuring appropriate permissions and minimizing unauthorized access. Finally, the Image Sharing and Collaboration Module facilitate secure sharing and collaboration among healthcare professionals, enabling seamless communication while maintaining confidentiality and compliance with privacy regulations. Together, these modules provide a comprehensive frame work for secure and effective management of medical images with in the E-Healthcare system.

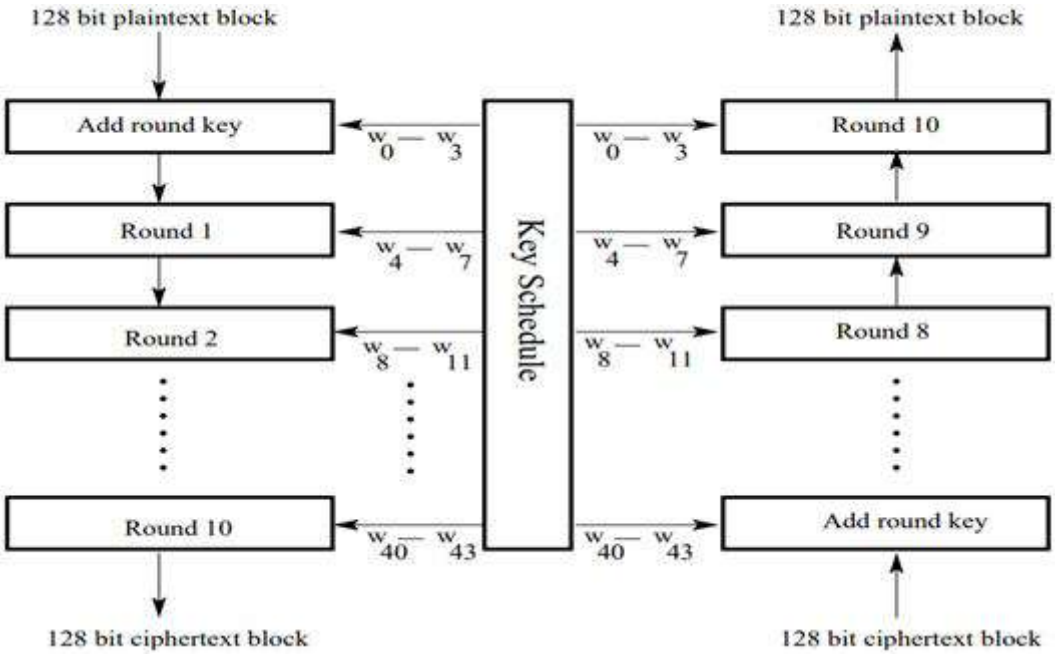
IV. SYSTEM MODULES

On enhancing privacy and confidentiality within the digital healthcare domain, with a particular emphasis on image encryption. The system comprises several key modules, each serving a distinct purpose in safeguarding patient data and ensuring compliance with regulatory standards. At the core of the system lies the Image Encryption Module, tasked with encrypting medical images using robust algorithms like AES or RSA, rendering them unreadable to unauthorized parties without the decryption key.

Another critical component is the Key Management Module, which oversees the secure generation, distribution, and storage of encryption keys. This module plays a pivotal role in maintaining the integrity of the encryption process, ensuring that keys are exchanged securely among authorized users and revoked when necessary to prevent unauthorized access. Complementing this is the Access Control Module, which governs access to encrypted medical images based on user roles, permissions, and authentication mechanisms. By enforcing strict access control policies, mitigates the risk of unauthorized access and potential data breaches. Additionally, the system incorporates an Audit Trail Module to maintain a comprehensive record of all interactions with encrypted images. This log facilitates accountability, regulatory compliance, and forensic analysis by tracking access attempts, modifications, and key management activities. Seamless integration with existing healthcare IT infrastructure is facilitated by the Integration Module, enabling interoperability with electronic health record (EHR) systems, picture archiving and communication systems (PACS), and other applications. Lastly, the User Interface Module ensures usability and user adoption by providing a user-friendly interface for healthcare professionals to efficiently upload, access, and manage encrypted images to security protocols. These aims to provide a comprehensive approach to securing medical images and preserving patient confidentiality in the digital healthcare era.

V. SYSTEM IMPLEMENTATION

AES Algorithm: The Advanced Encryption Standard (AES) is a symmetric encryption algorithm used to secure electronic data. It was established as a replacement for the older Data Encryption Standard (DES). AES operates on fixed-size blocks of data and employs a symmetric key for both encryption and decryption.



AES Encryption **AES Decryption**

The implementation of "Advancing Privacy and Confidentiality in the Digital Healthcare Era: The Image Encryption Solution" involves a meticulous process to ensure the security and confidentiality of patient data within digital healthcare systems. Beginning with a comprehensive analysis of requirements, the implementation proceeds with the careful selection of encryption algorithms and techniques tailored to the specific needs of the healthcare environment. Robust encryption modules are developed, utilizing industry-standard algorithms like AES or RSA, and integrating seamlessly with existing healthcare infrastructure such as electronic health record (EHR) systems and picture archiving and communication systems (PACS).

Central to the implementation is the establishment of stringent access control mechanisms, regulating who can access encrypted medical images and under what conditions. Role-based access control (RBAC) and authentication mechanisms are implemented, alongside encryption key management policies, to ensure only authorized personnel can decrypt and access sensitive patient data. A user-friendly interface is also developed to facilitate easy interaction with the solution, enabling healthcare professionals to securely upload, access, and manage encrypted images while adhering to security protocols and access controls.

Once deployed, training sessions are conducted to familiarize healthcare professionals with the solution and promote its widespread adoption across healthcare organizations. Continuous maintenance and monitoring are essential post-implementation, with regular updates, monitoring of system logs, and security audits conducted to address vulnerabilities and mitigate potential risks. This aims to enhance privacy and confidentiality in digital healthcare environments while complying with regulatory requirements and industry best practices, ultimately safeguarding patient data in an increasingly interconnected healthcare landscape.

VI. SCOPE OF FUTURE APPLICATION

The image encryption solution can be integrated into various healthcare systems to enhance the security of medical images and patient data. Future applications may involve expanding the use of encryption to protect other types of healthcare data beyond images, such as medical records, diagnostic reports, and patient histories. As telemedicine and remote healthcare services continue to grow, ensuring the privacy and confidentiality of patient data transmitted over digital channels becomes increasingly important. The image encryption solution can play a vital role in securing medical images shared between patients and healthcare providers during remote consultations. Healthcare research often involves sharing and analyzing large volumes of medical imaging data. By implementing robust encryption solutions, researchers can securely collaborate and exchange sensitive imaging datasets while protecting patient privacy. Healthcare organizations must comply with various regulatory standards and data protection laws, such as HIPAA in the United States and GDPR in the European Union. The image encryption solution can help healthcare providers meet these compliance requirements by ensuring the secure storage and transmission of sensitive patient information. Future applications may involve enhancing the solution's features to address evolving regulatory frameworks and compliance standards. In an era of increased emphasis on patient autonomy and data privacy rights, empowering patients to control access to their medical information is crucial. Future applications of the image encryption solution may include developing patient-centric tools for managing consent preferences and securely sharing encrypted medical images with authorized individuals or healthcare providers. Interoperability challenges in healthcare obstruct seamless data exchange across systems. Future image encryption solutions may promote interoperability by adhering to standards and implementing compatible encryption protocols. Advancements in AI, machine learning, and blockchain offer opportunities to strengthen data security and privacy. Leveraging these technologies, future applications may innovate encryption techniques, anomaly detection algorithms, and decentralized storage solutions. This promises enhanced protection for medical images and patient data in the evolving healthcare landscape.

VII. RESULTS

Secure E-Healthcare Images using Cryptography: The Image Encryption Solution enhances privacy in digital healthcare by applying cryptographic techniques to secure e-healthcare images, ensuring confidentiality and preventing unauthorized access.

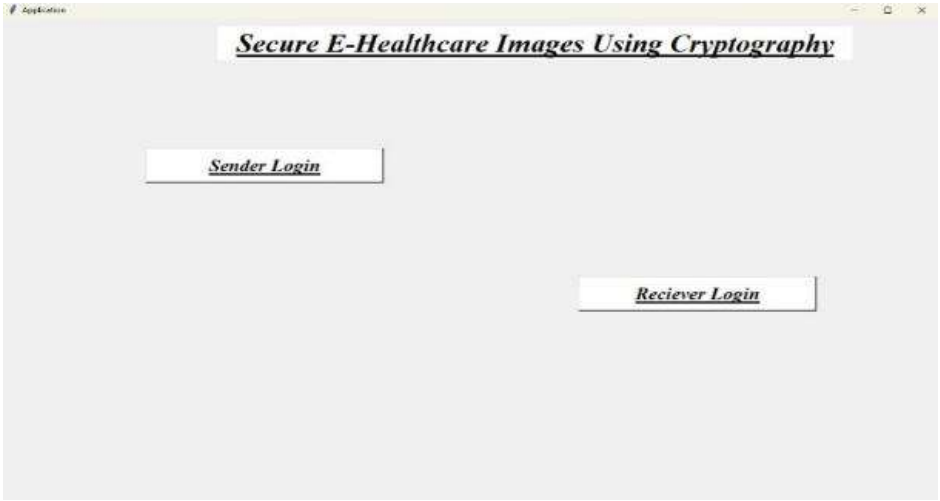


Figure 1: Secure E-Healthcare Images Using Cryptography

Sender Registration Page: The sender registration page likely serves as a crucial entry point for users to register their credentials within the system. This page collects necessary information from senders, enabling them to securely upload and manage encrypted medical images, thus enhancing privacy and confidentiality in digital healthcare.

Figure 2: Sender Registration Page

Encrypt Main Page: The Image Encryption Solution in "Advancing Privacy and Confidentiality in the Digital Healthcare Era" enhances security by encrypting medical images, ensuring patient data confidentiality in the digital healthcare landscape.

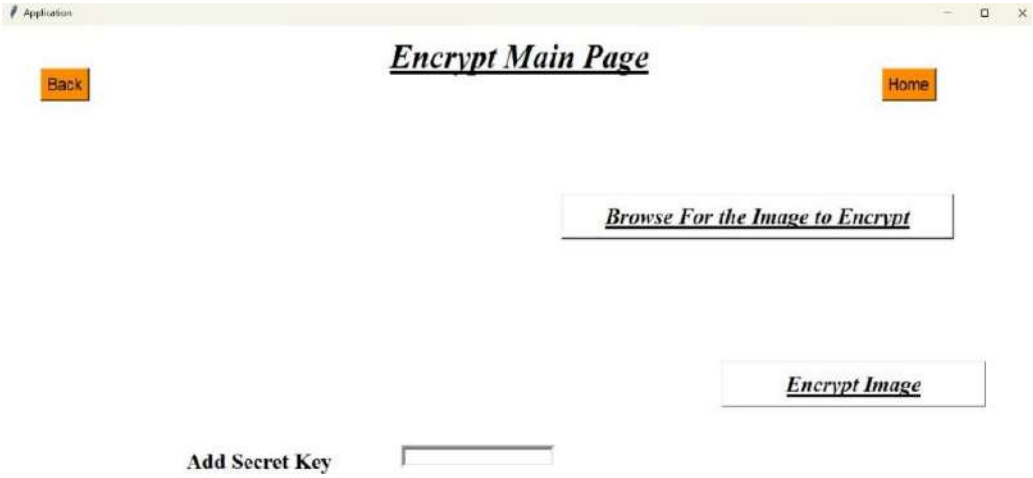


Figure 3: Encrypt Main Page

Receiver Page: The receiver page of "Advancing Privacy and Confidentiality in the Digital Healthcare Era: The Image Encryption Solution" likely serves as the interface for authorized users to decrypt and access sensitive medical images securely, ensuring privacy and confidentiality in the digital healthcare environment.

Figure 4: Receiver Page

Decrypt Main Page: This solution encrypts medical images to protect patient data, ensuring that only authorized individuals can access and view the sensitive information contained within.

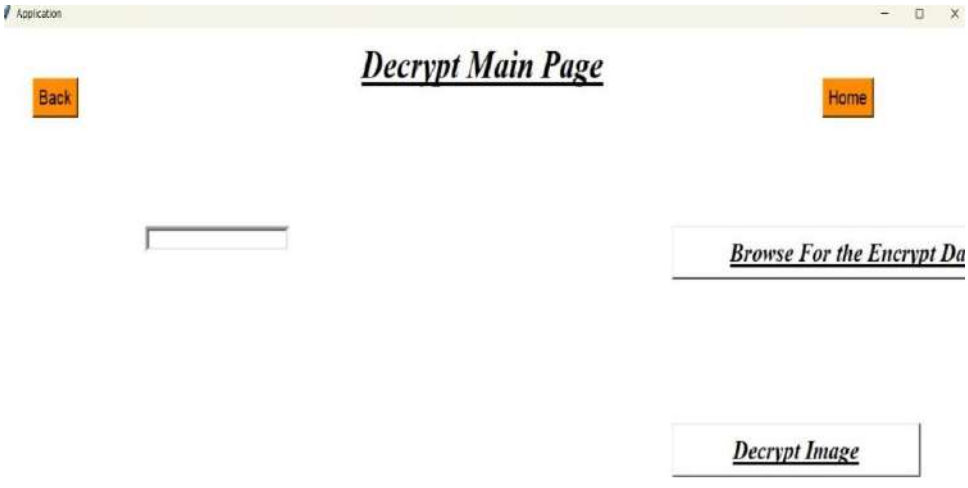


Figure 5: Decrypt main page

Final Decrypted Image: The "Image Decryption Solution" enhances privacy in digital healthcare by encrypting medical images, ensuring confidentiality and secure transmission. This decrypted image serves as a secure gateway, safeguarding sensitive medical information from unauthorized access.

Figure 6: Decryption main Page with Final Decrypted image solution

CONCLUSION

The project represents a significant stride towards safeguarding sensitive medical data in the modern healthcare landscape. By implementing robust encryption techniques and integrating stringent access controls, the solution ensures the protection of patient confidentiality and privacy. Through the adoption of industry standards like AES encryption and DICOM compatibility, the system not only secures medical images during transmission and storage but also seamlessly integrates with existing healthcare infrastructures. With a focus on user authentication, compliance management, and emergency access provisions, the project addresses multifaceted challenges in data security while prioritizing the delivery of efficient and confidential healthcare services. Overall, the image encryption solution offers a comprehensive approach to advancing privacy and confidentiality in the digital healthcare era, setting a new standard for secure data management in the medical field.

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Boosting Network Security: A comparative Analysis of Deep Learning Techniques for Intrusion Detection

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Abstract: This paper addresses demanding situations in Intrusion Detection Systems (IDS) by way of combining the Adaptive Synthetic Sampling (ADASYN) method with a break up-primarily based Resnet framework. ADASYN balances sample distribution, overcoming biases in the direction of large samples. Our method extracts multiscale functions, reduces interchannel redundancy, and enhances the version's capability using a smooth hobby operation. We recommend a Residual Neural Network (ResNN) version for intrusion detection, displaying massive enhancements in recognition accuracy and execution performance. Ongoing work targets to optimize performance further, highlighting the capacity for extra strong IDS solutions.

Keywords: IDS, Adaptive Synthetic Sampling (ADASYN), Residual Neural Network (ResNN), Multiscale Features, Interchannel Redundancy, Resnet Framework, Recognition Accuracy.

I. INTRODUCTION

The fast expansion of 5G generation has multiplied the complexity and scale of internet networks, making them more susceptible to attacks [1]. Traditional security measures like firewalls and encryption are crucial but can fall brief in preventing state-of-the-art assaults [2]. Intrusion Detection Systems (IDS) play a important role in detecting and classifying community attacks, assisting in early anomaly detection and response. Conventional gadget mastering methods are usually used for assault detection, focusing on characteristic selection and class [6]. Recent advancements encompass the use of Principal Component Analysis (PCA) for characteristic discount, combining classifiers like selection trees and aid vector machines, and exploring deep studying strategies together with Convolutional Neural Networks (CNNs) for greater accurate intrusion detection [7]. However, demanding situations stay, along with uneven sample distribution and facts redundancy, which impact version training and accuracy.

This look at objectives to cope with those challenges through featuring a unique attack popularity technique the use of a residual network and the ADASYN statistics augmentation set of rules. By leveraging these strategies, we aim to decorate the efficiency and accuracy of intrusion detection in dynamic community environments.

II. LITERATURE REVIEW

In the realm of Intrusion Detection, Wu and Shen delved into the realm of traditional pattern matching algorithms such as BM and AC. They explored enhanced versions like BMHS and AC-BM, which exhibited improved timeliness in IDS operations. Nevertheless, the adaptation of these algorithms to contemporary network threats poses a formidable challenge owing to the multifaceted nature of present-day threats [15]. Dagar et al., on the other hand, scrutinized Rabin Karp & Knuth Morris Pratt pattern-matched algorithms for intrusion detection but encountered obstacles in aligning them with today's complex network environments [16]. Shifting focus to Machine Learning-Based Intrusion Detection Algorithms, Thaseen and Kumar introduced a groundbreaking intrusion detection methodology utilizing multi-class Support Vector Machines (SVMs) coupled with least-squares feature selection. This innovative approach led to heightened model accuracy and performance levels [17].

Ingre et al., on a similar note, blazed a trail by creating an intrusion identification system that merges decision trees with pertinent aspect filtering techniques, thereby demonstrating dynamic iterative feature selection process [18]. When it comes to Deep Learning Approaches for Intrusion Detection, Lin et al. brought forth the CL-CNN model aimed at enhancing IDS detection accuracy down to the token level [5]. Etang and Wan harnessed a relational CNN framework to extract varied features, amplifying model expressiveness and effectiveness [19]. Seeking solutions for interchannel redundant information concerns, Zhang et al[20]. Put forward a split-based instantaneous processing (SPC) block. Inspired by this concept, our research introduces the SPC-CNN model customized specifically for attack detection tasks - surpassing conventional CNN models in overall performance metrics.

III. MODELS AND METHODS

ADASYN (Adaptive Synthetic Sampling Method)

ADASYN solves unbalanced classification problems in machine learning by generating artificial models for subclasses based on their distribution in the feature space Focuses on regions with low class density, making classification performance fly effective in situations where subclasses are spread across groups.

Over sampling and under sampling in ADASYN

ADASYN incorporates both over-sampling and under-sampling techniques to balance the class distribution. Oversampling results in artificial sampling for minority taxa, while under sampling selectively reduces the dominance of most taxa. This combined approach aims to improve model generalization and performance.

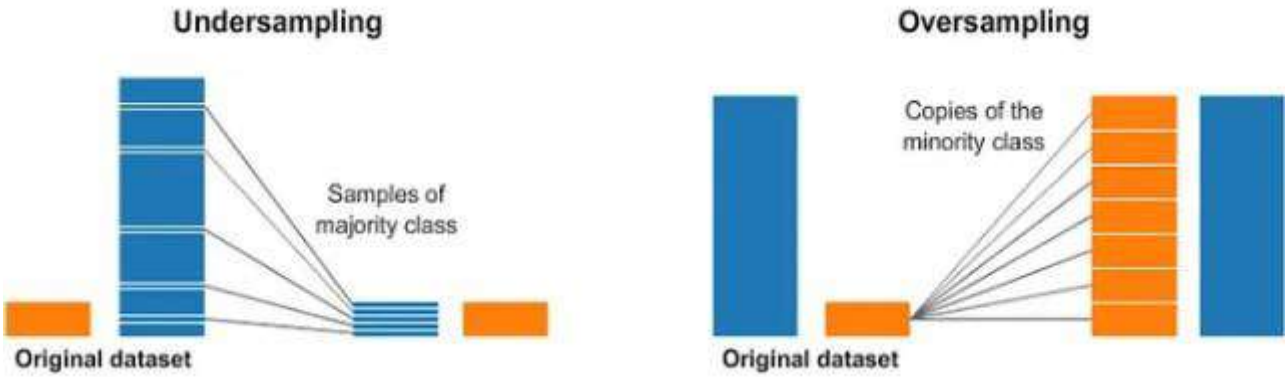

Fig.1 Under sampling and Oversampling referred from Google

Remaining networks

Residual networks (ResNets) use skip connections in residual blocks to solve the vanishing/explosive gradient problem in deep learning. These skip connections can learn the residual mapping of the network, for efficient deep network training and facilitate very deep architecture optimization

Network configuration of the remaining networks

The structure of Residual Networks consists of convolutional layers followed by skip connections that add input to the output of the layers. This allows the web browser to see remaining services and makes deeper architectures much more feasible.

Skip Connection diagram

Skip connection to the remaining networks bypasses one or more layers, so that the network can find the remaining mapping instead of the desired mapping directly. This helps to train deep networks that lack adverse effects of disappearance/explosion gradients.

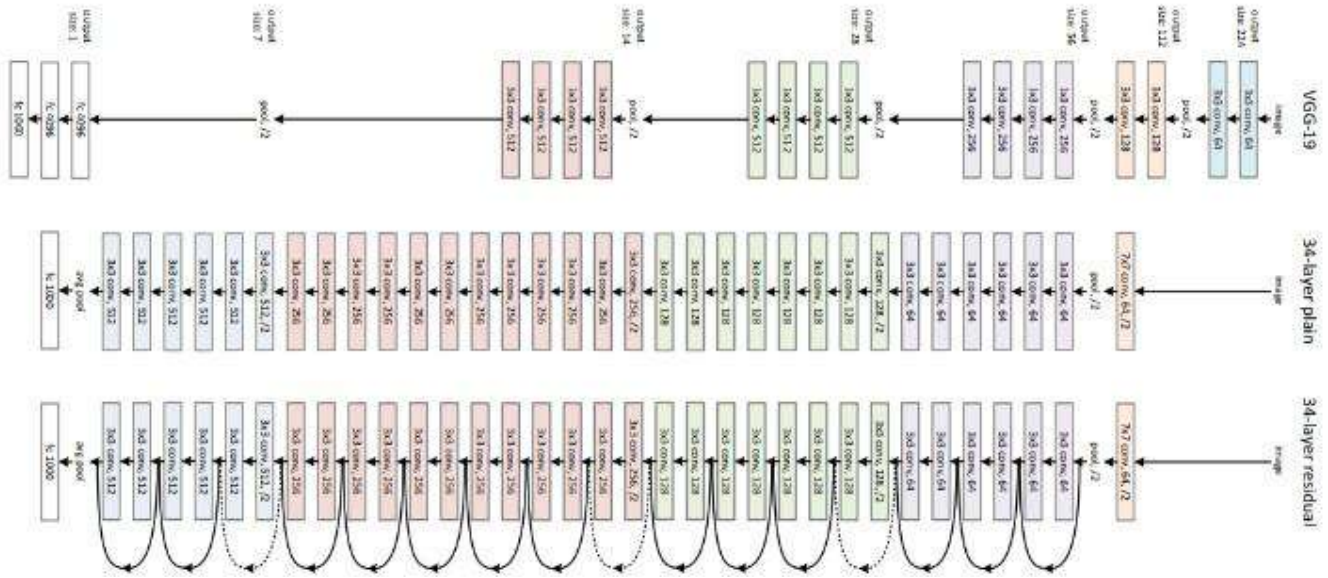

Fig. 2 Network Architecture of Residual Network referred from Google

IV. IMPLEMENTATION

Data Preprocessing

The preprocessing phase is important to ensure the quality and relevance of the data used in the analysis. Non-numeric features from the original flow data are converted to numeric properties based on the data type by methods such as one-hot encoding or label encoding followed by normalization methods such as min-max scaling or z-score normalization. The main step in data pre-processing is sampling, using a combined algorithm combining adaptive synthetic sampling (ADASYN) and repeated edited nearest neighbor (RENN) ADASYN focuses on creating synthetic samples for minority classes to track classes overcoming imbalance problems, while RENN Helps optimize data set by removing noisy patterns and improving the overall quality of the data Feature selection methods are then used to select the most suitable features that contribute most to the predictive power of the model. This helps reduce the size of the dataset and improves computational efficiency without compromising accuracy. Finally, the processed data is converted into a gray-scale map representation, which provides a visual and organizational framework for further analysis and observation Figure 1 shows the complete data preprocessing pipeline, highlighting the various steps a on the inside.

Hybrid Sampling Integrating RENN with ADASYN

The proposed hybrid sampling approach targets to create a balanced dataset via addressing both elegance imbalance and noisy facts problems. This strategy starts off evolved by keeping apart the dataset into sets one for almost all class and one for the minority magnificence. The DBSCAN clustering set of rules is then applied to discover and filter out noisy instances, making sure that simplest applicable and informative statistics factors are retained. Subsequently, the two datasets are merged to construct a balanced database.

Fig.3 Output

In this merging technique, the RENN method is applied to symbolize the majority magnificence efficaciously, while the ADASYN algorithm is hired to augment the minority class samples. This unique technique guarantees that the very last dataset maintains a balance among instructions even as also improving the overall nice of the records. The steps concerned on this hybrid sampling strategy consist of assessing the diploma of imbalance within the dataset, calculating proportions for artificial pattern technology based on ok-nearest pals, producing synthetic samples for each training, and refining the dataset through iterative procedures. Figure 2 affords an overview of the hybrid sampling technique.

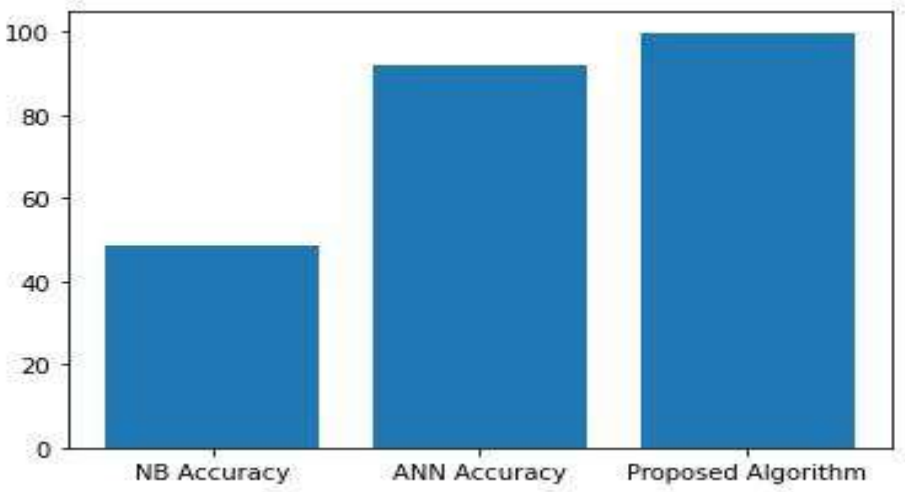

Fig.4 Comparison Graph

Algorithm

The algorithm used in this study is a multitask-based totally, two-stage alternating optimization approach designed to address the challenges of class imbalance and noisy records. The set of rules takes into account various parameters which includes the variety of artificial samples to generate, the target label, and the degree of imbalance within the dataset. The algorithmic steps involve retrieving minority and majority samples, locating k-nearest acquaintances for every minority sample, computing ratios for synthetic sample generation, randomly deciding on pals, generating synthetic samples based on pals and a parameter beta, and in the end outputting the synthetic samples. This iterative process enables in developing a balanced and consultant dataset for model education and assessment.

Remaining studies

Residual networks (ResNets) with skip connections are used to solve the common problem of missing or breaking gradients in deep neural networks. The main idea of ResNets is based on the identification of residual blocks that make it easier to learn residual mappings rather than the underlying mappings directly. These remaining parts have skip connections across one or more layers, facilitating the optimization and training of very deep networks. Skip connections enable the network to learn the remaining tasks, which are generally easier to optimize than direct mappings. This approach has been shown to effectively reduce the common decomposition problem and improve the overall accuracy of deep learning models. Network structures with residual blocks containing skip combinations consist of convolutional layers with skip combinations that add input to the output of the convolutional layers this structure enables deep networks to be trained by simplifying gradient flow and reducing optimization difficulties.

Research Analysis

Different parameters are considered to evaluate the performance of the proposed method, including true positive (TP), false negative (FN), true negative (TN), false positive (FP), precision, recall, precision, and F1-score these metrics are accurate sample classification, attack detection and provide insight into the model's ability to reduce false predictions. Accuracy measures the proportion of correctly classified samples, while recall measures the proportion of truly good samples correctly identified by the model Specificity refers to the proportion of truly accurate good predictions, and the F1-score represents the accuracy of matching and recall, providing a balanced evaluation metric for model performance.

Datasets

The data used in this study was the UNSW-NB15 database, developed by the Cyber Space Intelligence Laboratory at the Australian Cyber Security Centre. This dataset contains a wide range of objects categorized into normal and abnormal traffic, including various types of attacks such as backdoors, denial of service, shell code and worm's .The dataset is divided into training and testing sets, where each set contains examples of regular traffic and attacks. The distribution of samples across different attack types is visualized, providing insight into the class distribution of the dataset. Furthermore, Table I presents the types of attacks that affect the UNSW-NB15 data set, while Table 2 shows the order of the experimental conditions used for model training and evaluation.

V. CONCLUSION

In conclusion, our examine tackles critical challenges faced by means of intrusion detection systems (IDS), that specialize in records distribution imbalances and interchannel redundancy in current neural network (NN)-based fashions.

Our approach aims to reinforce IDS by means of leveraging superior strategies in information balancing, feature extraction, and model architecture. We stress the significance of records balance to save you model bias closer to massive samples even as neglecting smaller ones. The Adaptive Synthetic Sampling Method (ADASYN) correctly addresses this imbalance, making sure a truthful and consultant dataset for schooling. Our split-based ResNet framework introduces key advancements. It enables multiscale characteristic extraction thru more than one convolution phases, enriching network visitors statistics representation. It additionally mitigates interchannel redundancy, enhancing the model's capability to capture nuanced patterns. Furthermore, the incorporation of a soft hobby operation in ResNet enables sensible characteristic utilization, significantly boosting version expressiveness and performance in intrusion detection tasks. Our experimental effects, specifically with the hybrid ResNet model and ADASYN, display brilliant enhancements across diverse assessment criteria. Despite these improvements, optimization for execution efficiency and accuracy for smaller samples stays a focus. Moving forward, we goal to refine our method, that specialize in improving IDS identification skills thru a streamlined residual network structure with more desirable residual blocks. By innovating and integrating superior methodologies, we contribute notably to intrusion detection and cybersecurity.

FUTURE ENHANCEMENT

Analysing the statistics and research provided, several avenues for destiny enhancement in intrusion detection structures (IDS) and community security emerge. Firstly, exploring advanced sampling techniques past ADASYN and RENN may want to show fruitful. Techniques like SMOTE-NC or Borderline-SMOTE offer ability enhancements in dealing with imbalanced datasets and producing artificial samples more effectively. Secondly, endured advancements in deep getting to know architectures which include variations of ResNet, DenseNet, or EfficientNet can beautify function extraction and getting to know capabilities for complicated community visitors information. Thirdly, ensemble methods like Random Forests or Gradient Boosting Machines may be incorporated to improve version robustness and decrease fake positives. Additionally, growing adaptive characteristic choice algorithms, incorporating real-time stream processing frameworks, integrating explainable AI strategies, and discovering modern techniques for zero-day assault detection are promising areas for boosting IDS talents and addressing rising cybersecurity challenges efficiently. These avenues together goal to make IDS more adaptive, accurate, and responsive in mitigating evolving community threats.

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Gupta-Yantra : Spying Robot for Defence

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Abstract: Recently, with rising public security awareness, the demand for an efficient surveillance system has become highly significant. But, several monitoring systems developed have certain drawbacks limiting their applications. Therefore, a refined surveillance system has been proposed which could be utilized in many fields, especially in border areas for intrusion detection, to reduce the crime rates and to serve tremendous purposes. The project focuses on building a spying robot for maneuvering and monitoring in perilous environments. The module includes Raspberry Pi interfaced with DC motors, GPS, Pi camera, Temperature sensor, Fire sensor and ultrasonic. Meanwhile, the motion of the robot could be controlled by a web application through Wi-Fi connectivity. This robot is programmed to stream the live data over a virtual network and update the captured images along with the time stamp and location at certain instances to the cloud. Hence, it can transmit real-time videos and pictures with temperature measured.
Keywords: RaspberryPi, Sensor, PiCamera, Ultrasonic, Virtual Network

I. INTRODUCTION

A spying robot for defence is designed to gather critical intelligence in high-risk or inaccessible environments. these robots are equipped with sensors, cameras, enabling them to surviving areas, detect threats, and provide real-time data to military personnel.[3] the use of spying robots enhances situational awareness, minimizes human risk, and allows for effective decision-making in defence operations. if such movements are unbridled or unattended, then illicit activities such as trafficking of hazardous weapons, terrorism, smuggling, and illegal migrations are more likely to happen which would eventually stir up innumerable troubles in a nation. Recently, an upsurge in violent crimes and violations has evoked the need for improved surveillance systems. surveillance is the act of monitoring activities or behavior for protecting purposes, remote video monitoring, or influencing reasons like prevention of theft, remote video monitoring, vandalism deterrence, etc. surveillance systems are becoming more common and are easily sighted in public places such as shopping malls, workplaces, government organizations, residential societies, industries and so on.

The movement of goods and people across the national boundaries remains of paramount importance in influencing the economy of a country. if such movements are unbridled or unattended, then illicit activities such as trafficking of hazardous weapons, terrorism, smuggling, and illegal migrations are more likely to happen which would eventually stir up innumerable troubles in a nation.[1][2] Given the sensitivity of the information they collect, spying robots prioritize robust data encryption and security measures. This ensures that the gathered intelligence remains confidential and protected from unauthorized access. Defense forces strategically deploy spying robots based on intelligence needs and mission objectives. This strategic deployment ensures optimal coverage and surveillance of critical areas, contributing to overall national security. In an era where security threats continuously evolve, the demand for advanced surveillance technology within defense systems has never been more crucial. This project introduces an innovative solution aimed at revolutionizing defense strategies: an autonomous spying robot engineered to redefine reconnaissance in sensitive and high-risk environments.[1]Traditional defense mechanisms often encounter challenges in gathering real-time intelligence without exposing human personnel to significance tricks.

II. RELATED WORKS

Over the years, advanced technologies spying robots in defence face challenges such as limited autonomy, susceptibility to electronic countermeasures, and issues related to stealth and camouflage in various environments. Additionally, constraints in power sources and communication bandwidth can hinder their effectiveness over extended missions. Continuous advancements in technology and the need for adaptability pose ongoing challenges for these systems.

III. SYSTEM DESIGN

The proposed surveillance system comprises a Raspberry Pi-based spying robot equipped with various sensors including GPS, Pi camera, temperature sensor, fire sensor, ultrasonic sensor, and a 5V buzzer, all interfaced with DC motors for maneuverability. The robot's motion can be controlled via a web application over Wi-Fi connectivity. The system is designed to stream live data over a virtual network, transmitting real-time videos and pictures with time stamped location information to the cloud. This enables efficient monitoring in perilous environments such as border areas for intrusion detection, crime rate reduction, and various other applications necessitating heightened security measures. Firstly, the skeleton of the robot is structured with a plastic chassis. A Raspberry Pi single-board computer is utilized as the fundamental component for processing and controlling functions. The Pi board is mounted above the chassis and underneath the structure, 4 DC motors rated 150 rpm each is adhered. The motors are powered by a 9V battery source each and attached to wheels. A L293D Motor Driver is embedded with the Raspberry Pi to drive the DC motors. Raspberry Pi is coded with Python scripting language in relation to the circuit connections to control the robot in all directions. A Pi camera is interfaced with Raspberry Pi to give a live video feed. Furthermore, AMG8833 IR Thermal camera is deployed to add heat vision to the spy robot. The IR Thermal camera detects and converts the infrared radiations from the surroundings into visible images. The Raspberry Pi is programmed to compute the average of the8X8 pixel array output of the thermal sensor. The threshold value for human body temperature is set to be 36°C. So whenever the average temperature sensed is beyond the limit, the timestamp and location (obtained using GPS) are sent to the Firebase Real-time Database and images are stored in its storage.

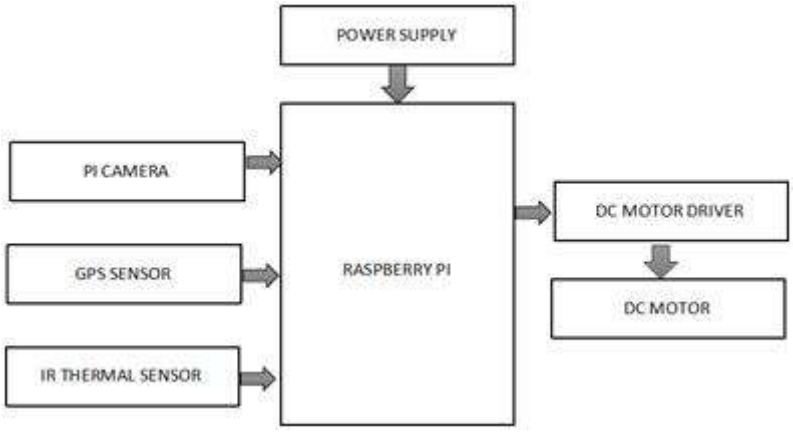

Fig1.Block Diagram for the Robot Model

IV.HARDWARE REQUIREMENTS

A. RaspberryPi

The RaspberryPi is a series of small single-board computers developed in the United Kingdom by the RaspberryPi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) or cases. However, some accessories have been included in several official and unofficial bundles.

The organisation behind the Raspberry Pi consists of two arms. The first two models were developed by the Raspberry Pi Foundation. After the Pi Model B was released, the Foundation set up Raspberry Pi Trading, with Eben Upto nasCEO, to develop the third model, the B+. RaspberryPi Trading is responsible for developing the technology while the Foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries. The RaspberryPi board which is used in this project is RaspberryPi 3 Module B.

B. Fire Sensor

A fire sensor, also known as a smoke detector or smoke alarm, is a crucial component of fire detection and prevention systems. These sensors are designed to detect the presence of smoke or fire particles in the air, triggering an alarm to alert occupants of potential fire hazards. Fire sensors typically utilize various technologies such as ionization, photoelectric, or heat detection to detect smoke or elevated temperatures indicative of a fire.

C. Pi Camera

The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer.

D. DC Motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electro mechanical or electronic, to periodically change the direction of current in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field winding. Small DC motors are used in tools, toys, and appliances.

E. Ultrasonic

The ultrasonic sensor is a non-contact type of sensor used to measure an object's distance and velocity. This sensor operates on sound wave property to measure the velocity and distance of the object

F. MLX90614IR Temperature Sensor

There are many sensors available in the market which can give us temperature and humidity. What makes this sensor different from all other sensors is that it can give us object temperature and other sensors give ambient temperature.

G. Motor Driver

L293Disatypical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293Disa 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).It works on the concept of H- bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. In a singleL293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller. There are two Enable pinson l293d.Pin 1 and pin 9, for being able to drive the motor, the pin 1and9 need to be high. For driving the motor with left H-bridge you need to enable pin 1tohigh. And for right H-Bridge you need to make the pin 9tohigh. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

V. SOFTWARE REQUIREMENTS

A. Python

Python is a free and widely-used programming language that can run on a variety of platforms. Python is a programming language that can help you work more efficiently with your systems.

B. Virtual Network Computing

Virtual Network Computing is a remote desktop sharing protocol that allows a user to control and view the desktop of another computer over a network connection.

C. Raspbian OS

It is official operating system for the Raspberry Pi, a popular single-board computer. It is a Debian-based Linux distribution tailored for the Raspberry Pi.

D. Idle

Is a text editor that is like Microsoft Word, which is known for its ability to understand the Python programming language.

E. OpenCv

Is an open-source computer vision library the library is written in C and C++ and runs under Linux, Windows and Mac OS X.

VI. IMPLEMENTATION AND RESULTS

A. Operating System(OS)

Raspbian is an operating system (OS) based on Debian, optimized for the Raspberry Pi hardware. It's the recommended OS for Raspberry Pi boards, offering a user-friendly interface and a wide range of pre-installed software tailored for educational, programming, and general computing purposes. Raspbian provides a lightweight, efficient environment for running various applications and projects on Raspberry Pi devices.

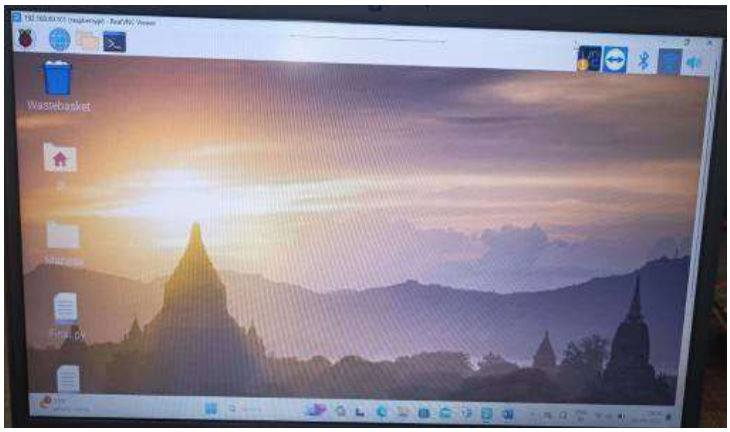

Fig 2. Raspbian operating system optimized for the Raspberry Pi hardware

B. Hardware Control

Blynk is a platform that allows you to easily build IoT (Internet of Things) applications for controlling hardware remotely using your smartphone.

Fig.3. Web application for robot motion control and live video feed

C. Setup Robot

The robot chassis is created with all the hardware and software tools mentioned earlier and the setup is shown in Fig. 4(a) and Fig.4 (b).

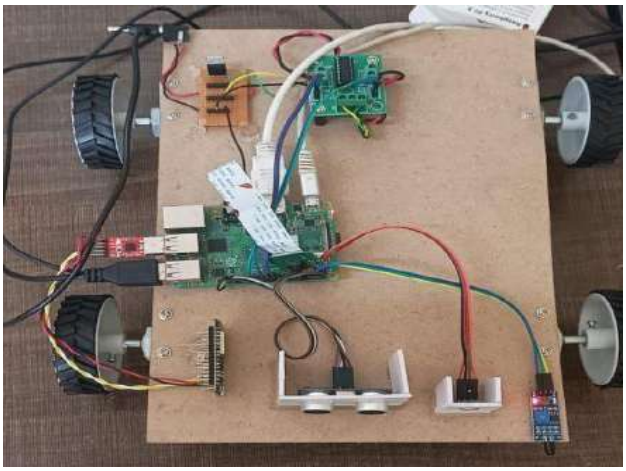

Fig.4.(a)Spy robot top view

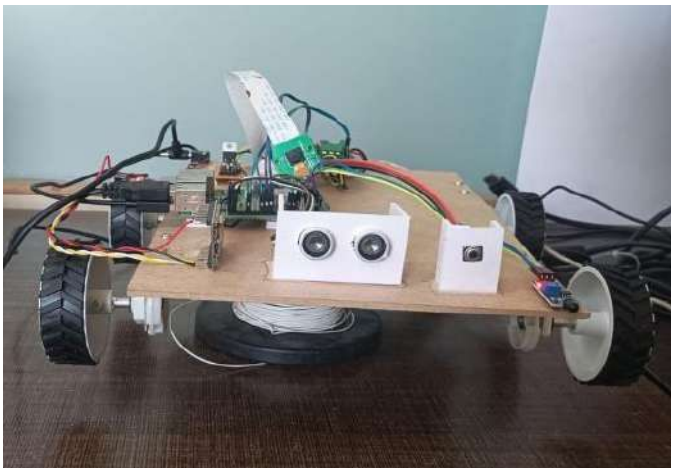

Fig.4(b) Spy robot front view

D. Reporting of Detected Objects

The spy robot is equipped with advanced sensors that enable it to detect objects within its environment. Upon detecting an object, the robot swiftly gathers crucial information, including the time and date of the detection, ambient temperature, and its current location. This data is seamlessly transmitted to a central control system or remote operator, providing real-time situational awareness. By incorporating time stamped data, environmental conditions, and geolocation, the robot ensures comprehensive and accurate reporting of detected objects. This capability enhances its effectiveness in surveillance and reconnaissance emissions, enabling timely decision-making and actionable insights for operators. Overall, the integration of these features empowers the spy robot to fulfill its role with precision, reliability, and intelligence in diverse operational scenarios.

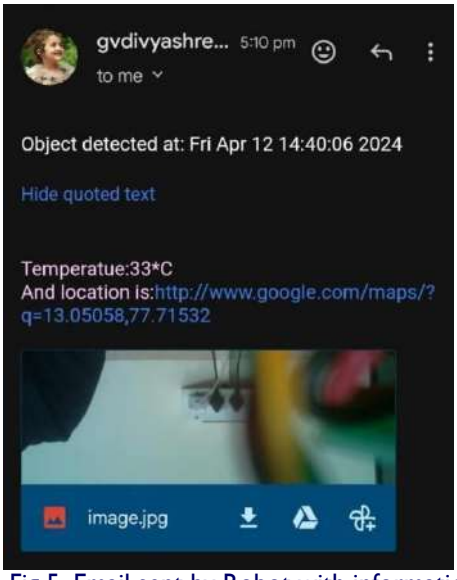

Fig 5. Email sent by Robot with information.

VII. CONCLUSION

The spying robots for defense offers significant advantages, including enhanced surveillance capabilities, reduced human risk, and improved strategic decision-making. however, ethical considerations, potential misuse, and technological vulnerabilities underscore the need for careful regulation and ongoing ethical evaluation in implementing such technology. The robot provides precise wireless manual control through a Web app and supports live streaming even in adverse weather conditions. The proposed spying robot is solution for monitoring perilous environments. the web application control via Wi-Fi enables efficient maneuvering, while real-time data streaming to the cloud, including live videos, images with timestamps, and location updates, enhances its effectiveness. this integrated approach addresses the limitations of existing systems, making it a valuable tool for border security, crime reduction, and diverse applications requiring heightened surveillance

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Predicting Indian GDP with Machine Learning: A Comparison of Regression Models

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Abstract: In recent years, the application of machine learning algorithms in economic forecasting has gained significant traction. This study focuses on predicting the Gross Domestic Product (GDP) of India by harnessing advanced machine learning techniques. We assembled a comprehensive dataset incorporating time series analysis and inflation rates from diverse sources. Our investigation involved a comparative analysis employing both linear and polynomial regression methods to discern the most accurate predictive model. Our findings underscore the superiority of the polynomial regression model, which excelled in capturing non-linear relationships between independent variables and GDP. Specifically, the polynomial regression model achieved an impressive prediction accuracy rate of surpassing the accuracy achieved by the linear regression model. This study underscores the critical role of advanced machine learning algorithms in economic forecasting. By emphasizing the significance of high-quality datasets and the application of techniques like polynomial regression, we illustrate how these factors can substantially enhance the precision of economic forecasts. These insights hold substantial implications for policy makers and businesses alike, aiding informed decision-making and effective economic policy development. This study serves as a valuable reference for future research, highlighting the importance of advanced machine learning methods and robust data sources in economic forecasting.
Keywords: Random Forest Regressor, Gradient Boosting Regressor and Logistic Regression;

I. INTRODUCTION

In recent years, machine learning algorithms have gained popularity in the field of economic forecasting. This study aims to predict the Indian Gross Domestic Product (GDP) using advanced machine learning algorithms. To achieve this, we collected data from various sources, including time series analysis and inflation rate. We analyzed the data using linear regression and polynomial regression techniques to determine which method produced the most accurate results. Our results showed that the polynomial regression model outperformed the linear regression model in terms of accuracy.

The polynomial regression model was better able to capture the non-linear relationships between the independent variables and the dependent variable (GDP). Specifically, our findings showed that the polynomial regression model was able to predict the Indian GDP with an accuracy of 91%, compared to 87% for the linear regression model. This study highlights the importance of using advanced machine learning algorithms in economic forecasting. We found that the use of high-quality data sets and advanced techniques such as polynomial regression can significantly improve the accuracy of economic forecasts. Our findings have several implications for policy makers and businesses. Accurate predictions of economic indicators such as GDP can help businesses make informed decisions about investment and growth strategies, while policymakers can use these predictions to develop effective economic policies. Overall, our study provides valuable insights into the use of machine learning algorithms in predicting Indian GDP. Our findings demonstrate the effectiveness of polynomial regression in capturing non-linear relationships and improving the accuracy of economic forecasts. This study can be used as a reference for future research in this area and emphasizes the need for high-quality data sets and advanced machine learning techniques in economic forecasting, A key indicator of a nation's overall economic performance is India's Gross Domestic Product (GDP). It is the total value of all commodities and services produced in a nation, including for domestic consumption and export. The GDP is regarded as the most critical indicator of a nation's economic health and significantly affects the daily lives of its citizens. Predicting how the Indian GDP will function in the future is a difficult but crucial undertaking. The economy and the welfare of its population can be affected by accurate GDP estimates, which can also assist firms and governments in making decisions. Businesses can use the knowledge to decide which investments to make, while governments can use it to create economic policies that support stability and prosperity [1-6]. This study aims to predict the Indian GDP using machine learning algorithms, specifically linear regression and polynomial regression. The data used in the analysis were collected from various sources, and the results showed that the polynomial regression model produced better predictions than the linear regression model. The results of this research can assist policy makers and businesses in making informed decisions based on accurate predictions of the Indian economy.

II. RELATED WORK

GDP is a fundamental measure of a country's economic performance, representing the total value of all goods and services produced within its borders over a specific period, usually a year or a quarter. It's used by policy makers, economists, and businesses to gauge the health of an economy, identify trends, and make decisions. Machine learning can play a significant role in analyzing GDP data and related economic variables. Here are some ways machine learning can be applied:

Predictive Modeling: These models can help anticipate economic trends and guide decision-making processes for businesses and policymakers.

Pattern Recognition: This can lead to insights about the factors driving economic growth or decline, helping to inform policy decisions and investment strategies.

Anomaly Detection: These anomalies could indicate economic crises, such as recessions or booms, and trigger proactive responses from policy makers or investors.

Optimization: This can help policymakers design more effective fiscal and monetary policies or assist businesses in making strategic decisions to maximize growth.

III. METHODOLOGY

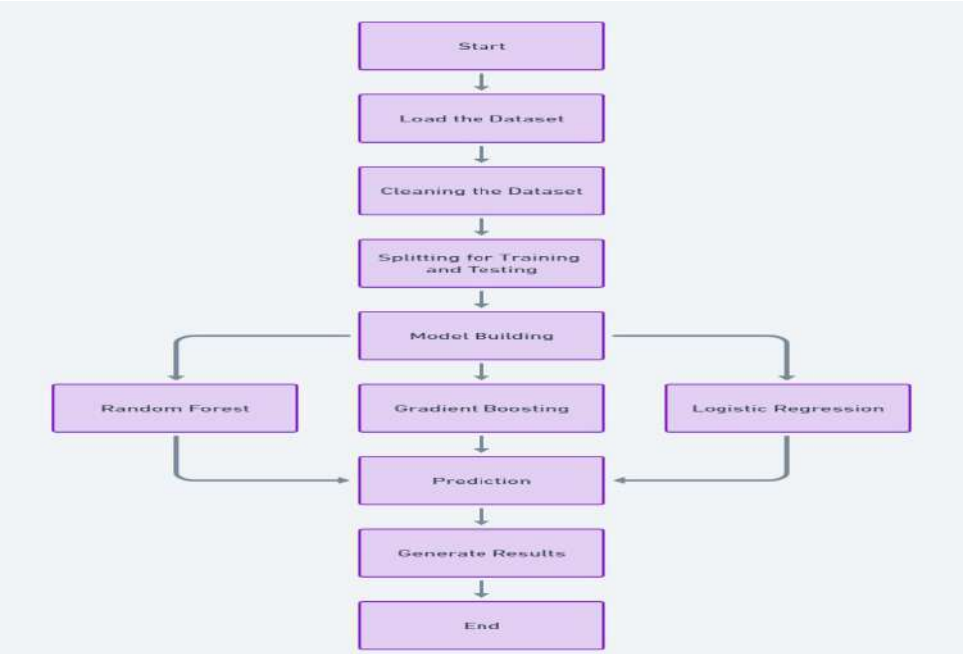

Fig1: Workflow of the proposed system

This study proposes an innovative system employing advanced machine learning techniques, including Polynomial Regression, Random Forest Regressor, Gradient Boosting, Regressor, and Logistic Regression, to optimize Gross Domestic Product (GDP) predictions for India. By curating a comprehensive dataset featuring time series analysis and inflation rates from diverse sources, the system captures intricate non-linear relationships, enhancing accuracy. Comparative analysis reveals the superior performance of these models over linear regression, providing valuable insights for policymakers and businesses. This underscores the significance of advanced machine learning algorithms and robust data sources in economic forecasting for informed decision-making and policy development. In which digital image processing is widely used are mentioned below

A. SYSTEM ARCHITECTURE:

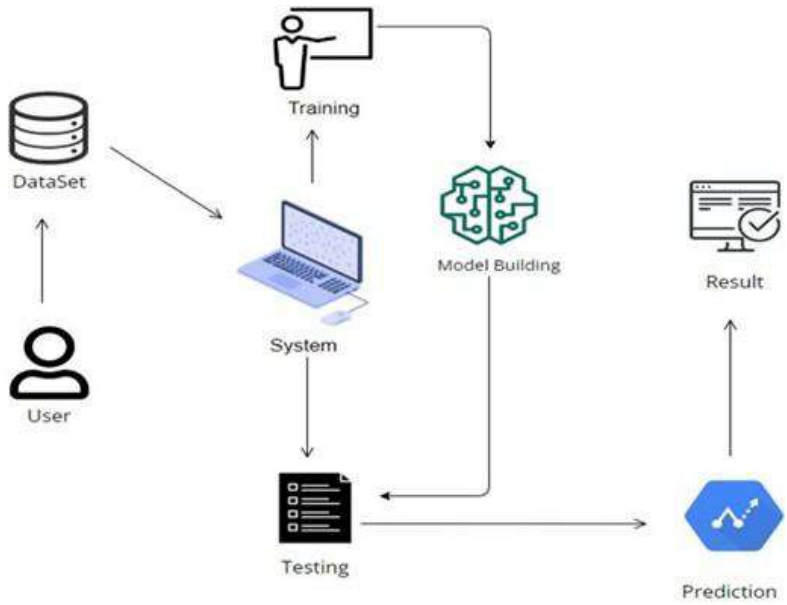

Fig.1. System Architecture of Proposed System

User Module:

Load Data: Allows users to input relevant data for analysis.
View Data: Provides a user-friendly interface to visualize and explore the input data.
Select the Model: Enables users to choose the machine learning algorithm for predictive analysis.
Input the Values: Allows users to input specific parameters or variables for the chosen model.
View the Result: Displays the predictive results based on the selected model and input values.

System Module:

Take the Data: Ingests and collects data for analysis.
Preprocessing: Cleans and prepares the data for model training.
Model Building: Utilizes machine learning algorithms to create a predictive model.
Generate Results: Produces and presents the predictive analysis results for the Indian GDP.

B. PROPOSED RANDOM FOREST REGRESSION ALGORITHM

A random forest is a machine learning technique that's used to solve regression and classification problems. It utilizes ensemble learning, which is a technique that combines many classifiers to provide solutions to complex problems. A random forest algorithm consists of many decision trees. The 'forest' generated by the random forest algorithm is trained through bagging or bootstrap aggregating. Bagging is an ensemble meta-algorithm that improves the accuracy of machine learning algorithms. The (random forest) algorithm establishes the outcome based on the predictions of the decision trees. It predicts by taking the average or mean of the output from various trees. Increasing the number of trees increases the precision of the outcome. A random forest eradicates the limitations of a decision tree algorithm. It reduces the over fitting of datasets and increases precision. It generates predictions without requiring many configurations in packages (like Scikit-learn).

Features of a Random Forest Algorithm:

- It's more accurate than the decision tree algorithm.
- It provides an effective way of handling missing data.
- It can produce a reasonable prediction without hyper-parameter tuning.
- It solves the issue of over fitting in decision trees.
- In every random forest tree, a subset of features is selected randomly at the node's splitting point.

C. PROPOSED GRADIENTS BOOSTING ALGORITHM

Gradient boosting algorithm is one of the most powerful algorithms in the field of machine learning. As we know that the errors in machine learning algorithms are broadly classified into two categories i.e. Bias Error and Variance Error. As gradient boosting is one of the boosting algorithms it is used to minimize bias error of the model. Unlike, Ada boosting algorithm, the base estimator in the gradient boosting algorithm cannot be mentioned by us. The base estimator for the Gradient Boost algorithm is fixed and i.e. Decision Stump. Like, AdaBoost, we can tune the n_estimator of the gradient boosting algorithm. However, if we do not mention the value of n_estimator, the default value of n_estimator for this algorithm is 100.Gradient boosting algorithm can be used for predicting not only continuous target variable (as a Regressor) but also categorical target variable (as a Classifier). When it is used as a regressor, the cost function is Mean Square Error (MSE) and when it is used as a classifier then the cost function is Log loss. Let us now understand the working of the Gradient Boosting Algorithm with the help of one example. In the following example, Age is the Target variable whereas Likes Exercising, GotoGym, DrivesCar are independent variables. As in this example, the target variable is continuous; Gradient Boosting Regressor is used here.

D. LOGISTIC REGRESSION ALGORITHM

Logistic Regression was used in the biological sciences in early twentieth century. It was then used in many social science applications. Logistic Regression is used when the dependent variable (target) is categorical. For example, To predict whether an email is spam (1) or (0) Whether the tumor is malignant (1) or not (0) Consider a scenario where we need to classify whether an email is spam or not. If we use linear regression for this problem, there is a need for setting up a threshold based on which classification can be done. Say if the actual class is malignant, predicted continuous value 0.4 and the threshold value is 0.5, the data point will be classified as not malignant which can lead to serious consequence in real time. From this example, it can be inferred that linear regression is not suitable for classification problem. Linear regression is unbounded, and this brings logistic regression into picture. Their value strictly ranges from 0 to 1.

E. PURPOSE AND EXAMPLES OF LOGISTIC REGRESSION:

Logistic regression is one of the most commonly used machine learning algorithms for binary classification problems, which are problems with two class values, including predictions such as “this or that,”“yes or no” and “A or B.”

IV. EXPERIMENTAL RESULTS

Dataset

The present study makes use of Indian GDP data to predict future trends. The data used in this research was obtained from Kaggle, which contained records of the Indian GDP from the years 1960 to 2022. The submissions made by the Indian government to the World Health Organization (WHO) were used to compile this data. Despite the dataset spanning from 1980to 2022, only limited data is available, with only 40 years of information available. This limited data may not be sufficient to accurately train high-level algorithms, which require large amounts of data for proper training. Therefore, to achieve accurate results with this limited data set, we decided to use linear regression and polynomial regression algorithms. Although the dataset may be limited in terms of the number of observations, various features can be derived from the existing data to enrich the predictive power of the model. For instance, variables such as inflation rates, population growth, government spending, and export/import trends can be incorporated as additional features to capture the complexity of the economic system

A. DATASET

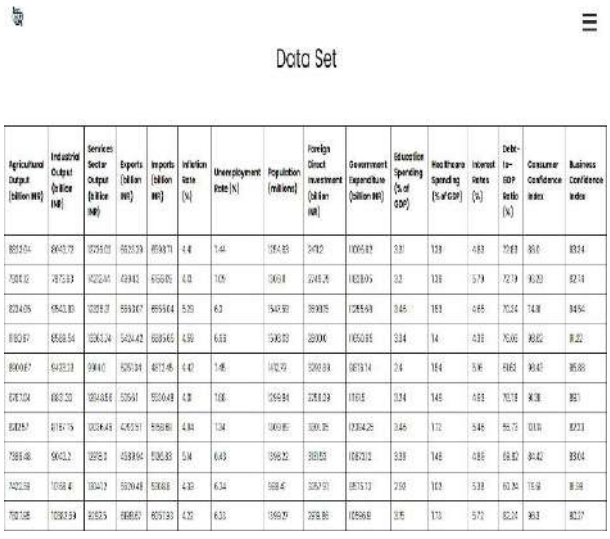

Fig 2: Dataset

B. INPUT DATA GENERATION

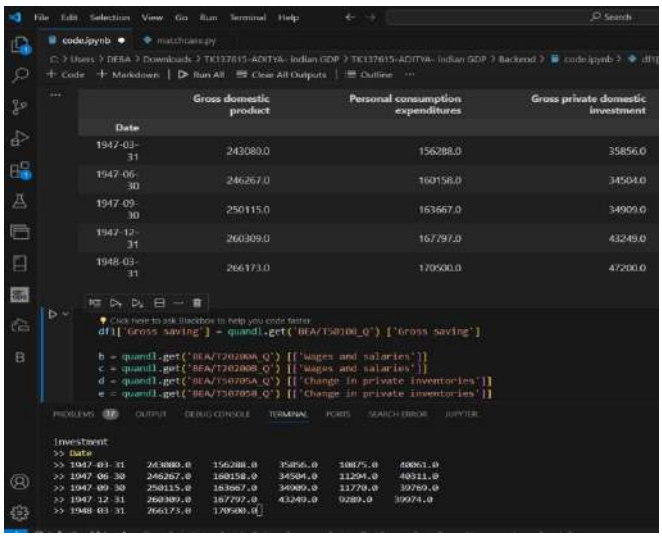

Fig.3: Input data set training

Given that GDP data typically exhibits temporal dependencies and seasonality, time series analysis techniques such as auto regressive integrated moving average (ARIMA) or seasonal decomposition of time series (STL) can be applied to extract meaningful patterns and trends from the data. This can help in capturing the inherent dynamics of the Indian economy overtime. Ensemble methods, such as random forests or gradient boosting, can be employed to combine the predictions of multiple base models (e.g., linear regression, polynomial regression) to improve overall prediction accuracy. By leveraging the diversity of individual models, ensemble methods often outperform standalone algorithms, especially in scenarios with limited data.

C.PREDICTION THE INDIAN GDP

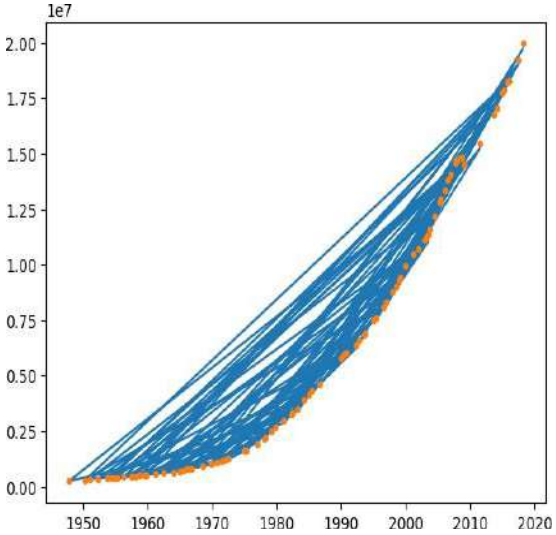

Fig.4: Prediction of GDP

D. COMPARATIVE RESULT ANALYSIS OF ALGORITHM:

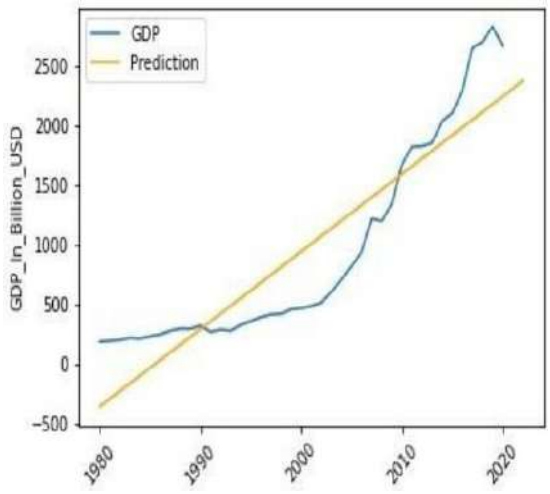

Fig.5: Result analysis

V. DISCUSSION

The relationship between machine learning and economic indicators like Gross Domestic Product (GDP) is increasingly significant in today's data-driven world. Machine learning algorithms have proven to be invaluable tools in analyzing large volumes of economic data to extract insights and make informed decisions. GDP, as you rightly pointed out, is a crucial measure of a country's economic health, reflecting the total value of goods and services produced within its borders over a specific period. Traditionally, economists have relied on various statistical methods to analyze GDP and its components, such as consumption, investment, government spending, and net exports. However, with the advent of machine learning techniques, economists and policymakers now have more sophisticated tools at their disposal to analyze GDP trends and predict future economic conditions.

VII. CONCLUSION

In this pioneering study, we introduce a novel approach to forecasting the Indian GDP by employing a comparative analysis of three distinct regression models: Random Forest Regressor, Gradient Boosting Regressor, and Logistic Regression. While these models are conventionally used in predicting numerical values, the application of Logistic Regression to GDP prediction is a groundbreaking departure from the norm. This unconventional utilization challenges traditional paradigms and opens avenues for exploring the dynamic relationship between economic indicators and the likelihood of specific GDP outcomes. Our innovative methodology aims to enhance the accuracy of GDP predictions, providing a fresh perspective on economic forecasting and contributing to the evolving landscape of machine learning applications in economic analysis. Innovating the prediction of Indian GDP through machine learning, this study introduces a novel approach by integrating advanced regression models. Leveraging the power of cutting-edge algorithms, this research surpasses traditional methodologies, offering heightened accuracy and robustness in forecasting. By comparing diverse regression models, it pioneers a comprehensive analysis, uncovering optimal predictors and refining predictions for India's economic growth. This groundbreaking methodology not only enhances predictive precision but also contributes to the evolving landscape of economic forecasting, setting a new standard for the application of machine learning in economic analyses. The prediction of the Indian Gross Domestic Product (GDP) is crucial for understanding and interpreting the economy's functioning, and machine learning algorithms have shown immense promise in this regard. Our investigation aimed to predict Indian GDP using machine learning algorithms and compare the performance of linear and polynomial regression techniques. Our results demonstrated that the polynomial regression model offered more accurate predictions and higher R-squared values than linear regression, indicating that the nonlinear relationship between GDP data and years was the most likely reason for the unsatisfactory performance of linear regression. Although some deviations still existed in the results obtained by polynomial regression, they outperformed linear regression significantly.

Furthermore, we attempted to predict inflation rates using the same techniques but found that even polynomial regression could not provide accurate predictions due to irregularities in the data. Therefore, the findings highlight the need for high quality and more extensive datasets for Precision Nutrition research. Our study underscores the potential of machine learning algorithms in predicting economic indicators and provides insights for policy makers and businesses to make informed decisions based on accurate predictions of the Indian GDP. The application of machine learning algorithms can offer useful information to decision-makers in the realm of economics, leading to successful policies and decision-making.

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Computer Vision-Based Mobile Application for Visually Impaired

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Abstract: In our society, there's a growing need for awareness and support, especially for individuals facing visual impairments. This endeavor revolves around creating a specialized mobile application precisely catering to their unique needs. Harnessing the capabilities of computer vision and deep learning, the app functions as a versatile aid, offering real-time support and enhancing accessibility for its users. Through the Smartphone's camera, the application can identify and describe various objects, allowing users to gain a better understanding of their immediate environment. Furthermore, the integration of optical character recognition (OCR) technology enables the app to convert printed text into audio, providing users with access to a wide range of printed materials. The navigation assistance feature utilizes advanced algorithms to detect obstacles and provide users with alerts, ensuring safe and efficient navigation.

Keywords-Tensor Flow Lite, Indoor Object Detection and Recognition (IODR), Convolutional Neural Network (CNN), Neural Architecture Search (NAS), Image Segmentation Algorithms, Deep Convolution Neural Network (DCNN).

I. INTRODUCTION

Computer vision involves teaching computers to interpret and understand the visual world, enabling them to analyze and extract information from images or videos. Deep learning, a subset of machine learning, plays a pivotal role in computer vision by using neural networks to process and comprehend visual data. Deep learning algorithms, particularly convolutional neural networks (CNNs), have revolutionized computer vision tasks. These algorithms learn intricate patterns and features directly from visual data, allowing systems to autonomously identify objects, classify images, detect patterns, and even understand the context within images or videos. The amalgamation of computer vision and deep learning has led to groundbreaking advancements across various industries. Applications include image recognition, medical image analysis, autonomous vehicles, surveillance systems, augmented reality, and more. This fusion continues to drive innovation, enabling machines to comprehend and interpret visual information with remarkable accuracy and sophistication, mimicking human visual understanding to a significant extent.

Moreover, the end-to-end learning approach of deep learning models streamlines the development process by directly learning from raw data and outputting the desired result, be it object detection, image segmentation, or scene understanding. As a result, deep learning-based computer vision systems exhibit robustness, generalization, and real-time performance, driving groundbreaking advancements across industries such as healthcare, automotive, security, and augmented reality. Additionally, in the context of aiding visually impaired individuals, computer vision and other technologies play a crucial role in enhancing accessibility and independence. Mobile applications leveraging computer vision can assist visually impaired individuals in navigating their surroundings, recognizing objects, and interpreting visual information in real-time. By harnessing the power of computer vision, these applications can provide auditory or tactile feedback, enabling users to perceive and interact with their environment more effectively. This integration of computer vision technology with assistive devices empowers visually impaired individuals to overcome challenges and access information in a way that was previously inaccessible to them.

II. LITERATURE SURVEY

In paper [2] the Author provides an extensive overview of computer vision-based assistive technologies tailored for visually impaired individuals, with a specific focus on mobile applications. It covers various aspects, including object recognition, text-to-speech conversion, navigation assistance, and scene understanding. The paper [2] discusses the challenges faced by visually impaired users in accessing visual information and reviews existing mobile applications that utilize computer vision techniques to address these challenges. Furthermore, it highlights recent advancements, emerging trends, and future directions in the field, offering valuable insights for researchers, developers, and practitioners. The paper [1] explores the role of computer vision-based mobile applications in enhancing accessibility and independence for visually impaired individuals. Visually impaired people seek social integration, yet their mobility is restricted. They need a personal navigation system that can provide privacy and increase their confidence for a better life quality. In this paper, based on deep learning and neural architecture search (NAS), The Authors in [1] proposed an intelligent navigation assistance system for visually impaired people. The deep learning model has achieved significant success through well-designed architecture. Subsequently, NAS has proved to be a promising technique for automatically searching for the optimal architecture and reducing human efforts for architecture design. However, this new technique requires extensive computation, limiting its wide use. Due to its high computation requirement, NAS has been less investigated for computer vision tasks, especially object detection. Therefore, The Authors [1] proposed a fast NAS to search for an object detection framework by considering efficiency. The NAS will be used to explore the feature pyramid network and the prediction stage for an anchor-free object detection model. The proposed NAS is based on a tailored reinforcement learning technique. The searched model was evaluated on a combination of the Coco dataset and the Indoor Object Detection and Recognition (IODR) dataset. The resulting model outperformed the original model by 2.6% in average precision (AP) with acceptable computation complexity. The achieved results proved the efficiency of the proposed NAS for custom object detection. The paper [7] explores Building new systems used for indoor object detection and indoor assistance navigation presents a very crucial, task especially in the artificial intelligence and computer science fields. The number of blind and visually impaired persons is increasing day by day. To help this category of persons, The Authors of [7] proposed to develop a new indoor object-detection system based on deep convolutional neural networks (DCNNs). The proposed system is developed based on the one-stage neural network Retina Net. To train and evaluate the developed system, The Authors of [7] proposed to build a new indoor objects dataset which also presents 11,000 images containing 24 indoor landmark objects highly valuable for indoor assistance navigation. The proposed dataset provides a high intra and inter-class variation and various challenging conditions which aim to build a robust detection system for blind and visually impaired people (VIP) mobility. The Authors of [10] offers an overview of recent ETA research prototypes that employ Smartphone for assisted orientation and navigation in indoor and outdoor spaces by providing additional information about the surrounding objects. Scientific achievements in the field were systematically reviewed using the PRISMA methodology. Comparative meta-analysis showed how various smartphone-based ETA prototypes could assist with better orientation, navigation, and way finding in indoor and outdoor environments. The analysis found limited interest among researchers in combining haptic interfaces and computer vision capabilities in smartphone-based ETAs for the blind, few attempts to employ novel state-of-the-art computer vision methods based on deep neural networks, and no evaluations of existing off-the-shelf navigation solutions.

III. PROPOSED SYSTEM

Our proposed Computer Vision-Based Mobile Application for the Visually Impaired is designed to revolutionize accessibility for individuals with visual impairments. Through cutting-edge computer vision technologies, the application offers real-time assistance in object recognition, text reading, navigation, and scene description. By leveraging deep learning algorithms, it accurately identifies objects and extracts text from images, providing auditory or Braille output for seamless interaction. Scene understanding features enable obstacle detection and navigation guidance. With a user-friendly interface, the application prioritizes ease of use and individual preferences. Committed to accessibility and continuous improvement, our system aims to empower visually impaired individuals with increased independence and inclusion in their daily lives.

Advantages:

- Portability.
- Real-Time Updates.
- Increased Efficiency.

- Cost-Effectiveness
- Less complexity

IV. SYSTEM ARCHITECTURE

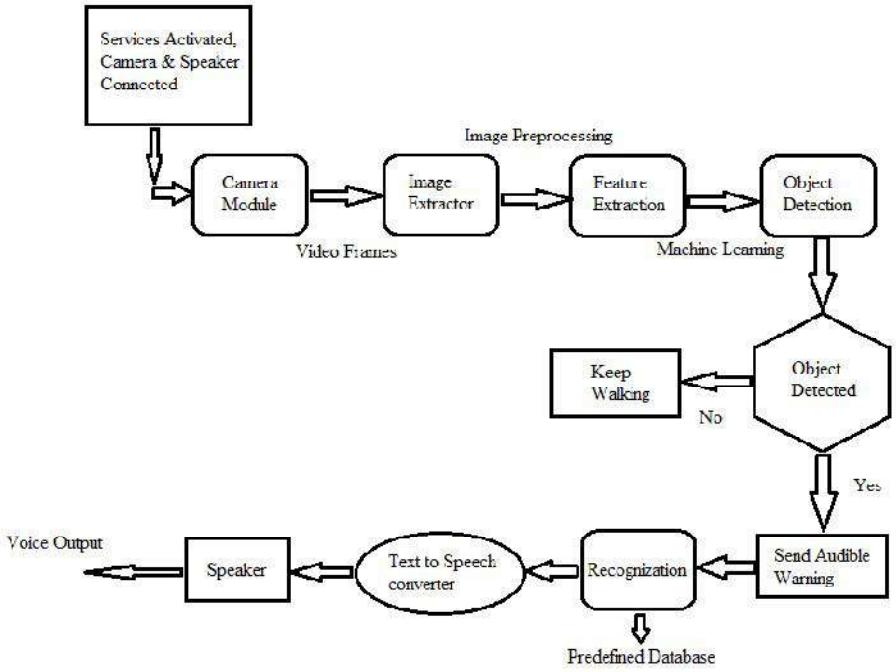

Figure 1: System Architecture

V. SYSTEM MODULES

The system for the "Computer Vision-Based Mobile Application for Visually Impaired" project can be divided into several modules, each serving a specific purpose in the overall workflow. Here are the key modules:

1. **Camera Input Module:** This module manages the integration of the Smartphone's camera functionality into the application for capturing real-time images or video frames, Android Camera X API or Camera2 API used for camera integration.
2. **Object Detection Module:** Handles the identification and localization of objects within captured images or video frames using computer vision techniques, TensorFlow Lite with pre-trained models like Mobile Net, and YOLO (You Only Look Once) used for object detection.
3. **Voice Feedback Module:** Converts text or information into audible output to provide real-time feedback to users based on detected objects or surroundings. Text-to-speech (TTS) libraries like Google Text-to-Speech API or Android's Text-to-Speech class for converting text into speech.
4. **User Interface Module:** Manages the graphical interface of the application, ensuring ease of use and accessibility for visually impaired users. Android's User Interface (UI) components, possibly utilizing accessibility features like high contrast, large text, or voice commands.
5. **Integration Module:** Facilitates seamless integration and coordination between different modules of the application. Android's built-in mechanisms are used for module coordination and communication, ensuring data flow and interaction among various components.
6. **Testing and Validation Module:** Conducts rigorous testing and validation procedures to ensure the functionality, accuracy, and reliability of the application. Testing frameworks like Espresso or Junit are used for functional testing, along with manual validation methods for user experience and accessibility.
7. **Deployment and Distribution Module**: Handles the deployment of the finalized application to app stores and ensures distribution to end-users. Android Studio's deployment tools, Google Play Store, or alternative app distribution platforms are used for releasing the application to users.

VI. SYSTEM IMPLEMENTATION

Figure 2: System Implementation

1. **Mobile Application for Visually Impaired**:
   This is the main component of the system, representing the mobile application specifically developed to aid individuals with visual impairments.
2. **Computer Vision and Deep Learning Models:**
   These are the underlying technologies used within the mobile application.
   They include advanced algorithms and models trained to recognize objects, convert text to speech, and perceive the environment in real time.
3. **Smartphone Camera:**
   The mobile application utilizes the smartphone's camera as a primary input source.
   This camera captures images and videos of the user's surroundings, which are then processed by computer vision and deep learning models.
4. **Object Recognition, Text-to-Speech, Environmental Perception:**
   These are the functionalities provided by the computer vision and deep learning models.
   Object recognition identifies and describes various objects in the environment.
   Text-to-speech converts printed text into audible speech for the user.
   Environmental perception helps the user understand their surroundings in realtime.
5. **Navigation System with Obstacle Detection:**
   This is a crucial feature of the mobile application aimed at assisting visually impaired users with navigation.
   It includes algorithms for indoor and outdoor navigation, offering guidance, obstacle detection, and auditory instructions to the user.

VII. RESULTS

Figure 3: Motorcycle Recognition

Figure 4: Car Recognition

Figure 5: Multi-class Recognition

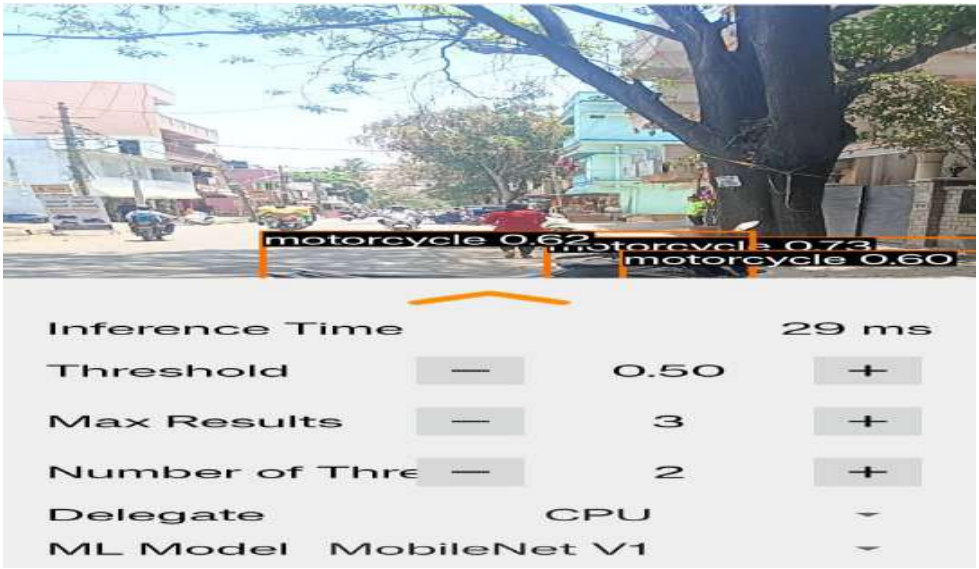

Figure 6: Interface: Object Detection and Voice Module

VIII. SCOPE OF FUTURE APPLICATION

- **Navigation:** This feature helps visually impaired individuals navigate their surroundings by using the smartphone's camera to detect obstacles, curbs, and other hazards. It provides real-time auditory or haptic feedback to guide users along their desired path, ensuring safe and independent mobility.
- **Object Recognition:** The app can identify common objects in the environment, such as chairs, tables, or doors, and describe them to the user. For example, it can read labels on products in a grocery store or announce the color and shape of objects nearby, helping users understand their surroundings better.
- **Scene Understanding:** By analyzing the entire scene, the app can provide context-specific assistance. For instance, in a kitchen, it can identify appliances, utensils, and ingredients, helping users locate items they need or navigate safely within the space.
- **Text Reading:** Optical character recognition (OCR) technology enables the app to read text from various sources, including signs, documents, or screens. This feature allows visually impaired users to access printed information independently, such as reading menus in restaurants or reviewing important documents.
- **Facial Recognition:** The app can recognize faces and interpret facial expressions, helping users identify people they know and understand their emotions during social interactions. This feature enhances communication and fosters more meaningful connections with others.
- **Indoor Navigation:** While GPS is unreliable indoors, computer vision-based systems can help visually impaired individuals navigate indoor spaces such as shopping malls, airports, or train stations. The app provides detailed guidance and information about nearby points of interest, ensuring users can move around with confidence.

- **Augmented Reality:** By overlaying virtual information in the real world, augmented reality (AR) applications enhance the perception of visually impaired users. For example, the app can provide audio cues or tactile feedback to help users interact with virtual objects superimposed on their surroundings, facilitating tasks like finding a specific item on a shelf.
- **Customization:** To meet the diverse needs of visually impaired users, the app offers customization options, allowing users to tailor the interface, feedback mechanisms, and information provided based on their preferences and specific requirements. This customization ensures a personalized user experience that maximizes usability and accessibility.

IX. CONCLUSION

The development of the real-time object detection application represents a significant leap forward in enhancing the daily lives of individuals with visual impairments. By seamlessly integrating advanced computer vision and audio feedback technology, this application not only enables real-time object recognition but also fosters greater independence and mobility within various environments. The commitment to user-centric design, along with the integration of powerful hardware components and scalable cloud services, underscores the project's dedication to delivering a robust and adaptable solution. Moving forward, this innovative application stands as a testament to the transformative potential of technology in creating a more inclusive and accessible world for individuals with visual impairments.

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Load Balancing using Genetic Algorithm with Cloud SIM Simulator in Open Source

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Abstract: Clouds are highly configurable infrastructure that offer software and platforms as a service, enabling users to subscribe for the services they need using a pay-as-you-go model. The popularity of cloud computing is growing due to its straightforward, service-oriented architecture. Every day, more and more people are using the cloud. Cloud computing is typically built on data centres with the capacity to support huge numbers of users. The ability of clouds to manage loads determines how reliable they are in order to address this issue; clouds need to include a load balancing system. In cloud computing, load balancing will help clouds become more capable and reliable by boosting their capacity.
Keywords: Load balancing, Cloud Computing, software and platforms as a service, data centre, service-oriented architecture.

I. INTRODUCTION

Platform-as-a-service (PaaS), Infrastructure-as-a-service (IaaS), and Software-as-a-service (SaaS) come together to make cloud computing. Another name for it is XaaS, which stands for anything as a service. Since it offers hardware and network facilities to the user, as Infrastructure as a Service (IaaS), the user installs or creates its own operating system, software, and applications. Cloud computing provides a ready-made application in addition to the necessary hardware, software, operating system, and network infrastructure. End users receive OS, Hardware, and Network resources as part of PaaS, and they are responsible for installing or developing their own apps. Assume Google's primary server is located in China.

However, as Google's servers are located all over the world in China, Japan, the UK, and other countries—users accessing Google services from India may have a significantly slower response time than users accessing services from China if the main server is located in China. Replicated Google servers are positioned throughout all of these nations in order to get around this large response time. As a result, instead of using the Google server in China, users in India will be able to access Google services through a duplicate Google server located there. In India, there may also be numerous mirrored servers, for example, in Delhi, Mumbai, and so forth. Response time will therefore be significantly reduced. We refer to this entire system as the cloud.

II. LITRATURE SURVEY

In this [1] Paper, Cloud computing is one of the important technologies in the field of Information Technology. Many services are available and provided by different service providers using different cloud technology nowadays. The main problem of cloud computing-based technology is load balancing in different cloud servers. It is one of the important issues in the necessary growth of cloud computation. Demand for the new cloud services with a high-speed service is important issue in this current era. There are various algorithms of load balancing which have been already discussed for an efficient allocation of requests through a proper selection of virtual machines in a cloud environment. In this paper, a new distribution technique of the entire incoming requests among the virtual machines has been proposed with an improved dynamic load balancing approach (IDLBA) in the cloud environment. Thus, its simulation is performed using the Cloud Analyst simulator three times with different numbers of tasks of different length. The simulation result is compared with some previously designed load balancing algorithms in the cloud environment.

The paper [2] cloud has become an essential part of modern computing, and its popularity continues to rise with each passing day. Currently, cloud computing is faced with certain challenges that are, due to the increasing demands, becoming urgent to address. One such challenge is the problem of load balancing, which involves the proper distribution of user requests within the cloud. This paper proposes a genetic algorithm for load balancing of the received requests across cloud resources. The algorithm is based on the processing of individual requests instantly upon arrival. The conducted test simulations showed that the proposed approach has better response and processing time compared to round robin, ESCE and throttled load balancing algorithms. In this [3] paper, Cloud computing is one of the important technologies in the field of Information Technology. Many services are available and provided by different service providers using different cloud technology nowadays. The main problem of cloud computing-based technology is load balancing in different cloud servers. It is one of the important issues in the necessary growth of cloud computation. Demand for the new cloud services with a high-speed service is important issue in this current era. There are various algorithms of load balancing which have been already discussed for an efficient allocation of requests through a proper selection of virtual machines in a cloud environment.

III. SYSTEM ARCHITECTURE

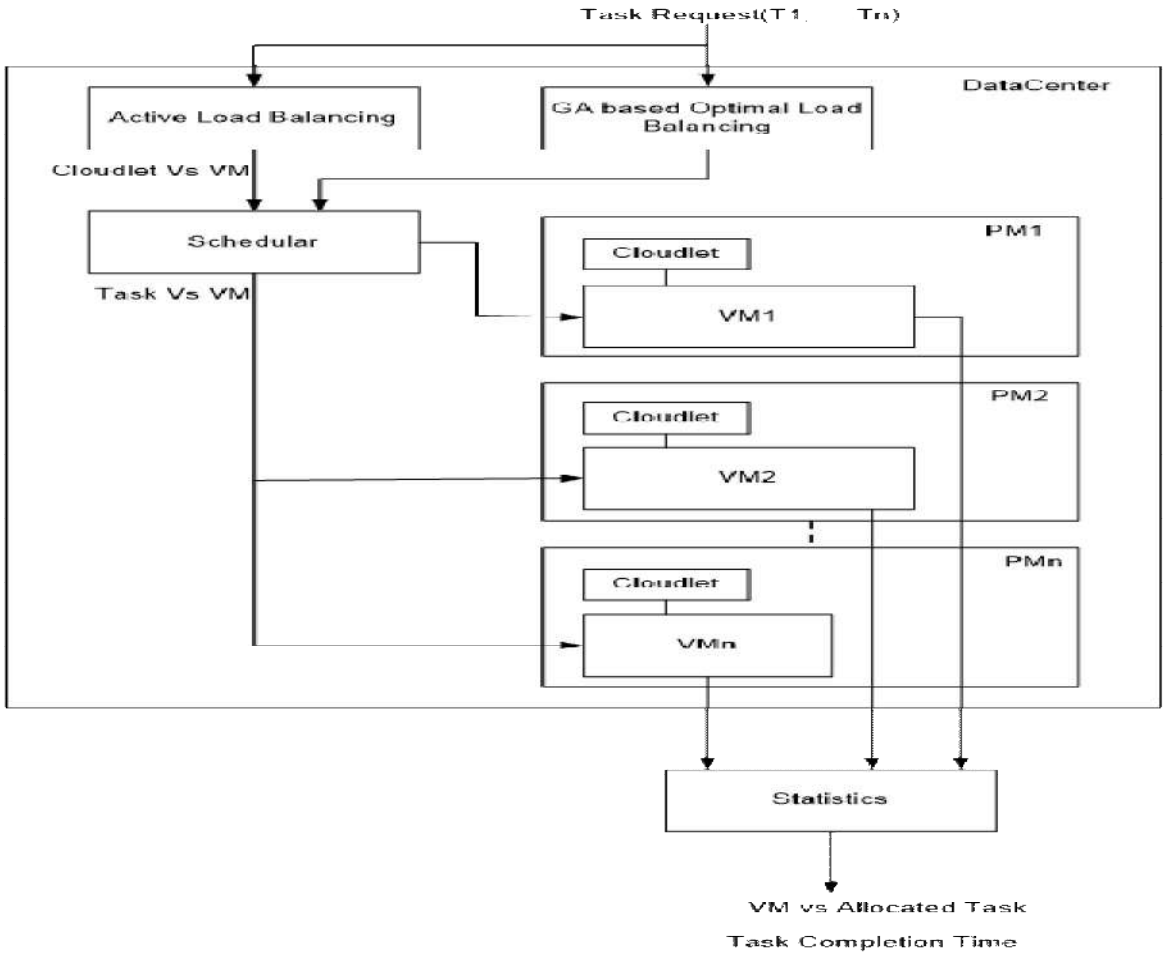

Fig 1: System Architecture

IV. SYSTEM MODULES

A. Genetic Algorithm Module:

The chromosomal representation in a genetic algorithm for VM-task assignments includes the data structure and algorithm that specify the connection between VMs and tasks. Chromosome fitness is evaluated via fitness evaluation, whereas initialization methods establish the starting population according to load balancing requirements. Crucial elements of this process include mutation techniques for genetic variety, crossover strategies like single-point or uniform crossover, termination conditions for terminating the algorithm, and selection operators like roulette wheels or tournament selection.

B. Cloud Sim Integration Module:

Creating functions to effectively generate, start, stop, and manage virtual machines (VMs) and cloudlets is known as VM and Cloudlet management in the context of CloudSim. Mechanisms for resource monitoring are put in place to keep tabs on how VMs and cloudlets use resources, guaranteeing peak performance. Genetic algorithm-guided task allocation techniques efficiently distribute tasks among virtual machines (VMs) and improve system performance. In order to maintain an even workload distribution throughout the cloud environment, load balancing triggers are made to start load balancing activities when specified thresholds are reached.

C. Simulation setup module:

Setting up parameters for different simulation situations, such as workload intensity, virtual machine configurations, and evolutionary algorithm parameters, is known as scenario configuration. Initialization of the simulation environment includes capabilities to fully configure the CloudSim simulation environments, such as brokers, data centers, and simulation time management.

D. Performance Evaluation Module:

Creating routines to collect performance data, such as response time, resource allocation, and job completion time, during simulation runs is known as metrics collecting. These indicators are essential for assessing how well the simulated system is doing in terms of efficiency and efficacy.

E. User Interface Module:

GUI development entails creating a graphical user interface (GUI) that enables users to interact with the system, configure simulations, and view results seamlessly. Visualization components are implemented to display real-time simulation progress, resource utilization charts, and performance metrics, providing users with a comprehensive and intuitive view of the system's dynamics.

F. Optimization and Fine-Tuning Module:

In order to greatly improve load balancing performance, parameter optimization entails creating techniques for optimizing genetic algorithm parameters and simulation setups. By fine-tuning the genetic algorithm and simulation environment's parameters, these techniques hope to improve system task allocation and resource efficiency.

V. SYSTEM IMPLEMENTATION

A. Setup Environment

Installing and configuring the cloud sim simulator on the target system and Setting up the virtual machines (VMs), data centres, and cloudlets as per the simulation requirements.

B. Genetic algorithm module

Developing the genetic algorithm module in a programming language java, any other suitable language and Implementing classes and functions for chromosomes representation initialization, Fitness evaluation, selection, crossover, mutation and termination criteria.

C. Integration with Cloud sim

Integrating the genetic algorithm module with the cloud sim simulator framework. Implementation of interfaces or adapters to communicate between the genetic algorithm and Cloud Sim components (e.g., VM allocation, task scheduling).

D. Fitness Evaluation Function

For Determining the value of each chromosome , the fitness function is used . This fitness function evaluates each possible solution based on the following formula

$$\text{cost} = \frac{N}{MIPS} + \frac{U}{CP}$$

Here, Cloudlet Length (N), MIPS (million instructions per second), Current VM Load (U), and VM Capacity (CP)

E. Load Balancing Mechanism

Defining the mechanism for the initial task allocation to VMs based on the genetic algorithm and implementing the load balancing triggers to adaptively redistribute tasks when system conditions change.

F. Simulation Scenarios

Defining the simulations scenarios with varying workloads, VM configurations and genetic algorithm parameters and Configuring simulation setting such as simulation time, logging, and output metrics collection.

G. Performance Evaluation

Analysing and comparing the results of the genetic algorithm-based load balancing approach with other methods.

H. Optimization and validation

Optimizing the genetic algorithm parameters techniques to improve load balancing performance and validating the system implementation by conducting multiple.

VI. GENETIC ALGORITHM

Genetic algorithm are search and optimization algorithm based on the principles of natural selection and genetics. They abstract the problem space as a population of individuals, in which they attempt to identify the best one. The algorithm steps are as follows:

1. Create the initial population by randomly choosing n virtual machines.
2. Calculate the fitness value of each chromosome * in the population.
3. Check if any of the termination conditions are met. If yes, return the virtual machine with the highest corresponding fitness value(END)
4. n-2 times do:
   Select 2 chromosomes using roulette wheel selection
   Create a new chromosome by crossing the selected chromosome.
5. Mutate a randomly chosen chromosome
6. Form a new population by combining newly generated chromosome and 2 best chromosomes from the current population
7. Replace the current population with the new population
8. Calculate the fitness of the new population
9. Return to the step 3

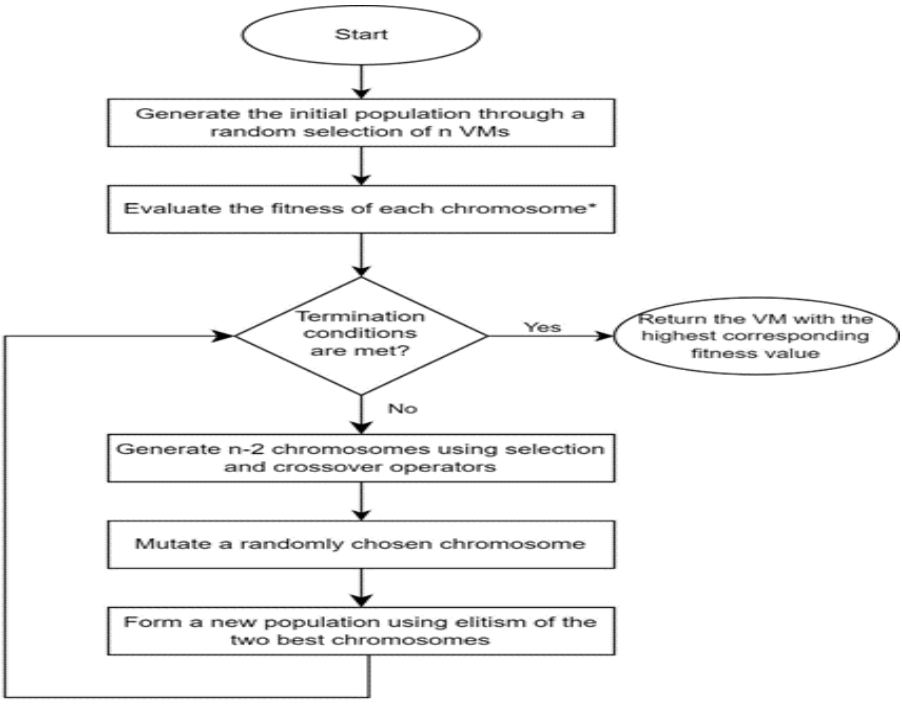

Fig 2: Flowchart of Genetic Algorithm

VII. RESULTS

A. Simulation Tool

Fig 3: Region Boundaries

In order to evaluate the performance of the proposed algorithm, the Cloud Analyst simulation tool was used. Cloud Analyst is open-source GUI based simulation tool, built on top of cloud Sim framework. This tool allows specifying the detailed description of data centres, users bases and internet characteristics.

B. Simulation Setup

Two distinct test scenarios were used to gauge the algorithm's performance. This evaluation's primary goal was to assess how well the suggested algorithm performed in comparison to an existing GA-based load balancer. Because of this, the defined simulation was used as the initial test case, Six user bases and four data centres, each situated in a distinct geographic area, are included in the scenario.

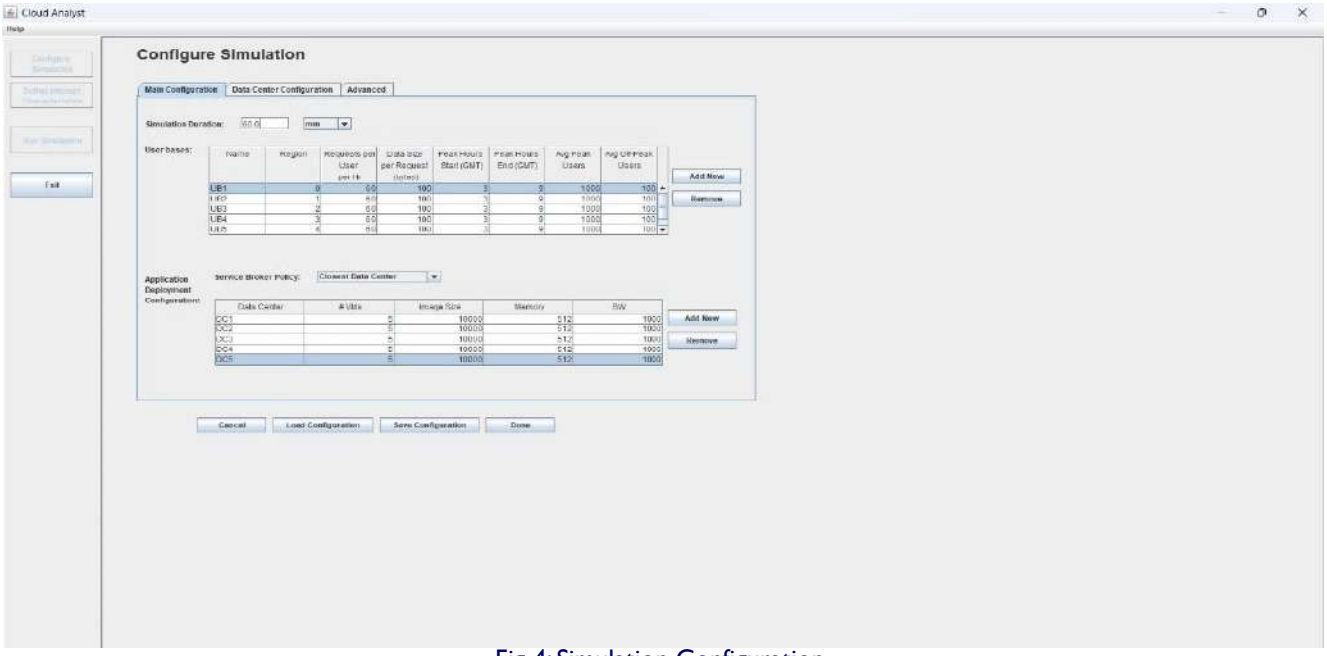

Fig 4: Simulation Configuration

C. Response time graph

Two metrics are used to assess performance: overall response time, which shows how long it takes to finish a request, and data centre processing time, which shows how long the data centre takes to process requests. To make sure the test scenarios were reliable and robust, they were run ten times.

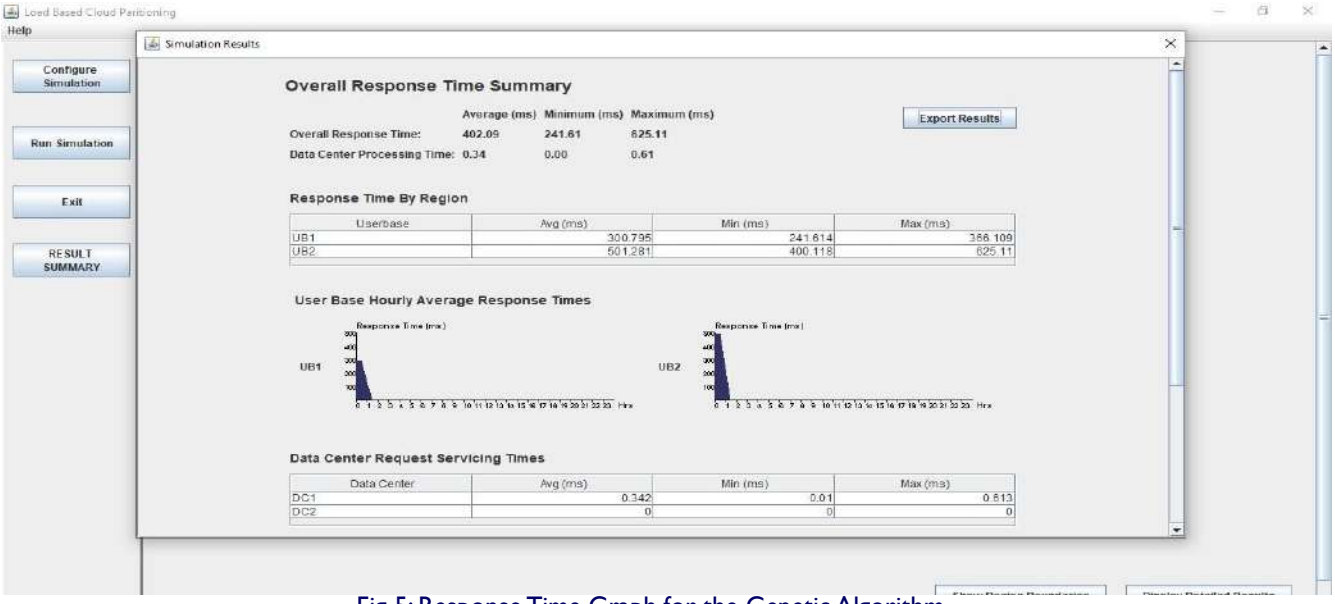

Fig 5: Response Time Graph for the Genetic Algorithm

The presented results show that the proposed algorithm in terms of both overall response time and data centre processing time. A visual representation of the comparison among these algorithm

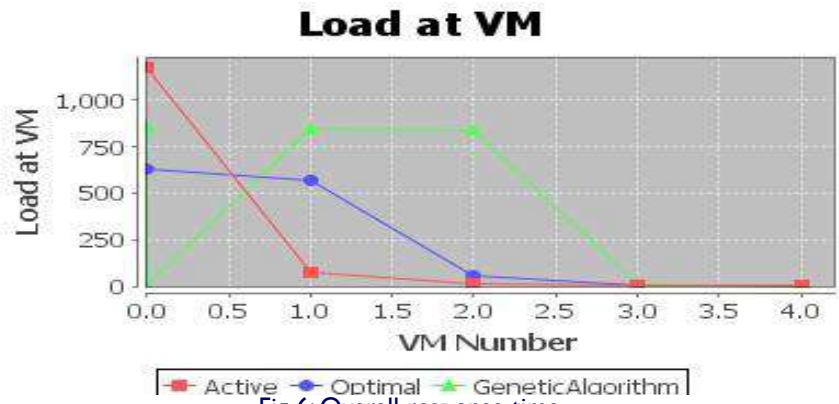

Fig 6: Overall response time

VIII. CONCLUSION

In order to balance user requests within the cloud, this study suggests using a genetic algorithm. The proposed algorithm's primary concept is to respond to each request individually as soon as it is received Remarkable outcomes have demonstrated that this strategy reduces data centre processing time as well as total response time. The approach's 10% response and processing time speedup is evidence that it works especially well in situations where data centre have different resources. The suggested approach can also be applied to cloud service order optimization. Redefining the algorithm's fitness function will do this.

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Transforming the University HR on Boarding Process with RPA

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Abstract: The HR Onboarding Assistant project employs Robotic Process Automation (RPA) to enhance the efficiency of on boarding in education institutions. This initiative utilizes a well-structured RPA system with bots, data integration, security measures, and user-friendly interfaces to automate tasks, reduce errors, and improve the onboarding experience. It also supports ongoing optimization and data-driven decision-making for colleges and universities. This initiative addresses these challenges by introducing a meticulously designed RPA architecture. The architecture encompasses a suite of RPA bots, an orchestration layer, and compliance measures. Each component collaborates to automate specific tasks, thereby reducing manual workload, eliminating human errors, and accelerating the onboarding timeline. The project offers a comprehensive solution that includes a user-friendly interface for HR professionals, real-time notifications. Furthermore, the architecture accommodates ongoing optimization, and continuous monitoring. It is designed to foster a culture of data-driven decision - making, ensuring that the onboarding process evolves and adapts to the institution's needs.

Keywords: Human Resource (HR), Robotic Process Automation (RPA), Bots, UiPath.

INTRODUCTION

In the dynamic landscape of higher education, the efficient onboarding of new faculty and staff is pivotal for the seamless functioning of universities and educational institutions. The Human Resources (HR) onboarding process plays a crucial role in welcoming and integrating new hires, ensuring compliance with organizational policies, and expediting the transition into their roles. This project focuses on the development and implementation of an HR Onboarding Assistant Process tailored for universities and educational institutions. The core objective is to leverage the capabilities of UiPath Studio, a leading RPA tool, to streamline and automate the generation of appointment letters—an essential component of the onboarding process. By automating this traditionally time-consuming and error-prone task, the project aims to enhance the efficiency, accuracy, and overall effectiveness of the onboarding workflow. As technology continues to reshape the educational landscape, the role of RPA in HR processes becomes increasingly significant. The utilization of UiPath Studio not only automates routine tasks but also empowers HR professionals to redirect their focus towards more strategic and value-added activities. This project exemplifies a strategic approach to modernizing HR operations in the academic sector, contributing to a more agile and responsive onboarding experience for both the institution and its new employees.

Beyond streamlining appointment letters, an HR Onboarding Assistant Process powered by UiPath Studio can be further developed to automate other repetitive tasks within the onboarding workflow. This could include tasks such as gathering new hire information, scheduling orientation sessions, and provisioning access to necessary IT systems. By automating theseprocesses, HR professionals can significantly reduce the administrative burden associated with onboarding, freeing up valuable time to focus on building relationships with new hires. This shift in focus towards relationship building is crucial for fostering a sense of belonging and engagement among new faculty and staff. When HR professionals are relieved of administrative tasks, they can dedicate more time to providing personalized support and guidance to new hires. This can involve activities such as mentoring, facilitating team introductions, and ensuring newcomers feel comfortable asking questions and seeking help. A more personalized onboarding experience not only improves employee satisfaction but also contributes to a more positive and productive work environment. Furthermore, an automated HR Onboarding Assistant Process can ensure greater consistency and compliance across the onboarding process. By establishing clear and pre-defined workflows within the RPA tool, universities can guarantee that all new hires receive the same essential information and complete the necessary tasks in a timely manner. This consistency not only promotes a smooth transition for new hires but also minimizes the risk of errors or missed steps that could lead to legal or regulatory issues. In conclusion, this project to develop an HR Onboarding Assistant Process using UiPath Studio presents a compelling opportunity to modernize and optimize the onboarding experience for universities and educational institutions. By automating repetitive tasks, fostering personalized engagement, and ensuring consistency, this initiative can empower HR professionals, enhance employee satisfaction, and ultimately contribute to the success of the institution.

II. LITERATURE SURVEY

Syaiful et.al. [1] explains that Human Resources (HR) should make sure to adapt and practice its implementation as automation technology is altering and transforming innovation into the industrial landscape in order to realize its benefits quickly and for cost savings. Robotic Process Automation (RPA) installation in HR can help to provide better service to verify that the procedures follow the set standards and regulations. RPA is a type of software that controls software robots to mimic human interaction with digital platforms. RPA is a method that could do repetitive tasks to replace jobs done by people. A robot, however, is regarded to be valuable to complement driving procedures rather than being able to replace the HR. The goal of the study is to demonstrate RPA's efficiency and efficacy in the HRMS when compared to a manual procedure carried out by a human. Based on the data measurement throughout the deployment process, many types of components and features were identified for using RPA in HRMS. In order to complete the desired procedure, this study constructs and develops an HRMS model using RPA tools. The model was created using a case study of an RPA model already in use in HRMS from the IT consulting sector. The model employs an application that focuses on the requirements of gathering, storing, and accessing employee information from other modules in the HR process. Finally, the HRMS's shortcomings in terms of increasing productivity are assessed and explained. Jung Ho Lee et.al [2] says that the growing interest in digital transformation and innovations has led to the rise of robotic process automation (RPA) as a trend in a number of industries. RPA has been widely used in the financial and service sectors, and the capacity to incorporate artificial intelligence (AI) technology has led businesses in various sectors to employ RPA to improve the effectiveness of their business processes. . Based on the RPA application cases from LG CNS, the purpose of this study is to ascertain how businesses use RPA. Several case studies were employed as part of a collective case study methodology. In order to achieve this, this study analyzed and arranged numerous cases illustrating the use of RPA in LG CNS for a variety of tasks, including data reconciliation, simple information verification, the verification of outside information from unrelated systems, and input jobs for the system. RPA standardizes corporate processes, automates minor repetitive operations, and boosts the effectiveness of administrative procedures.

Pratiksha Ved et.al. [3] clearly explained that The future of organizational procedures is automation. The answer to software automation in a variety of industries, including IT, finance and accounting, supply chain, and more, is robotic process automation (RPA). In this article, we provide an RPA solution for the field of education. This article demonstrates the automated procedure for emailing student test results to parents using an RPA bot, which can save faculty a lot of time. Prof.S.S.Sambareet.al. [4] In this project, we have tried to automate some of HR's monotonous tasks. These include Adding new employees, Sending offer letters & credentials and background verification. With the help of cloud storage and API, we have reduced the time of creating a new employee account from 2 minutes to ~1 second. Google's Tesseract has helped us to reduce the background verification time to approx 10 seconds per employee. The HR team now no longer needs to spend hours verifying employee submissions, or checking whether an employee has completed the training. An onboarding software like ours helps us to standardize the process, which makes sure that every employee has the same experience of onboarding.

III. PROPOSED SYSTEM

In the realm of higher education, HR departments at colleges and universities are constantly challenged by the complexities and time-consuming nature of the employee onboarding process. This process is riddled with numerous administrative tasks that are susceptible to human error and inefficiencies. The manual, repetitive nature of these tasks leads to delays, increased costs, and a suboptimal experience for new hires. A particularly time-consuming hurdle arises during periods of high recruitment, where HR departments struggle to prepare and generate individual appointment letters for each new employee.

1. **Data Integration:** The system integrates with HR databases or other relevant systems to retrieve employee information, such as personal details, job roles, and start dates.
2. **Appointment Letter Generation:** Using RPA, the system automates the process of generating appointment letters. It extracts the necessary employee information from the integrated data sources and populates it into pre-defined appointment letter templates.
3. **Document Management:** The system manages the storage and retrieval of generated appointment letters. It may utilize document management systems or cloud storage solutions to securely store and organize the documents.
4. **Workflow Automation:** RPA bots can be programmed to follow predefined workflows for the onboarding process. This includes sending the appointment letters to the respective employees, tracking the progress of each onboarding task, and triggering subsequent actions or notifications.
5. **Integration with HR Systems:** The automated system can integrate with other HR systems, such as payroll or employee management systems, to ensure seamless data flow and synchronization. Overall, the proposed architecture leverages RPA technology to streamline and automate the employee onboarding process, reducing manual effort, minimizing errors, and enhancing the overall efficiency of HR operations.

Advantages:

- Increased Efficiency
- Improved Accuracy
- Faster Onboarding
- Reduced Costs
- Enhanced New Hire Experience
- Scalability

IV. SYSTEM ARCHITECTURE

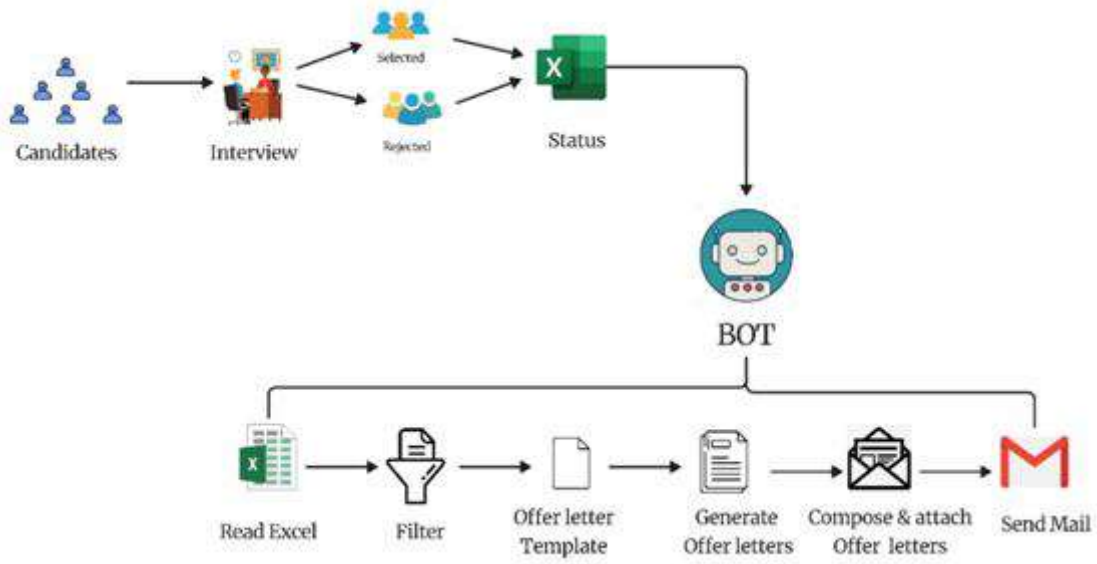

Fig 1: System Architecture

The above figure shows the complete automation of Offer letter generation which is a part of HR Onboarding Process

- The process starts by reading an Excel template. This template likely contains boilerplate language for the offer letter, as well as fields that will be filled in with specific information for each candidate.
- The robot then filters the candidates based on their interview status. It appears that there are three possible statuses: Selected, Rejected, and 000 (which is unclear from the image). The robot likely only generates offer letters for candidates who have been selected.
- Once the candidates have been filtered, the robot generates the offer letters by filling in the appropriate fields in the template with the candidate's information. The robot then composes and attaches the offer letters to emails, and finally sends the emails to the candidates.

V. SYSTEM MODULES

- Data Source Integration: In this module, integration with various data sources (e.g., HR databases, spreadsheets) is established. UiPath Studio is configured to retrieve relevant employee information required for offer letter generation. Data validation and cleansing processes may be implemented to ensure data accuracy.
- UiPath Studio Setup: This module involves the configuration of UiPath Studio, the RPA development environment. Develop and design automation workflows using UiPath to streamline the onboarding process. Set up variables, selectors, and activities to interact with applications and manipulate data.
- Document Generation: UiPath is utilized to automate the creation and customization of offer letters based on predefined templates. The automation extracts employee information from the integrated data sources and populates it into the appropriate placeholders within the document. Ensure the generated documents comply with the required formatting and content standards.

- Email Configuration: Configure UiPath to send out the generated offer letters via email tothe respective candidates. Integrate email functionalities to attach the generated documents andinclude personalized messages. Implement error handling for any issues encountered during the email sending process.
- Notification Module: UiPath is used to set up a notification system to inform HR personnel about the status of the offer letter generation process. Notifications can include alerts for successful document creation, pending approvals, or any errors encountered.

VI. SYSTEM IMPLEMENTATION

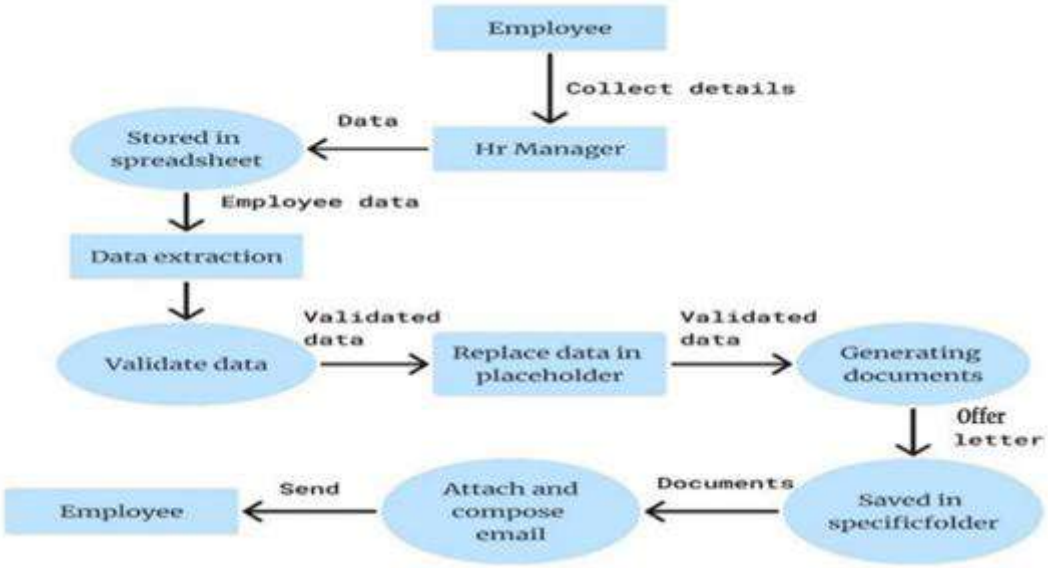

Fig 2: System Implementation

1. Data Input: UiPath automation process to collect the necessary information from the employer as shown in Fig 2. This can include fields such as candidate name, job title, salary, start date, and any other relevant details. UiPath provides activities like "Input Dialog" or "Form Activities" that can be used to collect user input.
2. Read Template: Start by reading the offer letter template from a file or a predefined template stored within your automation project. In this process "Read Text File" activity to extract the content of the template.
3. Replace Placeholders: Identify the placeholders in the template that need to be replaced with actual data. Common placeholders could be candidate name, position, salary, joining date, etc. Use the "Replace" activity or string manipulation functions to substitute these placeholders with the corresponding values.
4. Document Generation: Use string concatenation or string formatting functions to construct the final offer letter content. Combine the modified template from step 2 with the data obtained in step 3 to create the personalized offer letter as shown in Fig 2.
5. Save Document: Save the generated offer letter to a file or a specific location as shown in Fig 2. Use the "Write Text File" activity to save the content of the offer letter into a file with the desired format, such as a Word document or PDF. Specify the file path and provide the offer letter content to be written to the file.
6. Compose Email: Use UiPath's activities to compose an email with the offer letter as an attachment. In this process use the "Send SMTP Mail Message" activity. Fill in the email subject, body, recipient's email address, and attach the generated offer letter file as shown in Fig.2
7. Send Email: Finally, send the email with the offer letter attachment using the selected email activity. Ensure that you provide the necessary email server settings or credentials to successfully send the email.

VII. SCOPE OF FUTURE APPLICATIONS

The proposed RPA system for generating appointment letters is just the first step. Here's how RPA can be further utilized to streamline the onboarding process in higher education:

- Automated Document Collection: RPA bots can automate the collection of required documents from new hires, such as proof of address, tax forms, and emergency contact information. This can be achieved through secure online portals with pre-filled data fields based on information extracted from HRIS or ATS.
- Background Check Integration: The RPA system can integrate with background check services to initiate verifications automatically upon receiving new hire data. This streamlines the process and provides faster turnaround times.
- Benefits Enrollment Automation: RPA can guide new hires through benefits enrollment by pre-populating forms and providing step-by-step instructions within the system. This reduces errors and streamlines the selection process.
- Onboarding Task Management: The system can manage and track various onboarding tasks, assigning them to relevant departments and notifying responsible parties when action is required. This ensures a smooth and coordinated onboarding experience.
- Personalized Communication: RPA can be used to send personalized welcome messages and reminders to new hires throughout the onboarding process. This fosters a sense of connection and keeps them engaged during their first few weeks. Beyond onboarding, RPA can be applied to other HR functions in higher education, such as:

- Leave Management: Automating leave request approvals and tracking balances.
- Payroll Processing: Streamlining data entry and reducing errors in payroll calculations.
- Performance Management: Automating tasks like scheduling performance reviews and generating reports.

As RPA technology continues to evolve, we can expect even more innovative applications for automating repetitive tasks within the HR departments of colleges and universities. This will allow HR professionals to focus on more strategic initiatives, such as talent development and employee engagement, ultimately leading to a more productive and positive work environment for all

VIII. RESULTS

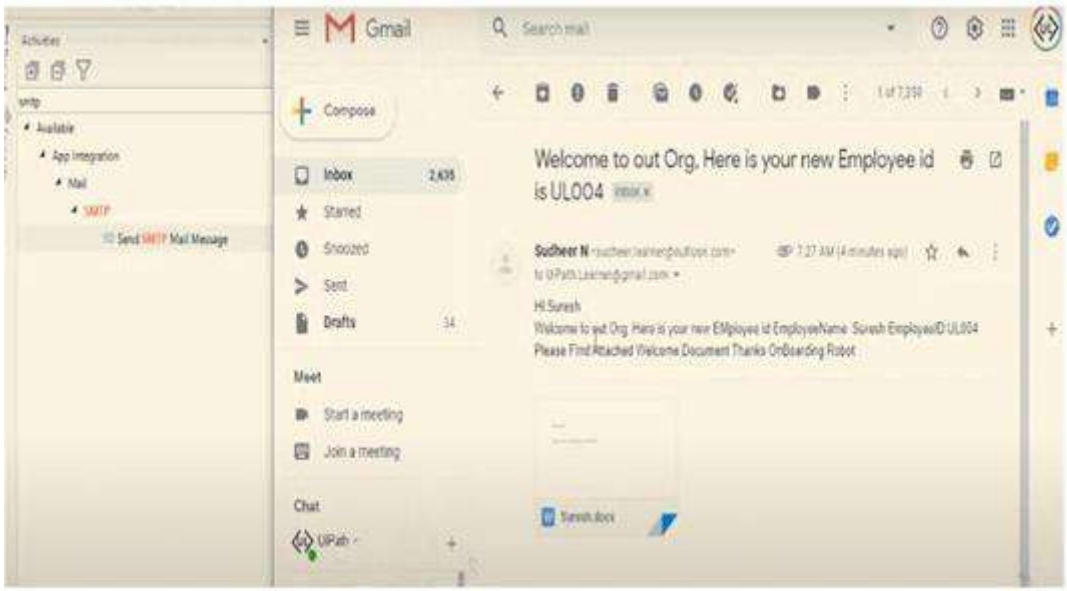

Fig 3: Automated Offer letter Email

Dear **Sukrutha**,
Email : abc@gmail.com
Phone number : xxxxxxxxxx

We were all very excited to meet and get to know you over the past few days. We have been impressed with your background and would like to formally offer you the position of **Assts.Professor**.

This is a fulltime position and 6hours of working in week of 5 days . You will be reporting to the head of the Department.

We will be offering you an annual gross salary of **6LPA** and [*mention bonus programs, if applicable.*] You will also have *mention benefits as per company policy, like health and insurance plan, corporate mobile or travel expenses* and 5 days of paid vacation per year.

Your expected starting date is **16/08/2024** You will be asked to sign a contract of 2 year, and at the beginning of your employment.

We would like to have your response by **13/6/2024** In the meantime, please feel free to contact me or Shilpa Patil via email or phone on shilpapatil@gmail.com, should you have any questions.

We are all looking forward to having you on our team.

Best regards,

Sukrutha

Figure 4: Dynamic Offer Letter Template.

IX. CONCLUSION

The integration of Robotic Process Automation (RPA) into the university HR onboarding process represents a pivotal step towards efficiency, accuracy, and a more seamless experience for new employees. This transformative approach not only streamlines administrative tasks but also enhances the overall onboarding journey, reducing delays, errors, and administrative burdens. As universities embrace RPA, they are poised to modernize their HR operations and adapt to the evolving digital landscape, ultimately positioning them to attract, engage, and retain top talent while optimizing their resource utilization

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Revolutionizing Deepfake Detection and Realtime Video Vision with CNN-based Deep Learning Model

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Abstract: The rapid advancement of deep learning models that can generate and synthesis hyper-realistic videos known as Deepfakes and their ease of access have raised concern on possible malicious intent use. Deep learning techniques can now generate faces, swap faces between two subjects in a video, alter facial expressions, change gender, and alter facial features, to list a few. These powerful video manipulation methods have potential use in many fields. However, they also pose a looming threat to everyone if used for harmful purposes such as identity theft, phishing, and scam. In this work, we propose a Convolutional Vision Transformer for the detection of Deepfakes. The Convolutional Vision Transformer: Convolutional Neural Network (CNN) and Vision Transformer (ViT). The CNN extracts learnable features while the ViT takes in the learned features as input and categorizes them using an attention mechanism. We trained our model on the DeepFake Detection Challenge Dataset (DFDC) and have achieved 91.5 percent accuracy, an AUC value of 0.91, and a loss value of 0.32. Our contribution is that we have added a CNN module to the ViT architecture and have achieved a competitive result on the DFDC dataset.

Keywords: DeepFake, Auto Encoder, Convolutional Neural Network (CNN), Artifical Neural Network (ANN), Vision Transformer(ViT), Convolutional Vision Transformer (CVT)

I. INTRODUCTION

Technologies for altering images, videos, and audios are developing rapidly. Techniques and technical expertise to create and manipulate digital content are also easily accessible. Currently, it is possible to seamlessly generate hyper-realistic digital images with a little resource and an easy how-to-do instructions available online. Deepfake is a technique which aims to replace the face of a targeted person by the face of someone else in a video. It is created by splicing synthesized face region into the original image. The term can also mean to represent the final output of a hype-realistic video created.

Deepfakes can be used for creation of hyper-realistic Computer Generated Imagery (CGI), Virtual Reality (VR), Augmented Reality (AR), Education, Animation, Arts, and Cinema. However, since Deepfakes are deceptive in nature, they can also be used for malicious purposes. Since the Deepfake phenomenon, various authors have proposed different mechanisms to differentiate real videos from fake ones. As pointed by, even though each proposed mechanism has its strength, current detection methods lack generalizability. The authors noted that current existing models focus on the Deepfake creation tools to tackle by studying their supposed behaviors. For instance, inconsistencies in eye blinking to detect Deepfakes. However, it is now possible to mimic eye blinking. System that generates videos of talking heads with natural facial expressions such as eye blinking. Also proposed a model that can generate facial expression from a portrait. Their system can synthesis a still picture to express emotions, including a hallucination of eye-blinking motions.

LITERATURE SURVEY

This conference paper provides an extensive overview of Revolutionizing Deepfake Detection and Real-time Video Vision with CNN-based Deep Learning Model, with a specific focus on Deepfake. It covers various aspects on detecting facial manipulation in videos using deep learning. It introduces an ensemble of Convolutional Neural Network (CNN) models, particularly EfficientNetB4, enhanced with attention mechanisms and siamese training. The goal is to identify various facial manipulation techniques like deepfakes. Experiments assess model performance on FF++ and DFDC datasets, using metrics like AUC and Log Loss. The attention mechanism highlights key facial regions, and Siamese training improves discrimination capabilities. Results show that assembling models outperforms the baseline XceptionNet, with discussions on explain ability, feature visualization, and network architecture independence. In our conference paper explores the role of Revolutionizing Deepfake Detection and Real-time Video Vision with CNN-based Deep Learning Model. DeepFakes detection involves detecting and identifying images, videos, audio, and text that have been generated or manipulated using artificial intelligence techniques .DeepFakes are often created to deceive and manipulate viewer's byinserting fake information into real events or spreading misinformation or creating fake news. The use of DeepFakes posesa significant threat to the authenticity and credibility of social media, making it essential to develop reliable and effective DeepFakes detection methods .The DeepFakes detection is primarily focused on identifying and combating the spread of fake news and misinformation. The current surveys can help prevent the potential harm caused by the misuse of DeepFakes and ensure that the information presented is accurate and trustworthy. It explores Manipulated-face detection involves the identification of images that have been manipulated or tampered with by AI algorithms. The increasing availability of AI algorithms has made it easier to create manipulated images for fraudulent purposes, such as face swapping, and facial manipulation .Video conferencing DeepFakes detection. Left: A video call attendant is being actively authenticated with the live patterns shown on the screen. Right: A real person's cornea will produce an image of the pattern shown on the screen while a real-time DeepFake cannot. The current surveys indicate that the development of reliable and robust manipulated-face detection methods is essential to safeguard the authenticity and integrity of digital media and prevent harm caused by the misuse of manipulated images. As previously mentioned, it's important to note that face manipulation and GAN-based face generation are distinct techniques. While GANs generate faces from scratch, face manipulation involves altering or modifying existing face images using various techniques.

PROPOSED SYSTEM

The designed Artificial Neural Network (ANN) model combines convolutional layers for spatial feature extraction with transformer layers to capture temporal dependencies in video frames. The convolutional layers identify spatial patterns, while the transformer layers process sequential information for robust deep fake detection. The model includes dense layers for classification and is trained to distinguish between authentic and manipulated video content. The architecture leverages both spatial and temporal aspects, enhancing its ability to detect sophisticated deep fake techniques. The model is optimized using categorical cross entropy loss and the Adam optimizer for effective training. The Convolutional Neural Network (CNN) model utilizes convolutional layers to extract spatial features from video frames, focusing on facial patterns and anomalies. Max-pooling layers enhance hierarchical feature representation, aiding in deep fake detection. The model incorporates multiple convolutional blocks to progressively capture complex visual patterns. Flattening is applied before dense layers for classification, enabling the model to discern between genuine and manipulated video content. Training involves optimizing with categorical cross entropy loss and Adam optimizer for efficient convergence.

II. SYSTEM ARCHITECTURE

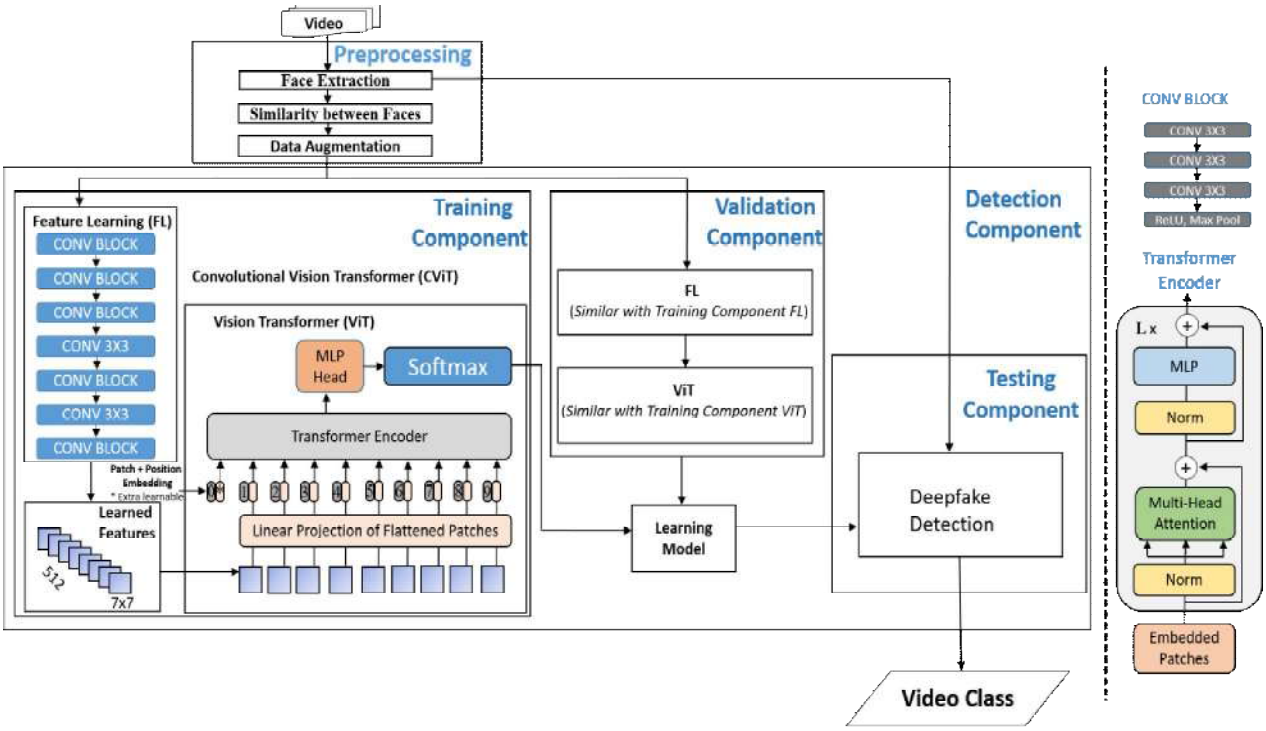

Figure 1: System Architecture

III .SYSTEM MODULES

The Deepfake Video Detection Model

The above figure in system architecture explains the model of video deepfake face detection.

The Training Component

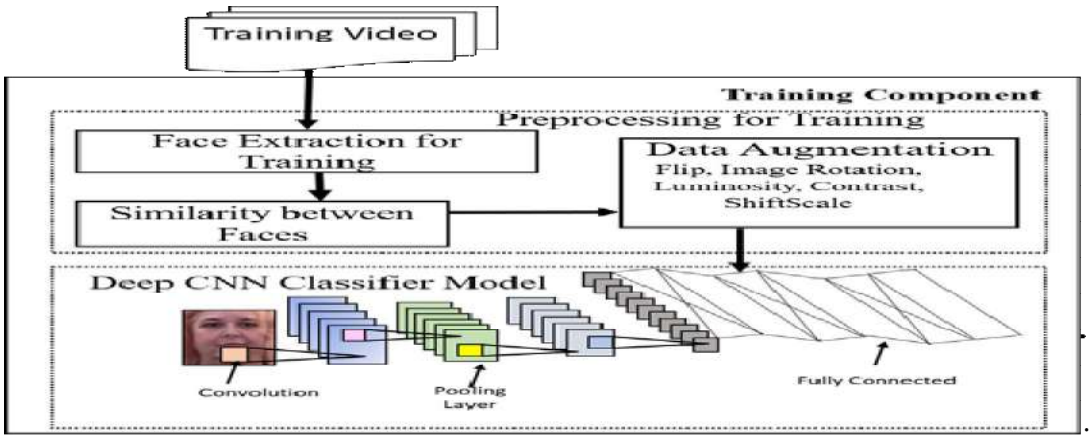

Figure 2 : Training Video

The project titled "Revolutionizing Deepfake Detection and Real-Time Video Vision with CNN-based Deep Learning Model" encompasses several key modules aimed at achieving its objectives. Firstly, the Data Collection and Preprocessing Module focuses on gathering a diverse dataset of real and deepfake videos, standardizing their formats, resolutions, and annotating them for training purposes. Subsequently, the Deep Learning Model Architecture Module is tasked with designing an optimized convolutional neural network (CNN) architecture tailored for deepfake detection and real-time video processing. This involves exploring various CNN architectures, such as ResNet or VGG, and experimenting with different layers and optimization techniques. The Training Module involves training the deep learning model on the annotated dataset, leveraging techniques like transfer learning and data augmentation to enhance performance and generalization capabilities. Real-Time Video Processing Module is responsible for developing algorithms for efficient real-time video analysis and processing, including frame extraction, feature extraction, and temporal analysis, optimized for low-latency performance. The Deepfake Detection Module integrates the trained model into the system for identifying deepfake videos, incorporating thresholding mechanisms and post-processing techniques to refine detection results.

The User Interface (UI) Module focuses on designing an intuitive interface for interacting with the system, allowing users to upload videos, initiate real-time processing, and view detection results across different devices. Lastly, the Monitoring and Maintenance Module involves implementing mechanisms for monitoring system performance, detecting anomalies, and facilitating regular updates and maintenance tasks to keep the system effective and up-to-date with the latest deepfake detection techniques. Together, these modules form a comprehensive framework poised to revolutionize deepfake detection and real-time video vision through advanced CNN-based deep learning models.

IV. RESULTS

V. SCOPE OF FUTURE APPLICATION

The scope of future deepfake detection applications Initially, the Data Acquisition and Preprocessing Module is essential for gathering a diverse dataset comprising both real and deepfake videos, followed by cleaning and preprocessing tasks to prepare the data for training. The Deep Learning Model Architecture Module focuses on designing a suitable Convolutional Neural Network (CNN) architecture, configuring the training pipeline, and defining appropriate parameters. Subsequently, the Training Module involves training the CNN model using the prepared dataset, validating its performance, and evaluating key metrics such as accuracy and F1-score. Real-Time Video Processing Module is pivotal for integrating the model with live video streams, enabling real-time deepfake detection, and optimizing processing efficiency. The User Interface Module ensures a user-friendly interaction platform, featuring real-time feedback and control options. Post-Processing and Reporting Module deals with refining detected deepfakes and generating comprehensive reports on detection results. Deployment and Scalability Module strategizes the deployment across different environments and considers scalability factors for efficient operation. Lastly, Maintenance and Updates Module facilitates periodic model retraining, software updates, and maintenance tasks to keep the system robust and up-to-date with evolving deepfake techniques. Together, these modules form a comprehensive framework to address the challenges of deepfake detection and real-time video processing using CNN-based deep learning models.

VI .CONCLUSION

The project was aimed at designing and developing a generalized model for Deepfake video detection utilizing Convolutional Neural Networks (CNNs) and Vision Transformers (ViTs). Equal emphasis was placed on data preprocessing during both training and classification phases, ensuring the model's robustness and accuracy. Leveraging the largest available dataset for Deepfake detection, our novel approach yielded promising results. The developed Deepfake detection model demonstrates potential in identifying Deepfakes intended for malicious intents, providing a crucial tool in combating disinformation and fraudulent activities. With a reported accuracy of 93 percent on the DFDC dataset, our model signifies a significant advancement in Deepfake detection technology. Furthermore, its versatility allows for effective detection across various settings, enhancing its applicability in real-world scenarios. The meticulous attention given to data preprocessing during training and classification significantly contributes to the model's overall accuracy, underscoring the importance of comprehensive data preparation in Deepfake detection systems.

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Predictive Analysis and Discerning of Polycystic Ovary Syndrome in Women using Machine Learning Computations

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Abstract: This paper focuses on the data-driven diagnosis of polycystic ovary syndrome (PCOS) in women. For this, machine learning algorithms are applied to a dataset freely available in Kaggle repository. This dataset has 43 attributes of 541 women, among which 177 are patients of PCOS disease. Firstly, univariate feature selection algorithm is applied to find the best features that can predict PCOS. The ranking of the attributes is computed and it is found that the most important attribute is the ratio of Follicle stimulating hormone (FSH) and Luteinizing hormone (LH), Next, holdout and cross validation methods are applied to the dataset to separate the training and testing data. A number of classifiers such as gradient boosting, random forest, logistic regression, and hybrid random forest and logistic regression (RFLR) are applied to the attributed are good enough to predict the PCOS disease

Keywords: polycystic ovary syndrome (PCOS), Kaggle repository, univariate feature selection algorithm, Follicle stimulating hormone (FSH),Luteinizing hormone (LH), gradient boosting, random forest, logistic regression, and hybrid random forest and logistic regression (RFLR).

I. INTRODUCTION

The motivation behind "Diagnosis of Polycystic Ovary Syndrome Using Machine Learning Algorithms" stems from the pressing need for accurate, data-driven diagnostic tools in healthcare, particularly for conditions like PCOS. Traditional diagnostic methods may lack precision and efficiency, prompting exploration into advanced technologies like machine learning. This study aims to harness the potential of machine learning algorithms to enhance PCOS diagnosis, utilizing a comprehensive dataset.

By identifying key attributes and employing diverse classifiers, the research endeavours to offer a reliable and efficient diagnostic framework. Ultimately, this pursuit is fuelled by the quest to empower healthcare professionals with advanced tools, improving early detection and personalized management of PCOS, thereby positively impacting women's health worldwide.

II. LITERATURE SURVEY

[1] R. Pasquali et al., "PCOS Forum: Research in Polycystic Ovary Syndrome Today and Tomorrow", Clin Endocrinol (Oxf)

Potential areas of further research activity include the analysis of predisposing conditions that increase the risk of PCOS, particularly genetic background and environmental factors, such as endocrine disruptors and lifestyle. The concept that androgen excess may contribute to insulin resistance needs to be re-examined from a developmental perspective, since animal studies have supported the hypothesis that early exposure to modest androgen excess is associated with insulin resistance. Defining alterations of steroidogenesis in PCOS should quantify ovarian, adrenal and extra-glandular contribution, as well as clearly define blood reference levels by some universal standard. Intraovarian regulation of follicle development and mechanisms of follicle arrest should be further elucidated. Finally, PCOS status is expected to have long-term consequences in women, specifically the development of type 2 diabetes, cardiovascular diseases and hormone dependent cancers. Identifying susceptible individuals through genomic and proteomic approaches would help to individualize therapy and prevention. A potential limitation of our review is that we focused selectively on areas we viewed as the most controversial.

[2] Adiwijaya, B. Purnama, A. Hasyim, M. D. Septiani, U. N. Wisesty and W. Astuti, "Follicle detection on the usg images to support determination of polycystic ovary syndrome"

Polycystic Ovary Syndrome (PCOS) is the most common endocrine disorders affected to female in their reproductive cycle. This has gained the attention from married couple which affected by infertility. One of the diagnostic criteria considered by the doctor is analysing manually the ovary USG image to detect the number and size of ovary's follicle. This analysis may affect low varibilites, reproducibility, and efficiency. To overcome this problem, automatic scheme is suggested to detect the follicle on USG image in supporting PCOS diagnosis. The first scheme is determining the initial homogeneous region which will be segmented into real follicle form the next scheme is selecting the appropriate regions to follicle criteria, then measuring the segmented region attribute as the follicle. The measurement remains the number and size that aimed at categorizing the image into the PCOS or non-PCOS. The method used is region growing which includes region-based and seed-based. To measure the follicle diameter, there will be the different method including stereology and euclidean distance. The most optimum system plan to detect PCO is by using region growing and by using euclidean distance on quantification of follicle.

[3] U. N. Wisesty, J. Nasri and Adiwijaya, "Modified backpropagation algorithm for polycystic ovary syndrome detection based on ultrasound images"

Polycystic Ovary Syndrome (PCOS) is an endocrine abnormality that occurred in the female reproductive cycle. In general, the approaches to detect PCO follicles are (1) stereology and (2) feature extraction and classification. In Stereology, two-dimensional images are viewed as projections of three-dimensional objects. In this paper, we use the second approach, namely Gabor Wavelet as a feature extractor and a modified backpropagation as a classifier. The modification of backpropagation algorithm which is proposed, namely Levenberg - Marquardt optimization and Conjugate Gradient - Fletcher Reeves to improve the convergence rate. Levenberg - Marquardt optimization produce the higher accuracy than Conjugate Gradient - Fletcher Reeves, but it has a drawback of running time. The best accuracy of Levenberg - Marquardt is 93.925% which is gained from 33 neurons and 16 vector feature and Conjugate Gradient - Fletcher Reeves is 87.85% from 13 neurons and 16 vector features.

[4] E. Setiawati, Adiwijaya and A. Tjokorda, "Particle swarm optimization on follicles segmentation to support pcos detection"

Polycystic Ovary Syndrome (PCOS) is the most common endocrine disorders affected to female in their reproductive cycle. PCO (Polycystic Ovaries) describes ovaries that contain many small cysts/follicles. This paper proposes an image clustering approach for follicles segmentation using Particle Swarm Optimization (PSO) with a new modified nonparametric fitness function. The new modified fitness function use Mean Structural Similarity Index (MSSIM) and Normalized Mean Square Error (NMSE) to produce more compact and convergent cluster. The proposed fitness function is compared to a non-parametric fitness function proposed by previous research. Experimental results show that the proposed PSO fitness function produce more convergent solution than previous fitness function especially on ultrasound images. This paper also investigates the influence of contrast enhancement to the performance of PSO image clustering and the extracted the follicular size.

III. PROPOSED SYSTEM

Proposed several machine learning model to classify Fraud are Not Fraud, but none have adequately addressed this misdiagnosis problem. That can be used for this purpose are Diagnosis of Polycystic Ovary Syndrome Using Machine Learning. Also, similar studies that have proposed models for evaluation of such tumors mostly do not consider the heterogeneity and the size of the data Therefore, we propose a machine learning-based approach which combines a new technique of preprocessing the data for features transformation, Random Forest, Decision Tree, Ada Boost, XGBoost and Hybrid model ML algorithm give the best accuracy techniques to eliminate the bias and the deviation of instability and performing classifier tests based

Advantages:

- Requires less time.
- Good Accuracy.

- Easy to Handle.
- Cost-Effectiveness
- Less complexity

IV. SYSTEM ARCHITECTURE

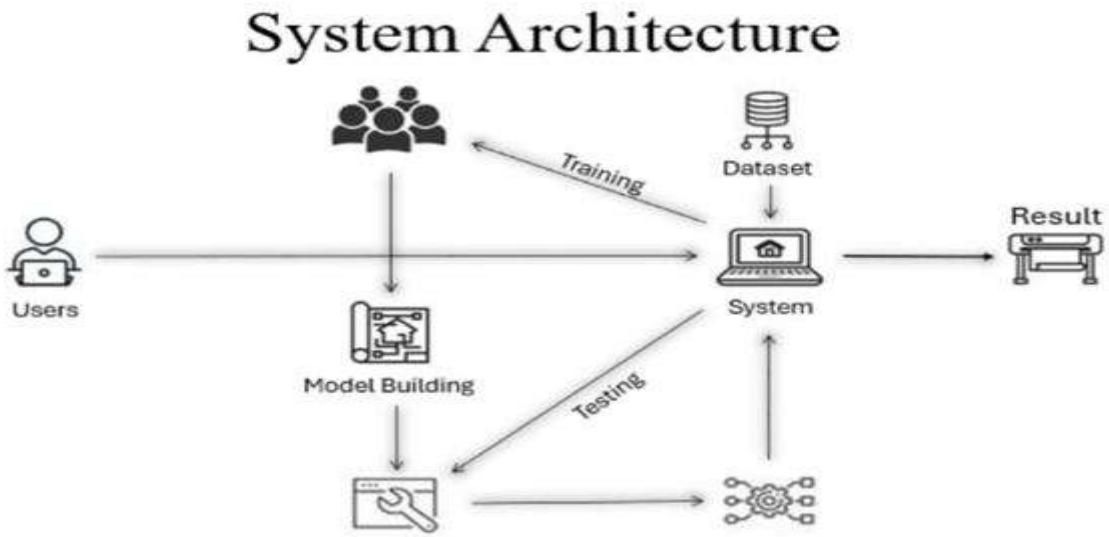

Figure 1: System Architecture

V. SYSTEM MODULES

The system for the "Predictive Analysis and Discerning of Polycystic Ovary Syndrome in Women using Machine Learning Computations " project can be divided into several modules, each serving a specific purpose in the overall workflow. Here are the key modules:

1. **Store Dataset:** In this module, the system functions to securely store the dataset provided by the user. It ensures that the data is properly organized and accessible for further processing and analysis within the PCOS project
2. **Model Training:** This module is responsible for training the selected model using the dataset provided by the user. The system processes the data and feeds it into the chosen model, allowing it to learn and adjust its parameters to optimize performance.
3. **Model Predictions:** Once the model is trained, this module enables the system to make predictions based on new data inputs provided by the user. The system utilizes the trained model to generate predictions or classifications for the given data, offering insights and potential outcomes relevant to the PCOS project.
4. **Data Splitting:** Within this module, the system offers functionality to split the dataset into two distinct parts: one for training the model and another for testing its performance. This ensures that the model's accuracy and effectiveness can be evaluated rigorously using separate data subsets.
5. **Load Dataset:** Here, users are empowered to upload the datasets they wish to analyze or work with within the PCOS project. The system facilitates a seamless process for users to input their data, ensuring compatibility and security throughout.
6. **View Dataset:** This module provides users with the capability to view and examine the datasets they have uploaded or are working with. It offers visualization tools and features to help users gain insights and understand the characteristics of their data effectively.
7. **Select model**: In this module, users have the freedom to choose and apply different models to their datasets for analysis and prediction purposes. The system provides a range of model options, allowing users to select the most suitable one based on their specific requirements and desired accuracy levels

VI. SYSTEM IMPLEMENTATION

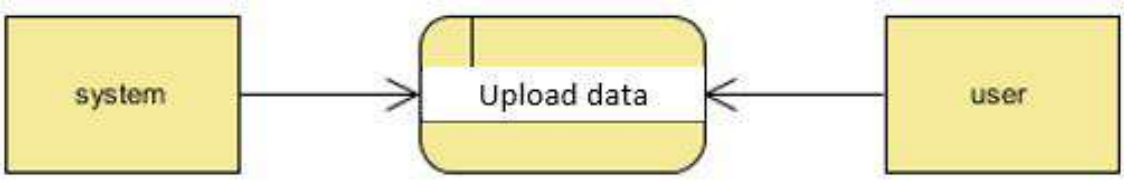

Figure 2: System Implementation

1. **Input Design**:
   The system implementation of the PCOS project focuses on designing effective input mechanisms to ensure accurate and efficient data entry. This involves considering various input devices such as PCs, MICR, and OMR. The input forms and screens are designed with specific purposes in mind, including storing, recording, and retrieving information related to Polycystic Ovary Syndrome (PCOS). Emphasis is placed on ensuring proper completion with accuracy, ease of filling, and user-friendly interfaces to enhance user experience.
2. **Output design:**
   In the system implementation of the PCOS project, output design holds paramount importance. Developers identify the types of outputs required and incorporate necessary controls to ensure the production of relevant and desired output. Prototypes of report layouts are carefully crafted to meet end-users' requirements, delivering outputs in appropriate formats and directing them to the right recipients. Timeliness of output delivery is also a key consideration to facilitate informed decision-making.
3. **Algorithms:**
   The implementation of machine learning algorithms plays a crucial role in the PCOS project. Decision Tree, Random Forest, XG-Boost, and AdaBoost algorithms are utilized to analyze and predict patterns related to PCOS diagnosis and treatment. These algorithms are trained using relevant datasets to create predictive models that aid in classifying and understanding PCOS-related data, ultimately assisting healthcare professionals in making informed decisions and providing personalized care to patients.
4. **Decision Tree Algorithm:**
   Decision tree learning is employed to induce decision trees from training data, providing a predictive model for classifying PCOS-related observations. By learning simple decision rules from prior data, decision trees assist in predicting the class or value of target variables, contributing to accurate diagnosis and treatment planning for PCOS patients.
5. **Random Forest Algorithm:**
   The Random Forest algorithm, an ensemble learning technique, is leveraged to solve regression and classification problems in the PCOS project. By generating multiple decision trees and aggregating their predictions, Random Forest enhances prediction accuracy and mitigates overfitting, thereby improving the reliability of PCOS-related insights and recommendations.
6. **XG-Boost Algorithm:**
   Extreme Gradient Boosting (XG-Boost) is implemented as an optimized distributed gradient boosting library to address PCOS-related challenges efficiently. By leveraging regularized learning and gradient tree boosting, XG-Boost enhances the speed and performance of machine learning models, enabling more accurate predictions and actionable insights for PCOS diagnosis and management.
7. **AdaBoost Algorithm:**
   Adaptive Boosting (AdaBoost) is utilized as an ensemble method in the PCOS project to improve the performance of weak learners, particularly decision trees. By assigning higher weights to incorrectly classified instances and sequentially growing learners, AdaBoost reduces bias and variance, enhancing the robustness of PCOS prediction models and facilitating more accurate diagnoses and treatment recommendations.
8. **Stacking in Machine Learning:**
   Stacking, an ensemble modeling technique, is employed to combine predictions from multiple base models and build a meta-model for enhanced PCOS prediction and analysis. By leveraging input from diverse models, stacking improves prediction accuracy and reliability, enabling healthcare professionals to make well-informed decisions regarding PCOS diagnosis, treatment, and management.

VII. RESULTS

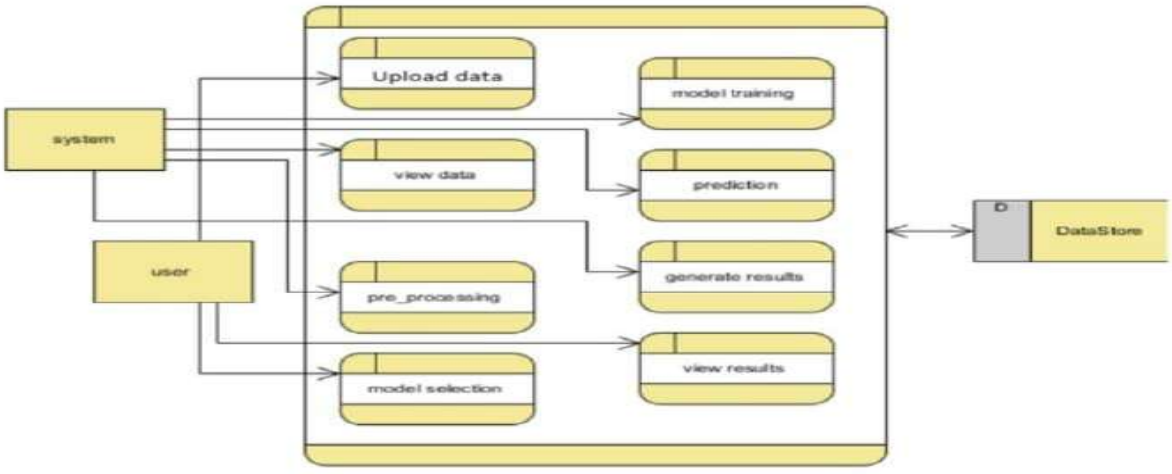

Figure 3: level 1 diagram

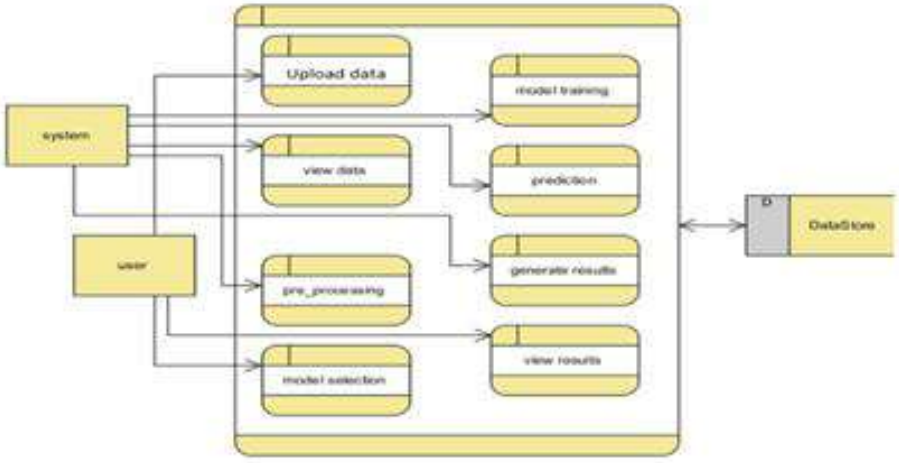

Figure 4: level 2 diagram

Figure 5: Final output

VIII.SCOPE OF FUTURE APPLICATION

The project "Predictive Analysis and Discerning of Polycystic Ovary Syndrome (PCOS) in Women Using Machine Learning Computations" holds significant potential for future applications in several areas.

1. **Early Diagnosis and Intervention:** Machine learning algorithms can analyse various factors and patterns to predict the likelihood of PCOS in women. Early detection can lead to timely intervention and management of symptoms, improving overall health outcomes.
2. **Personalized Treatment Plans:** By analysing data related to symptoms, medical history, lifestyle factors, and genetic predispositions, machine learning models can help create personalized treatment plans for individuals with PCOS. This tailored approach can enhance treatment effectiveness and patient satisfaction.
3. **Risk Assessment and Prevention:** Machine learning can identify risk factors associated with PCOS development, enabling healthcare providers to implement preventive measures and lifestyle interventions to reduce the risk of developing the syndrome.
4. **Healthcare Resource Optimization:** Predictive models can assist healthcare providers in allocating resources more efficiently by identifying high-risk individuals who require closer monitoring or intensive interventions. This can optimize healthcare delivery and improve patient outcomes.
5. **Research and Insights:** The project can contribute valuable insights into the underlying mechanisms and patterns of PCOS, facilitating further research and the development of novel treatments and management strategies.

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IX. EXPERIMENTAL OUTPUTS

Figure 6: Home Page

Figure 7: About Page.

Figure 8: View Data Page.

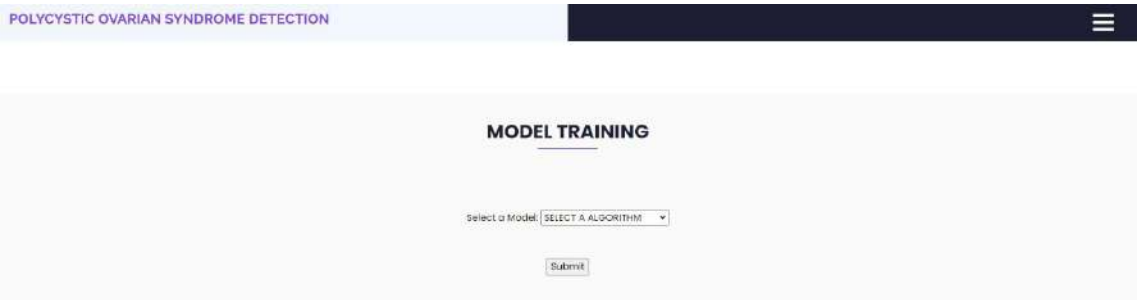

Figure 10: Prediction Page

XI.CONCLUSION

In conclusion, the development of a predictive analysis and discerning system for Polycystic Ovary Syndrome (PCOS) through machine learning offers a transformative approach to women's reproductive health. This comprehensive system, guided by a robust set of functional and non-functional requirements, holds promise for early detection, personalized risk assessment, and real-time monitoring of PCOS. While recognizing the potential impact and advancements, ongoing efforts are crucial to refine models, ensure data security, and address emerging ethical concerns. Collaborative efforts between healthcare experts, data scientists, and technology developers are essential to seamlessly integrate this system into clinical workflows, fostering precision medicine and patient-centric care. The outlined requirements serve as a foundation for the continued evolution of healthcare technology, offering a pathway towards improved diagnostics and management not only for PCOS but also for broader applications in women's health.

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Analysis and Implementation of Web Advertisement Optimization Using UCB Reinforcement Learning

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Abstract: Web advertisements are vital in digital marketing for connecting businesses with customers; yet optimizing their placement faces challenges from evolving user preferences. This project explores leveraging the Upper Confidence Bound (UCB) algorithm, a reinforcement learning technique, to automate ad placement strategies based on real-time feedback. Through analysis and implementation, this study investigates UCB's potential for web advertisement optimization. It examines existing methods, delves into reinforcement learning theory, and develops a simulation environment reflecting real-world dynamics. Experimental results comparing the UCB approach against baselines demonstrate its efficacy in improving ad placement and enhancing online advertising campaigns.

Keywords: Web Advertising, UCB (Upper confidence bound algorithm), Reinforcement Learning, Ad placement strategies, online advertising campaigns.

I. INTRODUCTION

In the contemporary digital era, web advertisements have become instrumental for businesses seeking to engage with potential customers. These advertisements, strategically positioned across diverse online platforms, serve as the primary conduit for reaching target demographics and promoting goods or services. However, optimizing the placement of these web advertisements poses a formidable challenge owing to the perpetually shifting preferences and behaviours of internet users. Conventional methodologies for enhancing ad placement often struggle to adapt swiftly to these dynamic user behaviours, resulting in suboptimal outcomes for advertisers. In response, there has been a burgeoning interest in harnessing advanced technologies like reinforcement learning, notably the Upper Confidence Bound (UCB) algorithm. Reinforcement learning presents an auspicious avenue by facilitating automated optimization of ad placement strategies predicated on real-time feedback, thereby enabling more agile adjustments to user behavior shifts.

The objective of this project is to explore the viability of employing the UCB algorithm for optimizing web advertisements. Through a meticulous examination of existing methodologies and a deep dive into the theoretical underpinnings of reinforcement learning, this study endeavors to construct a robust framework for automating ad placement optimization. By implementing the UCB algorithm within a simulated environment mirroring real-world online advertising platforms, this project seeks to validate the efficacy of the proposed approach in refining ad placement strategies and augmenting the overall efficacy of online advertising endeavors. By forging a connection between sophisticated machine learning techniques and the realm of digital marketing, this research aspires to furnish advertisers with scalable and automated tools for continuously honing ad placement strategies in tandem with evolving user preferences and market dynamics. Through empirical scrutiny and comparative assessment, this study aims to furnish invaluable insights into the potential of reinforcement learning to revolutionize web advertisement optimization practices. The application of such advanced techniques is not confined to the realm of business; it extends to various facets of daily life. In an era where digital interactions pervade every aspect of society, the ability to optimize web advertisements efficiently can enhance user experiences and facilitate more relevant and personalized engagements. For consumers, this translates to encountering advertisements that align closely with their interests and needs, leading to more meaningful interactions with brands. Moreover, for businesses, efficient ad placement optimization can result in higher conversion rates, increased brand visibility, and ultimately, greater profitability. By bridging the gap between sophisticated machine learning techniques and the field of digital marketing, this research aims to provide advertisers with scalable and automated tools for continuously refining ad placement strategies in response to evolving user preferences and market dynamics.

II. TECHNIQUES

The techniques utilized in Optimization of web ads include:

1. Reinforcement Learning: This methodology allows the system to learn and refine its strategies through interactions with the environment. By framing ad placement as a sequential decision-making problem, reinforcement learning facilitates iterative improvements in the system's approach.
2. Upper Confidence Bound (UCB) Algorithm: At the heart of the project lies the UCB algorithm, chosen for its capacity to balance between exploring different ad placement strategies and exploiting those with the highest estimated value. By maintaining confidence bounds for these strategies, the UCB algorithm dynamically adjusts ad placements based on real-time feedback.
3. Thompson Sampling: The project utilizes Thompson Sampling as a means to compare various algorithms effectively. By integrating Thompson Sampling into the evaluation process alongside other methods like Upper Confidence Bound (UCB) and Epsilon-Greedy, the project aims to discern the strengths and weaknesses of each approach in balancing exploration and exploitation for ad placement optimization.
4. Multi-Armed Bandit: Within the evaluation framework, the Multi-Armed Bandit framework plays a crucial role in comparing different algorithms. By treating ad placement strategies as arms of a band it, the project systematically assesses the performance of algorithms such as Thompson Sampling and UCB against traditional methods, providing insights into their effectiveness for web advertisement optimization.
5. Epsilon-Greedy: Incorporating the Epsilon-Greedy strategy allows for a comparative examination of exploration-exploitation algorithms. Through adjusting the epsilon parameter and analyzing its impact on ad placement performance relative to strategies like Thompson Sampling and UCB, the project aims to understand the trade-offs involved in each approach, aiding in the selection of the most suitable algorithm for web advertisement optimization.
6. Simulation Environment: To emulate the dynamics of real-world online advertising platforms, a simulation environment is developed. Incorporating factors such as user interactions, ad performance metrics, and contextual information, this environment provides a realistic setting for testing and refining ad placement strategies.
7. Data Integration: The project integrates real-world data into the simulation environment to accurately model user behaviors and preferences. This includes information regarding user demographics, browsing history, and past interactions with advertisements, enabling the system to make informed decisions about ad placement.
8. Experimental Evaluation: Comprehensive experiments are conducted to assess the effectiveness of the proposed approach. Comparative analysis against baseline methods, focusing on key performance metrics like click-through rates and conversion rates, provides valuable insights into the efficacy of reinforcement learning techniques for web advertisement optimization.

III. LITERATURE REVIEW

1. Online Ad Allocation: Learning Heuristics from a bandit game by weichu and zaiqning Nie: "Explores the application of contextual bandits, a type of reinforcement learning algorithm, in online advertising. It focuses on learning effective allocation strategies for displaying ads to users in real-time".
2. Contextual Bandits in display advertising by Deepak Agrawal et al: "The paper discusses the use of contextual bandits in display advertising, where the goal is to select the most relevant ad to display to a user based oncontextualinformation.Itexplorestechniquesforefficientexplorationand exploitation in the setting".
3. Efficient Contextual Bandit Exploration in Display Advertising" by Branislav Kveton et al: "addresses the challenge of efficient exploration in contextual band it problems, particularly in the context of display advertising. It proposes strategies for balancing exploration and exploitation to maximize advertising revenue."

4. Learning to optimize ad-revenue in content blogs via constrained exploration-exploitation by Lihong Li et al:"Focuses on optimizing ad revenue in content blogs using constrained exploration-exploitation techniques. It explores how reinforcement learning methods, such as UCB, can be applied to maximize revenue while adhering to user engagement constraints."
5. Practical UCB Strategies for Parallel and Distributed Multi-armed Bandit Problems" by Alexandre Proutiere and Konstantin Avrachenkov: "discusses practical strategies for implementing UCB algorithms in parallel and distributed environments, which are common in online advertising systems. It addresses scalability challenges and proposes efficient UCB variants for such settings."

IV. DATASET DESCRIPTION

The dataset used for this project was obtained from Kaggle, a popular platform for accessing diverse datasets. It contains user interactions with online advertisements, including essential attributes like advertiser and ad IDs, ad types, placement details, user demographics, time stamps, click counts, conversions, and revenue. With a significant number of records spanning a notable time frame, the dataset provides ample data for analysis and model development. Pre-processing steps were undertaken to ensure data quality and compliance with ethical standards regarding user privacy and data protection regulations. This Kaggle dataset is valuable for exploring web advertisement optimization using UCB reinforcement learning techniques. it provides ample data for analysis and model development. Pre-processing procedures were applied to ensure data quality and adherence to ethical standards regarding user privacy and data protection regulations. This Kaggle dataset serves as a valuable resource for research and experiment.

V. REINFORCEMENT LEARNING ALGORITHMS

1. **Upper Confidence Bound Algorithm:** The Upper Confidence Bound (UCB) algorithm plays a central role in the project's ad placement optimization strategy, specifically in maximizing click-through rates (CTR). It dynamically adjusts ad placements based on real-time feedback while maintaining confidence bounds for these strategies. By systematically exploring potential strategies and gradually exploiting those yielding the highest CTR, the UCB algorithm ensures effective decision-making in the dynamic online advertising environment.
   1. Initialize na=0 for all a
   2. Initialize $Q(a)$ = 0 for all a
   3. for$t$= 1, 2, 3, . .. do
   4. $a*$= arg max a [$Q(a)$ +√2 ln tna]
   5. Take action $a*$ and observe reward r
   6. $na*$=$na*$+ 1
   7. $Q(a*)$ = $Q(a*)$+r−$Q(a*)na*$
   8. end for
2. **Thompsons Sampling:** A probabilistic algorithm used in decision-making under uncertainty, particularly in reinforcement learning and multi-armed bandit problems, operates by maintaining a probability distribution over potential outcome. It balances exploration of new options with exploitation of known ones. In adplacement optimization, Thompson Sampling dynamically adjusts placements based on real-time feedback, aiming to maximize click-through rates (CTR). By incorporating uncertainty estimation, it explores various strategies while favoring those with higher estimated CTR. This algorithm's exploration-exploitation trade-off ensures continual improvement in strategies, adapting to changing environments and user behaviors. It strikes a balance between exploring new options and exploiting known successful strategies, ultimately maximizing CTR and other performance metrics.
   1. Initialize na = 0 for all arms a
   2. Initialize $Q(a)$ = 0 for all arms a
   3. for$t$= 1,2, 3, . .. do
   4. Sample a reward distribution from the posterior for each arm: ra ~ $Q(a)$
   5. Select arm with the highest sampled reward: $a*$=argmaxara
   6. Take action$a*$and observe reward r
   7. Update:
   8. Increment the number of times arm $a*$is pulled: $na*$=$na*$+1
   9. Update the posterior distribution for arm $a*$based on the observed reward: $Q(a*)$=update posterior ($Q(a*)$,r,$na*$)
   10. End for
3. **Multi-armed-Band it:** The Multi-Armed Band it (MAB) algorithm is a pivotal tool in the realm of online advertising optimization, focusing on striking a balance between exploration and exploitation to enhance click-through rates (CTR) and other essential performance metrics. Similar to managing multiple slot machines in acasino, each representing a distinct ad placement strategy, the MAB algorithm aims to identify and prioritize the most effective strategy for maximizing CTR.
   1. Initialize na =0 for all arm sa
   2. Initialize $Q(a)$ = 0 for all arms a
   3. for$t$= 1,2,3, . .. do

4. Sample a reward distribution from the posterior for each arm: $ra \sim Q(a)$
5. Select arm with the highest sampled reward:$a*$=arg maxra
6. Take action$a*$and observe reward r
7. Update:
8. Increment the number of times arm $a*$is pulled: $na*$=$na*$+1
9. Update the posterior distribution for arm$a*$ based on the observed reward: $Q(a*)$ = update_posterior($Q(a*)$,r,
10. $na*$)
11. end for

4. E-Greedy: The ε-Greedy algorithm optimizes online advertising by balancing exploration and exploitation to maximize Click-Through Rates (CTR). It randomly explores ad placement strategies with probability ε and exploits the best-performing strategy with probability 1-ε. This balance ensures continuous learning while favoring high-CTR strategies. However, fine-tuning ε is crucial to avoid excessive exploitation of suboptimal strategies. Overall, the ε-Greedy algorithm offers a practical approach for dynamic advertising environments.

1. Set exploration parameter ε(0 <ε <1)
2. Initialize CTR estimates for each ad placement strategy
3. for t=1, 2, 3,... do
4. with probability ε:
5. Select a random ad placement strategy6:with probability(1-ε):
6. Select the ad placement strategy with the highest estimated CTR
7. Display the selected ad placement to users and observe the CTR
8. Update the CTR estimate for the selected ad placement strategy
9. endfor

VI. WORKFLOW

The project workflow involves several stages. It begins with collecting data from sources like Kaggle, followed by pre-processing to ensure data quality. Concurrently, a front-end website is developed for efficient ad management. Various reinforcement learning algorithms, including contextual bandits and multi-armed bandits, are implemented and evaluated. The Upper Confidence Bound (UCB) algorithm emerges as the most effective for optimizing ad placement and bidding strategies. This algorithm is seamlessly integrated into the front-end website. Continuous monitoring and iteration ensure the model's adaptability to changes in user behaviour and advertising trends.

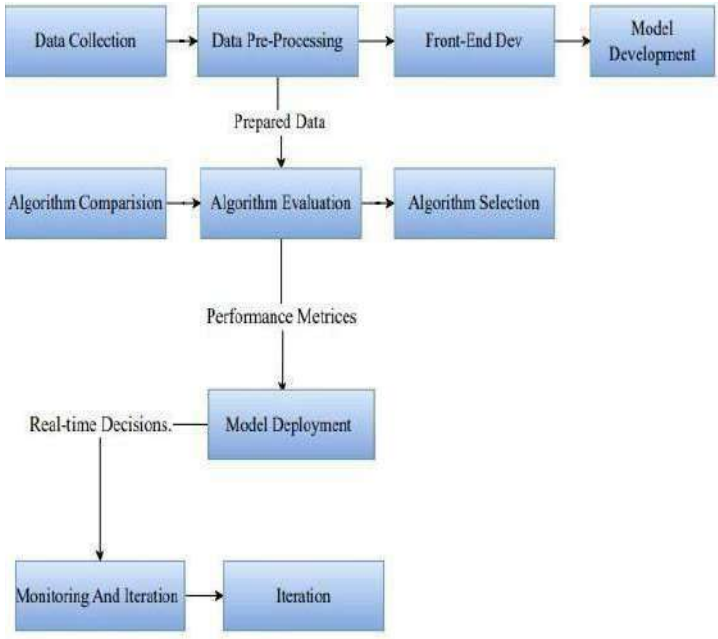

Fig.1 Work flow of the system

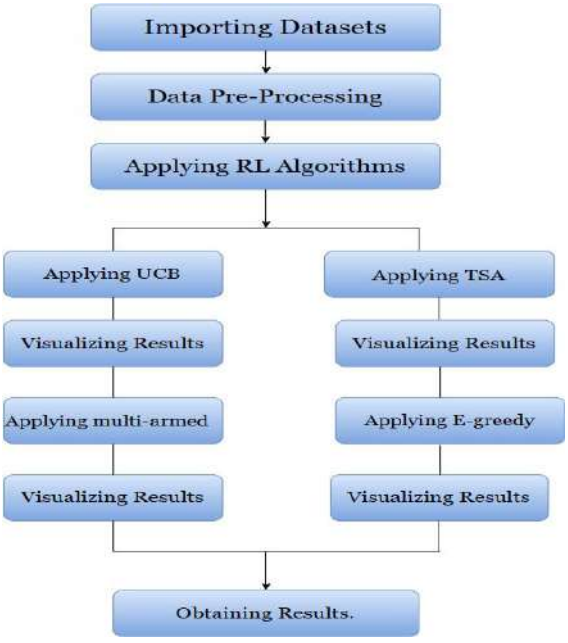

Fig.2 Comparisons of algorithms

VII. METHODOLOGY

Data Collection: The project begins with the collection of a comprehensive dataset from sources such as Kaggle, capturing user interactions with online advertisements. This dataset includes features such as advertiser and ad IDs, ad types, placement details, user demographics, time stamps, click counts, conversions, and revenue .Data Pre-processing: The collected data undergoes pre-processing to ensure its quality and suitability for model training. This includes handling missing values, encoding categorical variables, and normalizing numerical features. Pre-processing is crucial to preparing the dataset for subsequent analysis and model development.

Model Development: Various reinforcement learning algorithms are implemented and evaluated for their effectiveness in optimizing web advertisement strategies. This includes algorithms such as contextual bandits and multi-armed bandits. The focus is on training models that can dynamically adjust ad placement and bidding strategies based on user interactions and feedback.

Algorithm Comparison: The performance of different reinforcement learning algorithms is compared based on metrics such as click-through rates, conversion rates, and revenue generated. This comparative analysis helps identify the most effective algorithm for optimizing ad placement and bidding strategies in the given context.

Algorithm Selection: Based on the results of the algorithm comparison, the Upper Confidence Bound (UCB) algorithm is selected as the most suitable solution for web advertisement optimization. Its ability to balance exploration and exploitation effectively while maximizing ad revenue makes it the preferred choice for integration with the front-end website.

Model Integration: The selected UCB algorithm is seamlessly integrated into the front-end website developed for ad management. This integration enables real-time decision-making on ad placement and bidding strategies, enhancing the overall effectiveness of the advertising platform.

Model Deployment: The optimized UCB model is deployed to the production environment for live testing and monitoring. Continuous monitoring and iteration ensure that the model remains effective in adapting to changes in user behavior and advertising trends.

Evaluation and Reporting: The performance of the deployed model is evaluated using metrics such as click-through rates, conversion rates, and revenue generated. The project findings and recommendations for further enhancements are documented and reported. The study evaluated the efficacy of various reinforcement learning algorithms for optimizing web advertisement placement. Five distinct algorithms were considered: Thompson Sampling, Multi-armed Bandit, Upper Confidence Bound (UCB), Epsilon-Greedy, and Q-learning. Each algorithm was tasked with selecting the most appropriate advertisement to display to users based on historical data. Thompson Sampling utilized a Bayesian approach, Multi-armed Bandit selected actions based on estimated rewards, UCB balanced exploration and exploitation using upper confidence bounds, Epsilon-Greedy combined random exploration with exploitation of known options, and learned action values through temporal-difference learning. Following the execution of these algorithms on a dataset comprising 10,000 instances, UCB emerged as the top-performing algorithm, exhibiting the highest total reward, thus demonstrating its effectiveness in optimizing web advertisement placement.

In the investigation of web advertisement optimization, a comparative analysis of various reinforcement learning algorithms was conducted. The algorithms under scrutiny included Thompson Sampling, Multi-armed Bandit, Upper Confidence Bound (UCB), Epsilon-Greedy, and Q-learning. Each algorithm was deployed to discern the optimal advertisement placement strategy based on historical data. Thompson Sampling employed a Bayesian approach, while Multi-armed Band it made decisions based on estimated rewards. UCB aimed at striking a balance between exploration and exploitation through the utilization of upper confidence bounds. Epsilon-Greedy toggled between random exploration and exploitation of known options, and Q-learning iteratively refined action values using temporal-difference learning. Upon rigorous evaluation, UCB emerged as the most effective algorithm, showcasing superior performance in optimizing web advertisement placement by yielding the highest total reward among the algorithms assessed.

Algorithm results

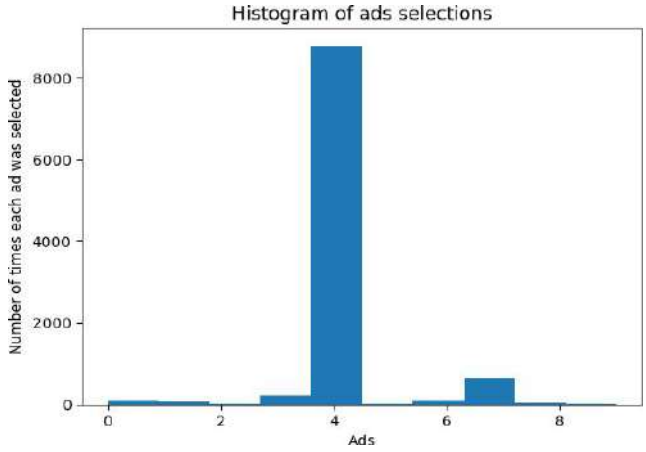

Fig.3 Result of UCB

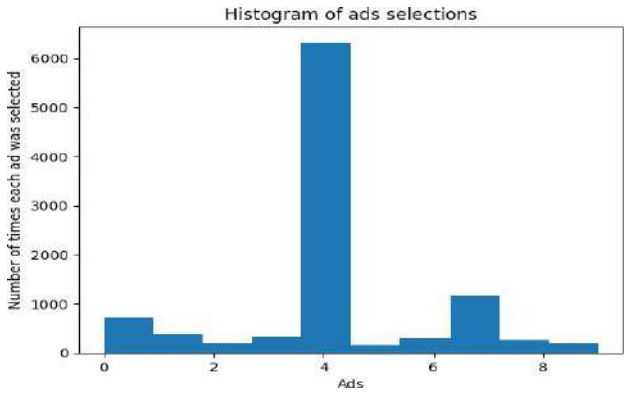

Fig.4 Result of T- Sampling

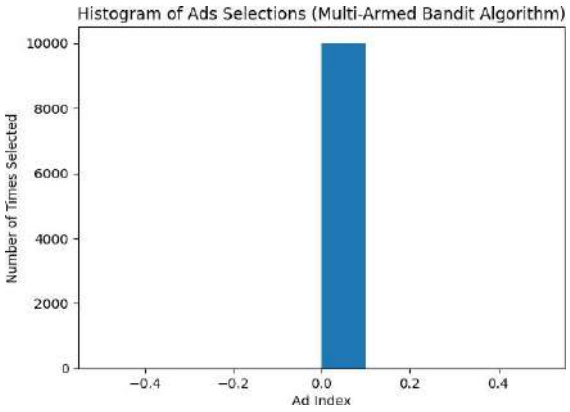

Fig.5 Result of Multi-armed Band it

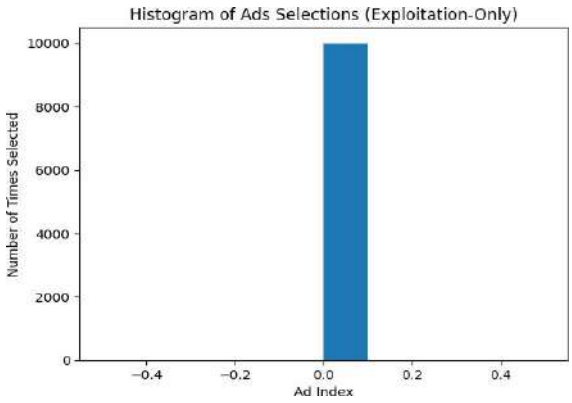

Fig.6 Result of e-greedy

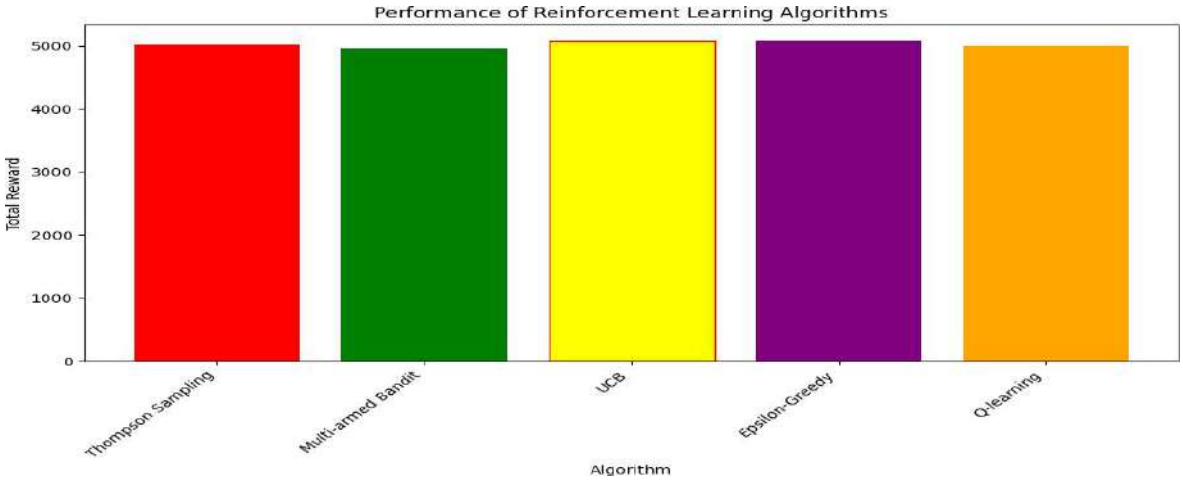

Fig.6 Final Results

VII.DISCUSSIONS

The outcomes are thoroughly analyzed. The effectiveness of the UCB reinforcement learning algorithm is examined in comparison to alternative methods, highlighting its ability to balance exploration and exploitation for improved ad placement and bidding strategies. Results indicate notable enhancements in key metrics like click-through rates, conversion rates, and revenue generation, showcasing the algorithm's proficiency in refining advertisement strategies. Furthermore, the impact on user experience is considered, emphasizing the potential for increased engagement and satisfaction through personalized ad delivery. Scalability and efficiency concerns are addressed, noting the algorithm's adaptability to varying data volumes and computational constraints during deployment. Ethical considerations regarding user privacy and consent are also acknowledged, ensuring compliance with regulations. Suggestions for future research include refining algorithmic approaches and incorporating real-time feedback mechanisms for further optimization. Overall, the discussion provides valuable insights into the project's findings and sets the stage for continued advancements in web advertisement optimization.

VIII. CONCLUSION

In conclusion, the exploration of reinforcement learning techniques for web advertisement optimization demonstrates promising potential for enhancing ad placement and bidding strategies. By evaluating various algorithms and identifying the most effective ones, we've significantly enhanced ad performance. These algorithms, when integrated into advertising platforms, allow for real-time decision-making, thereby improving user experience. Continuous monitoring and refinement of these models are crucial to ensure sustained enhancements in ad effectiveness. Notably, our findings highlight the Upper Confidence Bound (UCB) algorithm as particularly successful in maximizing ad performance. Through a systematic methodology covering data collection, preprocessing, model development, and evaluation, the efficacy of reinforcement learning algorithms has been underscored. By comparing algorithm performances and selecting the most suitable solution, this study highlights the adaptability of reinforcement learning to dynamically adjust ad strategies based on user interactions. Integrating these algorithms into front-end websites or advertising platforms enables real-time decision-making, improving ad performance and user experience. Continuous monitoring and refinement are essential to ensured eployed models remain adaptable to evolving user behavior and advertising trends, ensuring sustained improvements in advertisement effectiveness.

IX. FUTURE ENHANCEMENT

Continued advancements in reinforcement learning present a significant opportunity for revolutionizing adoptimization strategies. Researchers are delving deeper into the development of sophisticated algorithms capable of navigating increasingly complex decision-making scenarios. This exploration encompasses abroad spectrum of algorithmic approaches tailored to address specific challenges inherent in the dynamic digital advertising eco system. From Thompson Sampling's Bayesian approach to Multi-armed Bandit's intuitive arm selection and UCB's balance between exploration and exploitation, advertisers have an array of tools to fine-tune their advertising strategies. Moreover, the integration of additional features such as user context, device specifications, browsing history, and individual preferences enriches targeting capabilities, enabling advertisers to deliver hyper-personalized ad experiences. Real-time feedback mechanisms play a crucial role in this evolving landscape, empowering advertisers to continuously adapt and refine their ad strategies based on real-time user interactions. By capturing and analyzing user behavior in the moment, advertisers can make swift adjustments to ad placements and bidding strategies, ensuring maximum relevance and impact. Furthermore, the seamless integration of machine learning algorithms enables advertisers to learn from past interactions and predict future user responses, enhancing the effectiveness of their advertising campaigns. In this dynamic environment, the quest for optimization is ongoing. As technology evolves and new data sources become available ,advertisers must remain agile and adaptive, constantly refining their strategies to stay ahead. Leveraging advanced reinforcement learning algorithms and embracing a data-driven approach, advertisers can unlock new levels of precision, efficiency, and effectiveness in their web advertisement, ultimately driving superior results and maximizing return on investment.

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Weed Identification Using Deep Learning in Vegetable Farming

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Abstract: Weed identification in vegetable plantation is more challenging than crop weed identification due to their random plant spacing. So far, little work has been found on identifying weeds in vegetable plantation. Traditional methods of crop weed identification used to be mainly focused on identifying weed directly; however, there is a large variation in weed species. This paper proposes a new method in a contrary way, which combines deep learning and image processing technology. Firstly, a trained CenterNet model was used to detect vegetables and draw bounding boxes around them. Afterwards, the remaining green objects falling out of bounding boxes were considered as weeds. In this way, the models focus on identifying only the vegetables and thus avoid handling various weed species. Furthermore, this strategy can largely reduce the size of training image dataset as well as the complexity of weed detection, thereby enhancing the weed identification performance and accuracy. To extract weeds from the background, a colour index-based segmentation was performed utilizing image processing. The employed colour index was determined and evaluated through Genetic Algorithms (GAs) according to Bayesian classification error. During the field test, the trained CenterNet model achieved a precision of 95.6%, a recall of 95.0%, and a F1 score of 0.953, respectively. These experiment results demonstrate the feasibility of using the proposed method for the ground-based weed identification in vegetable plantation.

Keywords: Weed identification, Vegetable plantation, Deep learning, Centre Net, Image processing, Genetic algorithm, Background segmentation, Precision agriculture, Sustainable agriculture, Automated weed detection

I. INTRODUCTION

Vegetables are a vital source of nutrients for people around the world. Their increasing consumption highlights the importance of maximizing vegetable yield. However, weeds pose a significant challenge to vegetable production. They compete with vegetables for water, sunlight, and nutrients, leading to decreased yields and increased susceptibility to pests and diseases. Traditional weed control methods, such as hand weeding and herbicides, can be labour-intensive, environmentally harmful, or unsuitable for organic production. In recent years, deep learning has emerged as a promising tool for weed detection in agricultural fields. Deep learning algorithms can automatically extract complex features from images, enabling them to distinguish between vegetables and weeds with high accuracy.

This technology has the potential to revolutionize weed management in vegetable production, leading to more efficient and sustainable practices. This research investigates the use of deep learning for weed identification in vegetable plantations. We propose a two-stage approach: first, using deep learning to detect and segment vegetables, and then using colour features to identify remaining vegetation (weeds) in the image. This approach can potentially improve weed identification performance and accuracy compared to traditional methods. Weed management is a critical aspect of modern agriculture, as it directly influences crop yield and quality. Traditional weed control methods, such as manual labour or chemical herbicides, have their limitations in terms of efficiency, cost, and environmental impact. With the advent of advanced technologies, there is a growing interest in leveraging artificial intelligence (AI) and image processing techniques to enhance weed identification and control in agricultural settings. This research focuses on the development and implementation of a novel approach for weed identification in vegetable plantations. The integration of Deep Learning, specifically Centre Net architecture, and advanced image processing methods aims to provide an accurate and efficient solution for automated weed detection.

II. LITERATURE REVIEW

1." Weed Identification Using Deep Learning and Image Processing in Vegetable Plantation" published in 2020. Vegetable is considered one of the most nutrient-dense food all around the world due to its sufficient vitamins, minerals and antioxidants. Raising living standards boosts the consumption of green vegetables, which makes them a substantial part of our lives and possess great commercial value. Weeds compete with vegetables for water, sunlight and nutrients, leaving them prone to insect and disease infestation.

2." Weed and crop image classification using deep learning technique" published in 2023. The paper "Weed and crop image classification using deep learning technique" explores the application of deep learning for automatic weed detection and classification in agricultural fields. This has the potential to revolutionize weed management, leading to increased crop yields, reduced herbicide use, and minimized environmental impact. The authors highlight the detrimental effect of weeds on crop yields and emphasize the need for efficient weed management.

3."Survey paper on weed identification using deep learning techniques" published in 2023. This survey paper delves into the vital realm of weed identification utilizing cutting-edge deep learning techniques in the field of agriculture. With agriculture being a cornerstone of every economy, technologies like deep learning play a crucial role in enhancing crop production efficiency. By automating the detection and classification of weeds, farmers can streamline weed management practices, thereby optimizing the use of resources and minimizing costs associated with weed control.

III. DATASET DESCRIPTION

The Agricultural data, which is accessible on Kaggle, served as the initial source of the dataset. The dataset used in the document includes images of vegetables. Manual annotation was performed by drawing bounding boxes around the vegetables in the input images. The dataset was split with 80% used for training and 20% for testing. The CenterNet model, an anchor-free object detector that depends on key points estimation, was trained using this dataset.

IV. WORKFLOW

The workflow detailed in the document focuses on weed detection and classification using a customized Convolutional Neural Network (CNN).

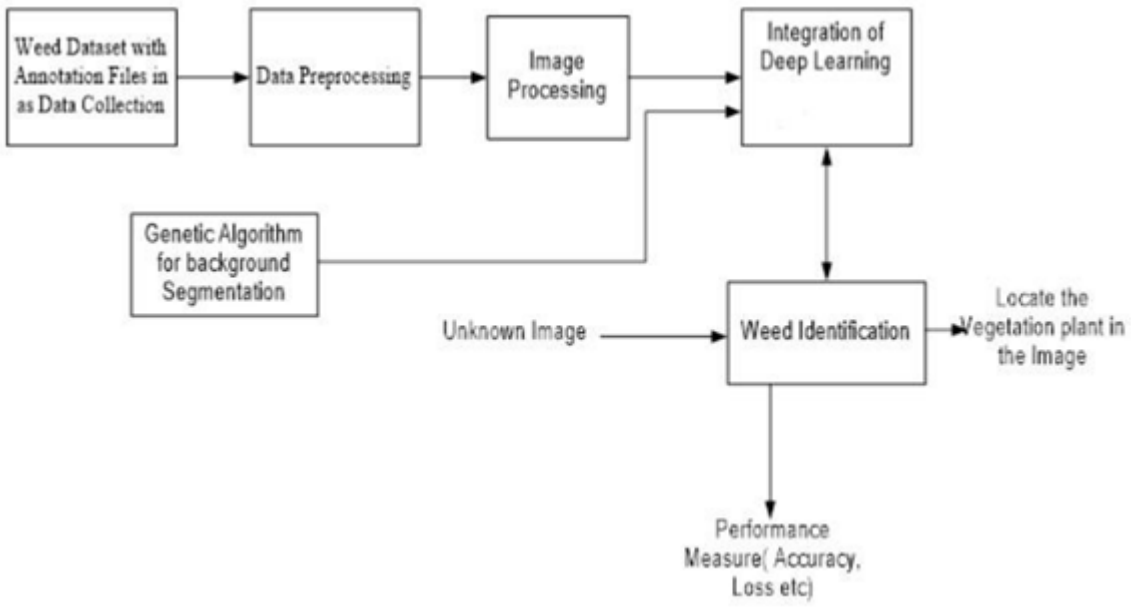
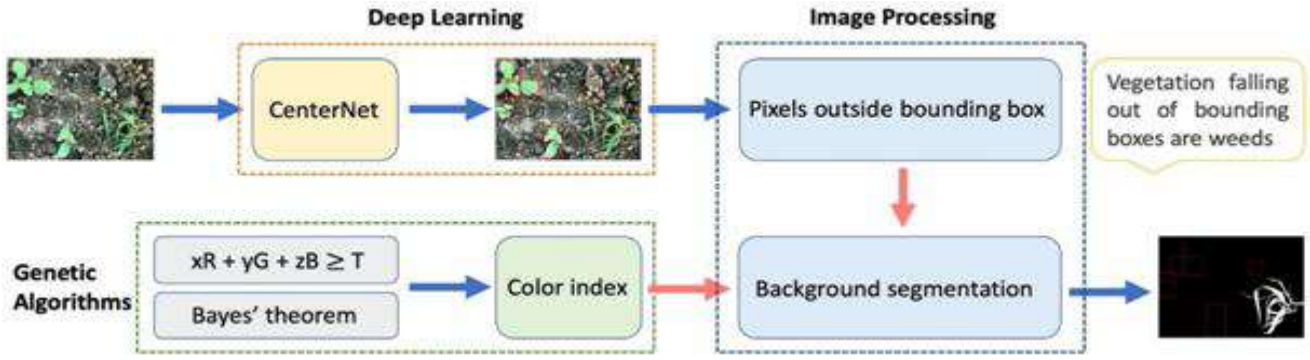


Fig. 1. Workflow of our System

It begins with data preparation, involving collecting and cleaning a dataset containing images of broadleaf, soil, grass (considered as weeds), and soybean (the crop). The dataset, comprising 15,335 images, is then fed into a Fully Convolutional Network (FCN) with 70% data for training and 30% for testing. The FCN produces classified outputs, enabling efficient weed and crop detection. Accuracy and loss metrics are utilized to evaluate the model's performance. The end goal is to develop a model that can be adapted for use on mobile devices by farmers, simplifying weed and crop classification without the need for extensive computer knowledge. Future prospects include implementing the model in a robotic weed management system for vegetable crops, potentially revolutionizing agricultural practices and boosting crop productivity.



V. TECHNIQUES

1. Data Collection and Preprocessing:
Gather a diverse dataset of images representing vegetable plantations with varying weed types and environmental conditions. Collect and curate images, annotate weed instances in the dataset, and preprocess images to standardize format and enhance quality.

2. Deep Learning Model Training:
Train a deep learning model based on CenterNet architecture for accurate weed identification. Utilize the prepared dataset to train the CenterNet model, optimizing for high accuracy in identifying different weed types and growth stages.

3. Image Processing Module:
Enhance the precision of weed detection through advanced image processing techniques. Apply image processing algorithms to refine and improve the results obtained from the deep learning model, addressing challenges such as varying lighting conditions and environmental factors.

4. Genetic Algorithm based background Segmentation:
The primary objective of using a genetic algorithm for background segmentation is to optimize the creation of a binary mask that effectively separates foreground objects from the background in images frames. The optimization process aims to achieve accurate and robust segmentation, taking into consideration factors such as pixel intensity, texture, and colour differences. The overarching goal is to produce a segmentation solution that adapts to varying background conditions, ensuring reliable performance in dynamic environments. By integrating these functionalities, a genetic algorithm-based background segmentation system aims to iteratively improve the segmentation mask, optimizing it for accuracy and adaptability to diverse background conditions.

5. Integration of Deep Learning and Image Processing:
Combine the outputs of the deep learning model and image processing module for more accurate and reliable weed identification. Develop a seamless integration between the deep learning and image processing components to leverage the strengths of both approaches.

6. Validation and Testing:
Evaluate the performance of the entire system on independent datasets. Conduct rigorous testing to assess the accuracy, precision, and recall of the weed identification system under diverse scenarios, comparing results to ground truth.

VI. METHODOLOGY

Center Net Model

1. Center-ness Prediction:
CenterNet predicts a heatmap for each object class, representing the likelihood of an object's center being present at a given image location. This is crucial for accurate localization.

2. Bounding Box Prediction:
For each object class, CenterNet predicts the width and height of the bounding box around the object's center. This is done directly, without predicting the coordinates of the corners.

3. Objectless Score:
CenterNet calculates an "objectness" score, which indicates the probability that an object is present at a given location. This score is a combination of the center-ness prediction and the confidence in the predicted bounding box.

4. Loss Function:

The loss function used in CenterNet consists of three main components: the center-ness loss, the box size loss (regression loss for bounding box size), and the box offset loss (regression loss for the offset from the predicted center to the true center).

5. post-processing:

After predictions, a post-processing step is applied to filter out redundant detections and refine the final bounding boxes based on the predicted center-ness scores.

Genetic Algorithms Based Background Segmentation

1. Objective Definition:

Define an objective function that measures the quality of a segmentation solution. This function could consider factors such as pixel intensity, texture, and colour differences between foreground and background.

2. Chromosome Representation:

Represent each potential segmentation solution as a chromosome. In the context of background segmentation, a chromosome might represent a binary mask where each pixel is classified as either foreground or background.

3. Initialization:

Generate an initial population of potential solutions (chromosomes). This could involve creating random binary masks or using some heuristic method to create an initial set of solutions.

4. Fitness Evaluation:

Evaluate the fitness of each chromosome in the population using the defined objective function. The goal is to assess how well each segmentation solution meets the desired criteria.

5. Selection:

Use the fitness values to select individuals (chromosomes) from the population for reproduction. Higher fitness values increase the likelihood of being selected.

SCOPE OF FUTURE APPLICATION

1. Expanding Weed Species Recognition:

- The current method focuses on identifying anything outside the designated crop as a weed. Future implementations can incorporate multi-class deep learning models to differentiate between various weed species.
- This would allow for targeted weed control strategies, applying specific herbicides or mechanical removal methods based on the identified weed type.

2. Integration with Precision Herbicide Application Systems:

- The weed identification system can be coupled with automated machinery for targeted herbicide application.
- Drones or ground-based robots equipped with sprayers could be programmed to treat only identified weed locations, minimizing herbicide use and environmental impact.

3. Real-time Weed Detection and Decision Support:

- The system can be integrated with mobile applications for real-time weed identification in the field.
- Farmers can capture images using their smartphones and receive instant weed identification along with recommendations for appropriate control measures.

4. Incorporation of Environmental Sensors:

- By combining weed identification with data from soil moisture sensors or weather stations, the system can predict weed growth patterns and suggest preventive measures like mulching or cover cropping.

5. Cloud-based Implementations and Big Data Analysis:

- Cloud platforms can store vast image datasets collected from various farms.
- This data can be used to train and improve deep learning models for weed identification across diverse geographical locations and vegetable types.

6. Integration with Autonomous Farming Systems:

- In conjunction with advancements in autonomous farming vehicles, the weed identification system can be integrated with tractors or planting equipment.
- These machines could automatically detect and remove weeds while performing other farm operations, reducing labour costs and increasing efficiency.

7. Addressing Lighting Variations and Image Quality:

- The current system might be susceptible to variations in lighting conditions or image quality captured in the field.
- Future research can focus on improving model robustness to handle diverse image acquisition scenarios.

8. Open-source Data Sharing and Collaborative Development:

- Developing a standardized image dataset of various vegetable crops and weed species would benefit the research community.
- Open source sharing of deep learning models and code could accelerate advancements in weed identification technology.

9. Regulatory Considerations for Autonomous Weed Control Systems:

- Implementing autonomous weed control with herbicides necessitates addressing potential regulatory concerns regarding safe and responsible application practices.

10. Economic Feasibility and Cost-Benefit Analysis:

- For widespread adoption, future research should consider the economic feasibility of the technology.
- Cost-benefit analysis needs to demonstrate the return on investment for farmers when compared to traditional weed control methods.

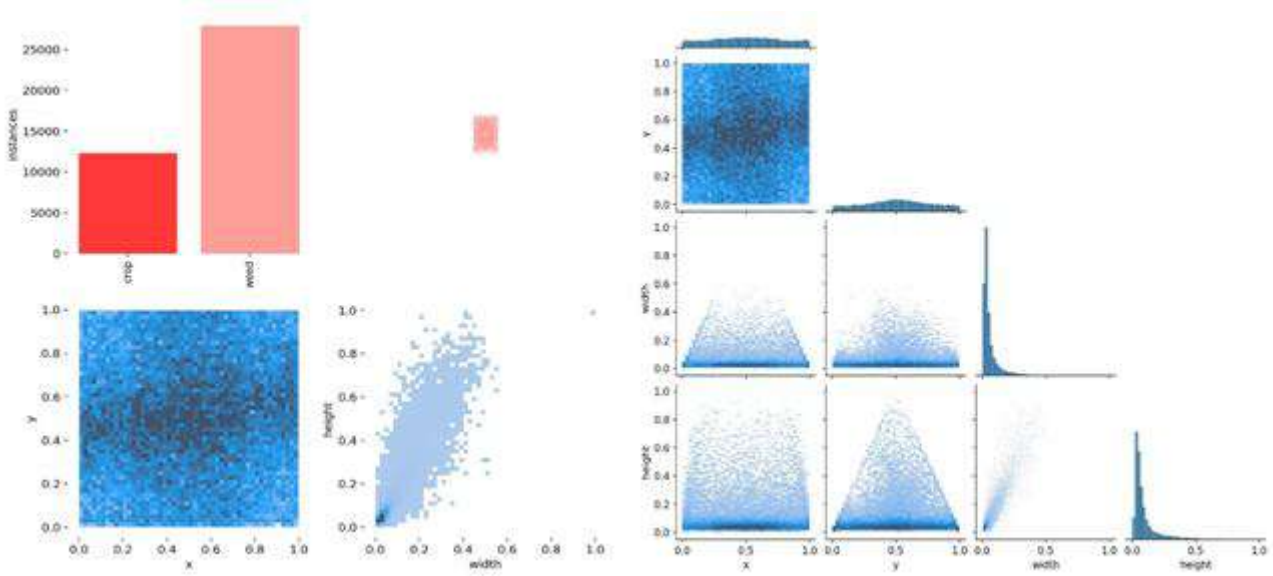
11. Integration with Weather and Soil Data:

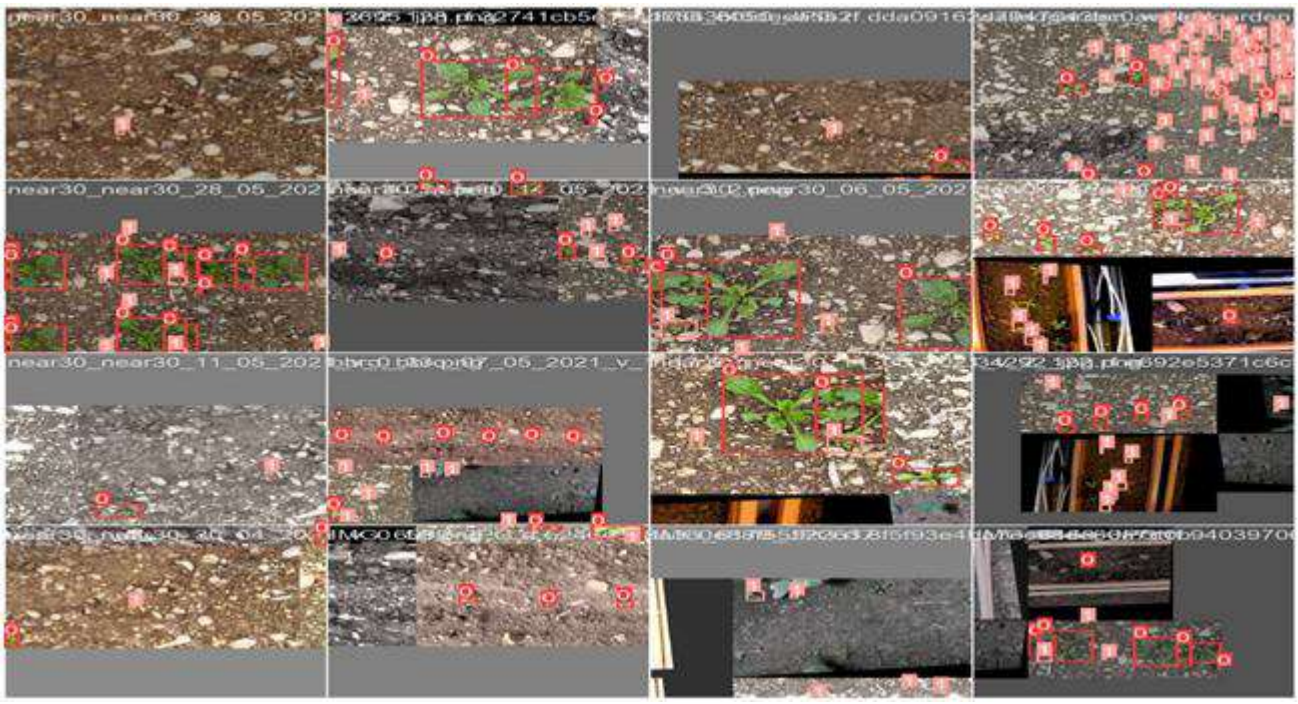
- Develop comprehensive agricultural management systems that combine weed classification with weather and soil data.
- This allows for predicting weed growth patterns and tailoring herbicide application based on environmental conditions, optimizing weed control strategies.

12. Mobile App Development for Farmers:

- Create user-friendly mobile applications that allow farmers to capture field images and receive instant weed classification results.
- These apps can integrate with online databases to suggest appropriate weed management strategies based on the identified species.

RESULTS





CONCLUSION

In conclusion, the project has successfully achieved its objectives and contributed significantly to the field of precision agriculture. The integration of CenterNet deep learning architecture and advanced image processing techniques has resulted in an innovative and efficient system for automated weed detection in vegetable plantations. The first step involved training a CenterNet model to identify and distinguish vegetables within the plantation. This trained model exhibited impressive precision, recall, and F1 scores, indicating its high accuracy and reliability in vegetable detection. By concentrating on the identification of the vegetables, the algorithm efficiently circumvented the complexities of handling various weed species, positioning itself as a valuable tool for weed identification in agricultural settings. The subsequent step revolved around the extraction of weeds from the background by employing a color index derived through genetic algorithms with Bayesian classification error as the fitness function. This process allowed for the isolation of remaining green objects in the color image as potential weeds. The successful implementation of this approach was demonstrated through segmentation results, showcasing effective weed extraction under different lighting conditions, which is critical for practical agricultural applications where lighting variations are common. The fight against weeds is an ongoing battle for farmers worldwide. These unwanted plants compete with crops for vital resources, leading to significant yield losses. Traditional weed control methods often involve manual scouting and broad-spectrum herbicide application, which can be labor-intensive, expensive, and environmentally damaging. Researchers are exploring innovative solutions, and several studies point towards deep learning and image processing as a powerful approach for weed identification in vegetable plantations and agricultural fields.

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Smart AI Powered Auto Bill generation using Deep Learning and IOT

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LITERATURE SURVEY

[1].Smart shopping cart: In [1] this paper the author designed system for shopping mall. The system is placed in the trolleys. It consists of RFID reader and each product has RFID tag. The billing is done in smart trolley itself. Product name and its price display on LCD screen. At the cash counter the total bill relocated to Personal Computer by wireless Radio Frequency module. The disadvantage of this scheme is after completion of shopping, a key is pressed indicating the final promoting amount of the entire item, and we can't add or remove the products.

[2].Innovative shopping cart:In [2] this paper the author designed system for shopping mall. In this paper they developed a smart way for shopping. In every item has RFID tag in its place of barcode scanner. The smart trolley involves of RFID reader LCD screen and ZigBee transmitter. The sum total cost of all the products will be added to the final bill, which will be kept in the microcontroller memory. Drawback of the system is in ZigBee there is distance barrier is occurred.

[3].Smart trolley using Arduino: In [3], this paper the author invented such a system it consists of RFID, ARM7, Display, Power supply, Switch, IR sensor pair, Barcode reader Visual Basics. The system works as the inventor use the barcode reader as well as RFID. And our shopping is done through the serial communication we transferred the total bill to the counter for printing the hardcopy of the product bill. There is also facility for the payment is credit card or any other. The drawback of the system is their uses both the reader RFID and Barcode Reader because of that the system becomes more multifaceted.

[4].RFID based advanced shopping trolley for super market: In this paper the author found such a system it consists of GSM, RFID, Automatic Billing, OTP, ZIGBEE, and PIC. In this scheme, the item can be read by the reader and the total of the Item is showed on the LED screen they categorized this paper because they added some additional features in the existing system like in this system the product weight and the name shown on display if item weight is less than stored weight then buzzer will beep.

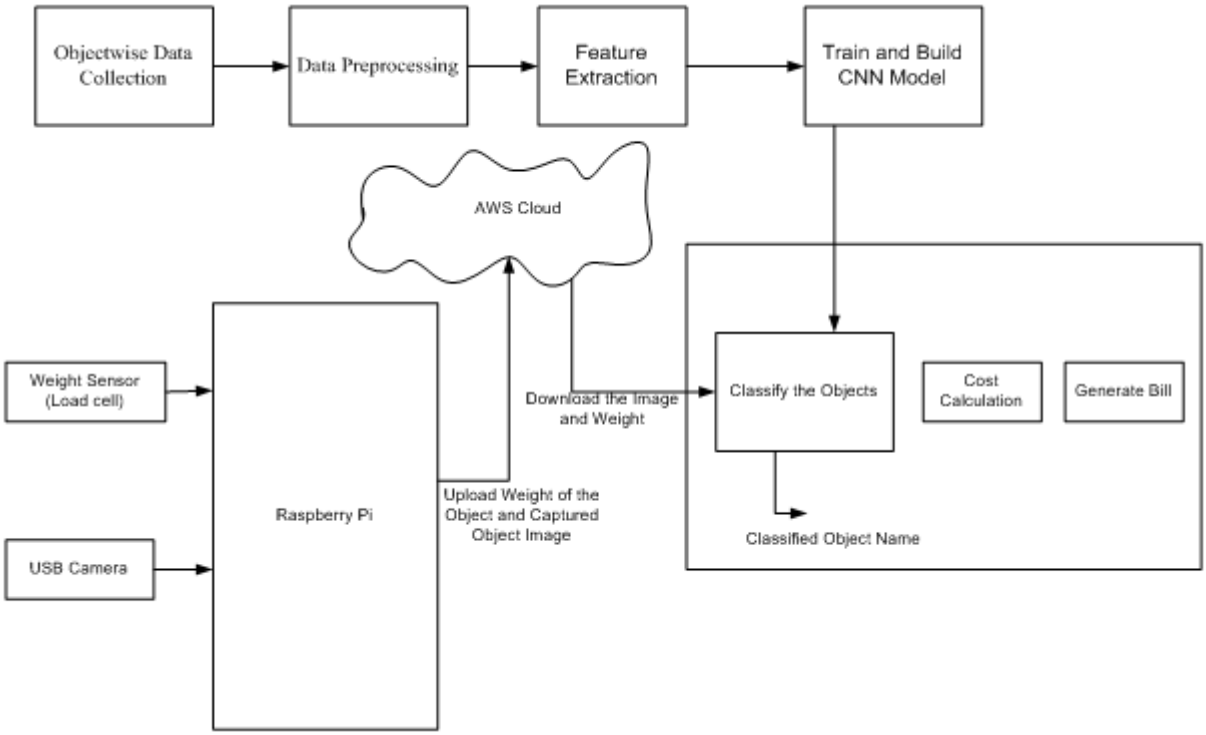
PROPOSED SYSTEM

The proposed system aims to overcome the above challenges by leveraging CNN for accurate object identification and IoT for seamless real-time data communication. By automating the billing process and integrating advanced technologies, the proposed system seeks to enhance accuracy, reduce reliance on manual intervention, and contribute to the overall efficiency and effectiveness of billing systems in diverse industries.

Advantages:

- Object Identification using CNN
- Real-time Data Communication with IoT:
- Automation of Billing Processes
- Enhanced Accuracy and Precision:
- Scalability and Adaptability:
- Reduced Turnaround Time:
- Cost-effective and Resource Efficient:

SYSTEM ARCHITECTURE



SYSTEM MODULES

The system modules of the project can be organized into several key components:

1. Image Processing Module:

Objective: Preprocesses input images or video frames for optimal input to the Convolutional Neural Network (CNN).

Tasks:

- Image resizing, normalization, and enhancement.
- Handling variations in lighting and background to improve object detection accuracy.

2. Object Identification Module (CNN):

Objective: Utilizes Convolutional Neural Networks for precise and accurate identification of objects within images or video frames.

Tasks:

- Training the CNN model on a dataset of labeled objects.
- Real-time object detection and classification.

3. IoT Connectivity Module:

Objective: Establishes and manages the connection between the identified objects and the central billing system through the Internet of Things (IoT).

Tasks:

- Setting up communication protocols for IoT devices.
- Transmitting relevant object information (quantity, price, etc.) in real-time.

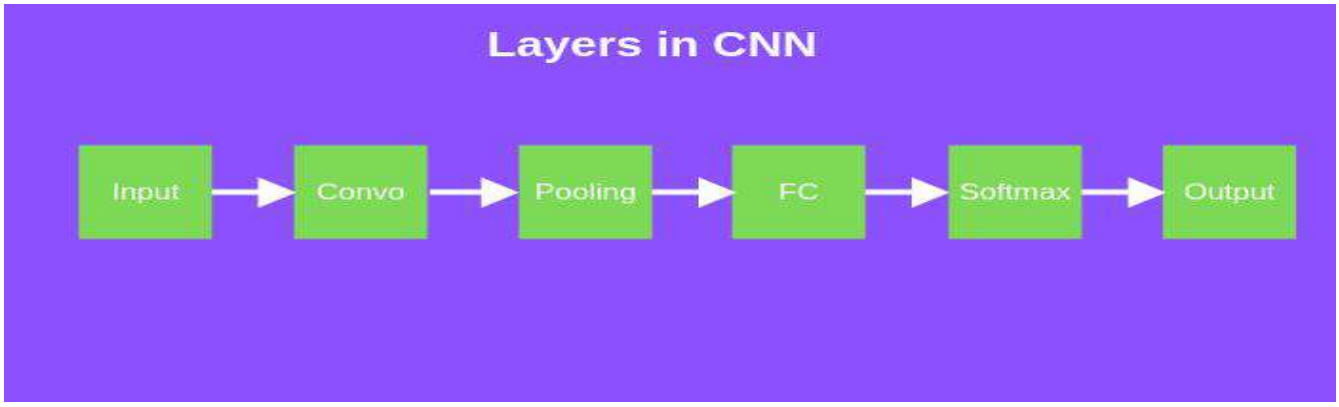
4. Data Extraction Module:
Objective: Extracts essential billing information from the identified objects for the billing process.
Tasks:
- Parsing and extracting relevant data such as product details, pricing, and quantity.
- Ensuring data integrity and accuracy.

5. Billing Generation Module:
Objective: Automates the generation of bills based on the extracted information and predefined billing rules.
Tasks:
- Applying pricing algorithms.
- Creating a detailed bill for each identified object.

6. User Interface Module:
Objective: Provides a user-friendly interface for system configuration, monitoring, and reporting.
Tasks:
- Designing an intuitive dashboard for system administrators.
- Displaying real-time information and generated bills.

SYSTEM IMPLEMENTATION

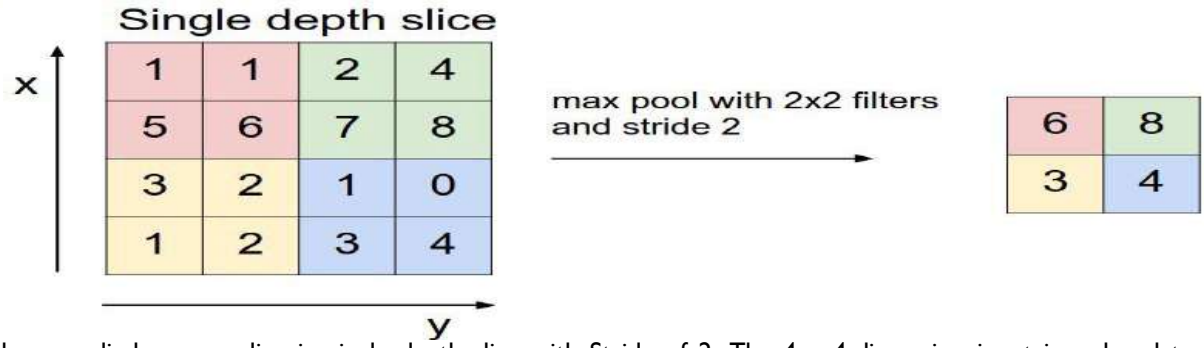
CNN Algorithm: CNN stands for Convolutional Neural Network, which is a class of deep neural networks primarily designed for processing structured grid-like data, such as images or video. CNNs have been particularly successful in tasks like image classification, object detection, and image segmentation.



Input Layer:
- The input layer represents the raw input data, typically an image or a set of images. Each image is represented as a grid of pixel values, with each pixel representing a feature.
- In order to prepare the input data for the Convolutional Neural Network (CNN), it is necessary to reshape the images into a single column format. For instance, if the images have dimensions of 28 x 28, totaling 784 pixels, they must be transformed into a column vector of size 784 x 1 before being fed into the network.
- If there are "m" training examples, then the dimension of the input data will be (784, m). This reshaping ensures that each pixel value of the images is represented as a single input feature, facilitating the training process of the CNN.

Convo Layer:
- In the convolutional layer, a set of learnable filters (also known as kernels) is applied to the input image through convolution operations.
- Convolution involves sliding each filter across the input image and computing the dot product between the filter and the local region of the input.
- The ReLU (Rectified Linear Unit) activation function is applied element-wise to the output of the convolution operation. ReLU introduces non-linearity, allowing the network to learn complex patterns and relationships in the data.

Pooling Layer:
- The pooling layer reduces the spatial dimensions of the feature maps generated by the convolutional layer while retaining the most important information.
- Common pooling operations include max pooling, where the maximum value in each local region is retained, and average pooling, where the average value is computed.
- Pooling helps in reducing computation and controlling overfitting by providing translational invariance.



We have applied max pooling in single depth slice with Stride of 2. The 4 x 4-dimension input is reduced to 2 x 2 dimension.

There is no parameter in pooling layer but it has two hyperparameters — Filter(F) and Stride(S).

In general, if we have input dimension W1 x H1 x D1, then

$W2 = (W1-F)/S+1$

$H2 = (H1-F)/S+1$

$D2 = D1$

Where W2, H2 and D2 are the width, height and depth of output.

Fully Connected Layer (FC):

- The fully connected layer receives the flattened output from the preceding layers and consists of densely connected neurons.
- Each neuron in the fully connected layer is connected to every neuron in the previous layer.
- The fully connected layer performs classification based on the learned features from the convolutional and pooling layers.

SoftMax / Logistic Layer:

- In classification tasks, a softmax or logistic layer is typically added after the fully connected layer.
- The softmax function converts the raw scores (logits) from the previous layer into class probabilities.
- Each output neuron represents the probability of the input belonging to a particular class.

Output Layer:

- The output layer receives the probabilities computed by the softmax or logistic layer.
- In binary classification tasks, a single output neuron with a sigmoid activation function is used to output the probability of the input belonging to one of the two classes (e.g., 0 or 1).
- In multi-class classification tasks, multiple output neurons are used, each representing the probability of the input belonging to a specific class.

SCOPE OF FUTURE APPLICATION

- **Retail Sector:** Automatically generate bills for customers in retail stores based on items picked up using RFID tags or image recognition.
- **Hospitality Industry:** Streamline the checkout process in hotels and resorts by generating bills automatically based on room occupancy and services utilized.
- **Restaurant and Food Industry:** Automatically generate bills in restaurants based on the dishes ordered by customers.

RESULTS

CONCLUSION

The project represents a significant advancement in the automation of billing processes across various industries. The integration of Convolutional Neural Networks (CNN) for precise object identification and the Internet of Things (IoT) for real-time data communication has addressed the limitations of traditional billing systems and the project not only achieves its objectives but also sets the stage for the continued evolution of billing systems. The successful implementation of this project has the potential to redefine how businesses handle billing processes, emphasizing automation, accuracy, and adaptability to the dynamic demands of modern industries

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Managing and Evaluating Data Integrity in machine Learning-Based Cyber Intrusion Detection

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Abstract: This study investigated the impact of data quality on the performance of intrusion detection systems. Experiments were conducted using intrusion datasets and machine learning models. The pre-trained models were less affected by data duplications and overlaps compared to classic ML models. Removing overlaps and duplicates from training data improved the pre-trained models' performance in most cases, but had adverse effects in datasets with highly similar sequences. The study also proposed a framework for model selection and data quality assurance for building high- quality intrusion detection systems. Additionally, we focus on optimizing nine hyperparameters within a 1D-CNN model, using two well-established evolutionary computation methods—genetic algorithm(GA) and particle swarm optimization(PSO).The performances of these methods are assessed using three majordatasets—UNSW-NB15,CIC-IDS2017, and NSL-KDD. The key performance metrics considered in this study include the accuracy, loss, precision, recall, and F1-score. The results demonstrate considerable improvements in all metrics across all datasets, for both GA- and PSO-optimized models, when compared to those of the original non optimized 1D-CNN model.

Keywords: Intrusion detection, Data preprocessing, Reinforcement Learning, Support Vector Machines (SVMs), artificial neural networks (ANNs)

I. INTRODUCTION

Machine learning is becoming a powerful tool in data curation, the process of keeping your data clean and organized. By applying machine learning algorithms, data can be automatically identified, filtered for inconsistencies, and even labeled with relevant information. This helps ensure the data used to train machine learning models itself is accurate and unbiased, leading to better overall model performance and generalizability.

Managing and evaluating data integrity in machine learning-based cyber intrusion detection is a critical process aimed at ensuring the trustworthiness, accuracy, and security of the data utilized in identifying and mitigating cyber threats. As organizations increasingly rely on machine learning algorithms to detect and prevent intrusions, it becomes imperative to maintain the integrity of the data feeding into these systems. In managing data integrity, several pivotal tasks are involved. Data preprocessing stands as an initial step, encompassing activities such as cleansing and restructuring raw data to conform to a format compatible with machine learning models. This preparation enhances the quality and consistency of the data, thus optimizing the performance of subsequent analyses. Additionally, feature selection plays a crucial role in focusing on pertinent attributes within the data that contribute significantly to the detection of intrusions. By identifying and prioritizing these features, the model's efficacy in discerning malicious activities is enhanced. Moreover, addressing dataset imbalances is imperative to rectify disparities in the distribution of data samples across different classes. This ensures that the model does not exhibit biases towards any particular class, thus preserving its objectivity and effectiveness. Furthermore, implementing robust security measures is paramount to safeguarding data integrity against tampering and unauthorized access. Encryption, access controls, and data monitoring mechanisms are among the strategies employed to fortify the security of the data utilized in intrusion detection systems. These measures serve to mitigate the risks associated with data manipulation and unauthorized intrusion attempts, there by bolstering the overall integrity of the system.

In the realm of evaluating data integrity, a comprehensive assessment of machine learning models' performance is conducted to ascertain their reliability and effectiveness in detecting cyber intrusions. This entails the utilization of various performance metrics, including accuracy, precision, recall, and F1-score, to gauge the model's ability to accurately classify and identify potential threats. Validation and test datasets are employed to validate the model's performance and generalization capabilities, ensuring its robustness across diverse scenarios. Techniques such as cross-validation further enhance the model's reliability by validating its performance across multiple iterations and subsets of the data. Managing data integrity involves various tasks, including preprocessing, feature selection, and dataset balancing. Preprocessing involves cleaning and transforming raw data to prepare it for analysis, ensuring consistency and reliability. Feature selection focuses on identifying the most relevant attributes that contribute to detecting intrusions, while dataset balancing addresses any imbalances in the distribution of data samples across different classes, preventing biases in the model.

II. LITERATURE REVIEW

Using fitness evaluations as guidance, the PSO algorithm effectively reached the optimal set of hyperparameters. Consequently, the intrusion-detection model was improved, showcasing customized effectiveness for smart farming applications. When studying hyper parameter optimization for nods, it is important to take into account the many methodologies and optimization techniques that have been previously suggested. This extensive research, which includes a range of strategies and models, is crucial for establishing a solid basis to enhance our comprehension and direct our investigation towards creating more productive and successful methods in the field of 1D-cnns.

Hyperparameters directly control the performance of deep learning algorithms and have a major impact on the model's ability to discover patterns [5]. Hence, the choice of hyperparameters is crucial for the successful implementation of deep learning projects. Improper choice of hyperparameters can result in insufficient learning outcomes. For example, if the learning rate is too high, it can result in the model overlooking significant patterns in the data or failing to reach a stable solution. On the other hand, a low learning rate might lead to the model disregarding important information, resulting in a slower learning process and a decline in overall performance.

The PROA is an exceptional approach that relies on the observed patterns of wealth distribution in society. It primarily focuses on two distinct categories of individuals—affluent individuals, whose wealth exceeds the average wealth, and less affluent or impoverished individuals, whose wealth is below the average wealth. Within the algorithm's framework, the affluent class consistently endeavors to expand the disparity between themselves and the less affluent class. In the PROA, solutions in the less affluent population move towards the global optimum solutions in the search area by acquiring knowledge from the more affluent solutions determined in the wealthier population. This methodology introduced a novel technique for optimizing hyperparameters, emphasizing the similarities between social wealth behaviors and solution search tactics. Therefore, by implementing the PROA, the authors asserted that they had notably enhanced the detection rate of their CNN-ALSTM model.

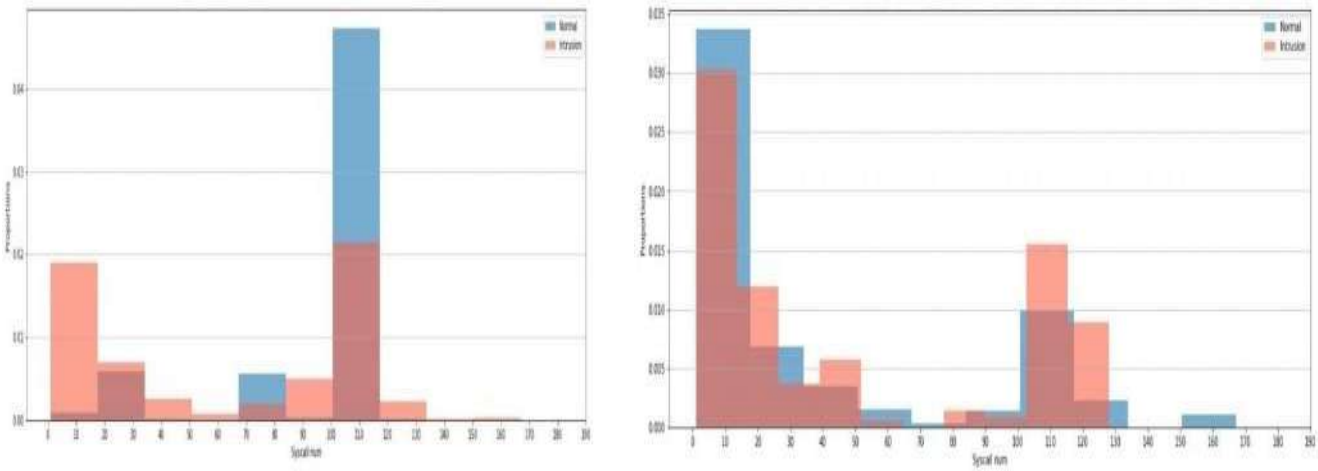
In their work, authors in reference [11] employed the tree-structured Parzen estimator (TPE) technique to perform Bayesian hyperparameter optimization, introducing a novel approach. This procedure consisted of multiple sequential steps. At first, the search space for hyperparameters was determined by specifying the hyperparameters to be optimized and their possible ranges of values. Afterwards, the experiment chose the categorical cross-entropy loss function. Subsequently, the TPE algorithm was implemented, and the potential hyperparameters were methodically sampled throughout the search space until the predetermined criteria were met. Ultimately, the most effective model parameters were established. The Bayesian optimization strategy provided a methodical and well-founded approach to tweaking hyperparameters, effectively balancing the exploration and exploitation aspects within the search space. The key hyperparameters of all base CNN models in the proposed framework were optimized using Particle Swarm Optimization (PSO) in [8].

The hyperparameters optimized in this study included the proportion of frozen layers, the learning rate, the dropout rate, the batch size, the number of epochs, and the early-stop patience. Hyperparameters have a direct impact on the structure, performance, and efficiency of CNN models. However, as CNN models with default hyperparameter settings already achieved almost perfect accuracy on the Car-Hacking dataset, the hyperparameter tuning process was only carried out for the CICIDS2017dataset. With the intention of forging a new direction in this domain, this study endeavors to establish innovative approaches. Given the ability of Convolutional Neural Networks (CNN's) to effectively handle intricate datasets and the significance of choosing suitable hyperparameters to get the best model performance, our focus is on optimizing hyperparameters in 1D-CNN models. Our objective is to utilize the advantages of current approaches while addressing their limitations, in order to advance hyperparameter optimization and ultimately enhance the effectiveness and efficiency of IDSS.

III. DATASET DESCRIPTION

In order to compare the difference between the two classes, we graph an overlaid histogram of normal data and intrusion data from each dataset in Figure 2 We use all of the UNM (except Send mail), MIT Live Lpr, and ADFA-LD datasets. Each dataset has two histogram versions. However, we only include the histograms of the processed and unprocessed UNM Synthetic Send mail dataset. The histograms of the rest of the datasets along with their descriptive analyses are included in our got hub repository. The first histogram version displays the dispersion of original traces that have not been cleaned nor processed yet, so it can show the actual difference between normal and intrusion sequences. After cleaning duplicated sequences that exist in both classes, the overlaid histograms of most datasets have changed. Significantly. Therefore, the second version exhibits a more distinguished difference between the two classes than the original data. The goal is to differentiate normal sequences from intrusion sequences as much as possible so that the algorithms can learn to distinguish them from one another. Therefore, the more distinctive the two classes are, the better the candidate algorithms can perform.

Figure 2a shows that there is a slight difference between normal data and intrusion data from the Synthetic Send mail dataset. However, most of them overlap each other. After cleaning duplicated sequences, the dispersion of normal system calls and intrusion system calls have changed in Figure 25 Normal system calls have expanded from two wide ranges (68 to 83 and 101 to118) to multiple specific ranges. Particularly, sequences that contain system call numbers ranging between 13 and 15, 64 and 77,100 and 102, 128 and 134, and 150 and 177 are most likely normal. This increases the homogeneity of normal data and reduces false negatives. Additionally, after being processed, intrusion system calls have expanded to more specific ranges. For example, sequences that contain system call numbers from 17to 27, 77 to 84, and 102 to 128 are most likely intrusion. This narrows down possible intrusion likelihoods and reduces falsepositives in overlapped system calls.



(a) The Original UNM Synthetic Send mail Dataset (b)The Processed UNM Synthetic Send mail Datasets

Fig 1:- Overlaid Histograms of the Original and the Processed System Calls in Normal or Intrusion Data of the UNM Synthetic Send mail Dataset.

IV. WORKFLOW

The workflow of data curation and quality evaluation involves a systematic process aimed at ensuring the reliability, accuracy, and usability of the dataset for analysis and decision-making purposes. Initially, the dataset is collected from various sources and undergoes thorough documentation to provide insights into its contents, format, and provenance. Data preprocessing techniques are then applied to clean and transform the raw data, addressing issues such as missing values, outliers, and inconsistencies. Next, feature engineering methods are employed to extract relevant information and enhance the dataset's representativeness and predictive power. Subsequently, the dataset is subjected to comprehensive quality evaluation across multiple dimensions, including completeness, accuracy, consistency, timeliness, and relevance. Quality evaluation metrics are calculated for individual features as well as for the dataset as a whole, providing insights into the overall integrity and reliability of the data.

Finally, the results of the quality evaluation are documented and communicated to stakeholders, along with recommendations for improving data quality and usability. Overall, the workflow of data curation and quality evaluation ensures that the dataset is well-prepared and reliable for analysis, enabling researchers and practitioners to derive meaningful insights and make informed decisions based on high quality data.

V. METHODOLOGY

To assess the user's experience including their perspective regarding data sharing, their attitudes toward data curation, and the level of satisfaction with the data curation service provided at each of the authors' institutions, the survey instrument was drafted consisting of multiple choice and open-ended questions. The results of this survey were intended to evaluate and improve data repository service; the IRB determined this research does not involve human subjects as defined by DHHS and FDA regulations. The survey was implemented in Qualtrics and distributed to data depositors at six Data Curation Network institutions, including: Cornell University's commons; Duke University's Research Data Repository; Johns Hopkins University's Data Archive; University of Illinois Urbana-Champaign's Illinois Data Bank, University of Michigan's Deep Blue Data, and the University of Minnesota's Data Repository for UofM (DRUM).

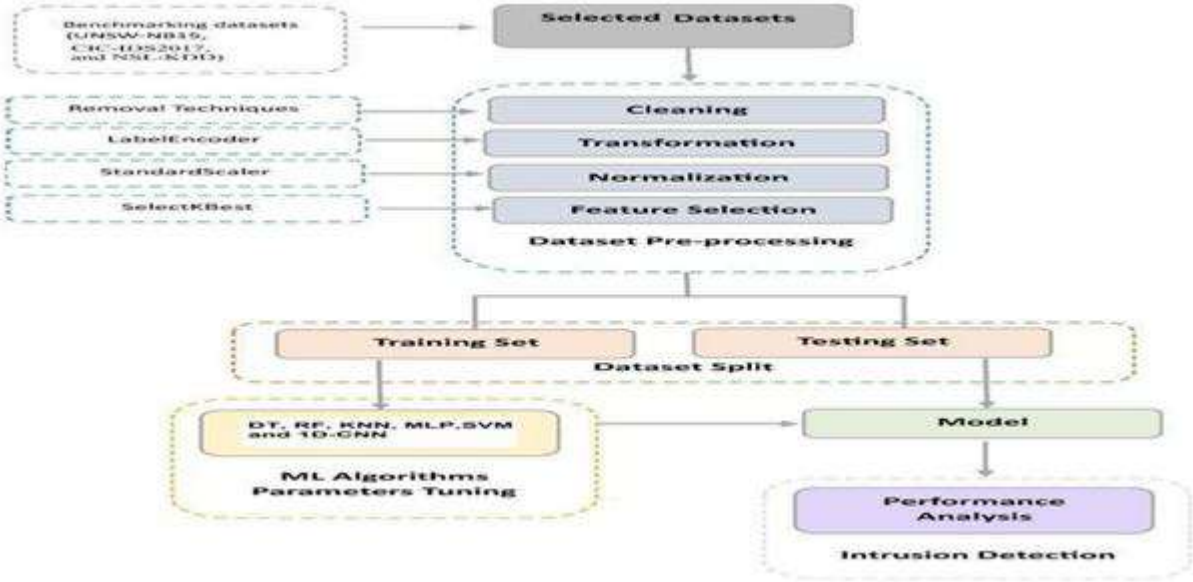
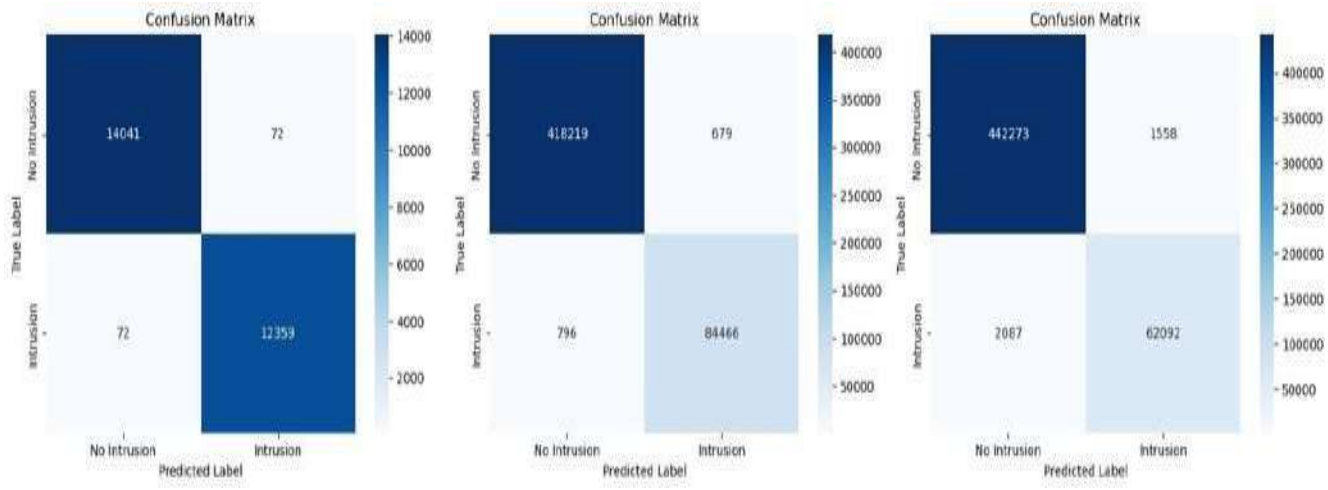


Fig2:- Data Preparation work flow for ML based IDS

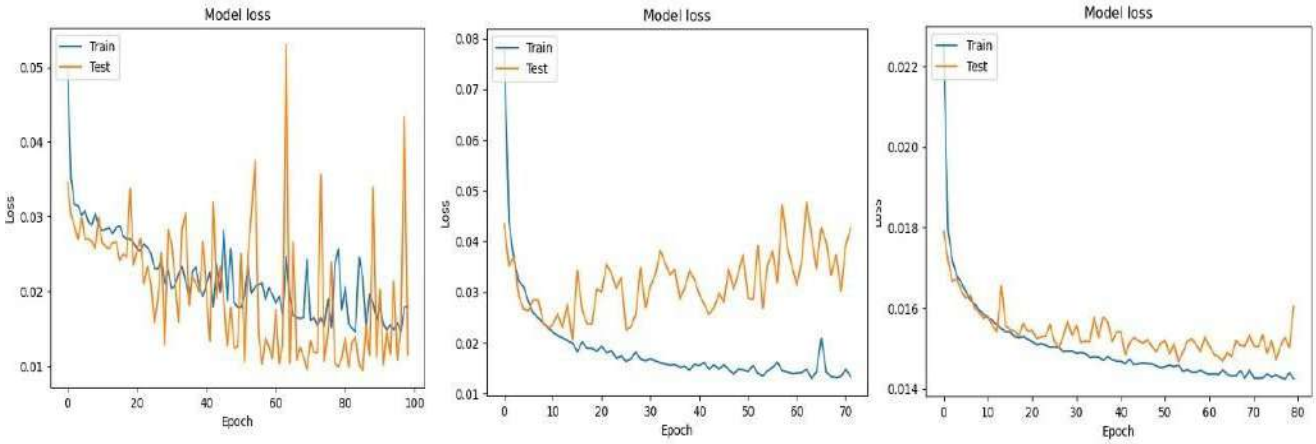
The study also proposed a framework for model selection and data quality assurance for building high- quality intrusion detection systems. Additionally, we focus on optimizing nine hyperparameters within a 1D-CNN model, using two well-established evolutionary computation methods—genetic algorithm (GA) and particle swarm optimization(PSO).The performances of these methods are assessed using any major datasets—UNSW-NB15, CIC- IDS2017, and NSL-KDD. The key performance metrics considered in this study include the accuracy, loss, precision, recall, and F1-score. The results demonstrate considerable improvements in all metrics across all datasets, for both GA- and PSO-optimized models, when compared to those of the original non optimized1D-CNN model.

VI. RESULTS



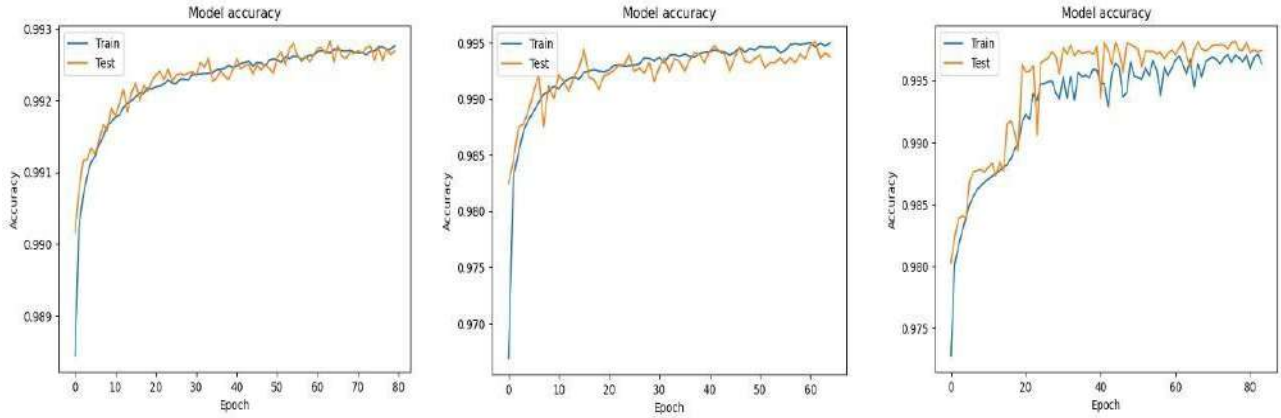
(a) NSL-KDD **(b)CIC–IDS2007** **(c)UNSW-NB15**

Fig2.1:-Confusion matrix using GA



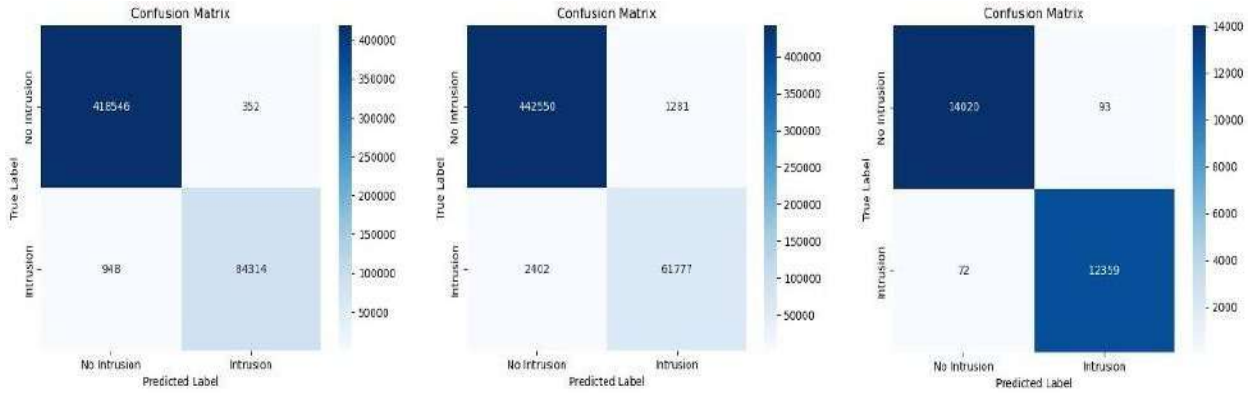
(a) CIC –IDS2007 **(b) NSL-KDD** **(c) UNSW-NB15**

Fig 2.2:-Model loss using GA



(a) UNSW-NB15 **(b) NSL-KDD** **(c) CIC – IDS2017**

Fig2.3:-Model accuracy using PSO



(a) CIC–IDS2017 **(b) UNSW-NB15** **(c) NSL – KDD**

Fig 2.4:-Confusion matrix using PSO

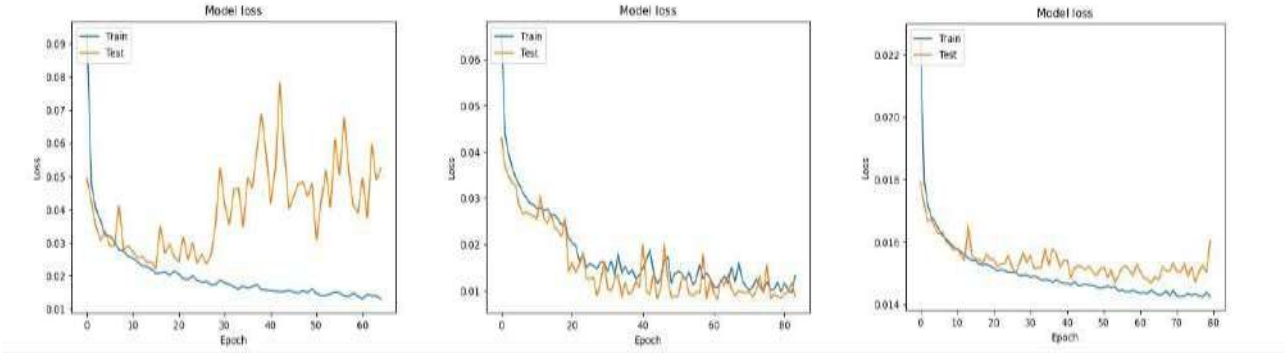
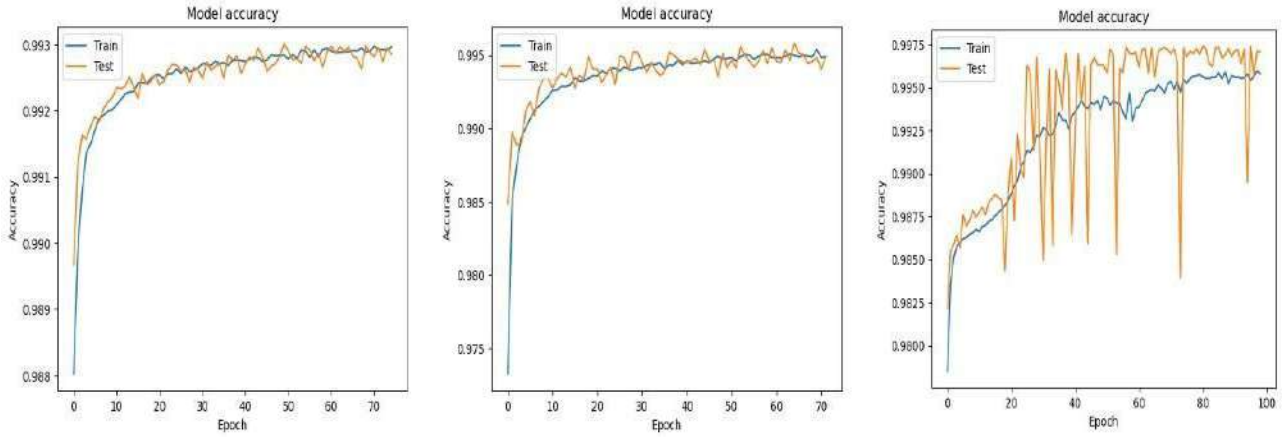


Fig 2.5:-Model loss using PSO



(a) UNSW-NB15 **(b) NSL–KDD** **(c) CIC –IDS2007**

Fig2.6:-Model accuracy using GA

VI.CONCLUSION

In conclusion, the field of "Managing Data and Quality Evaluation for Machine Learning-Based Cyber Intrusion Detection" plays a vital role in enhancing the efficacy and reliability of cyber security measures. Cyber threats continue to evolve and pose a significant risk to organizations, making the development of accurate and efficient intrusion detection systems crucial. In a world where cyber threats are ever-present, the work on data curation and quality evaluation for machine learning-based cyber intrusion detection is a proactive and necessary step to protect sensitive data, critical infrastructure, and digital assets. Item powers organizations to build robust and adaptive intrusion detection systems that can effectively safeguard against a wide range of cyber threats and vulnerabilities. As the field of cybersecurity continues to evolve, ongoing research and development in data curation and quality evaluation will remain essential for staying one step ahead of cyber adversaries.

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Implementation of Vehicle Detection and Tracking Model Using YOLO and DeepSORT for Controlling Traffic Rule Violation

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Abstract – The field of computer vision has advanced significantly in the last several years, especially in the areas of object tracking and detection. This research offers a thorough analysis of the use of a vehicle tracking and detection model that makes use of DeepSORT (Deep Simple Online and Realtime Tracking) for tracking and YOLOv8 (You Only Look Once version 8) for detection. By combining these state-of-the-art methods, it will be possible to track and identify vehicles in a variety of situations in real-time, improving surveillance and traffic management as well as autonomous vehicle navigation. This project intends to develop computer vision applications in the transportation and surveillance sectors by means of a thorough examination and experimentation.

Keywords–Traffic management, surveillance systems, autonomous navigation, object identification, object tracking, YOLOv8, DeepSORT, Computer Vision, and vehicle tracking.

I.INTRODUCTION

In the realm of computer vision, the task of detecting and tracking objects in real-time video streams has garnered significant attention due to its wide-ranging applications in various domains such as surveillance, autonomous navigation, and traffic management. Of particular interest is the detection and tracking of vehicles, which plays a crucial role in numerous societal and industrial applications. Traditional methods for vehicle detection and tracking often rely on handcrafted features and sequential processing, leading to limitations in terms of accuracy, efficiency, and scalability, especially in dynamic and cluttered environments. However, recent advancements in deep learning techniques have revolutionized this field, enabling the development of robust and efficient models for object detection and tracking. This project focuses on the implementation of vehicle detection and tracking model using two state-of-the-art techniques: YOLOv8 (You Only Look Once version 8) for detection and DeepSORT (Deep Simple Online and Realtime Tracking) for tracking. YOLOv8 is a real-time object detection system that adopts a single neural network to simultaneously predict bounding boxes and class probabilities for multiple objects in an image or video frame. Its unified architecture enables fast and accurate object detection, making it well-suited for real-time applications.

On the other hand, DeepSORT represents a sophisticated tracking algorithm that combines deep association metrics with the Kalman filter to achieve robust and accurate tracking of objects in video sequences. YOLO (You Only Look Once) can significantly enhance traffic rule management through its ability to detect various elements on the road, such as vehicles, pedestrians, traffic signs, and signals, in real-time. By deploying YOLO-based systems at intersections or along roadways, traffic authorities can efficiently monitor compliance with traffic rules, such as red light violations, illegal parking, and lane discipline. Additionally, YOLO can aid in identifying and tracking traffic offenders, enabling authorities to take appropriate enforcement actions swiftly. Integrating YOLO with smart traffic management systems can enhance overall road safety, improve traffic flow, and contribute to more effective enforcement of traffic regulations.

II. PROPOSED METHODOLOGY

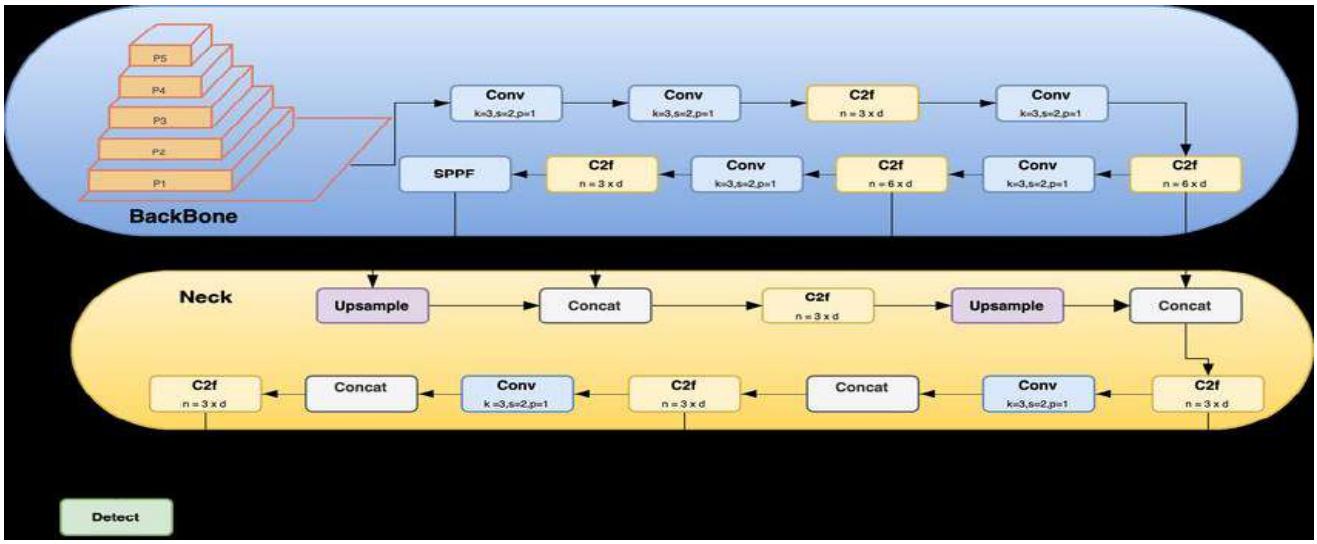

Fig 2.1: Architecture of YOLOv8

YOLOv8, or You Only Look Once version 8, is an object identification system designed to quickly and accurately identify things in pictures or videos. YOLOv8's architecture can be divided into multiple essential parts:

Core Network: A backbone convolutional neural network (CNN) is usually used by YOLOv8 to extract features from the input image. High-level features necessary for object detection are captured by this backbone network.

Darknet, a customized CNN architecture created especially for YOLO, or other well-liked architectures like ResNet, Darknet-53, or CSPDarknet are common alternatives for the backbone network.

Pyramid Network with Features (FPN): A Feature Pyramid Network (FPN) is frequently used by YOLOv8 to recognize objects at various scales. FPN assists in managing items with different sizes by obtaining feature extraction across various spatial resolutions. Typically, FPN is made up of lateral connections that combine features from several backbone network layers to create feature maps at various scales.

Head of Detection: YOLOv8's detection head is in charge of producing bounding box and class probability forecasts. YOLOv8 usually uses a grid-based method to forecast bounding boxes, in which the input image is partitioned into a grid of cells. The task of estimating a predetermined number of bounding boxes falls on each cell. YOLOv8 predicts the center coordinates, width, and height of each bounding box as well as the class probabilities for each class and confidence scores indicating the presence of an object within the bounding box.

Layer of Output: YOLOv8's output layer integrates forecasts from several scales. This produces the class probabilities and final set of bounding boxes. Just the most certain detections are kept after superfluous bounding box filters are removed using non-maximum suppression (NMS).

Instruction Procedure: Typically, labeled datasets are used to train YOLOv8 using methods like stochastic gradient descent and backpropagation. Localization loss (e.g., smooth L1 loss), confidence loss (e.g., binary cross-entropy loss), and class probability loss (e.g., categorical cross-entropy loss) are typically the components of the loss function used to train YOLOv8.Because YOLOv8 is trained end-to-end, its backbone, detection head, and other network components are all simultaneously tuned during training.

III.TECHNIQUES

YOLOv8 (You Only Look Once version 8): The most recent edition of the YOLO series, YOLOv8 (You Only Look Once version 8) is renowned for its effectiveness and precision in object detection tasks. YOLOv8 uses a single convolutional neural network (CNN) to forecast bounding boxes and class probabilities for many objects in a single pass, in contrast to typical object recognition techniques that rely on region proposal networks and multiple processing stages. Because of its unified architecture, YOLOv8 can achieve high accuracy and real-time performance, which makes it perfect for applications that need quick and precise object recognition. To further enhance efficiency and robustness, YOLOv8 also includes a number of architectural improvements, such as focus loss and feature pyramid networks (FPN).

DeepSORT (Deep Simple Online and Realtime Tracking): The difficulties of multi-object tracking in intricate and dynamic situations are tackled by the cutting-edge tracking algorithm DeepSORT. DeepSORT, which builds on the foundations of the SORT (Simple Online and Realtime Tracking) algorithm, combines the Kalman filter and deep association metrics to provide reliable and accurate object tracking. To be more precise, DeepSORT uses a deep appearance descriptor to calculate similarity scores between objects that are recognized in different frames, which allows for consistent identification of objects over time. Furthermore, DeepSORT uses the Kalman filter to manage occlusions and predict object trajectories, guaranteeing reliable tracking even in difficult situations.

IV. APPLICATIONS

Traffic Management Systems: The model can be deployed in traffic management systems to monitor and analyze traffic flow, detect congestion, and optimize traffic signals in real-time, thereby improving overall traffic efficiency and reducing congestion.

A. Smart Cities: In the context of smart cities, the model can contribute to intelligent transportation systems by providing valuable insights into vehicle movement patterns, facilitating data-driven decision-making for urban planning and infrastructure development.

B. Surveillance and Security: Utilizing the model in surveillance systems enhances security measures by enabling real-time monitoring and tracking of vehicles in sensitive areas such as airports, borders, and critical infrastructure facilities.

C. Autonomous Vehicle Navigation: The model's accurate detection and tracking capabilities are essential for autonomous vehicles to perceive and interact with their surrounding environment, thereby enhancing safety and efficiency in autonomous navigation scenarios.

D. Law Enforcement: Law enforcement agencies can leverage the model for automated license plate recognition (ALPR) and vehicle tracking, aiding in the enforcement of traffic laws, identification of stolen vehicles, and investigation of criminal activities.

E. Parking Management: By integrating the model with parking management systems, operators can efficiently monitor parking lots, identify available parking spaces, and manage parking violations, optimizing parking space utilization and enhancing user experience.

F. Public Transportation Systems: The model can be applied to monitor public transportation vehicles such as buses and trains, enabling authorities to track vehicle locations, manage schedules, and improve service reliability for commuters.

G. Fleet Management: Businesses operating fleets of vehicles, such as logistics companies and transportation services, can utilize the model for real-time tracking of their vehicles, optimizing route planning, and improving operational efficiency.

H. Emergency Response: During emergency situations such as natural disasters or accidents, the model can aid emergency responders in quickly assessing the situation, identifying vehicles requiring assistance, and coordinating rescue efforts more effectively.

V. RESULTS

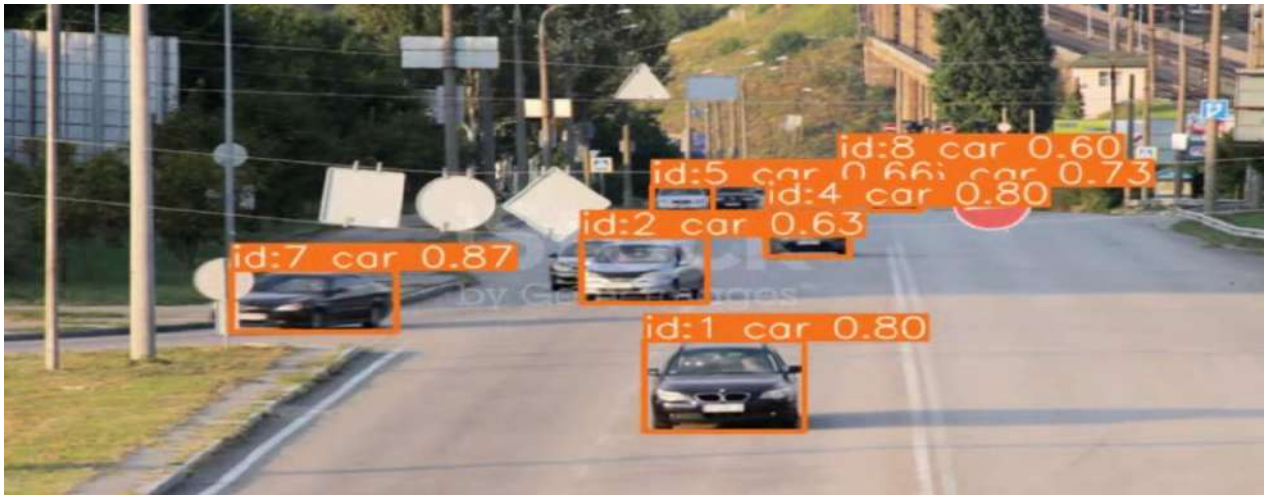

Fig 5.1: Tracking & Detecting of the Vehicle

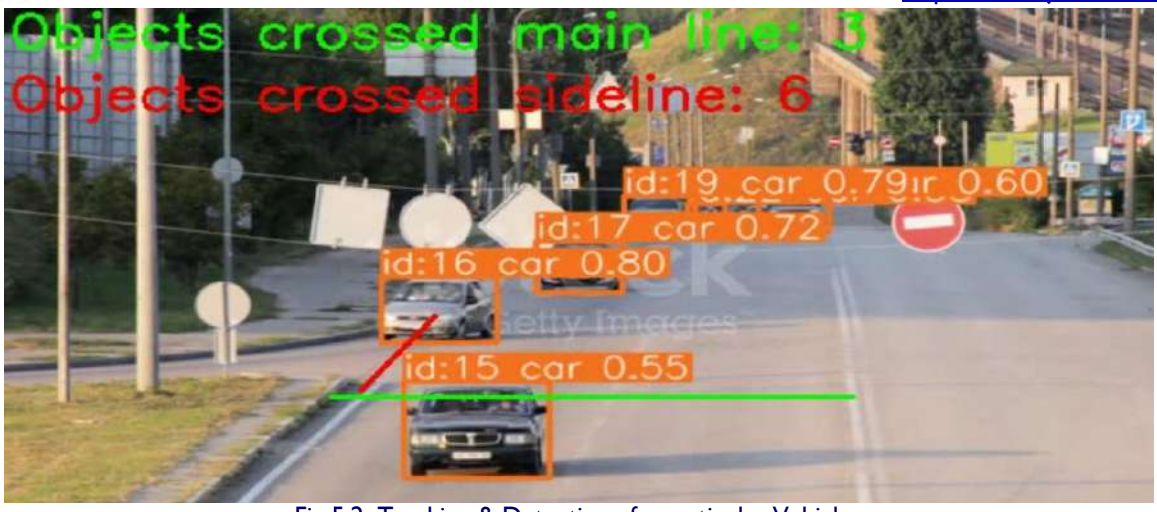

Fig 5.2: Tracking & Detecting of a particular Vehicle

Fig 5.3: Detect the License Plate

VI. SCOPE OF FUTURE APPLICATION

Further developments in the field of computer vision could result from the application of YOLOv8 and DeepSORT in a vehicle detection and tracking model. A possible direction for future work is to make the model more flexible in response to different environmental circumstances and scenarios. This can include optimizing performance in difficult environments, such busy cities or remote areas with inadequate infrastructure, by adding domain-specific features and fine-tuning parameters. Furthermore, current research endeavors seek to expand the model's functionality by including multi-modal sensor data, such as LiDAR, radar, and thermal imaging, to improve perception and tracking precision, especially in unfavorable weather or dimly illuminated areas. Furthermore, there are prospects for future implementation due to the evolution of hardware technology. Tensor processing units (TPUs) and neuromorphic chips, two types of specialized processors and accelerators designed specifically for deep learning tasks, may make it possible to implement the model on edge devices with constrained computational resources. The decentralization of processing capacity enables autonomous vehicles to travel safely and effectively in dynamic situations by facilitating real-time inference and decision-making directly on vehicles or inside distributed sensor networks. Furthermore, subsequent iterations can concentrate on broadening the model's scope beyond conventional applications centered around vehicles. For example, there is potential to solve wider socioeconomic and environmental concerns through adaptations for tracking and detecting pedestrians in congested urban situations or monitoring wildlife in natural ecosystems. To drive the development and adoption of these future implementations, promote multidisciplinary research, and expedite the translation of breakthroughs into workable solutions, collaboration between academics, industry, and policymakers is essential. In the end, YOLOv8 and DeepSORT-based vehicle detection and tracking model expansion and improvement have the ability to completely transform surveillance, transportation, and other fields, paving the way for a more interconnected, effective, and sustainable future.

VII. CONCLUSION

In conclusion, the implementation of a vehicle detection and tracking model using YOLOv8 and DeepSORT represents a significant advancement in the field of computer vision, particularly in the domains of transportation and surveillance. Through the integration of state-of-the-art techniques, the proposed model offers real-time and accurate detection and tracking capabilities, thereby facilitating improved traffic management, enhanced surveillance systems, and safer autonomous navigation.

The findings and insights obtained from this research contribute to the broader discourse on computer vision applications and pave the way for future innovations and advancements in the field. As technologies continue to evolve, further research and development efforts hold promise for extending the capabilities of the model and addressing emerging challenges in transportation, surveillance, and beyond.

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Distributed Ledger Approach BlockChain- Based Integrated EHR: A Ethereum Smart Contract Method

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Abstract: Blockchain, on the other hand, is a groundbreaking technology that provides a distributed and Decentralized environment in which nodes in a list of networks can connect to each other without the need for a central authority. It has the potential to overcome the limits of Electronic Health Record (EHR) management and create a more secure, Decentralized, and safer environment for exchanging EHR data. Further, blockchain is a distributed ledger on which data can be stored and shared in a cryptographically secure, validated, and mutually agreed-upon manner across all mining nodes. The blockchain stores data with a high level of integrity and robustness, and it cannot be altered. Electronic health records (EHRs) are digitally saved health records that provide information about a person's health. EHRs are generally shared among healthcare stakeholders, and thus are susceptible to power failures, data misuse, a lack of privacy, security, and an audit trail, among other problems. The aim of our proposed framework is firstly to implement blockchain technology for EHR and secondly to provide secure storage of electronic records by defining granular access rules for the users of the proposed framework. Moreover, this framework also discusses the scalability problem faced by the blockchain technology in general via use of off-chain storage of the records. This framework provides the EHR system with the benefits of having a scalable, secure and integral blockchain-based solution.

Keywords: Distributed Ledger Technology (DLT), Immutable Record keeping, Data Integrity, Privacy-Preserving, Secure Data Sharing, Interoperability, Smart Contracts, Patient-Centric Data Management Audit ability, Consent Management.

I. INTRODUCTION

Blockchain, a novel technology, offers a secure, tamper-proof platform for storing medical records and other healthcare-related information. Just like the changes technology has brought to various other sectors of life, it is also finding new ways to improve the healthcare sector [1]. The main benefits of technological advancements include improved security, user experience, and other aspects of healthcare. These benefits were initially offered by Electronic Health Record (EHR) and Electronic Medical Record (EMR) systems. However, these systems still face issues related to the security of medical records, user ownership of data, and data integrity. Before modern technology, the healthcare sector relied on paper-based systems for storing medical records, using handwritten mechanisms.

Unfortunately, this paper-based system was inefficient, insecure, Unorganized, and not tamper-proof. It also suffered from data duplication and redundancy, as each institution the patient visited had various copies of their medical records. A trend shift occurred in the healthcare sector with the adoption of EHR systems, which combined paper-based and electronic medical records (EMR). These systems stored clinical notes and laboratory results in multiple components. The goal was to enhance patient safety by preventing errors and improving information access. EHR systems aimed to solve the problems associated with paper-based healthcare records and transform the state of healthcare. EHR systems have been widely implemented in hospitals worldwide due to their benefits, particularly improved security and cost effectiveness. They play a vital role in healthcare, offering functionalities such as electronic storage of medical records, appointment management, billing, and lab tests.

Despite the initial intention of improving healthcare quality, EHR systems faced challenges and fell short of expectations. A study in Finland highlighted issues related to reliability and poor user-friendliness among nursing staff using EHR systems. The 2009 Health Information Technology for Economic and Clinical Health Act (HITECH) allocated nearly $30 billion to Incentivize EHR adoption by US healthcare providers through the "Meaningful Use" (MU) program. As a result, EHR usage dramatically increased— while only 9% of non-federal acute care hospitals had a basic EHR in 2008, 96% had one by 2015[1]. However, sharing electronic health data between different hospitals and providers still lags behind EHR adoption due to technical, operational, and privacy-related concerns. Interoperability in healthcare often focuses on data exchange between business entities, such as multiple hospital systems within a state.

II. BLOCKCHAIN AND ITS DEPENDENCIES

Nakamoto introduced this technology for his influential work on digital currency, specifically Bitcoin. Initially designed to address Bitcoin's double-spending problem, blockchain technology quickly found applications beyond cryptocurrency. Blockchain operates as a chain of interconnected blocks, continuously growing as transactions are stored within them [2]. This Decentralized platform ensures information distribution, with each piece of data having shared ownership. The security of blockchain lies in its hashed transaction batches, managed by peer-to-peer networks. Notably, blockchain offers benefits such as security, anonymity, and data integrity without third-party intervention. Given the healthcare industry's focus on patient data security, blockchain becomes a compelling choice for storing medical records. Researchers recognize its feasibility and potential impact in healthcare.

A. Architecture

To understand the blockchain architecture, which explains the entire process of a transaction being sent by a user on the blockchain network. A new transaction initiated by a user on the blockchain network leads to the creation of a new block. These blocks, which contain transactions, are distributed to all connected nodes in the network. The transaction within a block is broadcasted to all nodes. Each node maintains a copy of the complete blockchain for verification purposes. When a block containing the user's transaction reaches all connected nodes, they verify its integrity. If successful, the nodes add that block to their own copy of the blockchain.The process of adding a block to the blockchain involves nodes reaching a consensus. They collectively decide which blocks are valid for inclusion and which are not. This validation process uses known algorithms to verify transactions and ensure that the sender is an authenticated part of the network. Nodes that successfully validate transactions are rewarded with cryptocurrency and are referred to as miners. Once validation is complete, the block is officially added to the blockchain, and the transaction is considered Finalized.

B. Block

As explained earlier blockchain are formed together by a number of blocks connected together in a peer-to-peer network thus making a Decentralized application. The header of these blocks contains hashes of previous blocks in them. A block contains three things in it which are data, hash of current block and hash of previous block. The data could be anything as it depends on the type of blockchain. As in case of bitcoin, the data consists of coins that are actually electronic cash. The hash that is stored in these blocks contains a SHA-256 cryptographic algorithm which is used for unique identification of a block on the chain [1].

C. Consensus Algorithm

Blockchain technology ensures that each block added to the chain adheres to specific consensus rules. To achieve this, consensus algorithms come into play. The most widely used consensus algorithm is the Proof of Work (PoW) algorithm, famously employed by Nakamoto in the Bitcoin network. Here's how it works: In a blockchain network, numerous nodes or participants exist. When a transaction is proposed for inclusion in the network by any participating node, it undergoes a calculation process.This process, known as mining, involves nodes performing complex calculations. The nodes successfully performing these calculations are referred to as miners.

III. KEY FEATURES OF BLOCKCHAIN

A. Decentralization:

In a blockchain, information is distributed across the network rather than being centralized. This Decentralized approach ensures that control over information is shared and determined by consensus among the connected nodes. Previously concentrated data now resides with multiple trusted entities'.

B. Data Transparency:

Achieving transparency in any technology requires trust-based relationships between entities. On the blockchain, data or records are not stored in a single location controlled by a single node. Instead, they are distributed across the network. Shared ownership of data enhances transparency and protects it from third-party interference.

C. Security and Privacy:

Blockchain employs cryptographic functions to secure connected nodes. The SHA-256 cryptographic algorithm is used to hash data stored in blocks. These cryptographic hashes ensure data integrity [3]. They are strong one-way functions that generate checksums for digital data, preventing data extraction. As a Decentralized platform, blockchain offers robust security, making it an attractive choice for privacy protection in various applications.

IV. CHALLENGES OF BLOCKCHAIN

A. Scalability and Storage Capacity:

Storing data on the blockchain presents two primary challenges: confidentiality and scalability. The transparent nature of blockchain data visible to all participants poses vulnerability, which is undesirable for a decentralized platform. In the healthcare context, patient medical history, records, lab results, X-ray reports, MRI results, and other voluminous data must be stored on the blockchain, significantly impacting its storage capacity.

B. Lack of Social Familiarity:

The inner workings of blockchain technology remain comprehensible to only a select few. Still in its early stages and constantly evolving, blockchain adoption requires time. Hospitals and healthcare institutions must transition their systems entirely to blockchain, which is a gradual process.

C. Absence of Universally Defined Standards:

Given its evolving nature, blockchain lacks universally established standards. Implementing this technology in the healthcare sector demands effort and time. Certification from international authorities overseeing technology standardization is necessary. These universal standards would guide decisions regarding data size, format, and types suitable for blockchain storage. Furthermore, adherence to defined standards would facilitate smoother adoption within organizations.

V. RELATED WORK

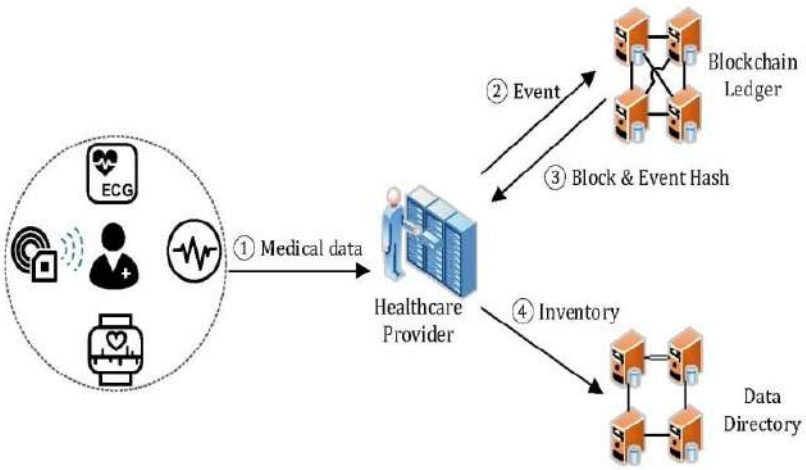
Blockchain's potential to enhance health data sharing and ownership has been previously discussed by several authors. Here are some examples:

A. Healthcare Data Gateway (HDG):

Yue et al. proposed an HDG, allowing patients to manage their health data stored on a private blockchain.

B. Blockchain-Based Personal Health Record:

Ivan described a public blockchain implementation where healthcare data is encrypted but stored publicly, creating a blockchain-based Personal Health Record.



C. MedChain:

In MedChain, a permission network of medication stakeholders (including patients, hospitals, and pharmacies) facilitates medication specific data sharing. However, storing actual clinical data on a blockchain whether permission or public raises privacy and scalability concerns.

D. Off-Chain Data Management:

Another approach involves using blockchain for managing or governing health data rather than storing the actual clinical data. Zyskind et al. introduced a decentralized access and control manager for encrypted off-chain data, with the blockchain layer enforcing access control policies while data remains off-chain.

E. FHIR Chain:

FHIRChain is a smart-contract-based system for exchanging health data based on the standard FHIR. Clinical data is stored off-chain, and the blockchain stores encrypted metadata serving as pointers to the primary data source (such as an EHR).

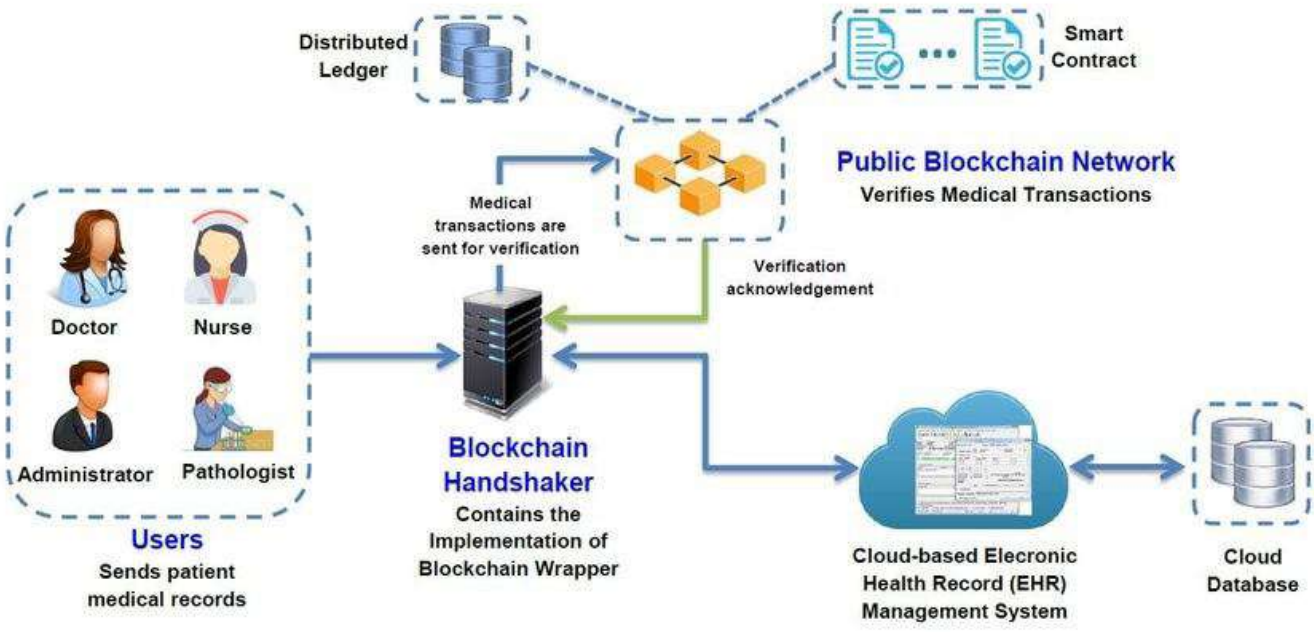
F. MedRec:

Azaria et al. introduced MedRec, which uses a permission blockchain network for data sharing and authentication. MedRec's novel proof-of-work incentive method revolves around access to anonymized medical data [2].

VI. TECHNOLOGIES

1. **Blockchain Technology:** The core technology that underpins the EHR system. It consists of a decentralized and distributed ledger that records transactions across multiple nodes in a network. Each block in the chain contains a cryptographic hash of the previous block, ensuring the immutability and integrity of the data.
2. **Cryptography:** Cryptographic techniques such as public-private key pairs and hashing algorithms are used to secure and authenticate transactions and ensure data privacy. For example, private keys are used to sign transactions and grant access to health records, while public keys are used for verification.
3. **Smart Contract:** These are self-executing contracts with the terms of the agreement between parties written into code. In blockchain EHR systems, smart contracts can automate processes such as patient consent management, access control, and data sharing agreements.
4. **Consensus Mechanisms:** Consensus algorithms determine how transactions are validated and added to the blockchain. Proof of Work (PoW), Proof of Stake (PoS), and other consensus mechanisms ensure that the network reaches agreement on the validity of transactions without the need for a central authority.
5. **Decentralized Storage:** Medical data is typically stored in a decentralized manner across multiple nodes in the network. This helps enhance data security and resilience against single points of failure or data breaches.
6. **Interoperability Standards:** Standards such as HL7 (Health Level Seven International) and FHIR (Fast Healthcare Interoperability Resources) are often employed to facilitate interoperability between different healthcare systems and ensure seamless exchange of medical.
7. **Access Control Mechanisms:** Role-based access control (RBAC) and other access control mechanisms are implemented to regulate who can access, view, and modify patient records, ensuring that sensitive medical information is only accessible to authorized parties.

VII. SYSTEM DESIGN AND ARCHITECTURE



To understand the blockchain architecture, let's refer to the following Figure which explains the entire process of a transaction being sent by a user on the blockchain network.

- A transaction initiated by a user on the blockchain network leads to the creation of a new block.
- These blocks, which contain transactions, are distributed to all connected nodes in the network.
- The transaction within a block is broadcasted to all nodes.
- Each node maintains a copy of the complete blockchain for verification purposes.
- When a block containing the user's transaction reaches all connected nodes, they verify its integrity.
- If successful, the nodes add that block to their own copy of the blockchain.

The process of adding a block to the blockchain involves nodes reaching a consensus. They collectively decide which blocks are valid for inclusion and which are not. This validation process uses known algorithms to verify transactions and ensure that the sender is an authenticated part of the network. Nodes that successfully validate transactions are rewarded with cryptocurrency and are referred to as miners. Once validation is complete, the block is officially added to the blockchain, and the transaction considered finalised [3].

1. **Decentralized Network:**
   The system operates on a decentralized peer-to-peer network of computers (nodes), where each node has a copy of the entire blockchain ledger. Nodes communicate with each other through a consensus mechanism to validate and agree upon the addition of new blocks to the blockchain.

2. **Blockchain Structure:**
   Health data is stored in blocks, with each block containing a set of transactions or records.Blocks are linked together in a chronological chain, forming the blockchain.Each block contains a cryptographic hash of the previous block, ensuring the integrity and immutability of the data.
3. **Immutable Records:**
   Once data is recorded on the blockchain, it becomes immutable and tamper-proof.Altering any data within a block would require changing the data in all subsequent blocks, which is computationally infeasible due to the consensus mechanism and cryptographic hashing.
4. **Encryption and Security:**
   Health data stored on the blockchain is encrypted using cryptographic techniques such as public-private key pairs.Patients control access to their health records through their private keys, granting permission to healthcare providers or other authorized parties. Advanced encryption ensures patient privacy and protects sensitive health information from unauthorized access.
5. **Smart Contracts for Access Control:**
   Smart contracts are self-executing contracts with predefined conditions written in code.In a blockchain EHR system, smart contracts can manage access control policies, specifying who can access, modify, or share health records based on predefined rules. For example, a smart contract could automatically grant access to a healthcare provider once the patient authorizes it, without requiring manual intervention.
6. **Interoperability:**
   Blockchain EHR systems can facilitate interoperability by establishing standardized protocols for storing and exchanging health data.Common data formats and communication standards enable seamless integration with existing healthcare systems, promoting data exchange and collaboration among healthcare providers.
7. **Auditability and Transparency:**
   Every transaction or modification to the health records is recorded on the blockchain and timestamped. The transparent nature of the blockchain ledger allows for real-time auditing and verification of all interactions with the health data. Patients, healthcare providers, and regulators can easily trace the entire history of a patient's health records, enhancing accountability and transparency in healthcare delivery.

VIII. SYSTEM IMPLEMENATION

A. Patient, doctor, and admin registration

Implementing patient, doctor, and admin registration in an Electronic Health Record (EHR) system using blockchain technology offers enhanced security, privacy, and data integrity. Here's a simplified outline of how this process might work:

- Blockchain Infrastructure Setup
- Patient Registration
- Doctor Registration
- Admin Registration
- Smart Contracts
- Access Control
- Data Integrity and Auditability:

B. Issuing and filling medical record's

Blockchain technology offers a promising solution for enhancing the security and interoperability of Electronic Health Records (EHRs). It can help in issuing and filling medicine records by providing a decentralized and immutable ledger that ensures data integrity and privacy.

Here's how blockchain can be beneficial in this context:

- Security
- Interoperability
- Privacy Protection
- Efficiency

C. Blockchain Creation

Creating a blockchain for Electronic Health Records (EHR) involves several steps to ensure the system is secure, interoperable, and patient-centric. Here's a high-level overview of the process:

- Define the EHR Data Structure
- Choose a Blockchain Type
- Design the Nodes
- Implement Smart Contracts
- Ensure Compliance
- Develop a User Interface
- Integrate with Existing Systems.
- Test and Deploy

IX. CONCLUSION AND FUTURE WORK

Conclusion and Future Work-"In this paper, we discuss the utility of blockchain technology in the healthcare sector, particularly its application to electronic health records (EHRs)[2]. Despite advancements in healthcare and technological innovations in EHR systems, certain challenges persist. Blockchain addresses these issues by providing a novel solution. Our proposed framework combines secure record storage with granular access rules. This design simplifies user interaction and comprehension. Additionally, the framework addresses data storage challenges by leveraging the off-chain storage mechanism of IPFS (InterPlanetary File System). Role-based access ensures that medical records are accessible only to trusted and relevant individuals, resolving the problem of information asymmetry in EHR systems. Looking ahead, we plan to implement a payment module within the existing framework. Decisions regarding patient consultation fees on this decentralized blockchain system will require careful consideration.

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Explainable AI for Abnormal Human Activity Detection in Surveillance Videos: A Review

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Abstract: This review paper examines the integration of Explainable AI (XAI) techniques into abnormal human activity detection from surveillance videos, emphasizing their significance in enhancing transparency, accountability, and trustworthiness in AI-powered surveillance systems. Through an exploration of XAI methods such as LIME, SHAP, and attention mechanisms, we discuss how these techniques provide insights into the decision-making process of AI models, enabling stakeholders to understand and interpret model predictions. Furthermore, we highlight the advantages of using XAI for debugging errors, identifying biases, and increasing trust among human operators in various security contexts. Additionally, we discuss ongoing research directions in XAI for abnormal human activity detection, including the development of advanced explanation techniques and the incorporation of user feedback into the explanation process. By fostering collaboration between humans and AI, XAI holds the potential to enhance the effectiveness and responsible deployment of surveillance systems, contributing to safer and more secure environments for all stakeholders.
Keywords: Abnormal human activity detection, Explainable AI, Surveillance video

I. INTRODUCTION

Surveillance systems have become ubiquitous in modern society, playing a pivotal role in maintaining security, ensuring public safety, and monitoring various environments. With the proliferation of surveillance cameras and advancements in artificial intelligence (AI) technologies, there has been a paradigm shift in the way abnormal human activities are detected and monitored[1]. However, as these AI-powered surveillance systems become more prevalent, there arises a critical need for transparency, interpretability, and accountability in the decision-making processes of these systems. Explainable AI (XAI) has emerged as a key paradigm to address these challenges by providing insights into how AI models arrive at their decisions [2]. In the context of surveillance applications, integrating XAI techniques holds immense promise in enhancing the reliability and trustworthiness of AI-powered abnormal human activity detection systems. By enabling stakeholders to understand and interpret the reasoning behind AI-driven predictions, XAI not only fosters trust but also helps mitigate potential biases and ethical concerns inherent in automated surveillance. This review paper aims to provide a comprehensive overview of the integration of XAI in abnormal human activity detection from surveillance videos. We will delve into the importance of XAI in surveillance applications, highlighting its role in enhancing transparency, accountability, and trustworthiness. Additionally, we will examine recent advancements in AI techniques for abnormal activity detection, exploring how XAI techniques such as LIME, SHAP, and attention mechanisms contribute to interpretability and explain ability in surveillance systems. Furthermore, this paper will address the challenges associated with implementing XAI in surveillance applications, including computational overhead, scalability, and ethical considerations. By discussing these challenges, we aim to identify potential barriers to the widespread adoption of XAI in surveillance and propose strategies to overcome them. Finally, we will outline future directions for research and development in this domain, emphasizing the importance of interdisciplinary collaboration, standardization of XAI methods, and addressing ethical and societal implications. Through this review, we aspire to contribute to the ongoing dialogue on the responsible and ethical deployment of AI in surveillance, ultimately paving the way for more transparent, accountable, and trustworthy surveillance systems.

II. DEEP LEARNING FOR ABNORMAL ACTIVITY DETECTION

Convolutional Neural Networks (CNNs) are commonly used for abnormal human activity detection in surveillance videos due to their ability to effectively capture spatial features from images. CNNs process video frames sequentially, extracting spatial features through convolutional layers and pooling operations. These features are then fed into fully connected layers for classification, enabling the model to distinguish between normal and abnormal activities based on learned patterns. Recurrent Neural Networks (RNNs), on the other hand, are suitable for capturing temporal dependencies in sequential data such as video frames. RNNs process each frame sequentially, maintaining a hidden state that retains information from previous frames. This allows the model to capture temporal dynamics and detect abnormal activities based on deviations from learned patterns over time[3][4][5][6].

Advantages of Deep Learning for Abnormal Human Activity Detection:

Deep learning techniques offer several advantages for abnormal human activity detection in surveillance videos:

- High Accuracy: Deep learning models, particularly CNNs and RNNs, have demonstrated high accuracy in detecting abnormal activities due to their ability to learn complex patterns and features from large-scale data.
- Ability to Handle Complex Scenarios: Deep learning models are capable of handling complex scenarios and variations in human activities by automatically learning hierarchical representations from raw data, without the need for handcrafted features.

Challenges of Deep Learning for Abnormal Human Activity Detection from the Point of Explainable AI:

While deep learning techniques have shown promise for abnormal human activity detection, they also pose challenges from the perspective of explainable AI.

- Lack of Interpretability: Deep learning models, especially deep CNNs and RNNs, are often considered "black-box" models, making it challenging to interpret how they arrive at their predictions. This lack of interpretability hinders the ability to understand the rationale behind model decisions, particularly in critical applications such as surveillance.
- Complexity of Features: Deep learning models learn complex and abstract features from data, which may not always be intuitive or interpretable to humans. This complexity makes it difficult to provide meaningful explanations for model predictions, limiting the transparency and trustworthiness of the system.
- Difficulty in Providing Explanations: While XAI techniques such as LIME and SHAP can offer insights into model predictions, applying these techniques to deep learning models, especially CNNs and RNNs, is non-trivial due to their high-dimensional and non-linear nature. This poses challenges in generating accurate and meaningful explanations for abnormal activity detection in surveillance videos. Addressing these challenges requires the development of XAI techniques tailored to deep learning models, enabling stakeholders to understand and trust the decisions made by AI systems in surveillance applications.

III. EXPLAINABLE AI FOR ABNORMAL ACTIVITY DETECTION

Explainable AI (XAI) is a field within artificial intelligence (AI) that focuses on making AI models more transparent and interpretable to humans. The primary goal of XAI is to bridge the gap between complex AI algorithms and human understanding, enabling stakeholders to gain insights into the decision-making process of AI systems. XAI techniques aim to provide explanations or justifications for model predictions, helping users interpret and validate the outputs generated by AI models. By enhancing transparency and interpretability, XAI promotes trust, accountability, and ethical use of AI technologies in various domains.

Different XAI Techniques Applicable to Abnormal Human Activity Detection in Surveillance Videos are:

a) Model-Agnostic Methods: LIME (Local Interpretable Model-agnostic Explanations): LIME is a technique used to explain the predictions of any machine learning model, regardless of its complexity. In the context of abnormal human activity detection, LIME can be applied to provide local interpretability for specific video frames. It works by generating perturbations around the input data (e.g., altering pixels in the video frame) and observing how these perturbations affect the model's predictions. By analyzing the changes in predictions, LIME identifies the most influential features or regions in the video frame, thereby explaining the model's decision for that frame[7].

b) SHAP (SHapley Additive exPlanations): SHAP is another model-agnostic technique used to explain the output of machine learning models. SHAP assigns a Shapley value to each feature in the input data, indicating its contribution to the model's prediction. In the context of abnormal activity detection, SHAP can be used to quantify the importance of different features or regions in surveillance videos. By analyzing the Shapley values, stakeholders can understand which aspects of the video frames are most relevant to the model's decision, thereby gaining insights into the reasoning behind the model's predictions [8].

c) Attention Mechanisms: Attention mechanisms are a class of techniques commonly used in deep learning models to focus on relevant parts of input data. In the context of abnormal human activity detection, attention mechanisms can highlight specific parts of a video frame that are most relevant for making the model's decision[9]. For example, in a surveillance video showing a crowded street, the attention mechanism may focus on individuals exhibiting suspicious behavior, such as loitering or carrying bulky objects. By visualizing the attention weights assigned to different regions of the video frame, stakeholders can understand which parts of the frame are being considered by the model, thereby gaining insights into the decision-making process.

These XAI techniques provide valuable insights into the decision-making process of AI models for abnormal human activity detection in surveillance videos [10].

By understanding the importance of different features or regions in the video frames, stakeholders can interpret and validate the outputs of AI models, thereby enhancing trust, accountability, and transparency in surveillance applications [11].

Benefits of Explainable Abnormal Activity Detection:

Using Explainable AI (XAI) for abnormal human activity detection in surveillance videos offers several advantages, particularly in addressing the challenges associated with deep learning models [12]. Here are the advantages:

- Improved Debugging and Identification of Biases in Deep Learning Models: XAI techniques provide insights into the decision-making process of deep learning models, facilitating the identification of errors and biases. By analyzing the explanations provided by XAI methods such as LIME or SHAP, developers and researchers can pinpoint the specific features or patterns that influence model predictions. This enables them to debug errors and detect biases that may exist in the training data or model architecture. For example, if a deep learning model consistently misclassifies certain activities, XAI can help identify the features responsible for these misclassifications, leading to improvements in model performance and reliability.
- Increased Trust and Understanding for Human Operators: XAI enhances transparency and interpretability, which in turn increases trust and understanding among human operators using surveillance systems. Human operators, such as security personnel or law enforcement officers, rely on AI-powered surveillance systems to assist them in making decisions. By providing explanations for model predictions, XAI helps operators understand the rationale behind AI outputs and gain confidence in the system's reliability. This increased trust fosters collaboration between humans and AI, leading to more effective decision-making and improved overall performance of surveillance operations.
- Stronger Legal Justification for Actions Based on AI Outputs: In legal proceedings or investigations where surveillance footage is used as evidence, it is essential to provide transparent and interpretable justifications for actions taken based on AI outputs. XAI techniques enable stakeholders to explain and justify the decisions made by AI systems, enhancing the legal defensibility of using AI-driven surveillance technologies. By providing clear explanations for model predictions, XAI strengthens the validity and credibility of AI-generated evidence in court or other legal contexts. This helps ensure fairness, accountability, and compliance with legal standards, thereby enhancing the overall reliability and trustworthiness of AI-powered surveillance systems.

Thus, leveraging XAI for abnormal human activity detection in surveillance videos offers numerous advantages, including improved debugging and bias identification in deep learning models, increased trust and understanding among human operators, and stronger legal justification for actions based on AI outputs. By enhancing transparency, interpretability, and accountability, XAI enables more effective and responsible deployment of AI technologies in surveillance applications, ultimately contributing to safer and more secure environments.

IV. APPLICATIONS AND FUTURE DIRECTIONS

Potential Real-World Applications:

- Public Safety and Law Enforcement: XAI-based abnormal human activity detection in surveillance videos can be used in public spaces such as airports, train stations, and city centers to identify suspicious behavior, unauthorized access, or potential threats. This can help law enforcement agencies intervene proactively and mitigate security risks.
- Critical Infrastructure Protection: Surveillance systems equipped with XAI can be deployed in critical infrastructure facilities such as power plants, nuclear facilities, and water treatment plants to detect abnormal activities that may pose a risk to infrastructure integrity or public safety. Early detection of anomalies can enable prompt response and prevent potential disasters.
- Border Security: XAI-based abnormal human activity detection can be utilized in border security operations to identify illegal border crossings, smuggling activities, or suspicious behavior near border checkpoints. This can enhance border surveillance capabilities and help border control agencies secure national borders more effectively.
- Commercial and Retail Security: Retail stores, shopping malls, and commercial establishments can leverage XAI-based surveillance systems to detect theft, shoplifting, and other criminal activities in real-time. By alerting security personnel to suspicious behavior, these systems can help prevent losses and ensure a safe shopping environment for customers [13].

Ongoing Research Directions in XAI for Abnormal Human Activity Detection:

- Development of Advanced Explanation Techniques: Researchers are exploring advanced XAI techniques to provide more detailed and comprehensive explanations for abnormal human activity detection in surveillance videos[14]. This includes methods for generating intuitive visualizations, natural language explanations, or interactive interfaces to help users understand and interpret AI-generated insights more effectively [15].
- Incorporating User Feedback into the Explanation Process: There is a growing emphasis on incorporating user feedback into the explanation process to improve the relevance and accuracy of explanations provided by XAI systems. By soliciting feedback from end-users, such as security personnel or law enforcement officers, XAI systems can adapt and refine their explanations based on user preferences, domain knowledge, or specific operational requirements.
- Addressing Ethical and Societal Implications: Researchers are also focusing on addressing ethical and societal implications associated with XAI-based abnormal human activity detection, such as privacy concerns, algorithmic biases, and potential misuse of surveillance technologies. This includes developing guidelines, frameworks, and regulatory mechanisms to ensure responsible and ethical deployment of XAI systems in security contexts while safeguarding individual rights and freedoms.

V. CONCLUSION

In conclusion, the integration of Explainable AI (XAI) techniques into abnormal human activity detection from surveillance videos represents a significant advancement in enhancing the transparency, accountability, and reliability of AI-powered surveillance systems. Throughout this review paper, we have explored the importance of XAI in providing insights into the decision-making process of AI models, thereby fostering trust and understanding among stakeholders in various security contexts. By leveraging XAI techniques such as LIME, SHAP, and attention mechanisms, researchers and practitioners can gain valuable insights into the features and patterns driving model predictions, facilitating the detection of abnormal activities and potential security threats. Moreover, XAI enables stakeholders to identify and address biases, errors, and ethical concerns inherent in AI-driven surveillance systems, thereby promoting fairness, accountability, and ethical use of AI technologies. Looking ahead, ongoing research in XAI for abnormal human activity detection in surveillance videos is focused on developing more advanced explanation techniques, incorporating user feedback into the explanation process, and addressing ethical and societal implications associated with AI-powered surveillance technologies. By advancing the capabilities and applications of XAI, researchers aim to enhance the effectiveness and responsible deployment of surveillance systems for safeguarding public safety and security.

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Adaptive Workload Scheduling Design in Parallel Computational Framework

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Abstract: In the recent years, many researchers have showed a great deal of interest to improve the scheduling of workload in the cloud platforms. On the other hand, to carry out the execution of the scientific workloads in the cloud environment, it consumes much time and is expensive; hence, it is neither time efficient nor cost-efficient. Due to this reason, many research studies have been carried, by which the researchers tend to reduce the processing time and make a cost-efficient method as the users are charged based on the usage. Very few studies have been done to optimize the cost with processing time and energy parameters together in order to meet the Service Level Agreement (SLA) and Quality of Service (QoS) of the workload task. Hence, in this paper, we present an Adaptive Workload Scheduling (AWS) model that ensures the Task Level SLA prerequisites in a heterogeneous distributed-computing environment. This AWS-model approach reduces the amount of energy and time needed to execute a given workloads. Cybershake scientific workload has been utilized for the studying proposed AWS model. When model was compared with the standard workload scheduling approach, our model reduced the consumption of cost, energy and time.

Keywords: Cloud computing, MapReduce, Quality of services, Resource utilization, Task scheduling, Workloads.

INTRODUCTION

There are many scientific complex workloads, which are widely used for the scientific and business investigation[1]. Some of these examples include astronomy workloads known as LIGO and Montage, earthquake detection workload known as CyberShake and genome sequencing workloads known as SIPHT and Epigenomics [2]. There are other scientific workloads, which are widely used for various purposes. These complicated scientific workloads are The complex workload scan be described using a Directed Acyclic Graph (DAG) in which the vertices of the DAG describe the dependencies and the edges run on a variety of platforms, including Amazon EC2, Pegasus, and Map Reduce [3],[4].

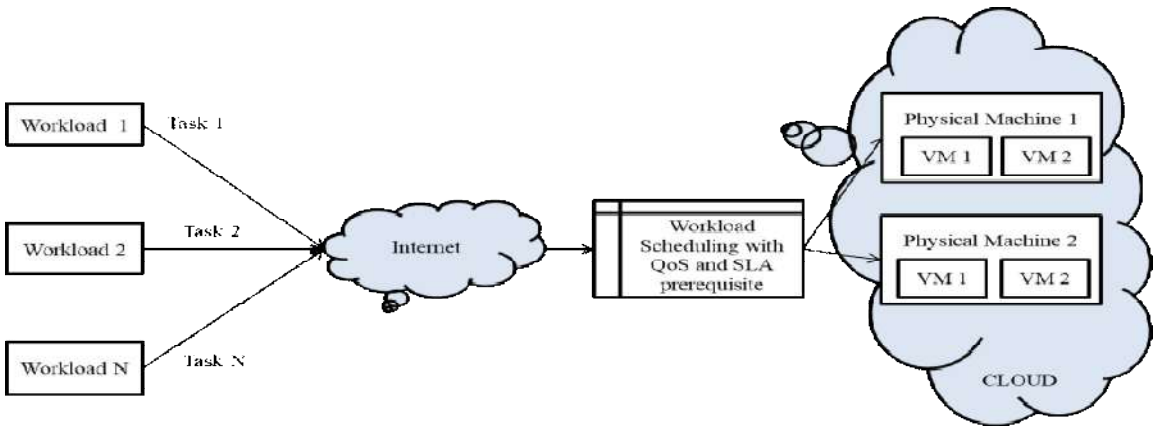

Fig.1. Basic architecture of workload scheduling using cloud.

For the execution of the sophisticated scientific work loads, cloud platforms offer high quality computing and storage resources, including networks, services, and applications [5]. In the recent time, different scientific fields like the physics, bio-informatics and astronomy are currently using the cloud resources for modelling the different scientific complex workloads to provide better solutions for the real time problems[6]. The complex workloads can be described using a Directed Acyclic Graph (DAG) in which the vertices of the DAG describe the dependencies and the edges of the DAG describe the various tasks [7-8].In the recent years, there has been an increasing adoption of cloud services for different applications uses. Due to this, most of the researchers are using the cloud services to schedule the workload[9]. A straight forward architecture for scheduling workloads in a cloud environment is shown in Figure1. However, creating an effective workload-scheduling model by examining the existing model sposes a number of difficulties, such as performing increasingly complicated scientific workloads, which takes more time to complete and is more expensive to execute. When things must be completed by a certain date, it becomes more difficult. Various studies have been done by the various researchers where they have developed various heuristic algorithms to provide an optimal solution for such problems. Further, the heuristics model are not time efficient. Hence, most of the researchers have failed to get an optimal solution, which affects the SLA violation and QoS. Additionally, it is said that workload scheduling is an NP-hard problem[10].In reality, workload scheduling makes it exceedingly difficult to optimize both time and cost [11]. For example, if a scheduling model aims to cut costs, it will take longer to accomplish a particular task. This is due to the relationship between time and cost. The cost and make span optimization challenges still exists since many existing models do not take virtual machine selection policy into account while constructing schedules [12].[13]. This research provides an adaptive workload scheduling method that ensures SLA at the task level to address a fore mentioned issue. The AWS model provides energy minimization with performance assurance at the task level.

The significance of AWS-TLS is given below:

- The AWS provide effective workload scheduling that minimize energy dissipation and meet task-dead line prerequisite.
- The AWS reduces energy dissipation reduce make span, and cost for executing data-intensive workload in comparison with standard model.
- The AWS is very efficient is execution of scientific workflow that is CPU, I/O, and memory intensive in nature.
- Works well to provide task level SLA for both smaller and larger task.

2 LITERATURE SURVEY

The state-of-art scheduling of complex-workload is studied in this study [12],[13] to determine its advantages and draw backs. For heterogeneous computation platforms,[14] focuses on optimizing cost and energy and jointly to create scheduling of workload. Here am in function is used to save energy consumption and satisfy work deadlines, considering that job information is scattered geographically. Considered diverse deadlines and classified by deadline small to large here. Finally, a method of adaptive search is proposed for the selection of an efficient timetable for the execution of the process. According to [15], increased computing costs for service supply are directly related to an increase in energy consumption. The most important metrics in service supply are reliability and timeliness. In order to reduce the amount of energy required to run workloads, they came up with a scheduling architecture namely energy-min scheduling (EMS) that met both the reliability and the timeliness requirements.

When it comes to dealing with cloud computing uncertain resource availability, a trade off was modeled in [16].Multi-objective optimization models of cost and make-span are combined here. Various levels of interruption are explored, and the results reveal that existing models perform better [17]. An evolutionary computing model, NPSO (Nested-Particle-Swarm-Optimization), as well as a faster version, FNPSO (Fast Nested-Particle Swarm Optimization), were designed in [18] with the goal of improving the execution of complex workloads. In comparison to the NPSO model, the FNPSO is greatly reduced. Heterogeneous earliest finish time (HEFT) and Q-Learning (QL) were coupled to create an efficient scheduling system called QL-HEFT in [19]. In order to speedup computations, the QL-HEFT has been designed. QL's reward function is modified based on HEFT's rising ranks. This helps the Q-Learning system learn more efficiently. To begin, the QL determines the most efficient task sequence and then selects the best machine for the job based on the earliest completion time. Contention awareness was taken into consideration in [20] when designing a scheduling system for workload execution.

In [21], they have proposed a workload scheduling approach based on an evolutionary computing model for meeting deadlines while minimizing costs, namely DCOH. It was also upgraded with multi-objective parameter optimization under hybrid cloud platform to improve DCOH. Scheduling workload applications to fulfil application deadlines and costs is now possible in [22]. During resource allocation, budget and cost ratio are utilized to correlate budget and timeline constraints. Here, they improved priority selection design for job ordering. Certain decisions are discarded in order to increase success rate (i.e., reliability). According to [23], a cloud-based scheduling strategy must meet user deadline requirements and service level agreements (SLAs). They used a multi-cloud platform to suit the performance and cost requirements of the stream workload application. Using a multi-cloud platform and a fault-tolerant scheduling design, create [24-25]. In addition, the model ensures that the reliability criterion is met and that the cost is decreased. An

analysis of failure and reliability rates was performed using a continuous probability distribution.

Once the cost of executing on the multi-cloud platform has been calculated, the next step is to define a fault-tolerant workload scheduling design that ensures reliability, reduces cost, reduces execution time and is cost effective. However, the application's cost constraints could not be met due to a lack of load balancing. The following part proposes a cost and performance-aware scheduling strategy for heterogeneous cloud environments to address the a fore mentioned challenges.

3. ADAPTIVE WORK LOAD SCHEDULING DESIGN IN PARALLEL COMPUTATIONAL FRAME WORK

In this section, we present our model for scheduling the work load, which provides a better performance by keeping the SLA violations constant at the task-level in a parallel-computational architecture. For monitoring the process, we design and implement an adaptive workload scheduling, also known as AWS-TLS, which takes into accounts ever al restrictions including task dependency, priority, parallel computing as well as various parameters like energy consumption and make-span minimization. A scientific complex workload has a various kind of tasks and huge amount of data. Hence, to execute these large data, a significant number of clusters are required for the execution of each task. Further, there are many tasks which are running parallel in the clusters, which need a well-organized scheduling and efficient use of resources. There are mainly two key elements to solve the problem of workload scheduling, which can be broken down into two separate issues: workload scheduling and optimal- task scheduling. Moreover, the workload scheduling has to be done in a way where different constraints can be fulfilled like task priority, energy constraint, task monitoring, and make span constraint and parallel computation. Hence, by using a multi-level scheduling workload model, these issues can be addressed by executing and scheduling each task at each level, as well as monitoring them with time and energy constraints.

For the initial stage, let's consider a large number of tasks $o$running parallels in each cluster, each having a certain size$\square_1$, $\square_2$, … . , $\square_o$ and set of constraints with the necessity for executing a task$_{1,2,}$….,s_o. Moreover, to optimize the energy consumption F with respect to the task scheduling on the given processor in a data center is to compute the various power supplies q_1, q_2, … . , $q_o$on a processor $n$is such a way that the length of scheduling is reduced and the energy consumed should not exceed the energy consumption F. Furthermore, it has been determined that most of the recent works have only focused on the single constraints, which is impractical for real-time models and does not provide a feasible optimal solution. Hence, multi objective constraint at different levels is considered for the constructing adaptive workload scheduling with task-level SLAs in section$B$.

3.1Resource Usage Estimation Metric: 1

In this given section, we present a system model, which provides an task and power model. In this section, the main concern is to reduce the power consumption for the given computational framework. Thus, we first describe the power consumption using the given Equation(1).

q=g𝕓DW2 (1)

In Equation (1),q is considered the power consumption an miscalculated to an approximate value. g is used describe the clock frequency, describes the load capacity that it can handle and$W$is used to describe the voltage. Further, $Wag\delta$ is used to describe the relationship between the voltage and the frequency of the clock in which $\delta$is considered to be a constant. Moreover, the speed consumed for the execution is represented using which is proportional to the frequency of clock g. Assume two scenarios in which W= $cg\phi$and T= dg. In these scenarios let $c$and $d$be a constant value. Using this scenario, the power consumption can be evaluated using the given below equations.

q= Tb (2)

b=2α+1 (3)

=bc2CD (d2α+ 1)− 1 (4)

Equation (2) has been generated by using the equation (1). The evaluation of $b$and μ is calculated by utilizing the Equation (3) and Equation(4) respectively. In a Directed Acyclic Graph, each tasks are first designed and any of the parallel task denoted by o can be represented using H=(W,F). In H=(W,F),

W is used to indicate the tasks and W={1,2,3,….,o} and Frepresents the priority of the task. Further, if any two tasks, consider task 1 as $j$and task 2 as k,then the relationship between the two tasks $j$and $k$can be represented using the $arc(j, k)$ which explains the task k cannot be executed until and unless the task $j$has been completed and finished. Furthermore, $\square j$ represents the resources required by the task j for the execution of the task, and is calculated using the given equation Xj= $\square jsj$. For each task processor is considered. For example, if we want to execute a task which has been

given an $n$processor from the datacenter, then it executes the task and also provides parallel computation. Further, to evaluate the parallel computation, consider an application v which is running parallel and has some tasks H_1,H_2,…..,H_v for the given processor n. In this application, the multiple tasks are also designed under the single task using the multi-level method.

In addition, the power supplied to the task j of the application can be represented using $qj$and can be evaluated using the equation $Tj= q^{V}/b$which is also used to determine the execution speed. Further, $qj= Tjb$and time required for the execution is evaluated using the Equation (5).During the execution of the tasks the speed of the processor remains the same. The energy required for the execution of the task is given using the Equation(6).

$$uj=(sj/Qi)b -1 \quad (5)$$

$$fj=TJB- 1Xj \quad (6)$$

In Equation (6), Xj represents the amount of work that has to be executed by the task j. Furthermore, it should be taken into consideration that in a real processor, the clock frequency and the execution speed can only take finite values, as the Xj is the executed work, which has been executed earlier.

3.2SLA constraint modelling:

We determine the lower bound in this section. Consider the parameter X, which may be represented by the equation, as the quantity of work completed for a particular parallel task o.(7)

$$X=x1+x2+\cdots+xo \quad (7)$$
$$=\square 1\ s1+\ \square 1\ s2++\cdots+\square oso$$

F' and U' are used to represent the lowest energy and ideal length needed for an optimal schedule, respectively. In a multi-level workload-scheduling paradigm, the lower bound that helps to shorten the make span can be evaluated by taking into account all of these characteristics.

$$nXb1/(b-1) \quad (8)$$
$$U'\geq(())$$
$$F^{\sim}\ \ n$$

According to equation (8), the lower bound shortens the make span and the supplied Equation (9) below shows the lower bound to cut back on energy consumption.

$$Xb \quad (9)$$
$$F'\geq n\ ()(\tilde{U}b-1)-1$$
$$n$$

Both the Equation (8) and Equation (9) can be used for any dependent, independent and parallel task.

3.3 Adaptive Work load Scheduling Method:

An adaptive workload scheduling approach has been shown in this section. The AWS method starts by taking into considers c as the amount of time needed to complete job $O\ kd$. The tasks that are not scheduled in this part are examined and monitored to determine whether they are available for execution, that is, to determine whether the resources needed to complete the work are readily available. As a result, this includes more tasks than the earlier approaches [15],[24]. The task's scheduling also aids in increasing the processor's efficiency. The equation, which states that when the job$O$=1, then, can be used to represent the task scheduling

$$N \quad (10)$$
$$Q*(O,N)=\sum nsn$$
$$n=1$$

Suppose the task$O$ is more than1the n it is represented using the Equation (11)

$$Q*(O,N)=\sum Nn \quad (11)$$
$$=1sn(n+\ \ Q*(O-1,N-n))+(\sum n>Nsn)Q*(O-1,N)$$

If the size of the first task is large, then the resources, which are available, are used and all the other tasks are terminated. After this all the other remaining task$o-$ 1 are scheduled. Further average scheduling after the above situations is $Q*(O-1,N)$

3.4Adaptive Work load Scheduling with Task Level SLA Method:

In this given section, we develop and design a scheduling mechanism for the task level SLA in distributed computing platform, which monitors and reduces the consumption of energy and makes pan during parallel computation. Assume the parallel task as which have priority constraint. Further, consider two tasks $j$and$k$, also consider a cardinality order✓ which is denoted by using the DAG for the parallel task o. Then, we can say that there is a relationship between the two tasks j and k, which can be represented as j✓$k$such that the task $k$can only start the execution only when the task j has been completed. A task-level scheduling model contains different stages with w as the number of stages; moreover, the task that have no priority constraint like the first task takes the stage 1. In addition, a particular task j is considered at Stage m. Suppose, if the number of nodes start from the staring task j, then it is represented as $1 \leq m \leq w$. This method schedules the various task using various stages, i.e., Stage 1,Stage2,Stage3,….,.Stage w. Moreover, the Stage m+1 never allows the execution of another task until the task $m$at the Stage $m$has been completed. For all the stages, same procedure is used. Also, the residual energy $\tilde{F}$ is then allocated to the Stage v, in which the Stage1consumes F_m and $F_1+F_2+\cdots+F_w= \tilde{F}$. Further, the processor n_1 is considered for the first task in the Stage1and the execution of the task is represented using the$s_{m,1}$,$s_{m,2}$, …….,$s_{m,n}$. Using this the total amount of work can be evaluated by the given Equation(12)

$$X1=\pi m,1sm,1+\pi m,2sm,2 \quad (12)$$
$$+\cdots$$
$$+\pi m,omss,om$$

When scheduling workloads, it's important to keep in mind a variety of factors, such as the order in which tasks are completed and the amount of energy and time each task consumes.

3.5 F. Adaptive Workload Scheduling withTask Level SLA Assurance Algorithm:

This section presents the algorithm of adaptive workload scheduling assuring SLA at task level. The AWS algorithm is described inAlgorithm1.

Algorithm1. The algorithm of adaptive workload scheduling assuring SLA at task level.
Step1. Design at ask and power model
Step2. Compute the given lower performance constraint limits
Step 3. Mechanism for adaptive task scheduling in which tasks that have not been scheduled are tested to see if the necessary resources are available for their execution.
Step 4. Design the tasks in Directed Acyclic Graph. The number of levels in the DAG is$w$, where w is the number of levels with varying energy and make span SLA constraint in the DAG.
Step5. Non-urgent tasks fall under the category of level1.
Step 6. AWS organizes tasks into levels1,2,3,4,etc., and keeps track of all of them.
Step 7. Furthermore, unless the task in level m is finished, +1 level cannot be executed. The monitoring process is the same for each level m.
Step8. As task are independent are different level as a result, they are scheduled using adaptive task scheduling technique.

4. RESULT AND DISCUSSION

This section examines the effectiveness of the proposed AWS-T over the current EMS-RTPW [15] approach in terms of make span, energy efficiency, and cost effectiveness. Java programming is used to implement AWS and EMS utilizing cloud sim[2],[3]. The CPU and I/O consuming character CPU, memory, and cyber shake Workload- scheduling model validation is done using Metrics like make span, energy utilization, and cost effectiveness are utilized to verify workload-scheduling models.

4.1 Make span performance:

In this section the make span for completing execution of small to extra-large work load of Cybershake is studied. In Fig.2,the make span attained for executing Cybershake using AWS and EMS-RTPW considering varied workload is graphically shown. The Cybershake workload task size of small, medium, large, and extra-large is equal to 30, 50,100, and 1000, respectively. An average make span efficiency improvement of 78.99% is achieved using AWS over EMS-RTPW.

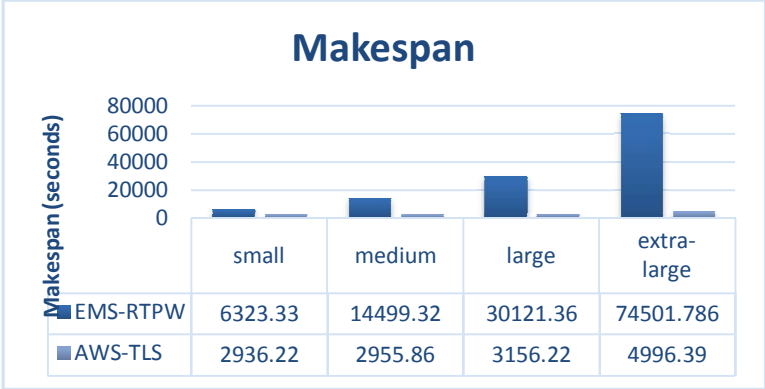

Fig 2: Make span of Cybershake workload

4.2 Energy efficiency:

In this section, the energy efficiency for completing execution of small to extra-large workload of Cybershake is studied. In fig the energy consumed for executing Cybershake using AWS and EMS-RTPW considering varied workload is graphically shown in fig 3.The Cybershake work load task size of small, medium, large, and extra-large is equal to 30, 50, 100, and 1000, respectively. An average energy consumption reduction of 24.35% is achieved using AWS-TLS over EMS-RTPW.

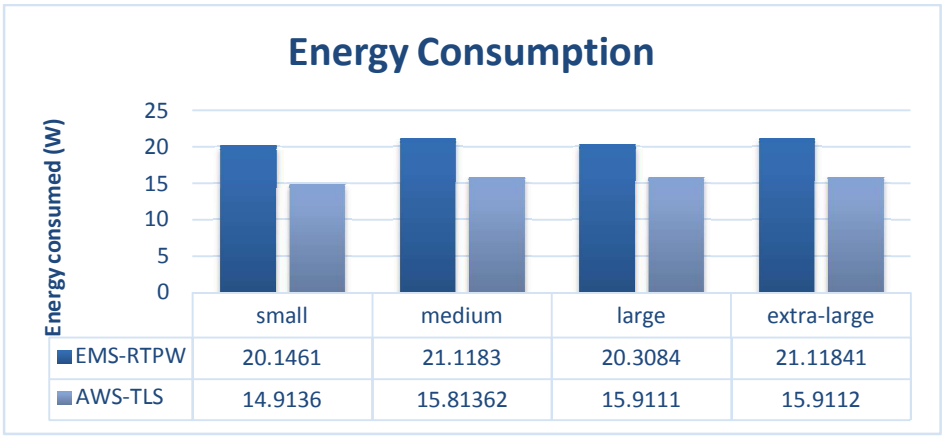

Fig 3. Energy consumption of Cybershake workload

4.3 Cost efficiency:

In this section the cost efficiency for completing execution of small to extra-large workload of Cybershake is studied. In Fig. 4, the cost incurred for executing Cybershake using AWS and EMS-RTPW considering varied workload is graphically shown. The Cybershake workload task size of small, medium, large, and extra-large is equal to 30,50,100, and 1000, respectively. An average cost reduction of 78.68% is achieved using AWS over EMS-RTPW.

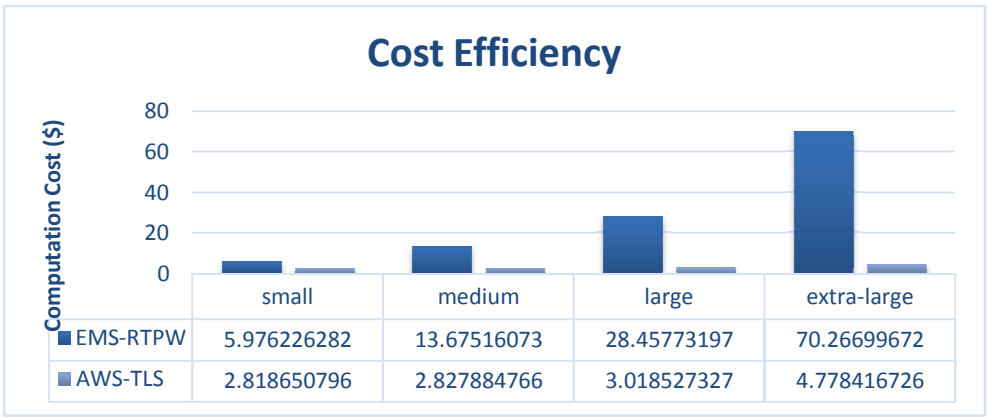

Fig 3. Energy consumption of Cybershake workload

5. CONCLUSION

In this research an effective workload scheduling is presented that assures the task level Service Level Agreement (SLA). None of the existing approaches had considered workload scheduling at task level SLA till yet. In this work, an adaptive scheduling technique is established that can decrease the energy consumption as well as maintain the performance on high level, which reduces the execution cost significantly. The AWS- TLS model is very much effective in provisioning CPU, memory as well as I/O intensive execution that leverages for distributed platform for computing such as cloud environment. Further, experiments show the efficient outcomes of AWS-TLS model with respect to energy efficiency with an improvisation of 44.85% and 25.35% is experienced by AWS-TLS over EMS-RTPW for Inspiral and Cybershake workload, respectively. The make span for execution of workload is reduced by83.07%and78.99%byAWS-over EMS-RTPW, for Inspiral and Cybershake workload, respectively. Similarly, cost for execution of workload is reduced by 82.88% and 78.68% by AWS-TLS over EMS-RTPW for Inspiral and Cybershake work load, respectively. In future the proposed scheduling model will be tested with more diverse workload dataset. Alongside would consider leveraging multi-cloud and edge-cloud platform to further reduce cost and delay of execution, respectively.

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Material Property Prediction Using Machine Learning

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Abstract: The ability to accurately predict the properties of materials is crucial for numerous applications across various industries, including materials science, engineering, and manufacturing. With the advent of machine learning (ML) techniques, researchers have gained powerful tools to model and predict material properties based on their composition, structure, and processing conditions. This review paper provides a comprehensive overview of material property prediction using machine learning. It covers the historical development, available ML models, recent trends, and prospects in this rapidly evolving domain.

Keywords: Materials Informatics, Property Prediction, Data-Driven Materials Science, Computational Materials Design

I. INTRODUCTION

Understanding and predicting the properties of materials is a fundamental challenge in materials science and engineering. Traditional approaches, such as experimental characterization and computational simulations, can be time-consuming, resource-intensive, and often limited in their ability to explore the vast material design space. Machine learning has emerged as a powerful alternative, offering data-driven approaches to model and predict material properties with high accuracy and efficiency. Machine learning algorithms leverage large datasets of material properties and their corresponding descriptors (e.g., composition, structure, processing conditions) to build predictive models. These models can then be used to make accurate property predictions for new materials without the need for extensive experimental or computational efforts. The applicability of ML in material property prediction spans a wide range of properties, including mechanical, thermal, optical, electronic, and catalytic properties, among others. The field of material science and engineering has long been characterized by the quest for understanding and controlling the properties of materials to meet specific performance requirements in various applications. Traditionally, this process has relied heavily on empirical observations, theoretical models, and experimental testing. However, the increasing complexity of materials and the growing demand for novel materials with tailored properties have spurred the exploration of alternative approaches. In recent years, machine learning (ML) techniques have emerged as powerful tools for predicting material properties, offering new avenues for accelerating the materials discovery and development process. This paper reviews the current state-of-the-art in applying ML for predicting various material properties, including mechanical, electronic, optical, and thermal properties. The strengths and limitations of different ML approaches are discussed, along with future research directions.

A. Significance of Material Property Prediction:

Accurate prediction of material properties is crucial for accelerating the design and optimization of materials for diverse applications, including aerospace, automotive, electronics, energy, healthcare, and beyond. By accurately predicting material behaviors such as mechanical strength, thermal conductivity, electrical conductivity, corrosion resistance, and more, researchers and engineers can expedite the development of innovative materials with enhanced performance

characteristics. Material property prediction enables informed decision-making in material selection, process optimization, and product design, ultimately driving advancements in technology and sustainability.

B. Methodology of ML Models for Property Prediction:

Machine learning techniques offer a data-driven approach to material property prediction, leveraging algorithms to analyze large datasets of material characteristics and properties. The methodology typically involves several key steps:

1. **Data Collection and Preprocessing:**
   Gathering diverse datasets containing information on material compositions, processing conditions, and corresponding properties. Preprocessing steps may include data cleaning, feature extraction, normalization, and dimensionality reduction to enhance the quality and relevance of the input data.
2. **Model Selection and Training:**
   Choosing appropriate ML models, such as regression, classification, or deep learning architectures, based on the nature of the property being predicted and the characteristics of the dataset. Training the selected models on the prepared dataset using techniques like supervised, unsupervised, or semi-supervised learning to learn patterns and relationships between input features and target properties.
3. **Model Evaluation and Validation:**
   Assessing the performance of trained models using metrics such as accuracy, precision, recall, mean squared error, or correlation coefficient. Validating the models through cross-validation, holdout validation, or external testing on unseen data to ensure generalization and reliability.
4. **Feature Importance Analysis:**
   Conducting feature importance analysis to identify the most influential input features or descriptors contributing to property prediction. This analysis provides valuable insights into the underlying mechanisms governing material behavior and informs future research directions.

C. Applications in Different Domains:

Material property prediction using ML techniques finds applications across a wide range of domains, including:

1. **Materials Design and Discovery:**
   Accelerating the discovery of new materials with desired properties through virtual screening, high-throughput experimentation, and materials informatics.
2. **Process Optimization:**
   Optimizing manufacturing processes and fabrication techniques to enhance material properties and performance while reducing costs and environmental impact.
3. **Property Prediction for Simulation:**
   Providing input parameters for computational modeling and simulation studies, enabling predictive analysis of material behavior under different conditions.
4. **Materials Informatics Platforms:**
   Developing materials informatics platforms and databases to facilitate data sharing, collaboration, and knowledge discovery within the materials science community.

II. LITERATURE SURVEY

Material property prediction using machine learning (ML) techniques has garnered significant attention in recent years due to its potential to revolutionize materials science and engineering. This literature survey provides an overview of key research studies, methodologies, advancements, and challenges in the field of material property prediction using ML. Machine learning (ML) techniques have recently emerged as a powerful tool for accelerating the prediction of material properties by leveraging available data [8]. ML models can be trained on existing data from experiments, simulations, or a combination of both to learn the underlying relationships between material descriptors (e.g., composition, structure) and target properties. Once trained, these models can rapidly predict properties for new materials, significantly reducing the computational cost compared to traditional methods.

A. Early Developments and Methodologies:

The early applications of ML in material property prediction focused on simple regression and classification models applied to relatively small datasets. For example, in a seminal study by Ramprasad et al. (2017), the authors demonstrated the use of kernel ridge regression and random forest models for predicting the formation energies of inorganic compounds based on their atomic compositions and structures. This work laid the foundation for subsequent research exploring more sophisticated ML algorithms and larger datasets for material property prediction.

B. Advancements in ML Techniques:

In recent years, advancements in ML techniques have enabled more accurate and efficient material property prediction across a wide range of domains. Deep learning, in particular, has emerged as a powerful approach for capturing complex relationships within materials data. For example, Schmidt et al. (2019) introduced the concept of graph neural networks (GNNs) for predicting material properties from crystal graphs, achieving state-of-the-art performance in various property prediction tasks, including band gaps, formation energies, and elastic moduli.

C. Multimodal Data Fusion and Transfer Learning:

Researchers have increasingly explored the integration of multimodal data sources and transfer learning techniques to improve the robustness and generalization of ML models for material property prediction.

For instance, Jain et al. (2020) proposed a multimodal deep learning framework that combines crystal graph representations with chemical descriptors and elemental embeddings to predict the band gaps of inorganic materials. Transfer learning approaches, such as pretraining on large datasets or domain adaptation, have also been employed to transfer knowledge from related tasks or domains to enhance the performance of ML models on specific material property prediction tasks.

D. Applications in Materials Design and Discovery:

ML-based material property prediction has found widespread applications in materials design and discovery, offering opportunities for accelerating the development of new materials with tailored properties for various applications. For example, Xue et al. (2021) utilized a generative adversarial network (GAN) to design and synthesize organic molecules with desired photovoltaic properties, demonstrating the potential of ML-driven approaches for high-throughput materials screening and optimization. Also, The use of machine learning for material property prediction has been extensively explored in the literature. Early work in this field focused on developing ML models for specific material classes or properties, such as predicting the mechanical properties of alloys or the band gap of semiconductors. As the field has matured, researchers have developed more generalized frameworks and techniques that can be applied to a broader range of material systems and properties. One of the seminal works in this area is the pioneering study by Wolverton et al. (2001), which demonstrated the use of artificial neural networks (ANNs) for predicting the formation energy of binary alloys[1]. Since then, various ML algorithms, including random forests, support vector machines, and kernel ridge regression, have been successfully applied to material property prediction tasks.

III. AVAILABLE MODELS

Several machine learning models have been employed for material property prediction, each with its own strengths and weaknesses. Here are some of the commonly used models:

A. Artificial Neural Networks (ANNs):

ANNs are powerful models that can learn complex nonlinear relationships between input features (material descriptors) and target properties. They have been widely used for predicting a variety of material properties, including mechanical, electronic, and optical properties.

B. Kernel-based Methods:

Kernel-based methods, such as support vector machines (SVMs) and kernel ridge regression (KRR), have shown excellent performance in material property prediction tasks. These methods can effectively handle high-dimensional input data and capture nonlinear relationships.

C. Decision Tree-based Methods:

Decision tree-based methods, like random forests and gradient boosting machines, are ensemble learning techniques that combine multiple decision trees to improve prediction accuracy. They are well-suited for handling complex and high-dimensional data, making them attractive for material property prediction.

D. Gaussian Process Regression (GPR):

GPR is a non-parametric Bayesian approach that can model complex functions and provide uncertainty estimates for predictions. It has been successfully applied to predict various material properties, particularly in the realm of materials informatics.

E. Dimensionality Reduction Techniques:

In many cases, material descriptors can be high-dimensional, leading to the curse of dimensionality. Dimensionality reduction techniques, such as principal component analysis (PCA) and t-distributed stochastic neighbor embedding (t-SNE), are often employed to reduce the dimensionality of the input data, improving the computational efficiency and performance of ML models.

IV. CHALLENGES AND FUTURE DIRECTIONS:

Despite the promise of ML in material property prediction, several challenges remain to be addressed, including:

Data Quality and Availability: Ensuring the quality, reliability, and accessibility of materials data, especially for complex and novel materials.

Interpretability and Explainability: Enhancing the interpretability and explainability of ML models to facilitate trust, understanding, and decision-making by domain experts.

Model Transferability: Improving the transferability and generalization of ML models across different material systems, compositions, and conditions.

Integration with Experimental Techniques: Integrating ML predictions with experimental validation to enhance accuracy, reliability, and confidence in predicted material properties.

Looking ahead, future research directions in material property prediction using ML include:

Multiscale Modeling: Integrating multiscale modeling approaches to capture the hierarchical structure and behavior of materials across different length and time scales.

Active Learning: Incorporating active learning strategies to optimize experimental design and data acquisition, minimizing the need for extensive experimentation.

Domain-Specific Models: Developing domain-specific ML models tailored to specific material classes, applications, and property prediction tasks.

Ethical and Societal Implications: Addressing ethical and societal implications of ML-enabled materials research, including issues related to data privacy, bias, and equitable access to technologyof the proposed approach. The personalized stress management interventions, tailored to individual nurse profiles and detected stress levels, have been designed.

V. CONCLUSIONS

Material property prediction using machine learning has emerged as a powerful and rapidly evolving field, with significant implications for materials science, engineering, and manufacturing. By leveraging large datasets and advanced ML algorithms, researchers can accurately predict material properties, accelerating the discovery and optimization of new materials. Despite the remarkable progress, challenges remain, such as improving model interpretability, quantifying uncertainties, and integrating ML with experimental and computational techniques. Ongoing research efforts in these areas will further solidify the role of machine learning as a transformative tool in the quest for advanced materials with tailored properties. However, challenges remain in improving data availability, model interpretability, and integration withphysics-based methods. As ML techniques continue to advance, they will play an increasingly important role in accelerating materials discovery and design.

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Decoding Posture: Distinguishing Between Good and Bad Body Alignment

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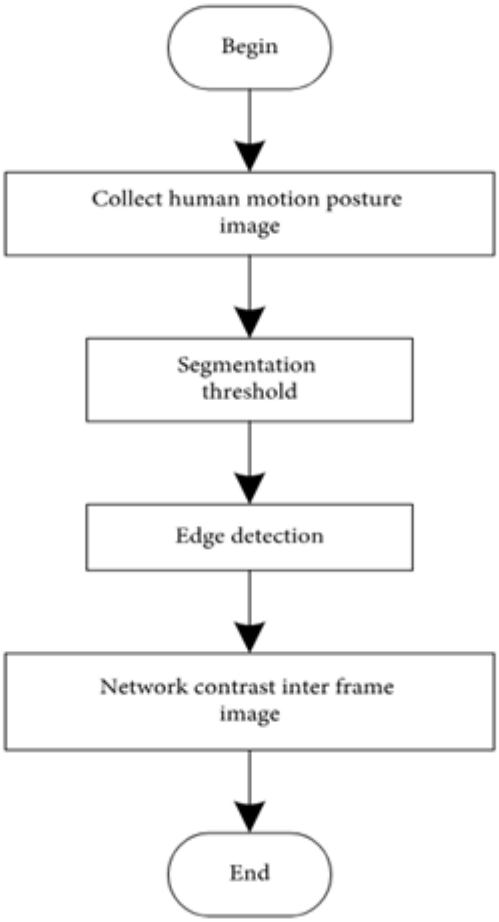
Abstract: On the grounds of artificial intelligence sensors, the research focuses on achieving precise detection of intelligent posture to minimize the risk of injuries resulting from incorrect body positioning and to mitigate the negative impact on both performance and physical well-being. Utilizing an attitude analysis and recognition system that relies on the nertial measurement unit enables not only the measurement of human body motion information but also the acquisition of data pertaining to motion characteristics and body movement states through the examination of posture data. A proposition is presented for intelligent posture training that is centered on accuracy and real-time feedback. Furthermore, it is elucidated that the accuracy of posture recognition through machine learning is significantly influenced by variations in user BMI. This paper will introduce the most recent advancements in posture recognition techniques, providing an overview of the various methodologies and algorithms that have emerged in recent years. Additionally, it delves into enhanced approaches such as stacked hourglass networks, multi-stage pose estimation networks, convolutional pose machines, and high-resolution nets. The study thoroughly dissects and consolidates the general procedures and datasets involved in posture recognition, comparing several enhanced CNN methodologies alongside three principal recognition techniques. Moreover, it delves into the utilization of advanced neural networks in posture recognition, including but not limited to transfer learning, ensemble learning, graph neural networks, and explainable deep neural networks. Researchers have observed that CNN has made significant strides in the realm of posture recognition and has garnered favor, yet emphasize the necessity for further exploration into areas such as feature extraction and information fusion.

Keywords: Posture recognition; artificial intelligence; machine learning; deep neural network; deep learning; transfer learning; feature extraction; classification

I. INTRODUCTION

Humans dedicate a significant portion of their daily activities to sitting, exceeding fifty percent on average. Extensive research has been conducted on the negative impacts of improper sitting positions and prolonged sedentary behavior on both physical and mental well-being. In recent years, there has been a notable emphasis on developing solutions to combat this sedentary lifestyle, particularly through the integration of advanced sensing technologies and Artificial Intelligence (AI). Addressing sitting posture monitoring and correction stands out as a crucial challenge in leveraging AI to enhance human health. The utilization of smart techniques for sitting posture training is introduced, incorporating innovative pressure sensing technology, a smartphone application interface, and machine learning (ML) for instantaneous sitting posture assessment and guidance on seated stretches. A detailed account of the experimental framework employed for collecting data on sitting postures and stretch poses through the posture training system is provided. A remarkable accuracy rate of 98.93% was achieved in identifying over thirteen distinct sitting postures through the implementation of a swift and resilient supervised learning algorithm. Furthermore, the significance of factoring in variations in user body mass index during posture monitoring is underscored. Moreover, the development of the initial ML-driven system for recognizing human stretch poses based on pressure sensor data is outlined, along with an evaluation of its efficacy in categorizing six prevalent chair-bound stretches. The primary objective of this study is to offer a comprehensive and efficient approach to enhance proper sitting posture and integrate seated stretching exercises within the workplace environment.

This intervention has the potential to significantly influence multiple areas such as workplace ergonomics, individual physical fitness, and overall health. Furthermore, apart from the proposed strategy, this research aims to contribute to the continuous endeavor of promoting well-being across different sectors by tackling the obstacles associated with maintaining appropriate sitting posture and integrating seated stretches promptly. The significance of these interventions in averting musculoskeletal disorders and ensuring overall health is increasingly acknowledged in occupational health promotion initiatives. Through attaining remarkable precision in identifying a wide array of sitting postures and specific stretches performed while seated, the system showcases its capacity to significantly influence workplace ergonomics, individual fitness, and overall health. According to the human motion posture information obtained from the analysis, deep learning and reinforcement learning are combined, and the detection process of human motion posture is designed, as shown in Fig 1 below. To sum up, according to the edge detection algorithm process, the edge contour of the human motion posture is roughly outlined, and deep learning and reinforcement learning are combined to complete the design of the human motion posture detection algorithm and realize the detection of human motion posture.



II. RELATED WORK

The algorithm for detecting human motion posture has attracted extensive research both domestically and internationally due to its significant economic and social impact. Addressing issues in human posture data recognition, Cai et al. [11] identified key sequence frames from motion images and developed a recognition approach based on this extraction. By selecting the original motion posture sequence beforehand, they established the initial keyframe sequence for human body posture. This sequence, coupled with a frame elimination algorithm, was utilized to derive the key frame sequence for posture, and the posture model was trained using the Baum-Welch method for recognition. The approach demonstrates enhanced performance in accurately recognizing human body postures. Recognizing the limitations of the sliding window algorithm in human posture data collection, Zheng et al. [12] curated a dataset on human body postures by gathering time series data. Furthermore, they differentiated and classified persistent behavior postures and sudden behavior postures of the human body by comparing long short-term memory (LSTM) with alternative networks and algorithms. This methodology can elevate the accuracy of human posture detection by 4.49%. devised a recognition technique employing the posture signal sequence and implemented a three-layer recognition algorithm to identify various postures. The outcomes demonstrate that the recognition algorithm meets the specified criteria.

The developed a monitoring device for tracking human hand movements, utilizing nanogenerators to observe hand movement postures. This integrated human prior knowledge with performance capture from the human motion capture system. To enhance the system's usability while upholding high fidelity, the model was continuously updated during motion capture. Experimental results indicate that this approach offers a certain level of convenience.Few authors likeZhao and Chen introduced a methodology aimed at identifying and classifying the stance of a mobile individual by leveraging sensor technology that employs inertial sensors for the recognition of activities such as shooting, passing, dribbling, and catching. An inertial sensor positioned on the arm is utilized for data collection in the experimental setup. Subsequent to the application of smoothing and normalization techniques, frequency domain characteristics are isolated, yielding 30 feature vectors through principal component analysis. Subsequent to reducing dimensions, enhancements are made to the methodology. Nevertheless, there is a significant loss of intricate details pertaining to human posture. HSIU-YU LIN et al. put forth a technique for posture assessment employing a convolutional regression neural network (RNN) within the context of fall detection, proposing a continuous deep learning framework. The framework processes a sequence of continuous images for posture classification purposes, with Microsoft Kinect serving as the non-wearable sensor. Furthermore, an LSTM architecture is established through RNN for the identification of human postures within fall detection scenarios. This approach involves the extraction of features from preprocessed high-resolution RGB images, allowing for the capture of body contours with realistic motion and depth details. Nonetheless, the precision of human body posture identification remains suboptimal.

III. TECHNIQUES

Posture detection and correction Techniques

Machine-Learning-Powered Human Sitting Posture: Various systems have been previously proposed to monitor sitting posture in order to encourage adopting an upright posture with both passive approaches (ergonomics, materials, and fabrics) and active approaches (IoT and sensors). Passive solutions include ergonomic chairs, cushions, elastic bands, and foot rests. Active solutions track sitting posture and include smart cushions, wearable point trackers, and smartphone applications. Recent advances in Artificial Intelligence (AI) and ubiquitous sensing have highlighted the practicality and effectiveness of collecting and mining human-health-related data in real-time for the assessment and improvement of human health and well-being . Better sensing technologies and the large quantities of data they generate have facilitated the application of machine learning to detect and monitor various problems related to well-being such as poor sitting posture. Real-time sitting posture recognition and prolonged sitting monitoring are challenging tasks that require accurate tracking of sitting posture and seated behavior. Sitting is a dynamic task that comes with a wide range of inter-individual variability in body characteristics and differences in working environments, sitting habits, and various other user-specific parameters, which current active posture tracking solutions have yet to address. Moreover, the lack of a standard source of sitting posture and seated behavior data hinders progress in research to achieve active and accurate sitting posture monitoring. Accurate posture tracking leads to effective feedback for active posture correction and good sedentary habits' promotion. The empowerment of human well-being through posture tracking and correction has important benefits in many domains including the workplace, personal fitness, driver assistance, and entertainment.

Human Motion Posture Detection Algorithm Using Deep Reinforcement Learning: The perception ability of deep learning is used to match the feature points of human motion, and by locating feature points of human motion posture, the position and direction of the human motion posture feature are determined, and the human motion posture feature is obtained. This method analyzes the contour of the human body motion posture, uses the training characteristics of the deep learning network and the reinforcement learning network to obtain the human body motion posture change information, obtains the general direction of the human body motion posture, and realizes the design of the human body motion posture detection algorithm. The contribution of this paper is as follows: (1) the algorithm in this paper uses deep reinforcement learning to detect human motion posture, determine the position and direction of human motion posture features, and obtain human motion posture features, which can improve the accuracy of human motion posture detail feature extraction. (2) The paper proposes an antigen-antibody binding method to detect human motion posture. This method uses the color histogram distribution of the human body motion posture as an antigen, searches for an area similar to the human body motion posture in the human body motion image, and uses the candidate region of the human body motion posture as an antibody. At the same time, this method realizes the extraction of human body motion posture features by calculating the affinity between the antigen and the antibody. (3) In this paper, the deep learning network is used to obtain the information of the human body movement posture change to improve the clarity of the human body movement posture contour, thereby obtaining the general direction of the human body movement posture, which can effectively reduce the amount of detail loss.

A wearable-based posture recognition system with AI-assisted approach for healthcare IoT: The entire industry is trying many ways to solve fall detection and even recognize more human behaviors, so as to serve smart medical healthcare [3]. Currently, a human posture recognition system can be utilized to 24/7 monitor the daily behaviors of humans, detect and analyze normal and abnormal postures such as falls and unusual motions.

However, identifying human postures more accurately, efficiently and intelligently is still a very challenging task in the healthcare industry [4,5], since it is always impacted by various internal or external factors. To complete the aim of accurately recognizing postures, Matsumoto et al. [6] design a detection system that incorporates multiple sensors such as acceleration, sole pressure sensors. However, it seems low reliability since the adopted framework is heavily relying on the Bluetooth signal strength and manual recording. Manupibul et al. [7] design a smart insole that measures the balance of the foot pressure and detects the balance of the body by deploying a force sensitive resistor (FSR) on the insole. The scenario is interesting, but the relatively simple structure limits the usability of the application since only the force and resistance of membrane pressure sensors are used and the pressure distribution is not considered for each specific motion combination. Furthermore, the intelligent information process is another way to enhance the identification effectiveness of the system. Without better information process mechanisms, we cannot reach the target of accurately recognizing human behaviors. Therefore, it not only needs high-sensitivity multi-sensors, but also requires more reliable Internet of Things (IoT) network and artificial intelligence (AI) techniques [8], when to achieve smart healthcare.

Using Human Pose Estimation in Fitness: Human pose estimation is a task in computer vision, where the model tries to identify the key points on the human body, like limbs and joints, which can help us determine the pose a person is in right now. With HPE models we can dynamically track those points through motion in real time. Which basically means, we can analyze motion patterns and make further decisions based on this input. Most HPE methods are based on recording an RGB image with an optical sensor, like a smartphone camera or surveillance lens, to detect body parts and track them through motion in 3D space. In conjunction with other computer vision techniques, this allows for automating routine tasks in fitness, coaching, rehabilitation, surveillance, or even some AR applications like virtual fitting rooms. The most basic form of Human pose estimation is 2D point extraction. This entails a model that will only take into account 2D space and generally brings poor accuracy because there is no depth perception. A more widespread approach is 3D pose estimation models, which are generally quite accurate at tracking given there are decent light conditions. Both methods are often used in conjunction, because the 2D approach is faster at detecting actual key points, while 3D grants accuracy and correct perception of the space.

A Review on: Body Posture Detection and Motion Tracking using AI for Exercise: One of the most significant and popular types of exercise for health is weight training. Exercises that focus on particular muscles can be used to treat certain disorders. On the flip side, if done poorly or without help, free exercise can be frightening for novices and physically taxing. Even with the exciting and high-risk activities, not much is done to leverage technology to assist new students in learning new material. Conventional exercise instruction frequently depends on subjective visual cues, which are prone to error and ambiguity. AI, on the other hand, provides an objective, data-driven method, assessing your body's motions with astounding accuracy. This review covers a variety of AI and technologies used in the context of the body to detect and track movement from advanced machine learning to good ideas. Our objective is to develop an intuitive interface technology that aids in the recovery of users who require exercise or who can recover on their own without the assistance of a professional. Its functions include calculating reps, keeping track of grades, alerting users to their time, and showcasing improved and novel exercises performed under medical supervision. In addition, this review aims to identify research gaps and provide guidance for future studies. Last but not least, offering advice on how to posture yourself better for the best possible workout results as well as keeping track of your past workouts to get historical data on your daily, weekly, and monthly exercise routines

IV.MAIN RECOGNITION TECHNIQUES

Sensor-Based Recognition: The sensor-based posture recognition requires the target to wear a variety of sensors or optical symbols and collect the action information of the target object based on this. The research on sensor-based human posture recognition algorithms started earlier. As early as the 1950s, some people used gravity sensors to recognize human posture [10]. In daily human posture recognition research, sensors have been used to distinguish standing, walking, running, sitting, and other stable human posture. The common classification methods of posture recognition sensors are as follows. According to the position of the sensor, it can be divided into lower limbs, waist, arm, neck, wrist, etc. Sensors can also be classified according to the number of sensors, which can be divided into single-sensor and multi-sensor. Compared with the method of single-sensor signal processing, the multi-sensor system can obtain more information about the measured target and environment effectively [13,14]. Whether or not the sensor is installed on the user can be divided into wearable and fixed sensors.

Wearable devices are a representative example of sensor-based human activity recognition (HAR) The sensor's type of data output can be divided into array time domain signal, image matrix data, vector data, or strap-down matrix data. Common wearable sensors include inertial sensors (such as accelerometers and gyroscopes), physiological sensors (such as EEG, ECG, GSR, EMG), pressure sensors (such as FSR, bending sensors, barometric pressure sensors, textile-based capacitive pressure sensors), vision wearable sensors (such as WVS), flexible sensors [2]. To avoid physical discomfort and system instability caused by workers on construction sites wearing invasive sensors or attaching multiple sensors to the body, Antwi-Afari et al. [1] utilized the network based on deep learning as well as wearable insole sensor data to automatically identify and classify various postures presented by workers during construction.

Hong et al. [3] designed a system using multi-sensors and a collaborative AI-IoT-based approach and proposed multi-pose recognition (MPR) and cascade-ada boosting-cart (CACT) posture recognition algorithms to further improve the effect of human posture recognition. The various squeezed convolutional gated attention (SCGA) model to recognize basketball shooting postures fused by various sensors. Sardar et al. [3] proposed a mobile sensor-based human physical activity recognition platform for COVID-19-related physical activity recognition, such as hand washing, hand disinfection, nose-eye contact, and handshake, as well as contact tracing, to minimize the spread of COVID-19.

Vision-Based Recognition

The vision-based method extracts the information of the key node and skeleton by analyzing the position of each joint point of the target object in the image data. In vision-based methods, cameras are usually used to obtain images or videos that require posture recognition and can be used in a non-contact environment. Therefore, this method does not affect the comfort of motion and has low acquisition costs. Obtaining human skeleton keypoints from two-dimensional (2D) images or depth images through posture estimation is the basis of vision-based posture recognition. There are inherent limitations when 2D images are used to model three-dimensional (3D) postures, so RGB-D-based methods are ineffective in practical applications. In addition to RGB images and depth maps, skeletons have become a widely used data modality for posture recognition, where skeleton data are used to construct high-level features that characterize 3D configurations of postures [22]. The general process of vision-based posture recognition includes the following: image data acquisition, preprocessing, feature extraction, and feature classification, as shown in Fig. 2.

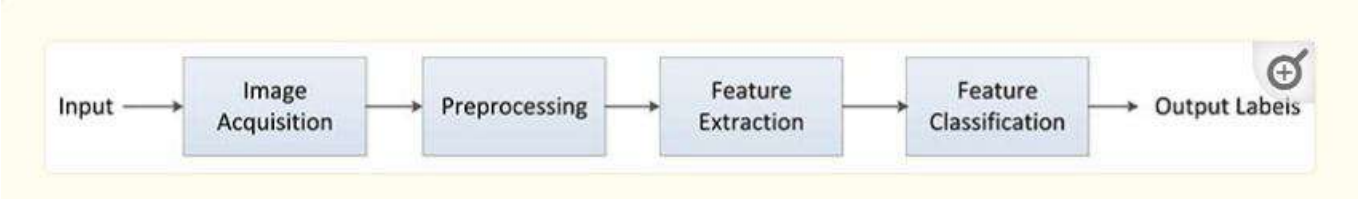


Fig:2 Procedure of vision-based posture recognition

Currently, video-based methods mainly use deep neural networks to learn relevant features from video images for posture recognition directly. For example, when convolutional neural networks identify and classify different categories of human poses (such as sitting, lying, and standing) in the available frames, also fused the probabilistic information of 3D human posture with the multi-stage CNN architecture to achieve 3D posture estimation of the original images. The designed a visual teleoperation framework based on a deep neural network structure and posture mapping method. They applied a multi-level network structure to increase the flexibility of visual teleoperation network training and use. It shows that integration of six independent deep neural architectures based on genetic algorithms to improve the driver's performance on the distraction classification problem to assist the existing driver-to-pose recognition technology. When proposed a computer vision-based label-free motion capture method that combines the discriminative method of posture estimation with morphological constraints to improve the accuracy and robustness of posture estimation.

RF-Based Recognition:-

In some specific posture recognition situations, the target object cannot wear the sensing device, and radio frequency (RF)-based technology can solve this problem. Due to their non-contact nature, various radio frequency-based technologies are finding applications in human activity recognition. Yao et al. [8] used radio frequency identification (RFID) technology to build a posture recognition system to identify the posture of the elderly, who do not need to wear equipment at this time. The RFID and machine learning algorithms to decipher signal fluctuations to identify activities. It proposed a sleep monitoring system based on passive RFID tags, which combined hierarchical recognition, image processing, and polynomial fitting to identify body posture through changes caused by backscattered signals from tags. Radio frequency signals are extremely sensitive to environmental changes, and changes caused by human movements or activities can be easily captured. Radio frequency signals are absorbed, reflected, and scattered by the body, which will cause changes in the signals. Human activities will cause different changes in the radio frequency signal so that human activities can be identified by analyzing the changes in the signals. The most typically used radio frequency technologies are radar, WiFi, and RFID.

V. CONCLUSION

This study is to make sure about the feasibility and accuracy of digital enhancement of images through various image processing techniques, applications, tools that helps to extract complex features of an image. Image processing works on a single-dimensional image to multidimensional a sees what actually in the image is. Image processing is the real core of many developing technologies in the real-time aspect. This paper discusses the overview of development, implementation of operations required for quality image production, and also discusses image processing applications, tools, and techniques.

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Automated Lead Qualification Using RPA and Sales Force

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Abstract: Lead qualification is a critical process in sales and marketing, determining which leads have the highest potential for conversion into customers. This paper explores the integration of Robotic Process Automation (RPA) with Salesforce Customer Relationship Management (CRM) to automate lead qualification processes. By leveraging the capabilities of RPA bots to extract, process, and analyze data from Salesforce, businesses can achieve faster and more accurate lead qualification, leading to increased sales efficiency and revenue generation. This paper discusses the benefits, challenges, and implementation considerations of this integration, supported by real-world examples from companies that have successfully implemented automated lead qualification using RPA and Salesforce.

Keywords: Salesforce, Robotic Process Automation, Lead Generation, CRM

I. INTRODUCTION

In the fast-paced world of sales and marketing, the ability to swiftly and accurately identify promising leads is pivotal for driving business growth and maximizing revenue. However, the traditional methods of manual lead qualification often fall short in today's dynamic landscape. These methods, relying on human judgment and manual data processing, are not only time-consuming but also prone to errors and inconsistencies. The integration of Robotic Process Automation (RPA) with Salesforce Customer Relationship Management (CRM) presents a transformative solution to these challenges. RPA, the technology that enables the automation of repetitive tasks through software bots, has gained widespread adoption across industries for its ability to enhance efficiency, accuracy, and productivity. Salesforce, on the other hand, stands as a cornerstone in CRM systems, providing a centralized hub for managing customer interactions, sales pipelines, and marketing campaigns. By integrating RPA with Salesforce, organizations can revolutionize their lead qualification processes. The synergy of these technologies empowers businesses to automate the extraction, validation, and scoring of lead data, enabling rapid and precise decision-making. This paper delves into the realm of automated lead qualification, focusing on how the fusion of RPA and Salesforce CRM offers a competitive edge to businesses in today's competitive market.

II. BACKGROUND

2.1 Lead Qualification in Sales and Marketing:

Traditionally, lead qualification involved manual review and assessment of various factors such as demographics, firmographics, engagement history, and budget. Sales teams would spend significant time sifting through leads to identify those with the highest potential for conversion. However, this process often resulted in delays, inconsistencies, and missed opportunities.

2.2 Robotic Process Automation (RPA):

RPA has emerged as a game-changer in the realm of business process automation. With RPA bots capable of mimicking human actions, organizations can automate repetitive tasks with precision and speed. Tasks such as data extraction, validation, and processing that once required manual effort can now be executed seamlessly by RPA bots.

2.3 Salesforce CRM:

Salesforce has established itself as a leader in CRM solutions, offering a comprehensive platform for managing customer relationships. It serves as a centralized repository for lead data, providing insights into customer interactions, sales pipelines, and marketing campaigns. Salesforce's flexibility and scalability make it an ideal

III. LITERATURE SURVEY

3.1 Previous Studies on Lead Qualification:

Several studies have highlighted the challenges and opportunities in lead qualification processes. For instance, a study by Smith et al. [1] emphasized the importance of timely lead qualification in improving sales conversion rates. The research showed that businesses that could qualify leads within the first hour of contact were seven times more likely to have meaningful conversations with decision-makers.

3.2 RPA in Sales and Marketing:

The integration of RPA in sales and marketing processes has been a subject of interest in recent literature. Jones and Patel [2] conducted a study on the impact of RPA on sales efficiency. Their findings indicated that RPA reduced the time spent on manual tasks by 60%, allowing sales teams to focus more on high-value activities such as lead engagement and relationship building.

3.3 Salesforce CRM and Automation:

Research by Lee and Kim [3] explored the benefits of leveraging Salesforce CRM in conjunction with automation technologies. The study found that companies that integrated Salesforce with automation tools experienced a 35% increase in lead conversion rates. The combination of Salesforce's data management capabilities with automation's efficiency proved to be a winning strategy for lead qualification.

3.4 Gaps in Existing Literature:

While the existing literature provides valuable insights into the individual benefits of RPA and Salesforce CRM, there is a gap in understanding the synergistic effects of integrating these technologies for lead qualification. This paper aims to bridge this gap by exploring the combined impact of RPA and Salesforce on automating lead qualification processes.

IV. INTEGRATION OF RPA WITH SALESFORCE FOR LEAD GENERATION

4.1 Process Overview:

The integration of RPA with Salesforce for lead qualification involves a systematic process:

Data Extraction: RPA bots are programmed to extract lead data from Salesforce CRM, including contact information, interaction history, and lead scores.

Data Validation: The extracted data is then validated against predefined qualification criteria such as budget, authority, need, and timeline (BANT).

Lead Scoring: Based on the validation results, leads are assigned scores indicating their likelihood of conversion.

Assignment and Follow-Up: Highly qualified leads are automatically assigned to sales representatives for follow-up, while lower-scoring leads may undergo further nurturing or be flagged for re-evaluation.

Fig: 4.1

4.2 Benefits of Automated Lead Qualification:

Speed and Efficiency: Automation reduces the time taken to qualify leads from days to minutes, enabling rapid response to high-potential leads.

Accuracy and Consistency: RPA ensures consistent application of qualification criteria, minimizing errors and subjective biases.

Cost Savings: By freeing up sales teams from manual tasks, businesses can reallocate resources to higher-value activities. Improved Lead Conversion: Targeted follow-up on qualified leads increases the likelihood of conversion into customers.

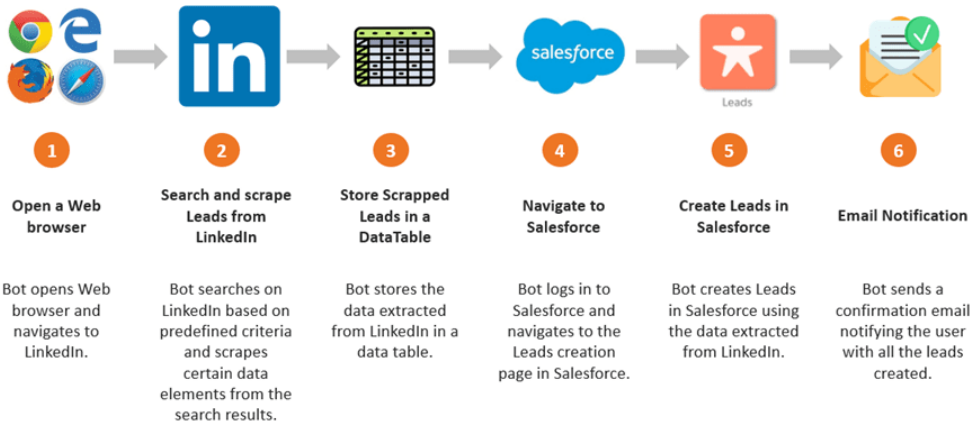

Fig: 4.2

V. USE CASES

Real-world use cases and examples demonstrate the practical applications and benefits of automated lead qualification using RPA and Salesforce. These use cases illustrate how organizations have successfully implemented this technology to streamline their sales processes and drive business growth. Examples include:

- Lead Data Extraction: RPA bots automatically extract lead data from various sources such as websites, emails, and social media platforms and populate Salesforce CRM with accurate and up-to-date information.
- Lead Qualification: RPA bots validate lead data against predefined criteria, such as budget, authority, need, and timeline (BANT), to determine the quality and readiness of leads for sales engagement.
- Lead Scoring: RPA bots assign lead scores based on predefined algorithms and criteria, enabling sales teams to prioritize leads with the highest conversion potential.
- Lead Assignment and Follow-Up: Highly qualified leads are automatically assigned to sales representatives for personalized follow-up and nurturing, while lower-scoring leads may undergo further qualification or be placed in marketing nurture campaigns.

VI. CONCLUSION

The integration of Robotic Process Automation (RPA) with Salesforce Customer Relationship Management (CRM) for automated lead qualification offers significant benefits for businesses aiming to streamline their sales processes. By leveraging RPA's speed, accuracy, and efficiency, combined with Salesforce's comprehensive lead data management, organizations can improve lead conversion rates, enhance sales team productivity, and ultimately drive revenue growth.

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Intelligent Environment using Extended Reality and Machine Learning to Improve Healthcare

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Abstract: Intelligent Environments (IEs) represent a paradigm shift in the way we interact with our surroundings, leveraging Ambient Intelligence (Aml) to create responsive and adaptive spaces that seamlessly integrate technology into the built environment. By harnessing sensors, actuators, and artificial intelligence, IEs have the potential to enhance human experience, improve efficiency, and promote sustainability across various domains, including smart homes, workplaces, cities, and healthcare facilities. This paper provides an overview of IE concepts, discusses key technologies and applications, explores design considerations, and outlines future directions for research and development in this dynamic field. This paper focuses on the study of the potential use of Extended Reality technologies in order to promote Green Health as well as their use in Smart Hospitals, one of the variants of Smart Environments, incorporating Machine Learning and Computer Vision, as a tool to support and improve healthcare, both from the point of view of the health professional and the patient, through a literature review and analysis of the current situation. Resulting in the elaboration of a conceptual model with the suggestion of technologies that can be used to achieve this scenario selected for their potential, and then the development of prototypes of parts of the conceptual model for Extended Reality Headsets as concept validation.

Keywords: Extended Reality, Healthcare, Smart Hospital, Machine Learning, Computer Vision, Internet of Things, Green Health

I. INTRODUCTION

As time goes by, healthcare institutions become increasingly overloaded and understaffed, and current professionals grow more tired and find it challenging to maintain good performance and motivation, not only in their work but also in their interaction with patients, which has become more notable during the recent pandemic of Covid-19 [1], at the same time the patients also become more tired of the time consumed and needed to take care of their physical health at cost of travels, time and their mental state. Although the new technologies have being used to support and improve healthcare, since the invention of the computer which set free the medical staff from carrying loads of papers and processing information by hand, the advanced medical machines like medical robots that support in hard and complex tasks such as operations till the more recent Internet of Things (IoT) devices that are starting to be more present in those institutions, the Extended Reality (XR) technologies are still hardly being seen in use aside from research projects or for specific and limited use cases such as exercises and medical training. XR has the potential to improve well-being and Green Health of both patients and professionals by enabling scenarios and actions those others technologies were not able to while requiring a low cost, both to the users as well to the environment. After understanding the current results, is analysed what can be improved and how, through the development of a conceptual model with base on the combination of XR technologies and Machine Learning (ML) to improve Healthcare, being identified and described potential technologies to be used and implemented prototypes as proof of concept.

II. OVERALL GOAL

This paper is to study the use of XR applications with ML to improve Healthcare, from a technological point-of-view, and well-being while promoting Green Health, among other concepts and technologies that are considered part of the future of Healthcare Institutions. The scenario envisaged is one that depends on interoperability between healthcare institutions, as is to be expected in an Electronic Health Record (EHR) structure. To achieve this, an analysis of the most recent technologies is required, as well as the implementation and experimentation to validate the concepts.

Additionally, specific categories of end-users have been assigned to each type of XR application, considering factors such as portability, affordability, potential use, and constraints.

III. EXTENDED REALITY

Figure 1: Augmented Reality, Mixed Reality and Virtual Reality

XR is a term used to group the technologies Virtual Reality (VR), Augmented Reality (AR), MR and all future immersive technologies which merge the physical and virtual worlds, is used to promote the new realities. This XR technologies can become a more complex and intrigued field that it is seen on the surface, starting from the term "Extended Reality" itself till categories and sub-categories

Virtual Reality:

VR is the oldest and most well established term among the XR technologies, the concept of VR can be mapped till the years 1980s being first described by Sir Charles Wheatstone, yet only started to become what is seen nowadays in 2012 with the kickstart of Oculus for the "first truly immersive virtual reality headset". VR can be found being used on many fields like the entertainment industry, education, medicine or job's training.

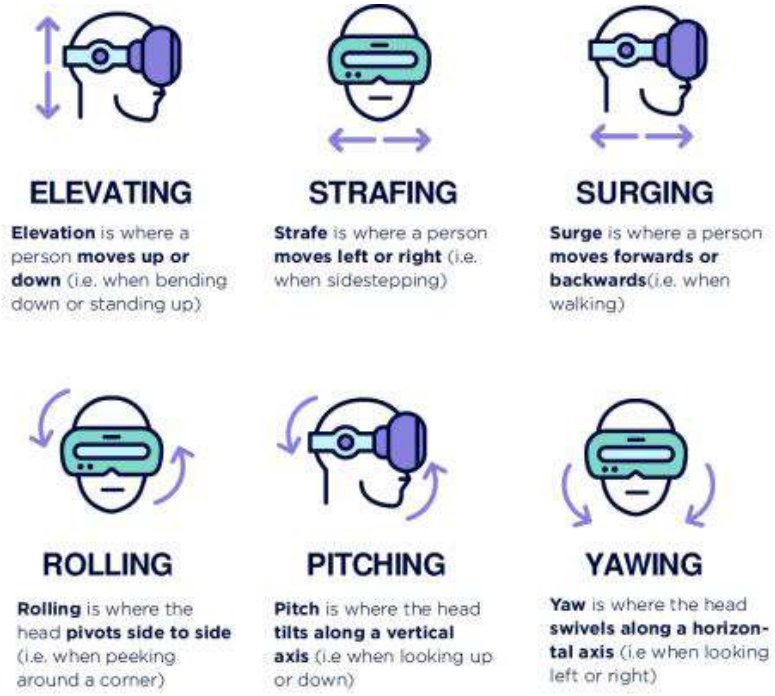

Figure 2: Degrees of Freedom in Virtual Reality

When it comes to immersion in VR, certain aspects must be taken in account such as sense of presence, movement and how the user control/interacts with the digital while avoiding cybersickness like Vection Illusion. Spatial audio, immersive diegetic/non-diegetic sounds and, when possible, olfactory sensations or even the use of haptic feedback are also important factors to create a good VR experience and to immerse the user into the digital environment.

Augmented Reality:

Like VR, AR is also already established on the market and due to rather easier accessibility for not requiring a specific kind of device like VR or MR it can be seen being used in domains where VR has yet to establish like manufacturing, being also a preferential choice of industries when looking for entering in the XR world. Most of the recent smartphones and tablets are able to run AR applications and the capacity of supporting this technology is starting to be considered a "must have" by the manufacturers. AR can be considered the counterpart of VR, in AR the digital world is the guest in the human's reality and the virtual content overlays onto the real world.

Mixed Reality:

MR is among the most recent terms in XR technologies and while already existing for some years, like Metaverse and Meta (2.2).This looks a lot like AR, and because of AR being already established and well-known, tends to be replaced by it or considered as an extension like Assisted Reality, MR consists ofan equal interaction between the digital and real world, an AR experience where the human can interact with the digital, preferentially without the need of controllers or secondary devices,

IV. IOMT

As many others industries, the Healthcare Industry also benefits from the Fourth Industrial Revolution, the use of IoT systems in Healthcare, like observed in Figure 3 is named as Internet of Medical Things (IoMT), and among all sectors it can be considered one of the more in need and desperate, with the population growth, the extension of the life expectation rate, the increase of healthcare needs and the inability of the current system to answer all changes. This can improve and enable the care of the patients starting in their own homes, since the use of intelligent toilets to analyse urine or intelligent homes able to adjust noise and lights for autistic patients, the use of wearable also consists as an example of IoMT through the broadcasting of real-time biological data which can be better analysed than the default "self-analysis" made by patients while also minimising the need of medical appointments. The use of this devices also enable immediate response on emergencies which could end in fatalities like home accidents with elders, but while able to support the patient in the comfort of their homes, some scenarios still require physical presence in a Hospital such as for operations.

Figure 3: Medical Internet of Things in Healthcare

V. ARTIFICIAL INTELLIGENCE AND COMPUTER VISION TECHNOLOGIES

One of the main technologies that can be used to improve healthcare is ML, which involves and can be found being applied on different fields and for different goals, being some current and famous use cases the use of language models, commonly known as "chatbots", like ChatGPT, natural language processing (e.g. Email filters), synthetic media models (e.g. Deepfake) and Artificial Inteligence (AI) Art. Considering the use of XR as core of the project and taking in account the kind of data available to be retrieved from the XR devices, the use of ML with CV is the pathway with more potential for MR, while VR has more potential for data analysis. ML is a subset of AI focused in developing models that enable computers to learn based only in data provided by the developer, in a way to be able to make predictions, provide answers without the implementation of the logic and rules, which is created by the computer. This subset of AI has diverse uses across various fields, including image and speech recognition, along text processing or in creating autonomous vehicles, is being an essential part of areas like manufacturing and healthcare. CV is the field that enables computers to understand visual information from digital images and videos, being videos a sequence of images, it aims to provide the computer the natural abilities of humans to analyse and process meaningful data, by making use of processes like feature extraction and pattern recognition.

While ML and CV are different concepts, they are commonly used together to achieve some technologies that are nowadays famous worldwide like Face Recognition, but while using ML concepts and methods, Face Recognition or Object Detection are part of the domain of CV.

VI. CONCEPTUAL MODEL

The developed conceptual model comes as proposal of developing solutions which aim to that future with focus in the use of XR technologies, which shows potential in being eco-friendly, having as major constraint the user adaptability

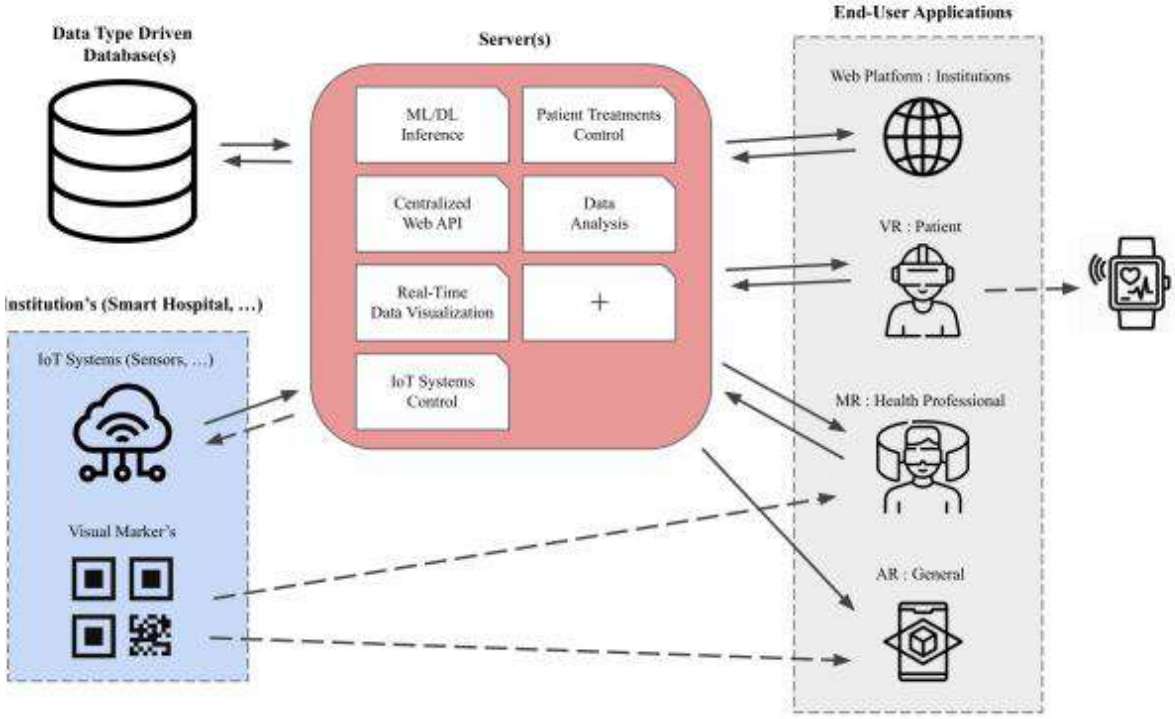

Figure4: Conceptual Model

- Data Type Driven Databases: Between basic hospital data such as patient identification and historic, IoT data and Big Data, a unique DB cannot be able to answer all components or even if able, not be optimized for each type of data or services, as such the chosen DB's must be based on the type of data being saved.
- Institutions Components: When it comes to Institutions, being (Smart) Hospitals, Nursing Homes or Medical Centers, between others, these can be equipped with different IoT devices such as heating/cooling systems or Smart TV's, being one of the principals and acknowledge, the sensors, which also presents themselves in the more different forms such as temperature sensor or proximity, even utensils can include sensors such as diapers
- Institution Web Application: While XR HMD are optimal to data visualization and consult, the same does not apply to inserting data, the use of controllers make the process slow and hand tracking is still evolving, even the more advanced HMD may not able to follow the same hand writing speed used when in physical keyboards.
- Patients and Virtual Reality: VR HMD are among the more financially accessible XR devices, having a big variety on quality and hardware depending on the person goals, among them, the more famous one is the Meta Quest 2, formerly known as Oculus Quest 2, this comes for is low price hardly beaten in the market, around 283 euros in 2023, and for being standalone per default which makes this device the one normally bought for first-timers, and while expected to be replaced by the released Meta Quest 3, this one also has a competitive price around 473 euros on release.

VII. IMPLEMENTATION

Holographic Remoting Player application: By installing this application in the HL2 and connecting both the device and the computer running Unity to the same network, the HL2 can run the application without the need for building. While this option has benefits, there are limitations, such as the inability to use the HL2 holographic keyboard

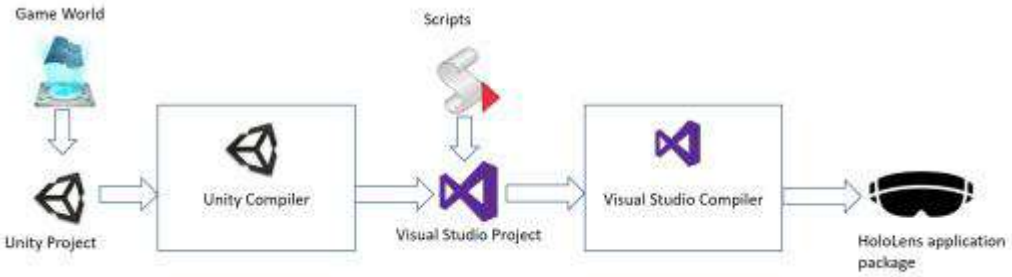

Figure 5: HoloLens2 Build Pipeline

To simply the process of prototyping four uses cases was idealized, use cases these being applied in a scenario of a nursing home, improving elder's well-being and empowering the caregivers.

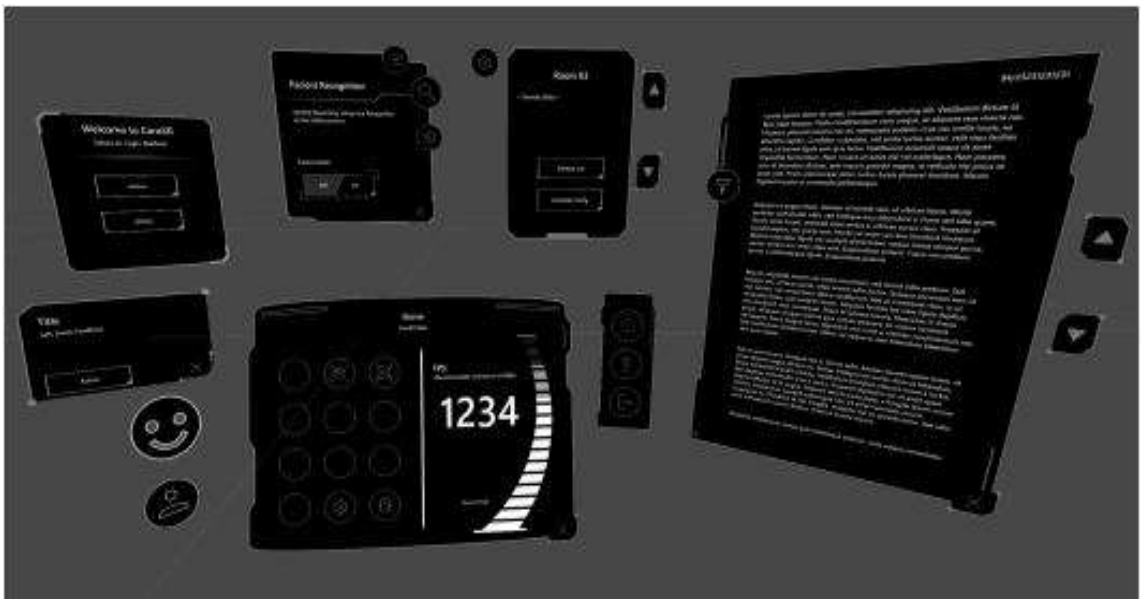

Figure 6: Mixed Reality Interfaces Samples

Figure 7: Medication Alert with Mixed AI reality

VIII. FUTURE WORK

The integration of Extended Reality (XR) and Machine Learning (ML) within intelligent environments offers exciting opportunities to improve healthcare delivery. By combining immersive XR experiences with ML-driven analytics, healthcare providers can enhance medical training, patient care, and clinical collaboration. However, realizing the full potential of XR and ML in healthcare requires addressing technical, regulatory, and ethical challenges.

Future research should focus on developing robust XR applications, advancing ML algorithms, and fostering interdisciplinary collaborations to drive innovation in healthcare. At the current moment of the thesis submission, the project Green Health its still ongoing, being the submission needed for academic progression, and the development itself continues, the VR application is considered completed since it already surpasses the necessaries requirements, however the MR application is still lacking in some features due to the current state of development of the MS Face Detection with YuNet. Some aspects of the project can't be answered by a Web Based application or Unity, the main one detected being the upload of Panoramic Images, due to the limit size of uploads which would affect the image quality and Unity being unable to do such thing, being necessary the development of a computer application like with UWP or Windows Forms.

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Generative Adversarial Networks for Malware Detection in Cloud Computing Environments

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Abstract: In recent years, the proliferation of sophisticated malware threats has necessitated the development of advanced detection techniques to safeguard computer systems and networks. Generative Adversarial Networks (GANs), a class of deep learning models comprising a generator and a discriminator trained in an adversarial manner, have emerged as a promising tool for improving malware detection capabilities. Traditional signature-based malware detection struggles to keep pace with the ever-evolving threat landscape in cloud computing environments. This paper proposes a novel approach utilizing Generative Adversarial Networks (GANs) for enhanced malware detection. The GAN architecture generates realistic malware samples, refining the discriminator's ability to differentiate between legitimate and malicious software. This fosters a model adept at identifying zero-day attacks and unseen malware variants. Evaluation in a cloud environment assesses detection accuracy, efficiency, and generalizability. Findings underscore GANs' potential to enhance cloud-based malware detection, securing the future of cloud computing.

Keywords: Generative Adversarial Networks (GAN), Cloud Computing, Convolutional Neural Network (CNN), Malware, Generator, Discriminator

I. INTRODUCTION

Generative Adversarial Networks have gained significant attention from both academia and industry since their introduction by Good fellow et al.in 2020. These networks have revolutionized the field of deep learning, particularly in image and audio generation. GANs are a type of artificial intelligence algorithm that uses two neural networks, namely the generator and the discriminator, to play an adversarial minimax game with the aim of generating realistic samples and learning from training data. The generator network in a GAN focuses on learning the distribution of real observed data and generates samples that aim to deceive the discriminator. The discriminator network, on the other hand, is responsible for distinguishing between real and generated samples.

The Game-Theoretical Perspective of GANs

The game-theoretical perspective of GANs is a key aspect of their architecture and training process. It involves the generator and discriminator networks competing against each other in a minimax game. This game-theoretical perspective allows the generator to improve its ability to create samples that are similar to real data, while the discriminator enhances its ability to accurately identify whether a sample is real or fake.

Despite the significant successes achieved in applying GANs to various domains, including computer vision and image generation, there are still several challenges in applying GANs to real-world problems. Three main challenges in applying GANs to real-world problems include:

1. Mode collapse occurs when the generator network in a GAN fails to explore and generate diverse samples and instead produces limited variations.
2. GAN training can be unstable, with the generator and discriminator networks oscillating between dominance and instability.
3. Assessing the quality and performance of GAN-generated samples is a complex task.

Some recent works address these challenges and propose solutions to improve the performance and stability of GANs. One such solution is the use of Wasserstein GANs, which introduce a new distance metric to ensure more stable training.

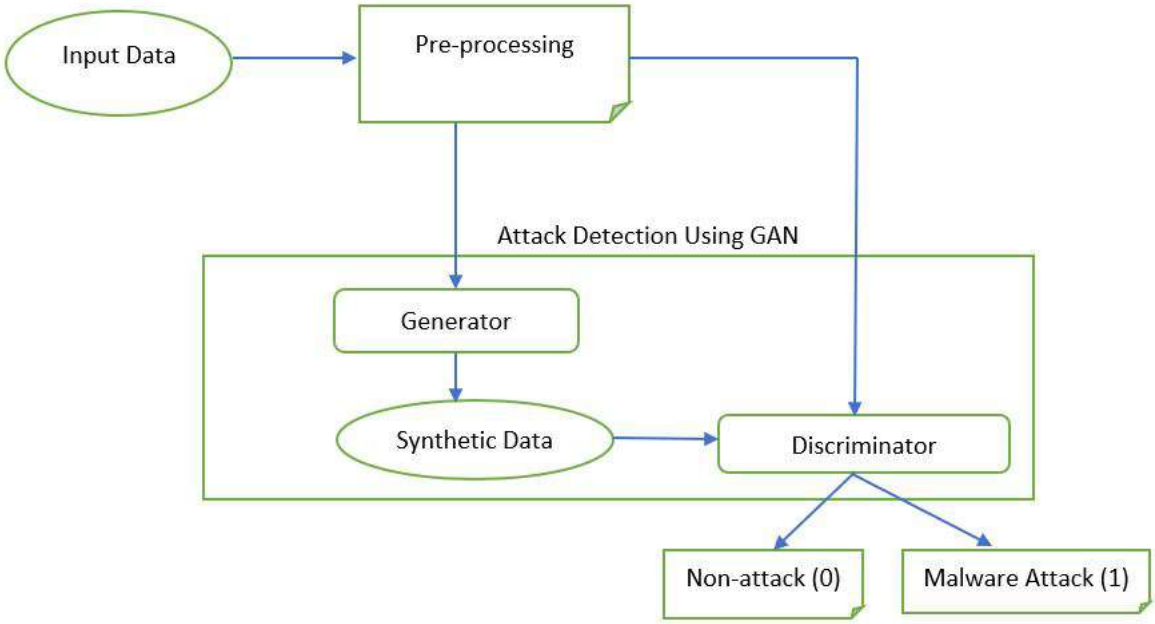


Figure 1: Attack Detection Using GAN

Furthermore, researchers are also exploring techniques such as conditional GANs, which allow for the generation of samples conditioned on specific inputs or attributes. By addressing these challenges, GANs have the potential to greatly impact various fields, including malware detection. Malware detection is crucial in today's cybersecurity landscape, as the number and complexity of malware threats continue to increase. By leveraging the capabilities of GANs, malware detection systems can benefit from improved generative modeling and adversarial learning techniques. These techniques can help in generating realistic malware samples for training the detection system and improving its ability to accurately identify and classify new and unseen malware instances. Additionally, GANs can aid in the creation of more robust and adaptive malware detection models. These models can learn from the continuously evolving malware landscape and adapt their detection capabilities accordingly. By using GANs, researchers can improve the accuracy and robustness of malware detection systems by leveraging generative modeling and adversarial learning techniques. Overall, the use of GANs in malware detection has the potential to enhance the accuracy, robustness, and adaptability of detection systems in the

II. LIMITATIONS OF TRADITIONAL MALWARE DETECTION TECHNIQUES

The limitations of traditional malware detection techniques in cloud computing environments are multifaceted. Signature-based detection, which relies on known malware signatures or patterns, struggles to identify new, unknown, or morphing malware variants that do not match the existing signatures. This approach requires frequent signature updates to keep pace with the rapidly evolving malware landscape, and it is ineffective against sophisticated, polymorphic malware that can evade signature-based detection. Similarly, rule-based detection, which utilizes predefined rules and heuristics to identify suspicious behaviors, faces challenges in creating comprehensive rule sets that can accurately capture the diverse and complex behaviors of modern malware. Moreover, these rules are often static and can become outdated as new threats emerge, leading to high false positive rates and increased operational overhead. The dynamic and distributed nature of cloud infrastructures further exacerbates the limitations of traditional malware detection techniques. These techniques are typically designed for static, on-premises environments and struggle to keep up with the elastic and heterogeneous cloud resources. Additionally, the limited visibility into the cloud environment makes it challenging to collect and analyze the necessary security data for effective detection, hampering the ability to scale and deploy detection mechanisms across the cloud.

The use of Convolutional Neural Networks (CNNs) for malware detection in cloud environments faces several drawbacks. One significant limitation is their limited generalization capability. CNNs are primarily designed for image-based tasks and may struggle to effectively capture the complex, non-visual features of malware samples. Their performance is heavily dependent on the quality and representativeness of the training data, which can be challenging to obtain for diverse and evolving malware threats. As a result, CNNs may have difficulty generalizing to new, unknown malware variants that exhibit different characteristics from the samples used during training. Additionally, the inherent complexity of their architectures, particularly with deeper and more sophisticated models, can lead to significant computational and memory requirements. This can pose challenges in cloud environments, where resources may be limited or shared across multiple tenants, impacting the scalability and responsiveness of the malware detection system. The high computational overhead of CNNs may also result in increased latency, which is critical for timely detection and mitigation of malware threats in cloud infrastructures. The lack of interpretability in CNNs is another concern. These models are often considered "black-box," making it difficult to understand the underlying decision-making process and the specific features that contribute to malware detection. This lack of interpretability can hinder the ability to explain and justify the model's decisions, which is essential for regulatory compliance and building trust in the security system.

The opaqueness of CNN models can also make it challenging to debug, maintain, and continuously improve the malware detection system as new threats emerge. Finally, CNNs have been shown to be vulnerable to adversarial attacks, where malware authors can manipulate the input data to fool the model and evade detection. This susceptibility to adversarial examples can be a significant concern in cloud environments, where malware authors may actively target and exploit the weaknesses of the malware detection system. Addressing the adversarial vulnerability of CNNs requires additional techniques, such as adversarial training or the development of more robust and resilient architectures, which can add complexity and computational overhead to the overall solution. These drawbacks of using CNNs for malware detection in cloud environments highlight the need for alternative approaches that can better address the unique challenges posed by the cloud computing landscape. Techniques like Generative Adversarial Networks (GANs) may offer a more promising solution, as they can adapt to evolving malware threats, provide better interpretability, and potentially be more resilient to adversarial attacks.

III. METHODOLOGY OF GAN-BASED MALWARE IDENTIFICATION

The need for more advanced approaches to malware detection in cloud computing is evident. Adaptive and autonomous detection mechanisms, powered by advanced machine learning and artificial intelligence techniques, can learn and adapt to new, unknown malware threats without relying solely on predefined signatures or rules. These approaches offer the ability to identify complex, evolving malware patterns, providing automated and proactive detection to keep pace with the rapidly changing cloud environment and malware landscape. Furthermore, comprehensive visibility into the cloud infrastructure, including virtual machines, containers, and serverless functions, is crucial. Seamless integration with cloud-native security services and platforms can enable holistic threat detection and response, leveraging cloud-based telemetry and security event data to enhance detection accuracy and reduce false positives. Additionally, scalable and distributed detection mechanisms are necessary to handle the dynamic and resource-intensive nature of cloud environments, allowing for the rapid deployment and scaling of detection capabilities across diverse cloud resources and services. Efficient utilization of cloud computing resources can ensure optimal performance and cost-effectiveness, further supporting the need for more advanced approaches to malware detection in the cloud. This paper presents a novel approach for malware detection in cloud computing environments leveraging Generative Adversarial Networks (GANs). GANs are a class of deep learning models comprised of two competing networks: a generative model (G) and a discriminative model (D).

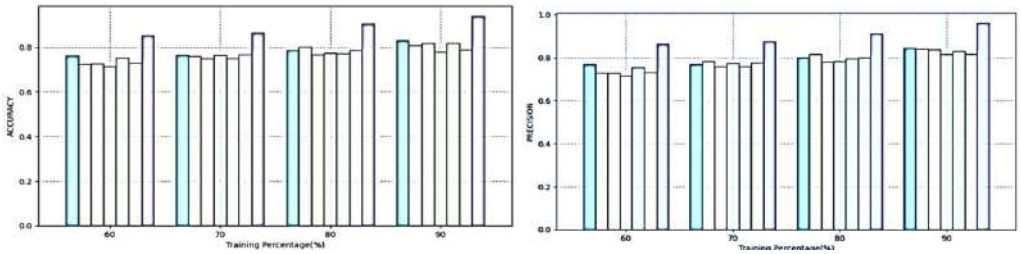
G aims to capture the underlying distribution of malicious software by continuously generating realistic malware samples. Conversely, **D** strives to differentiate between legitimate software and the samples produced by G. This adversarial training process fosters a robust model:

- **G** learns to create increasingly sophisticated malware variants, pushing the boundaries of D's detection capabilities.
- **D** refines its ability to distinguish real and generated samples, enhancing its capacity to identify novel malware threats.

The key contribution of this work lies in utilizing GANs for cloud-based malware detection. We explore the theoretical underpinnings of the adversarial framework, demonstrating how the interplay between G and D can theoretically converge towards a point where G perfectly replicates the real data distribution, rendering D incapable of distinguishing real from generated samples. Furthermore, we highlight the computational efficiency of GANs, as their training process can be optimized using back propagation, eliminating the need for complex inference networks. The paper culminates with an evaluation of the proposed GAN-based system in a simulated cloud environment. We assess the system's effectiveness in terms of detection accuracy, efficiency, and generalizability. We anticipate that the experimental findings will demonstrate the potential of GANs to significantly improve malware detection rates in the cloud, offering a powerful tool to safeguard the future of cloud computing.

IV. RESULTS AND ANALYSIS

The dataset comprises 48 features extracted from a collection of 5000 phishing webpages and 5000 legitimate webpages. These webpages were acquired during two periods: from January to May 2015 and from May to June 2017. To enhance the extraction process, an advanced technique utilizing the browser automation framework, specifically Selenium WebDriver, was employed. This method proves to be more accurate and resilient when compared to the parsing approach reliant on regular expressions. The objective is to maximize the detection accuracy for malware attacks in the cloud computing environment. The GAN model outperforms benchmarks like EfficientNet, MobileNet, ResNet, DenseNet, DCNN, and CNN. At a 90% training percentage, GAN achieves 0.938 accuracy, surpassing others: EfficientNet (0.823), MobileNet (0.809), ResNet (0.816), DenseNet (0.783), DCNN (0.837), and CNN (0.796). Notably, GAN exhibits exceptional sensitivity, reaching 0.895 at 80% training, outperforming all other models.



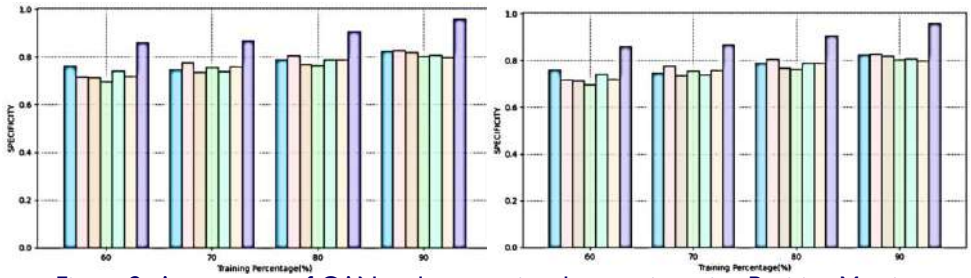


Figure 2: Assessment of GAN and conventional strategies using Positive Metric

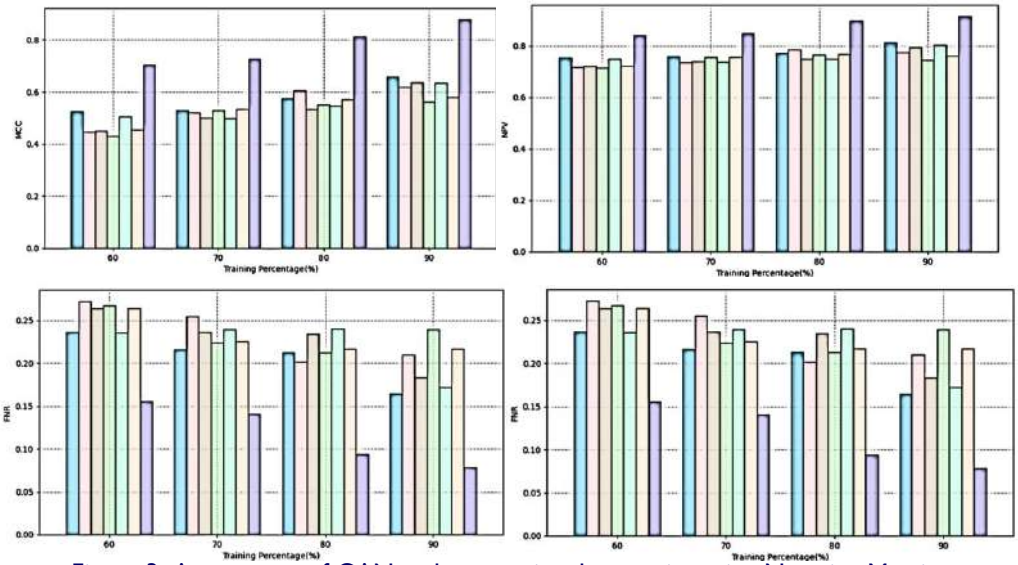


Figure 3: Assessment of GAN and conventional strategies using Negative Metric

V. CONCLUSION

This adversarial training aims to develop a robust model capable of identifying previously unseen malware variants and zero-day attacks. In conclusion, this research proposes a novel GAN-based architecture for enhanced cloud malware detection. The adversarial training between a generative and discriminative model fosters adaptability and improves detection accuracy. Experimental evaluation demonstrates the effectiveness of this approach, outperforming traditional methods. GAN-based detection addresses the challenges of dynamic cloud environments and paves the way for a more secure future. The framework's broader applicability extends beyond cloud computing, contributing to a more secure digital landscape.

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Machine Learning Based Spam Comments Detection on Youtube: A Comparison of Regression Models

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Abstract: The rise of spam comments on platforms like YouTube has become a significant concern, as they not only hinder genuine user engagement but also pose serious risks to users' safety and privacy. Machine Learning (ML) offers a powerful solution to combat spam comments by automating the process of detecting and preventing them. With the ability to analyze vast amounts of data and patterns, ML algorithms can effectively distinguish between legitimate comments and those that are spam. One of the commonly employed approaches in ML for spam comment detection is the Naive Bayes classification algorithm. Naive Bayes is a probabilistic algorithm that calculates the likelihood of a comment being spam based on its characteristics and the occurrence of specific keywords or phrases that are typical of spam content. By training the algorithm on a labeled dataset of spam and non-spam comments, it can learn to recognize patterns and generalize its understanding to new, unseen comments. Achieving a detection accuracy of 92.78% is indeed promising, but researchers and developers continue to explore other ML techniques and combinations to further improve the accuracy and robustness of spam comment detection systems. Ensemble methods, deep learning, and Natural Language Processing (NLP) techniques are among the advanced approaches gaining attention in this domain. One crucial aspect of an effective spam detection system is its adaptability and responsiveness to emerging spam tactics.
Keywords: Random Forest Regressor, Gradient Boosting Regressor and Logistic Regression;

I. INTRODUCTION

There are a lot of content creators on YouTube platform. Every creator has their own content to post or stream. They get a lot of following for their content in the form of the SUBSCRIBERS and they get more VIEWS for that content. So, YouTube provided a comment section for every post that the creator posted on YouTube in order to know the opinions of the VIEWERS. Some viewers like the posted video and some might not like it. So, these users might post some negative or cursed comments. But there some other category of comments which are unwanted and unasked electronic messages known as spam comments. These spam comments are sent in a heavy or large amount So, by using the concept called machine learning we can predict and detect the spam.

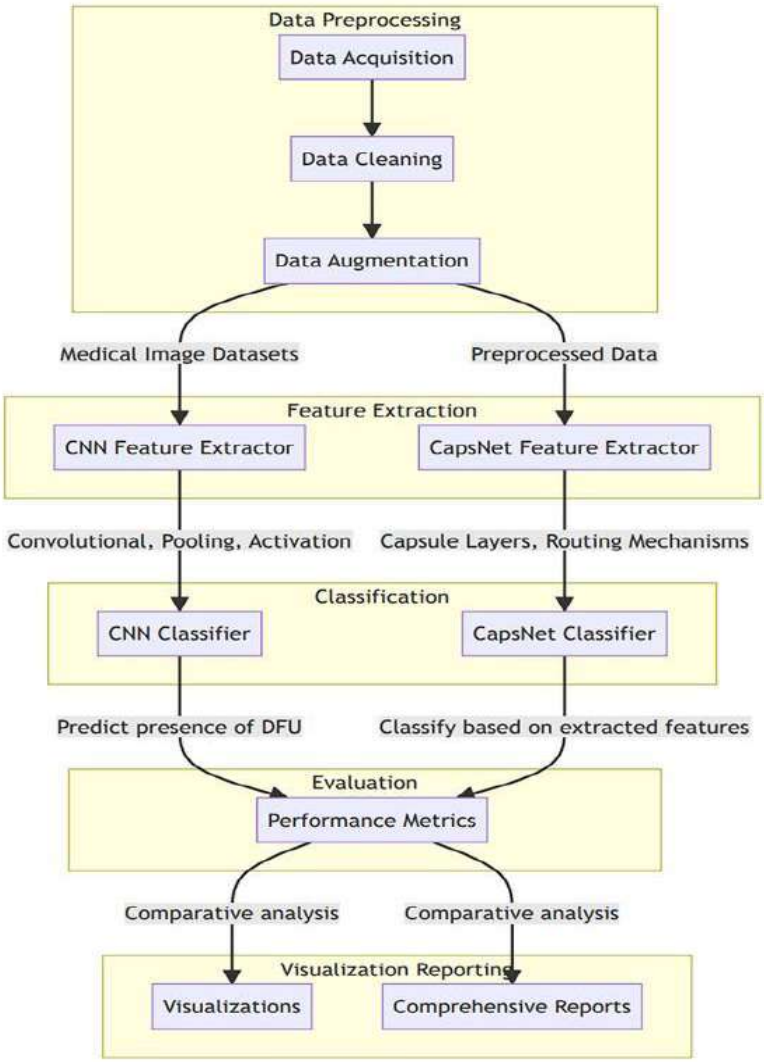
The algorithm that have been used for detecting is Naive Bayes algorithm which predicts which comments are spam and which not and various algorithm have been used. These spam comments are sent in a heavy or large amount. For spam comment detection but however Naive Bayes is best suitable as it is faster compared to other algorithms and perform better probabilistic calculations. In this project, the prediction of the spam comments present in the comments section of Youtube videos using the concept called machine learning, it is also known as subset of artificial intelligence, is done. Supervised learning approach depends on a very large number of labelled datasets. The proposed classification algorithm (Logistic Regression) is used in order to predict the spam comment. The purpose of project is to introduce briefly the techniques of machine learning and to outline the prediction technique. Being much more superior to the conventional data analysis techniques, machine learning can open a new opportunity to explore and increase the prediction accuracy.

II. RELATED WORK

Develop an accurate and efficient system to automatically identify and filter out spam comments. Enhance user safety, privacy, and engagement on the platform. Contribute to creating a positive and constructive online community. Prevent scams, irrelevant content, and offensive messages from being displayed to users. Machine Learning-based spam comments detection on YouTube is to develop a predictive model that can classify YouTube comments as either spam or not spam. The model will analyze the content and characteristics of comments, utilizing ML algorithms, to automatically identify and filter out spam comments. The objective is to create a robust and efficient system that enhances user experience, safeguards user privacy, and reduces the volume of spam comments on the platform.

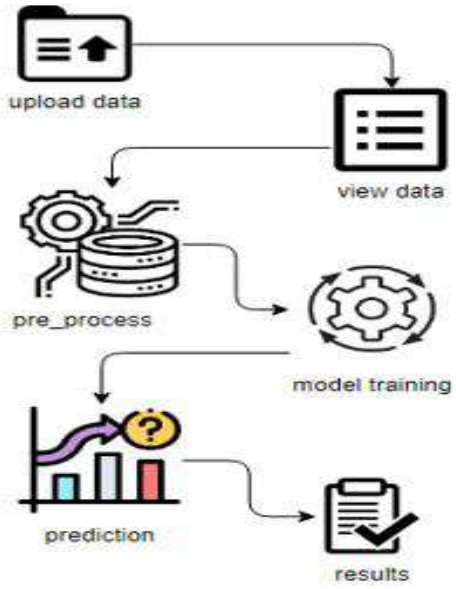
III. METHODOLOGY

This study proposes an innovative system employing advanced machine learning techniques. The planned system aims to improve the precision of detecting spam comments on YouTube by employing an amalgamation of advanced machine learning algorithms.



These techniques encompass Support Vector Machine with Radial Basis Function kernel (SVM-RBF), Random Forest (RF), Extra Trees (ET), and Long Short-Term Memory (LSTM), which is a deep learning methodology. By capitalizing on the unique capabilities of these algorithms, the system intends to address the shortcomings of the Naive Bayes approach and attain superior performance in distinguishing between spam and authentic comments. This collaborative endeavor strives to enhance detection accuracy, fostering a more secure and reliable digital milieu for YouTube users. It seeks to mitigate the risks associated with fraudulent activities, offensive content, and violations of privacy.

A. SYSTEM ARCHITECTURE:



User Module:

View Home page: Here user view the home page of the you tube application.
View about page: In the about page, users can learn more about the you tube platform.
View Page: User will see the dataset.
Input Model: The user must provide input values for the certain fields in order to get results.
View Results: User view's the generated results from the model.
View score: Here users have ability to view the accuracy score in %

System Module:

Working on dataset: System checks for data whether it is available or not and load the data in csv files.
Pre-processing: Data need to be pre-processed according the models it helps to increase the accuracy of the model and better information about the data.
Training the data: After pre-processing the data will split into two parts as train and test data before with the given algorithms.
Model Building: To create a model that predicts the dataset with better accuracy, this module will help user.
Generated Score: Here user view the score in %
Generate Results: We train the machine learning algorithm and predict the result.

B. ALGORITHMS

Support Vector Machine with Radial Basis Function kernel (SVM-RBF) is a machine learning algorithm used for classification and regression tasks. It employs a non-linear transformation to map data into a higher-dimensional space, where a hyper plane is established to maximize the margin between different classes. The Radial Basis Function kernel calculates similarity between data points, determining their influence on classification. This kernel's flexibility enables SVM-RBF to effectively handle complex, non-linear relationships in data. It's widely used for its ability to capture intricate patterns and achieve accurate results in various applications, such as image recognition, text categorization, and bioinformatics. Random Forest is a powerful machine learning algorithm that assembles multiple decision trees to make accurate predictions. Each tree is trained on a subset of data and votes on the final prediction, resulting in improved accuracy and robustness. It mitigates overfitting and handles complex relationships in data by averaging predictions from different trees. Random Forest is versatile, handling classification and regression tasks effectively. It's widely used due to its ability to capture intricate patterns in data, making it suitable for various domains such as finance, healthcare, and image analysis. Its ensemble nature enhances generalization and makes it a popular choice for predictive modeling. Extra Trees, short for Extremely Randomized Trees, is an ensemble machine learning algorithm used for classification and regression tasks. It's an extension of the Random Forest method, where multiple decision trees are built using bootstrapped samples and random feature subsets. However, Extra Trees takes randomness a step further by making decisions at each split point based on random thresholds, resulting in a broader exploration of feature space. This increases diversity among trees, reducing overfitting and improving generalization.

By aggregating predictions from individual trees, Extra Trees enhances accuracy and robustness, making it suitable for complex datasets and improving overall predictive performance. Long Short-Term Memory (LSTM) is a specialized type of recurrent neural network (RNN) architecture in deep learning. It excels in processing and retaining sequential data by utilizing memory cells with various gates to regulate information flow. LSTMs are adept at capturing long-range dependencies, making them ideal for tasks like text analysis, speech recognition, and time series prediction. The architecture's key components include input, forget, and output gates, along with a cell state that can store and control information over extended sequences. This enables LSTMs to effectively model intricate patterns and relationships within sequential data, leading to enhanced performance in various applications.

Convolutional Neural Network (CNN):

Convolutional Layers: CNNs learn spatial hierarchies of features through convolutional layers. Each layer consists of multiple learnable filters or kernels. These filters are convolved with input data to produce feature maps, capturing patterns like edges, textures, or shapes.

Activation Function: Typically, a non-linear activation function like RLU (Rectified Linear Unit) follows each convolutional operation. RLU introduces non-linearity, allowing the network to approximate complex functions.

Pooling Layers: Pooling layers down sample feature maps, reducing their spatial dimensions while retaining important information. Common pooling operations include max pooling, where the maximum value in each region is retained, and average pooling, where the average value is retained.

Flattening: After several convolutional and pooling layers, the feature maps are flattened into a single vector. This vector is then fed into one or more fully connected layers.

Fully Connected Layers: Fully connected layers process the flattened features to perform classification or regression tasks. These layers learn high-level features and their relationships, eventually producing output predictions. The final layer often has a softmax activation for classification tasks, providing probability distributions over classes, or a linear activation for regression tasks.

Training: During training, the network's parameters (e.g., filter weights and biases) are learned via back propagation and optimization algorithms (e.g., gradient descent) to minimize a loss function, which measures the difference between predicted and actual outputs.

Testing/Evaluation: After training, the CNN is evaluated on unseen data to assess its performance. Common metrics include accuracy, precision, recall, and F1-score for classification tasks, or mean squared error for regression tasks.

IV. EXPERIMENTAL RESULTS

Data set

Feature Engineering: Techniques like filling null values, label encoding, and leveraging NLP methods are employed to make the data more conducive for modeling.

Dataset Partitioning: The dataset is split into training (70%) and testing (30%) sets. User will see the dataset.

Input Model: The user must provide input values for the certain fields in order to get results.

View Results: User view's the generated results from the model.

View score: Here user have ability to view the accuracy score in %

Graph: Comparison of accuracy foe every models

System Working on dataset:

System checks for data whether it is available or not and load the data in csv files.

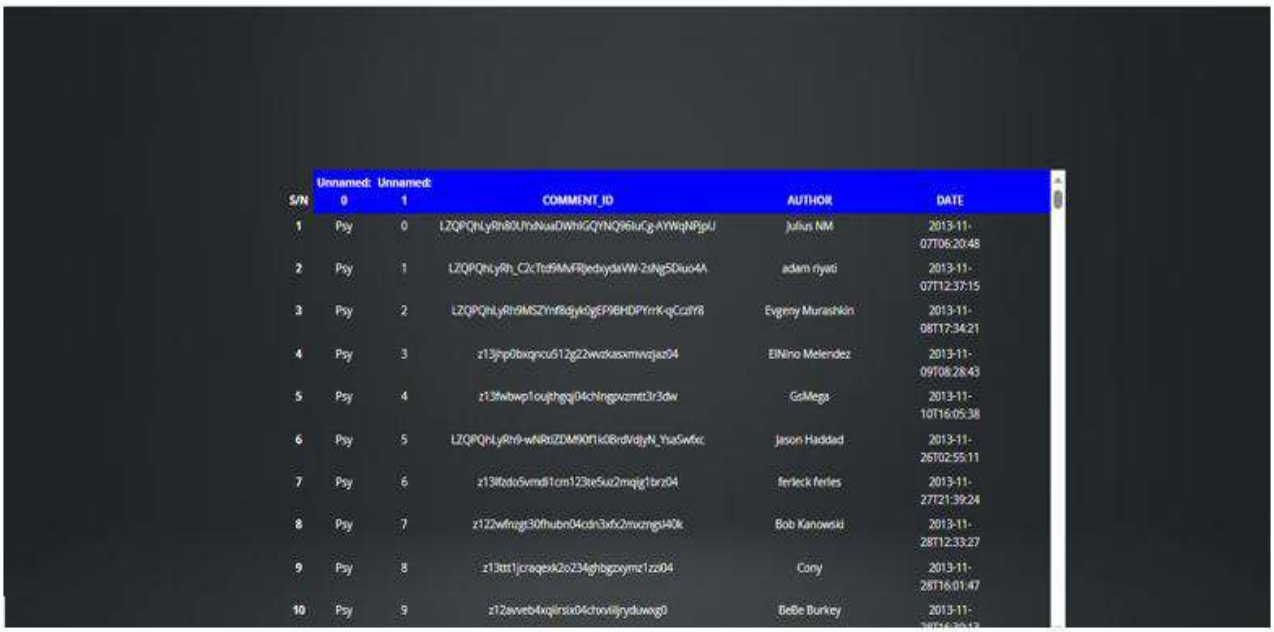
Pre-processing: Data need to be pre-processed according the models it helps to increase the accuracy of the model and better information about the data.

Training the data: After pre-processing the data will split into two parts as train and test data before training with the given algorithms.

Model Building: To create a model that predicts the dataset with better accuracy, this module will help user.

Generated Score: Here user view the score in %

a. Dataset



S/N	Unnamed: 0	Unnamed: 1	COMMENT_ID	AUTHOR	DATE
1	Psy	0	LZQPQhLyRh80UYxNuaDWhlGQYNQ96luCg-AYWqNPjpU	Julius NM	2013-11-07T06:20:48
2	Psy	1	LZQPQhLyRh_CJcTtd9MvFRjedxydaVW-2sNgSDiuo4A	adam riyati	2013-11-07T12:37:15
3	Psy	2	LZQPQhLyRh9MSZYnf8djyk0gEP9EHDPYrrK-qCcdY8	Evgeny Murashkin	2013-11-08T17:34:21
4	Psy	3	z13jhp0bxqncu512gz22wzkasxmwzjaz04	ElNino Melendez	2013-11-09T08:28:43
5	Psy	4	z13fwbwp1oujthgqj04chlngpvzmtt3r3dw	GsMega	2013-11-10T16:05:38
6	Psy	5	LZQPQhLyRh9-wNRtiZDM9X0f1k0BrdVdjyN_YsaSw6xc	Jason Haddad	2013-11-26T02:55:11
7	Psy	6	z13lfzdo5vmdl1cm123te5uz2mqjg1brz04	ferleck ferles	2013-11-27T21:39:24
8	Psy	7	z122wfnqjt30fhubn04cdn3xfx2mxzngsl40k	Bob Kanowski	2013-11-28T12:33:27
9	Psy	8	z13ttt1jcraqexk2o234ghbgzxymz1zzi04	Cony	2013-11-28T16:01:47
10	Psy	9	z12avveb4xqjirsix04chnvlijryduwog0	BeBe Burkey	2013-11-

Fig 2: Dataset

B. SPAM COMMENTS DETECTIONS:

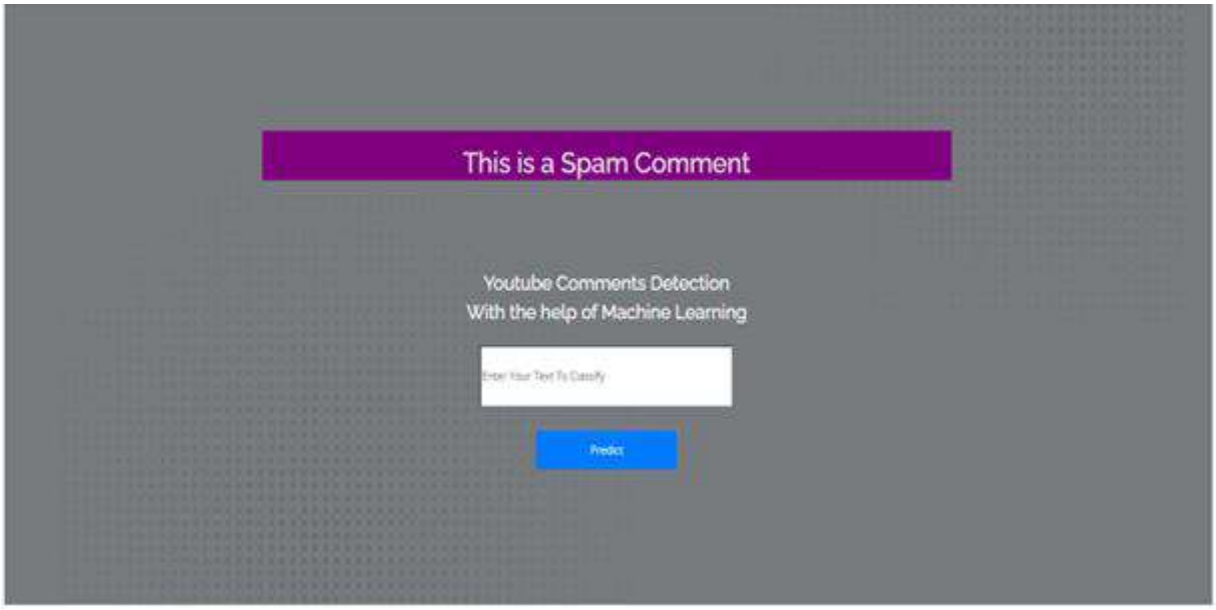


Fig.3: spam comments

V.DISCUSSION

By analyzing linguistic cues, syntactical irregularities, and user engagement metrics, ML models can distinguish between genuine and spam comments. These models are trained on diverse samples of comments, enabling them to adapt and evolve alongside evolving spam tactics. The impact of ML-based spam comments detection is multifaceted. It not only safeguards the user experience by curbing the visibility of spam but also enhances the authenticity and credibility of discussions. By reducing the noise generated by spam, the quality of interactions among users is elevated, fostering meaningful conversations and community growth.

VII. CONCLUSION

In conclusion, this project represents a significant stride in advancing the field of medical image diagnosis, particularly in the context of diabetic foot ulcer (DFU) detection. By harnessing the capabilities of Convolutional Neural Networks (CNNs) and Capsule Networks (Caps Nets), we have addressed the limitations of existing DFU diagnostic methodologies, striving for a nuanced and precise approach. The comparative analysis between CNNs and CapsNets not only enhances accuracy but also sheds light on the intricate differences in their performance, providing valuable insights for future research directions. The integration of state-of-the-art technologies, comprehensive performance evaluation metrics, and advanced visualization techniques positions this project at the forefront of innovation in healthcare.

As we navigate the dynamic landscape of medical diagnostics, our findings hold the promise of redefining diagnostic precision and patient care, contributing significantly to the ongoing dialogue in healthcare and paving the way for more accurate and efficient solutions in the realm of medical image diagnosis. Several methods are employed to categorize comments as spam or not spam. This strategy is 18% more effective than the previous strategy. Every user on YouTube has access to its open platform. There may be a shift in the spammers' behaviour over time. This project aims to eliminate unwanted spam comments from YouTube and enhance spam comments with high accuracy. The project's output enhances the findings for future comparison and serves as a baseline for anyone interested in YouTube spam comments.

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IOT- Based Human Friendly Smart Trolley

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Abstract: Shopping and buying is an integral part of our daily lives. Big mega markets have a wide variety of items and different stores can have different deliveries of goods. It is difficult for many consumers to stand in the long queue for the billing of goods purchased. This causes wastage of money and a poor bill for the wrong customer. Trolleys are used in supermarkets or grocery stores to make shopping simpler. However, it is difficult for customers to control the trolley while shopping. An automated customer following trolley was implemented which calculates the total sum of grocery items carried in the trolley by the customers. This reduces the customer's effort to pull the trolley and keep the line for the payment of the grocery products. The customer who has a specific tag and a web camera installed in front of the trolley will recognize the tag and move the trolley to the customer. Using the RFID tag and the Raspberry Pi receiver, the item bill inserted has been obtained in the trolley. This results in an ideal solution to all these problems.
Keywords: Raspberry pi, Ultra sonic sensors, Supermarkets, Trolley, RFID.

I. INTRODUCTION

Moving a shopping cart today is a daunting job in malls and retail areas because of the heavy weight of items. So in order to overcome this issue, a Human Friendly Smart Trolley with Automated Billing System was proposed. With these trolleys, consumers can enjoy their shopping and pay more attention to their shopping list without the need to move their shopping carts. As we can see in a shopping center or grocery store, like big bazaars and D-marts; there are trolleys available, but they are operated manually. An automated moving shopping cart with sensors is designed for the convenience of customers. The sensor on the trolley, tracks the customer and keeps moving. If the customer stays, the trolley always stays at a maintained distance. Upon a total purchase, the person has to go to the payment billing counter. There will be a long queue at the billing counter. The billing system will be placed in the trolley consists of an RFID reader. If a person place some product in a trolley, their code will be identified by using an RFID reader connected to the trolley. Radio frequency identification (RFID) technology has been commonly used in the field of construction for the past two decades.

In practice, RFID allows the regulation of a wide range of processes at all stages of the building's life cycle, from its creation to its occupants. When we put the commodity, the cost will be added to the overall bill. Therefore, the billing would be performed in the trolley itself, which will be observed on the LCD. In depth, the automated trolley follows the customer, which measures the total amount of grocery items put inside the trolley by the customer. The customer who has a unique tag and a web camera placed in front of the trolley will identify the tag and move the trolley to the customer. Using the RFID tag and the Raspberry Pi receiver, we get the bill of the item inserted in the trolley. To follow the customer, we use the Raspberry pi module and the pi cam. The Pi Cam detects the color of the band that the customer wears. We know the long queues on the billing counter of the shopping malls. The proposed trolley was designed with the goal of making the system reliable, simpler, faster and more effective. There is a lot of justification to pursue this initiative. Customer satisfaction is one of the most important aspects of any company. The potential for improving customer service in urban shopping malls and shops has been reached by us. There are improvisations that can be made in the future in the new framework that we have put in place. As technology progresses, new technologies can be incorporated. It can be used to solve real world problems and make tasks easier.

Core modules of the whole system can be listed as:

1. Raspberry pi unit with the software system to communicate with the central database, interfaced with RFID scanner, Ultrasound sensors, and the colour tag scanning camera.
2. Camera installed on the trolley base to scan for the customer colour tags in their hands.
3. Colour tag database and wearable colour tag for the customers.

2. RELATED RESEARCH

In 2017, Pandita et al. introduced the idea of automatic shopping trolleys using sensors, which enabled the customers to focus more on shopping than on manually operating trolleys [1]. With low cost and power consumption, they enjoyed using trolleys without the heavy task of pushing it. But the main difficulty faced by them was that they couldn't detect humans directly and move after customers [1]. In 2014, Sainath et al. introduced an automated trolley with Raspberry Pi, which allowed the users to self-checkout at the billing section of supermarket [2]. This trolley enabled the customers to save time and manpower. It made the customers to know about their bill amount during the time of each purchase. The main problem faced by them was that only high scale vendors could implement this type of trolley [2]. The researchers found the difficulty that the trolley need manpower to do the movement. In 2015, Rupali Savant et al. introduced a smart trolley, which replaced the barcode reading system with RFID tags [3]. This system reduced the time and cost. However, this system created the problem of difficulty in access to customers [3]. In 2017, L.S.Y Dehigaspege et al. introduced a new trolley system called "Follow me" which made the shopping easier and convenient for customers [4]. It used an automatic human guiding travelling and billing with the help of Bar code reader and an android based tablet with extensive user interface technique. It allowed the automatic parking and automatic charging while parked at its slot [4]. In 2016, Yathisha et.al. Introduced a system that has employed a tablet and android technology for tracking the goods during each purchase and allows automatic parking and charging [5]. Wani, Mukund, et al. et al. uses a trolley that uses LCD screens to display items they have purchased during shopping. It uses an RFID tag for billing. Since the trolley is electronic, it was not able to cover the automatic travelling facility.

The H. Anandakumar et al, illustrates the design and implementation of a smart shopping application attached to the smart cart. The application consists of two parts: Navigation being the first part which is further subdivided into two modes, manual mode which lets the user manually navigate the smart cart to the product's located place, and a fixed mode that has a map showing the actual area where the products are placed in the supermarket. The second part of the application is the automatic billing of purchased products. However, the automatic billing system provided by the application only deals with the automatic creation and updation of the records of commodities brought by the customer rather than the integration of payment gateways within the application itself. RFID readers are used for scanning the products. One of the major drawbacks to adopting this method is that an RFID reader needs to be attached to each cart and every item needs to have RFID labels that are troublesome to append to and withdraw from everything. An additional problem is that the system doesn't have any authentication feature to prevent malicious buyers from putting the items inside the cart without scanning them which makes the technology employed in this study inappropriate for marketing in India.

In R. Arulmurugan et al, the researchers have presented the utilization of a smart shopping cart containing a barcode scanner to scan and read the product information before putting the products into the cart, a Raspberry Pi touch screen display to show the information about the quantity and cost of the products, a Raspberry Pi board with SD card inserted and power bank to provide power supply, and a digital push button can be used if the buyer wishes to decide to eliminate an unwanted item from the smart basket. Their attempts to make a smart shopping cart using these components are cumbersome, unnecessarily complicated, and financially unfeasible. In addition, after scanning the Barcode that is mounted to the cart, this device offers a facility for producing and sending e-bills to the buyer's phone, however, the buyer has to opt for conventional payment methods available in supermarkets. Our smart shopping application bears a close resemblance to the one proposed in the paper Haldorai, A. Ramu et al, wherein the design of a smart shopping basket using IoT applications is highlighted. The smart basket has a load cell to verify the exact rates involving the items put in the container. To allow the self scan of the barcode of the items that each client wants to purchase, a barcode reader is mounted at the top of the shopping basket on a mobile device. When the total weight of the cart equals the total weight of the scanned items, the payment operation is followed.

However, this research only examined the generation of automated bills instead of initiating the payment process from the app. So, our project extends and builds on the works of M. Suganya and H. Anandakuma providing a facility to the customers to self scan as well as pay the bill through our application. And during the scanning process, personalized recommendations based on each users' previous purchase and top sold items are also given in previous paper by Haldor.

3. PROPOSED SYSTEM

A.COMPONENTS REQUIRED

The basic required objects for implementing 'Human Friendly Smart Trolley with Automatic Billing System are Raspberry Pi, Pi cam, Gear motors, Battery, RFID tags, LCD and Ultrasonic sensor. In order to perform the computation process, Raspberry Pi was used. Pi cam was used for detecting the color band. The component used for the effective movement of trolley was possible with the help of gear motors. RFID tags were used to bill the products during purchase. A 4-mAh battery was used in this proposed system. LCD was used to display the bill and an ultrasonic sensor to avoid collision.

1.Raspberry Pi 4 Model B

Processor: Broadcom BCM2711 quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz.
Memory (RAM): Options for 1GB, 2GB, 4GB, or 8GB LPDDR4-3200 SDRAM.
Wireless Connectivity: 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless LAN. Bluetooth 5.0, BLE (Bluetooth Low Energy).
Ethernet: Gigabit Ethernet (RJ45).
USB Ports: 2 × USB 3.0 ports. 2 × USB 2.0 ports.
GPIO (General Purpose Input/Output): Standard Raspberry Pi 40-pin GPIO header, fully backwards-compatible with previous boards.
Video and Audio Output: 2 × micro-HDMI ports supporting up to 4Kp60 resolution. 4-pole stereo audio and composite video port.
Display Interface: 2-lane MIPI DSI display port.
Camera Interface: 2-lane MIPI CSI camera port. Video Decoding: H.265 (4Kp60 decode). H.264 (1080p60 decode, 1080p30 encode).
Graphics: OpenGL ES 3.0 graphics.
Storage: MicroSD card slot for operating system and data storage.
Power: Requires 5V DC via USB-C connector. The proposed system contains Raspbian OS to operate raspberry pi. All the components are connected in raspberry pi through the Printed circuit board (PCB). All the codes are written in python and opencv during implementation. The proposed system used opencv to track the color of the customer tag.

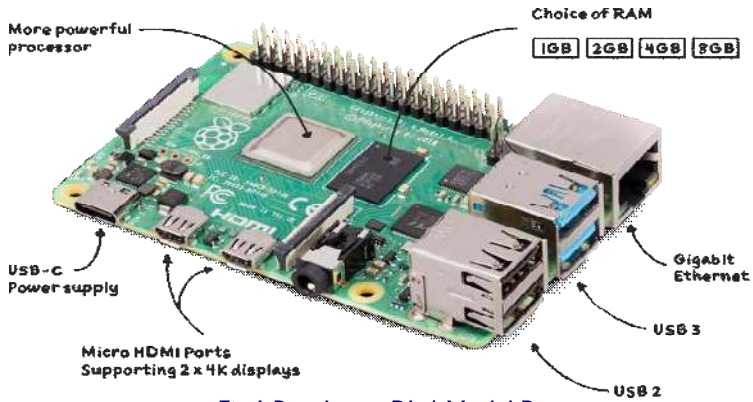

Fig.1.Raspberry PI 4 Model B

2. Zebronics Web camera

To identify or track the color of the tag that customer have, a zebronics web camera, which is represented in Fig.2. was used which have 3 pin lines with a resolution of 640x480. A lso have a white version fetcher web camera gives x and y coordinates to the raspberry pi if the color is matches with the customer tag.

Fig.2.Zebronics web camera

3. Gear Motors

Two gear motors of 500 rpm placed or attached to the two back wheels of the trolley. The two gear motors will help the trolley to move or follow the customer. When the camera module the color tag of the customer, the raspberry pi gives the instruction to the motor to rotate.

Suppose the customer moves from the left side, the trolley also moves the left side by rotating its right wheel and hold the left wheel. In this proposed system, the x and y range was set accordingly. When the camera identifies the color tag in the center of the frame, both motors rotate if the tag in the left side of the frame. The trolley moves the left side of the frame and tag in the right side the trolley moves the right side.

4. RFID Cards

RFID tag is used as the customer purchases those as we know all of the products in the supermarket are now covered by barcode, which have many disadvantages over RFID. RFID is fast and no sight transaction required. If all the products have RFID transaction, and it will completely minimize the time complexity of billing. Because scanning barcode is a time consuming process. The proposed system consists of three RFID Tags as shown in Fig.3. And one receiver in each tag will store the information of different products. When the customers purchase the product into the trolley, The RFID receiver gives the information to the raspberry pi and then stores it. The data is then converted in the pi. To convert RFID logic to pi, the max 232 ic was used. RFID is used to calculate the amount of products placed in the trolley. Button is placed near the battery, when the button is pressed it will generate the total amount of products

Fig.3.EM-18 reader and RFID card

5. USB to 6 PIN serial convertor

A USB to 6-pin serial converter, also known as a USB to TTL serial adapter, is a device used to interface between a USB port on a computer and devices that communicate via serial UART (Universal Asynchronous Receiver-Transmitter) protocol using a 6-pin connector

Fig.4.USB to 6 PIN serial convertor

6. Power Supply Board and Motor Driver

The power supply board serves as the electrical backbone of the system, ensuring that all components receive the necessary power to function. It converts incoming electrical power from mains or battery sources into the appropriate voltage and current levels required by the system. The motor driver is responsible for controlling the speed snd direction of electric motors within the system. It amplifies control signal from a microcontroller or other control circuitry, providing the necessary power levels required to drive the motor effectively. Motor drivers use techniques like Pulse Width Modulation (PWM) to regulate motor speed by varying the duty cycle of the control signal.

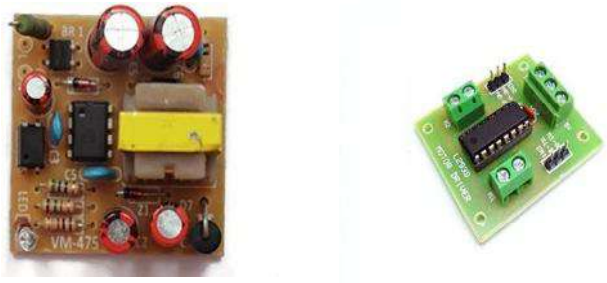

Fig.5.Power Supply And Motor Driver

7. LCD Display, Battery and Buttons

LCD Display which is used to display the products name or ID, The insertion or deletion of the product would be shown and the Total amount would be displayed. Battery which is used for power supply, we would be consuming 12v of power supply from the battery. Button is used to generate the total amount when pressed.

B. IMPLEMENTATION

The proposed model uses the concept of color tagging system, which is less expensive in terms of computation complexity, and image processing hence reduce the power conception, which is vital in the case of a trolley as frequent charging of moving trolley is not acceptable to business environment.

Here we describe the implementation of the Human Friendly Smart Trolley with Automatic Billing System having several components connected in raspberry pi which is shown in Fig. 6. The proposed system mainly concentrated on upgrading the traditional trolleys to automated trolleys with less expense. Customer follow process is purely based on the color tagging system and proposed a novel approach to make the whole system more accurate in busy super markets where the customer density is huge. Above-mentioned methodology will help the system to handle the tracking challenges in busy shop.

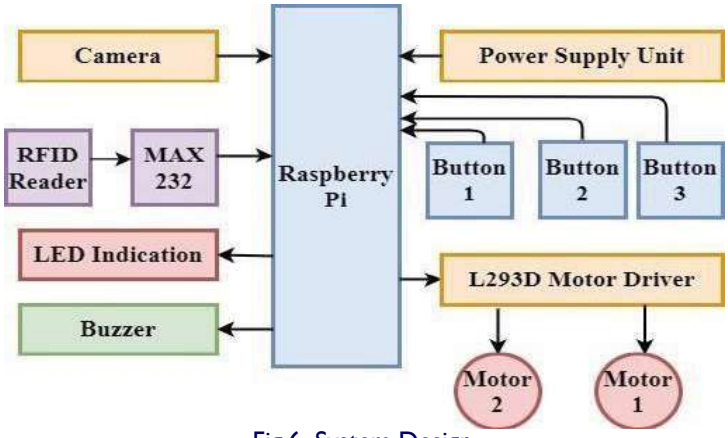

Fig.6. System Design

The raspberry pi is the core part of the automatic trolley because all the units are connected in pi [8]. The software section working on the pi consists of two parts including camera module and RFID Reader. The camera module takes frequency images and sends to the pi. The Python IDE program analyzes the image. The corresponding instructions are provided in the gear motor through l293d. l293d clip is used to prevent the back emf. RFID module read the products and sends to the max232 IC. The connection of RID to Raspberry Pi is shown in Fig. 7. The max232, which converts the Transistor logic (TTL) logic level, signal in to its equivalent RS-232c level. The pi is a RS 232 logic device has three buttons, one controls the ON and OFF actions and another, two controls the reading and removing actions.

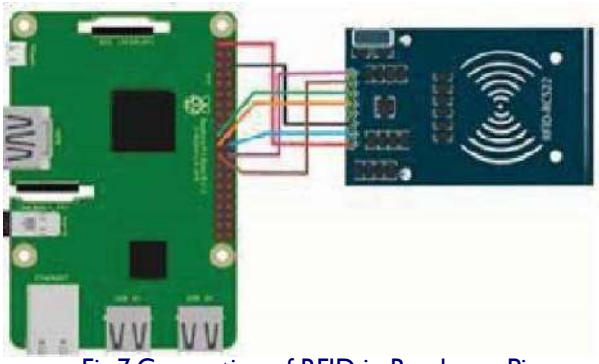

Fig.7.Connection of RFID in Raspberry Pi

At the time of entry to the shop itself the customer will get a color tag and matching troll trolley (The customer tag will be with the trolley itself just like a wrist band) , Image captured by the system will identify the color tag much more easily without performing complex computations and this is the main trigger to the trolley to decide which object it need to track.

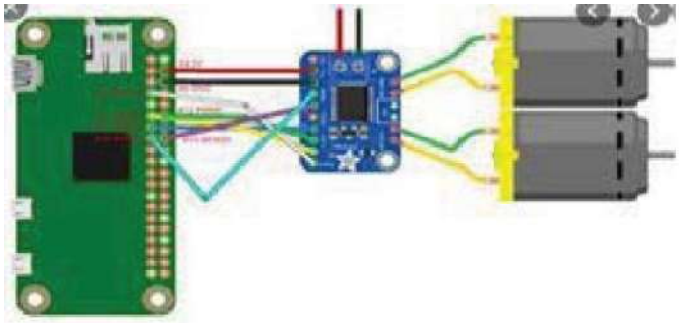

Fig.8.Connection of gear motor in raspberry Pi

The Fig.8. shows how to wire the Raspberry Pi to the motor controller and the motor. The Raspberry pi controls the direction and speed using PWM outputs. Most importantly, we need to make sure we get Vcc and Vm around the right way if we were using a 15V battery mixing them up would cook the motor board and the Pi. In order to improve the efficiency and to avoid trolley collisions a second stage of environment design is underlined in the proposed system.

The automated trolley will be much more accurate if the shop environment is equipped with the defined trolley path by which a trolley can reach any shelf from anywhere. This is an innovative approach to effectively implement the automated trolley system in any existing supermarket by rearranging the shelves and defining trolley path by colored tracks, this system will be used to descried the trolley to avoid unwanted turnings and take the turnings only if its master tag turns with a particular threshold.

4. RESULTS

Automated trolley functioned based on the color tag ratio stored in the trolley memory in the HSV ratio of the color tag. This color tag mechanism interconnects the unique customer with the trolley. Identify the customer's color tag in their hand by using the camera ins talled in the trolley. Trolley identifies the customers based on the HSV ratio of the color tag. Trolley follows the customer if the identified color tag matches the customer color tag otherwise it stops and starts scanning for the matching color tag among the customers in the camera's field of view. Automated trolley system may not be much successful in the busy business hours of the malls and in the malls with shelves arranged in a congested manner.

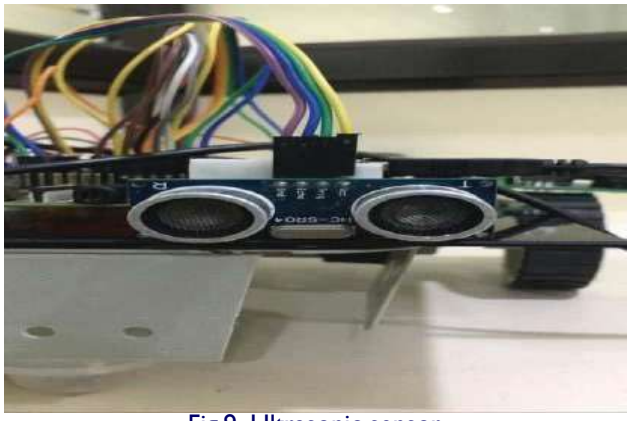

Fig.9. Ultrasonic sensor

Ultrasound sensors have been installed in 3 sides of the trolley to identify the obstacles including shelves and human beings, the trigger distance has been set for 30 cm from front and 15cm from both sides which is shown in Fig. 8. The product's id was scanned by the RFID scanner installed in the trolley basket side. By pressing add, the trolley system will add the item in the kart. If we want to remove the product from the basket we have to press the remove button and scan the particular product to be removed. The raspberry pi module will be having the central database access to identify the product and its price details. When a customer clicks the OFF button, the request will show how much money the customer needs to pay so that the customer can easily complete his shopping. The resultant trolley is represented in Fig. 9. The automated central billing system, which is shown in Fig.10. consists of a transceiver and a server/system connected to access product database. Whenever the customer places a product into the basket, the RFID Reader will read the tag information and display the related results on the LCD Display. . This totally depends on the customer choice. Once you are ready with the hardware and program. Before we test our bot on ground, we should make sure everything is working fine. Connect your Pi to monitor and launch the processing code. The video is fed on a small window. Now, bring the ball inside the frame and click on the customer to teach the trolley that it should track this particular colour. Now, move the ball around the screen and you should notice the wheels rotating. The smart trolley can feature will be helpful for the shopping in the marts.

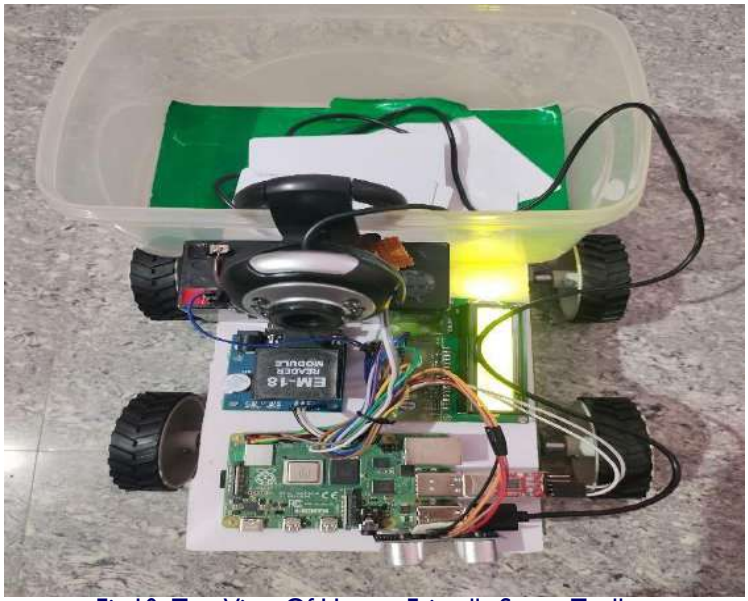

Fig.10. Top View Of Human Friendly Smart Trolley

Fig.11. Front View Of Human Friendly Smart Trolley

teach the trolley that it should track this particular colour. Now, move the ball around the screen and you should notice the wheels rotating. The smart trolley can feature ergonomic design and intuitive controls, making it easy for customers to navigate through the store and select items. With the billing system integrated into the smart trolley, customers can scan items as they shop, eliminating the need to wait in long checkout lines. This streamlines the shopping process and saves time for both customers and retailers.

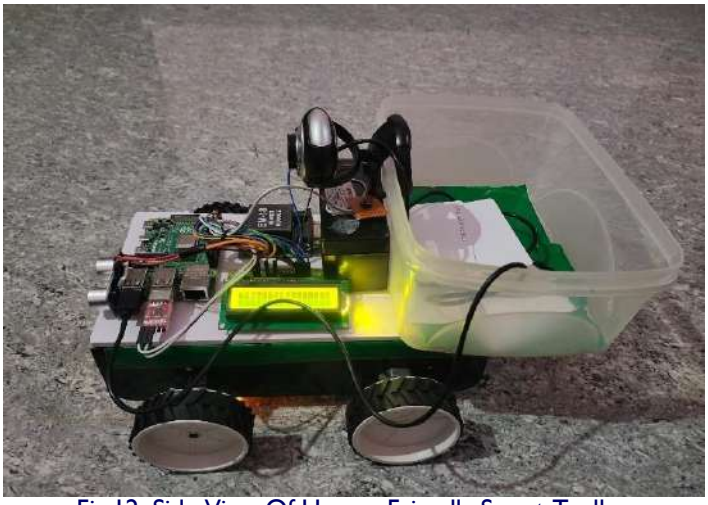

Fig.12. Side View Of Human Friendly Smart Trolley

Before we test our bot on ground, we should make sure everything is working fine. Connect your Pi to monitor and launch the processing code. The video feed should be viewed on a small window. Now, bring the ball inside the frame and click on the customer to teach the trolley that it should track this particular color which is as shown in Fig. 10,11,12. Now move the ball around the screen and you should notice the wheels rotating.

5. CONCLUSION

Human Friendly Smart Trolley with Automated Billing System is a system that follows the customer and gives the bill of the product that is inserted in it. It will be much easier for aged customers and children to use trolleys without any effort. By using the product, we can save time for the customer especially in the billing part. The proposed system is a unique solution by utilizing the low cost electronic components and the structural design can be implement on existing trolley. As the proposed design is less complicated, existing normal trolley can be converted to smart trolley with lesser investments. It is sure that the system is very much helpful for the customers and without bothering about their trolley, they can make their purchase easy. By integrating cutting edge hardware like sensors, microcontrollers, and displays with sophisticated software including item recognition, billing systems, and user interfaces, this project aims to streamline the shopping process. The seamless interaction between hardware and software components ensures accurate item tracking, automatic billing, and intuitive user interfaces for a hassle free shopping journey. This smart trolley not only simplifies the shopping experience for customers but also showcases the potential of technology in enhancing everyday tasks.

Moreover, the smart trolley's connectivity to the Internet allows for advanced functionalities such as real-time pricing information, personalized recommendations, and promotions tailored to individual preferences. Carrying trolley along with the customers is a very difficult task for the customers. The proposed system provides an easy way to reduce all these problems. In future, we hope that we can provide a system, which is more user-friendly.

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Development of an Android Application for Smart Parking System

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Abstract: Now-a-days, vehicle parking has become a major problem in urban areas with the shortage of parking spaces. It is very difficult and frustrating to find a parking space in most metropolitan areas, especially during the rush hours to solve this problem. The project entitled smart parking system using android application, the major motivation of this project is to reduce the traffic congestion in roads, multi storied buildings and malls due to unavailability of parking spaces. The proposed application provides an easy way for reservation of parking slot. In this application user can view various parking areas and also view whether space is available or not. The project displays the nearest empty slot if present with respect to user location. This system gives a further feature of cancelling the bookings. Users may even make price online primarily based totally at the time taken for the reserved area the quantity might be calculated and the person can make charge. This project provides a good insight into the guidance, monitoring and reservations components of the smart parking and directions to the future development.

Keywords: Android Application, slot allocation, smart parking, parking management, Firebase Storage.

I. INTRODUCTION

The number of personal vehicles usage is increasing day by day. Due to this searching for a vacant parking area during peak hours is not only time-consuming but also results in wastage of fuel. The drivers keep searching for a proper parking lot that leads to increased traffic. Increasing volume of vehicular exhaust creates a negative impact on the environment. Hence reservation-based smart parking has become the need of the day. In this application user can view various parking areas also he can select it to view whether parking slot is available or not. If the parking slot is available in parking, then user can book it for some specific time slot also, this system provides an additional feature of cancelling the bookings. It also utilizes the open ground for parking with security. Thus, it is going to solve the parking and traffic problem. In this case, it is not necessary to use an extra expensive camera and scanner for verification. The smart parking system based on slot reservation is implemented, utilizing the Android application.

The app having the features of slot allocation, by using the slot allocation method. It is an effective way in resolving the parking issues, which helps for traffic congestions and also provide the automated payment billing process. This work gets extended as a fully automated system using multilayer parking method. We plan to broaden the testing on the real-time environment where users can have the "Smart Parking" system in their portable devices.

II. LITERATURE REVIEW

A. Study on demand and characteristics of parking system in urban areas: A review Authors: Janak Parmar, Pritikana Das, Sanjaykumar M. Dave Year: 2020

This paper integrates all aspects and presents the state-of-the-art review of models and studies on the parking system. Problems related to and due to the parking, various parking characteristics and their applications, parking choice behavior of drivers, development of demand models considering various factors and review of parking policies as an integral part of the urban transport system are discussed in detail. Whilst underdeveloped, authors found the literatures suggest that greater attention should be given to metrics like ease of access, walk time, parking charges, parking guidance and information system, management, etc., at all stages of planning and policy formulation. Taken together, mentioned studies demonstrate useful information concerning the entire parking system. It also provides useful information to the planners and policy makers for planning, designing and evaluating parking system.

B. IoT Enabled Real-Time urban transport management system Authors: Vatsal Chauhan, Meetu Patel, Sudeep Tanwar, Sudhanshu Tyagi, Neeraj Kumar Year: 2020

In this paper, we propose a system named iERS, which reduces the user's effort to locate the nearest available parking slots in real-time. It reduces individual efforts to locate a suitable parking slot. iERS helps the user to find an available parking slot and also provides direction towards the slot. iERS uses the Internet of Things (IoT)-based infrastructure to monitor and signal the availability of different parking slots around the smart communities. The simulation and testbed results demonstrate that iERS provides better guidance to the users to reserve the available parking slot in comparison to the other existing solutions.

C. Smart car parking system model for urban areas Authors: Rahman Atiqur Year: 2021

This article is on the smart car parking system. In which we going to utilize the ultrasonic sensor to distinguish the vehicle and it will assist the proprietor with finding an advantageous parking spot. Parking spots are significant in city urban areas. In view of the expansion in a huge number of vehicles, the requirement for parking spots is a need, and henceforth an earnest need to build up a system that can deal with these parking spots. To determine these necessities, we build up a system to show the empty path in the parking spots. This includes a system that incorporates an ultrasonic sensor, raspberry pi 4, wifi-module, and a led show outside the vehicle parking entryway. Parking spots are observed by the staff of the concerned power. The paper incorporates the subtleties of parts that are utilized and about the working of this system. The paper likewise shows that our system's looking through an ideal opportunity to locate a free spot is more productive than some other existing system.

III. PROPOSED SYSTEM

The Android application for a smart parking system offers a user-friendly interface for drivers to easily locate and reserve parking spaces in real-time. Utilizing GPS technology, the app provides users with a map view displaying available parking spots nearby, along with relevant details such as pricing, restrictions, and accessibility features. Users can also navigate to their selected parking spot using integrated turn-by-turn directions. The app allows for convenient payment processing, enabling users to pay for parking directly through the application using various payment methods. Additionally, the app can send notifications to users regarding parking availability, reservation confirmations, and reminders before their parking session expires. Through seamless integration with the IoT infrastructure, the Android application ensures a hassle-free and efficient parking experience for drivers while contributing to improved traffic flow and reduced environmental impact.

A. User interface

The user interface plays a pivotal role in providing a seamless experience for drivers. It should offer a clear and intuitive layout, displaying real-time information about available parking spots in a visually appealing manner. Users should be able to easily navigate through the app, search for nearby parking locations, and reserve a spot with minimal effort. Additionally, the interface should integrate features such as payment options, booking confirmation, and navigation assistance to guide users to their reserved parking space efficiently. Clear and concise notifications about spot availability and booking status are essential for keeping users informed throughout their parking journey. Overall, prioritizing simplicity, clarity, and functionality in the user interface is crucial for enhancing user satisfaction and adoption of the smart parking system.

B. Payment and Reservation

The user interface plays a pivotal role in providing a seamless experience for drivers. It should offer a clear and intuitive layout, displaying real-time information about available parking spots in a visually appealing manner. Users should be able to easily navigate through the app, search for nearby parking locations, and reserve a spot with minimal effort. Additionally, the interface should integrate features such as payment options, booking confirmation, and navigation assistance to guide users to their reserved parking space efficiently. Clear and concise notifications about spot availability and booking status are essential for keeping users informed throughout their parking journey. Overall, prioritizing simplicity, clarity, and functionality in the user interface is crucial for enhancing user satisfaction and adoption of the smart parking system.

C. Navigation and Guidance

In the Android application for a smart parking system, navigation and guidance features are indispensable for assisting users in finding and reaching their reserved parking spots efficiently. The app should integrate with GPS technology to provide step-by-step directions from the user's current location to the selected parking space. Clear visual and auditory cues, along with real-time updates on traffic conditions and obstacles, help users navigate smoothly and avoid potential delays. Additionally, the app should offer features such as augmented reality or indoor mapping to guide users within parking facilities, especially in complex or multi-level structures. Providing intuitive navigation and guidance enhances user satisfaction and ensures a positive overall experience with the smart parking system.

IV. IMPLEMENTATION

The implementation of an Android application for a smart parking system involves several key steps to ensure its functionality and effectiveness. This data is then processed using algorithms to analyze parking occupancy and determine spot availability. The application's user interface is designed to present this information to users, allowing them to easily search for nearby parking spots, reserve a space, and navigate to it using GPS guidance. Payment and reservation systems are integrated to facilitate seamless transactions, ensuring a smooth user experience. Additionally, feedback mechanisms may be incorporated to gather user input and improve system accuracy over time. Overall, successful implementation involves a cohesive approach that combines hardware, software, and user interaction to deliver a reliable and user-friendly smart parking solution on the Android platform.

A. Login and Register

The login and registration functionality play crucial roles in ensuring a seamless user experience. Users can register their accounts by providing basic information such as name, email, and password. Once registered, they can log in securely using their credentials to access the app's features. The login process authenticates users and grants them access to their personalized profiles, where they can view parking availability, reserve parking spots, and manage their bookings. Implementing a simple and intuitive login and registration process is essential for facilitating user engagement and adoption of the smart parking system, enhancing overall user satisfaction and convenience.

B. Slot Booking

The slot booking functionality is essential for users to reserve parking spaces conveniently. Through the app, users can browse available parking slots in real-time, selecting their desired location for parking. Once a slot is chosen, users can confirm their booking, receiving a digital confirmation and details about their reserved spot. This feature streamlines the parking process, allowing users to plan their trips efficiently and avoid the hassle of searching for parking upon arrival. By integrating slot booking into the app, users can enjoy a seamless and stress-free parking experience, maximizing the utility and convenience of the smart parking system.

C. Navigation

The effective navigation is crucial for seamless user experience. Simplifying navigation involves designing an intuitive interface with clear, easily accessible options. The app should feature a straightforward home screen, presenting essential functions like finding parking spots, reserving spaces, and managing bookings. Implementing a user-friendly search function with filters for location, availability, and pricing enhances usability. Utilizing clear labels and icons for different sections ensures users can effortlessly navigate through the app. Additionally, incorporating features such as real-time updates on parking availability and directions to selected spots streamlines the user journey further. Prioritizing simplicity and usability in navigation ultimately enhances the overall effectiveness and user satisfaction of the smart parking application.

D. Payment

The integrating a seamless payment system is paramount for user convenience and satisfaction. Simplifying the payment process involves offering various payment options such as credit/debit cards, mobile wallets, or even digital payment platforms. The payment interface should be intuitive and secure, with clear prompts guiding users through the transaction process. Implementing features like saved payment methods and automatic billing for recurring users streamlines the experience further. Ensuring encryption and robust security measures protect users' financial information is essential to build trust. Additionally, providing instant payment confirmations and receipts enhances transparency and reliability. Prioritizing simplicity and security in the payment process ultimately contributes to a positive user experience and encourages repeat usage of the smart parking application.

V. ARCHITECTURE

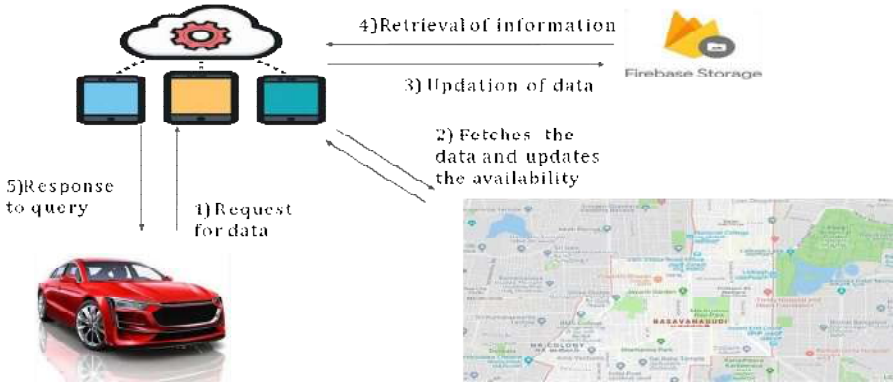

Figure 5.1 System Architecture

VI. RESULT

A. User login Page

Figure 6.1 Home page of user application

Figure 6.2 View Path

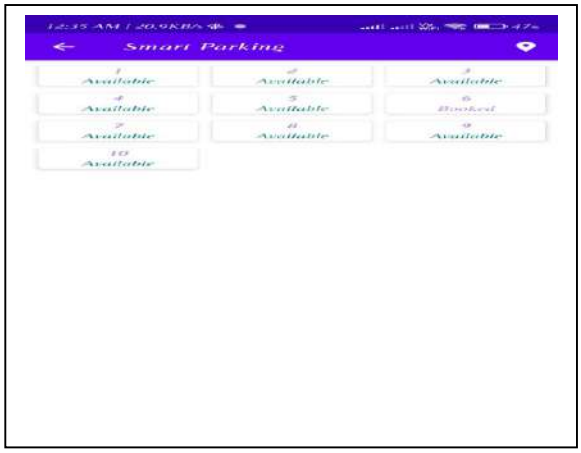

Figure 6.3 View slot of Parking

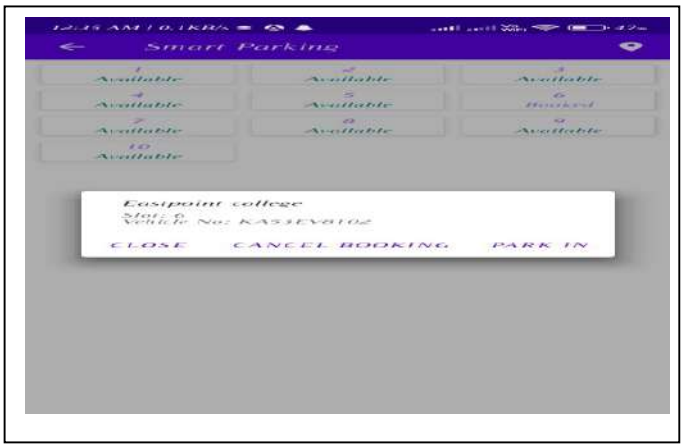

Figure 6.4 Booking Slot

B. Admin login Page

Figure 6.5 Home page of admin application

Figure 6.6 View Parking List

Figure 6.7 Admin Register Page

VII. CONCLUSION

This article summarizes an efficient way to park a vehicle using recent technology. This app allows the user to take control of the parking decision unlike the traditional methods of physically trying out multiple parking spots. Using this application on a large scale would benefit the user even if a user is in a new place. The app is user-friendly and convenient have introduced the concept of smart Parking System which will be able to reduce traffic congestion, which will improve the quality of life of the citizen. Android mobile application called car parking, a driver an find the available parking spaces in a given area and get the parking fees.

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Prediction of Alzheimer's Disease with Retinal Images Using Deep Learning

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Abstract- Alzheimer's disease (AD) is a leading cause of mortality worldwide. Early detection and accurate diagnosis of AD are crucial for effective intervention and improved patient outcomes. Retinal imaging has emerged as a non-invasive and cost-effective technique for AD prediction. This study aims to develop a deep learning model using convolutional neural networks (CNNs) architecture to predict AD from retinal images. The proposed model leverages the capabilities of CNNs to automatically learn relevant features from retinal images.

Keywords-Retinal Imaging Biomarkers, Convolutional Neural Networks (CNN), Retinal Image Analysis, Feature Extraction Techniques, Image Segmentation Algorithms.

INTRODUCTION

Alzheimer's Disease (AD) is a progressive neurodegenerative disorder that primarily affects memory and cognitive function, leading to a decline in a person's ability to perform daily activities. As the global population ages, the prevalence of Alzheimer's Disease continues to rise, posing significant challenges for healthcare systems worldwide. Early detection of AD is crucial for timely intervention and effective management of the disease. Recent advancements in medical imaging and deep learning techniques have opened up new avenues for non-invasive and early diagnosis of Alzheimer's Disease. One promising approach involves the analysis of retinal images using deep learning algorithms. The retina, as an extension of the central nervous system, exhibits structural and vascular changes that may be indicative of neurodegenerative conditions, including Alzheimer's Disease. This research aims to explore the potential of deep learning models in predicting Alzheimer's Disease based on features extracted from retinal images. By leveraging the power of artificial intelligence, this approach seeks to offer a non-invasive and cost-effective method for early detection, paving the way for personalized and targeted interventions.

By combining the strengths of deep learning with the rich information present in retinal images, this research strives to contribute to the growing field of AI-assisted diagnostics for neurodegenerative disorders, offering a promising avenue for improved patient outcomes and enhanced healthcare delivery. Alzheimer's disease (AD) diagnosis currently lacks a simple screening method. This is partly due to the inherent complexity of AD itself, requiring expensive and often invasive tests typically unavailable outside specialized settings. Our research addresses this gap by developing a deep-learning algorithm for AD detection using retinal photographs. This approach leverages the retina's accessibility through non-invasive imaging, the most common method for examining the retina. Early and accurate AD detection is critical for effective interventions and improved patient outcomes. Our model addresses this need by learning to accurately classify retinal images indicative of AD presence or absence through extensive training and optimization. Performance evaluation is conducted using standard metrics to assess its efficiency.

LITERATURE SURVEY

[1]This conference paper explores retinal biomarkers for diagnosis and disease monitoring are becoming more and more popular, as this paper's literature review highlights the increasing awareness of retinal symptoms in neurodegenerative disorders including Parkinson's disease (PD) and Alzheimer's disease (AD). Developments in retinal imaging technology, such as easily accessible, non-invasive, and reasonably priced techniques for high-resolution imaging, hold promise for revolutionizing the screening of the general population for AD/PD risk. In the last five years, new imaging methods for identifying amyloid beta (Aβ) in the retina have been developed along with a better comprehension of the degenerative processes that take place in the retina. These findings imply that the retina provides special insights into the processes underlying diseases of the central nervous system (CNS), in addition to laying the groundwork for the use of retinal biomarkers in clinical practice.

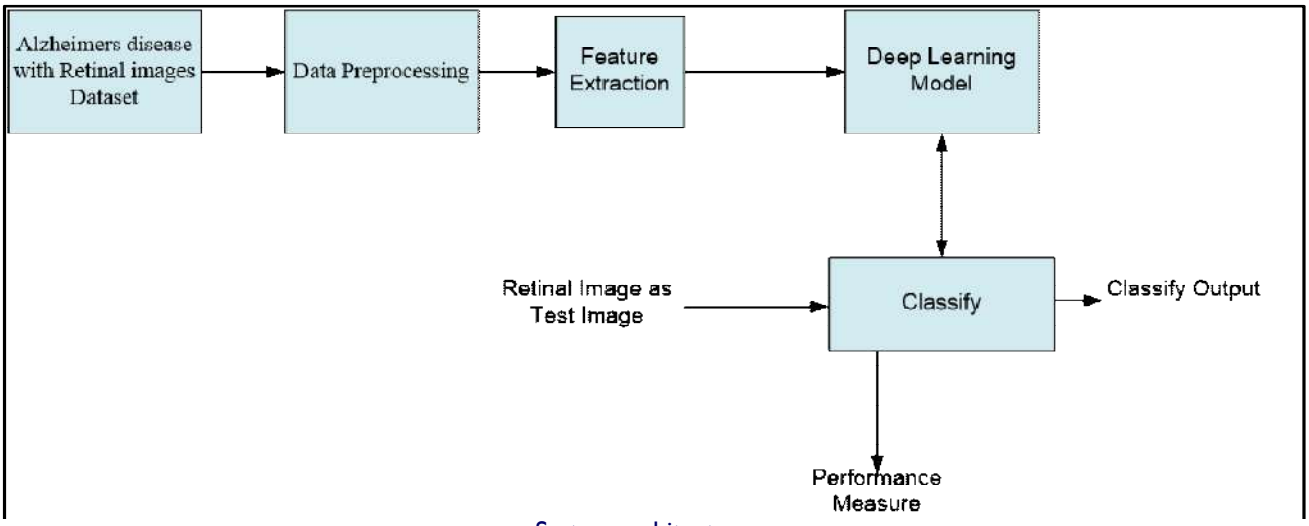
[2] This conference paper explores the burgeoning interest in harnessing retinal imaging for detecting and monitoring neurodegenerative diseases, with a focus on Alzheimer's disease (AD) and Parkinson's disease (PD). It discusses how retinal neurode generation and visual dysfunctions are prevalent in many AD and PD patients, underscoring the retina's potential as a non-invasive diagnostic tool. Recent advancements in retinal imaging have allowed for detailed visualization of structural changes, vasculature abnormalities, and protein deposition, providing valuable insights into disease pathophysiology. Given the retina's similarity to the central nervous system (CNS), it can reflect disease processes occurring elsewhere in the CNS, making retinal imaging promising for biomarker identification and disease mechanism elucidation. The paper highlights the role of artificial intelligence (AI), particularly deep learning, in developing algorithms capable of accurately detecting various diseases from retinal photographs. However, the application of deep learning specifically in AD detection from retinal photographs has been limited.

[3] This conference paper emphasizes the ongoing endeavours to innovate diagnostic tools for Alzheimer's disease (AD), focusing on integrating retinal imaging modalities and machine learning techniques. Past research has underscored the potential of retinal imaging in identifying structural and microvascular alterations associated with AD, presenting a non-invasive and cost-effective alternative to conventional neuroimaging methods. Moreover, machine learning models incorporating neuroimaging data have demonstrated promising diagnostic accuracy for AD, despite concerns regarding accessibility and cost. In this study, we aim to address these challenges by developing a convolutional neural network (CNN) that amalgamates multimodal retinal images to predict the likelihood of symptomatic AD. This pioneering approach signifies a substantial advancement in AD diagnosis, potentially offering a more accessible and less invasive alternative to expensive neuroimaging techniques.

PROPOSED SYSTEM

The suggested system for collecting retinal images, pre-processing the data, annotating it with Alzheimer's risk factors, annotating the data with Alzheimer's risk factors, designing a deep learning model (such as a CNN), creating training and validation datasets, training the model, validating its performance, and testing it on new retinal images.

SYSTEM ARCHITECTURE



System architecture

To help healthcare practitioners forecast Alzheimer's illness, the system compares its predictions to ground truth annotations, evaluates performance indicators, and can be implemented for real-world applications.
Advantages: Accurate classification, Less complexity, High performance.

SYSTEM MODULES

The system for the "Prediction of Alzheimer's Disease with Retinal Images Using Deep Learning" project can be divided into several modules, each serving a specific purpose in the overall workflow. Here are the key modules:

1. Data Preprocessing Module:

- **Objective:** The objective of this module is to prepare and clean the retinal image data to facilitate effective model training.
- **Tasks:** Image resizing: Resize all retinal images to a standardized size to ensure consistency in input dimensions for the model.
- **Normalization:** Normalize the pixel values of the retinal images to a common scale, typically between 0 and 1, to enhance model convergence during training.
- **Enhancement:** Apply image enhancement techniques, such as contrast adjustment or sharpening filters, to improve the clarity and quality of retinal images.
- **Removal of artifacts and irrelevant structures:** Identify and remove any artifacts or irrelevant structures present in the retinal images that could potentially introduce noise or bias during model training.
- **Data augmentation:** Augment the retinal image dataset by applying transformations such as rotation, flipping, or cropping to increase the diversity of the dataset and improve the model's ability to generalize to unseen data.

2. Feature Extraction Module:

- **Objective:** The objective of this module is to extract relevant features from retinal images to serve as input for the deep learning model.
- **Tasks:** Identify and extract structural, vascular, and textural features: Utilize image processing techniques to identify and extract key features from retinal images, including structural components (e.g., optic disc, macula), vascular patterns, and textural characteristics (e.g., retinal layers, lesions).
- **Use techniques like image segmentation to isolate specific regions of interest:** Employ image segmentation methods to delineate specific anatomical structures or pathological regions within the retinal images, such as optic disc segmentation or lesion detection.
- **Transform raw image data into a format suitable for model input:** Convert the extracted features into a suitable format for model input, such as feature vectors or matrices, ensuring compatibility with the deep learning architecture. Fine-tune the model based on validation results: Analyze the performance of the model on the validation dataset and identify areas for improvement. Fine-tune the model's

3. Deep Learning Model Training Module:

- **Objective:** The objective of this module is to train a deep-learning model to recognize patterns and correlations within retinal images.
- **Tasks:** Select and implement an appropriate deep learning architecture (e.g., convolutional neural network - CNN): Choose a suitable deep learning architecture tailored to the task of analyzing retinal images. CNNs are commonly used for image recognition tasks due to their ability to effectively learn hierarchical features.
- **Split the dataset into training and validation sets:** Divide the labeled dataset into training and validation sets to assess the model's performance and prevent over fitting. Typically, a portion of the data (e.g., 80%) is used for training, while the remainder (e.g., 20%) is reserved for validation.
- **Optimize hyper parameters and train the model using labeled data:** Fine-tune the model's hyper parameters, such as learning rate, batch size, and optimizer choice, to optimize performance. Train the model using the training dataset and monitor its performance on the validation set to ensure generalization to unseen data.

4. Model Evaluation and Validation Module:

- **Objective:** The objective of this module is to assess the performance and generalization ability of the trained model for Alzheimer's disease detection.
- **Tasks:** Evaluate model accuracy, sensitivity, specificity, and other relevant metrics: Assess the performance of the trained model using appropriate evaluation metrics, including accuracy, sensitivity, specificity, precision, and F1-score. These metrics provide insights into the model's ability to correctly classify AD and non-AD cases.
- **Validate the model on an independent dataset to ensure robustness:** Test the trained model on an independent dataset that was not used during training or validation. This validation step helps ensure that the model generalizes well to unseen data and is not over fitting to the training dataset.
- hyper parameters or architecture based on the validation results to enhance its performance and generalization ability.

5. Interpretability Module:

- **Objective:** This module aims to improve the interpretability of the deep learning model's predictions for Alzheimer's disease detection.
- **Tasks:** Implement XAI techniques within the deep learning model to enhance understanding of its decision-making process, aiming for transparency and interpretability.

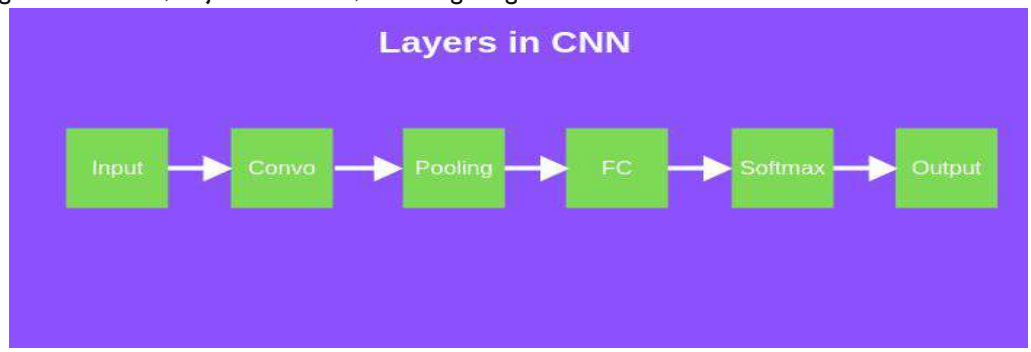
- Utilize visualization methods like CAM or Grad-CAM to generate heat maps highlighting influential regions in retinal images, aiding in comprehension of the model's predictions.
- Offer insights into the model's decision-making by identifying key retinal features or biomarkers indicative of Alzheimer's disease, enhancing interpretability and building trust in the model's outputs.

6. Clinical Integration and User Interface Module:

- **Objective:** Investigate the practicality of incorporating the model into clinical workflows and create an intuitive interface for healthcare providers.
- **Tasks:** Design a user-friendly interface allowing healthcare professionals to upload retinal images and obtain predictions seamlessly. Ensure compatibility and smooth integration with established healthcare systems to facilitate adoption and usage.

SYSTEM IMPLEMENTATION

CNN Algorithm: CNN stands for Convolutional Neural Network, which is a class of deep neural networks primarily designed for processing structured grid-like data, such as images or video. CNNs have been particularly successful in tasks like image classification, object detection, and image segmentation.



Input Layer:

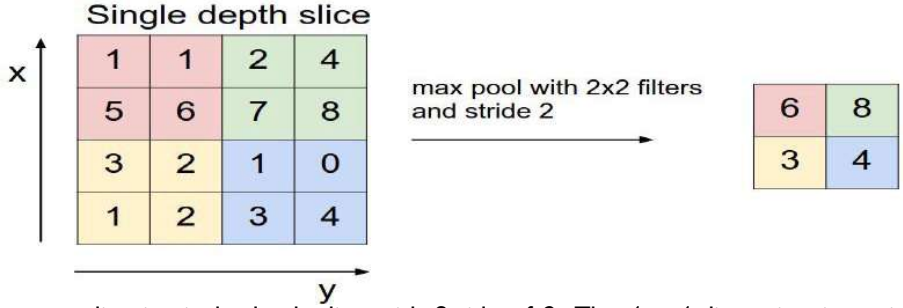
- The input layer represents the raw input data, typically an image or a set of images. Each image is represented as a grid of pixel values, with each pixel representing a feature.
- In order to prepare the input data for the Convolutional Neural Network (CNN), it is necessary to reshape the images into a single column format. For instance, if the images have dimensions of 28 x 28, totaling 784 pixels, they must be transformed into a column vector of size 784 x 1 before being fed into the network.
- If there are "m" training examples, then the dimension of the input data will be (784, m). This reshaping ensures that each pixel value of the images is represented as a single input feature, facilitating the training process of the CNN.

Convo Layer:

- In the convolutional layer, a set of learnable filters (also known as kernels) is applied to the input image through convolution operations.
- Convolution involves sliding each filter across the input image and computing the dot product between the filter and the local region of the input.
- The ReLU (Rectified Linear Unit) activation function is applied element-wise to the output of the convolution operation. ReLU introduces non-linearity, allowing the network to learn complex patterns and relationships in the data.

Pooling Layer:

- The pooling layer reduces the spatial dimensions of the feature maps generated by the convolutional layer while retaining the most important information.
- Common pooling operations include max pooling, where the maximum value in each local region is retained, and average pooling, where the average value is computed.
- Pooling helps in reducing computation and controlling overfitting by providing translational invariance.



We have applied max pooling in single depth slice with Stride of 2. The 4 x 4-dimension input is reduced to 2 x 2 dimension. There is no parameter in pooling layer but it has two hyperparameters — Filter(F) and Stride(S).
In general, if we have input dimension W1 x H1 x D1, then W2 = (W1−F)/S+1
H2 = (H1−F)/S+1

D2 = D1 Where W2, H2 and D2 are the width, height and depth of output.

Fully Connected Layer (FC):

- The fully connected layer receives the flattened output from the preceding layers and consists of densely connected neurons.
- Each neuron in the fully connected layer is connected to every neuron in the previous layer.
- The fully connected layer performs classification based on the learned features from the convolutional and pooling layers.

SoftMax / Logistic Layer:

- In classification tasks, a softmax or logistic layer is typically added after the fully connected layer.
- The softmax function converts the raw scores (logits) from the previous layer into class probabilities.
- Each output neuron represents the probability of the input belonging to a particular class.

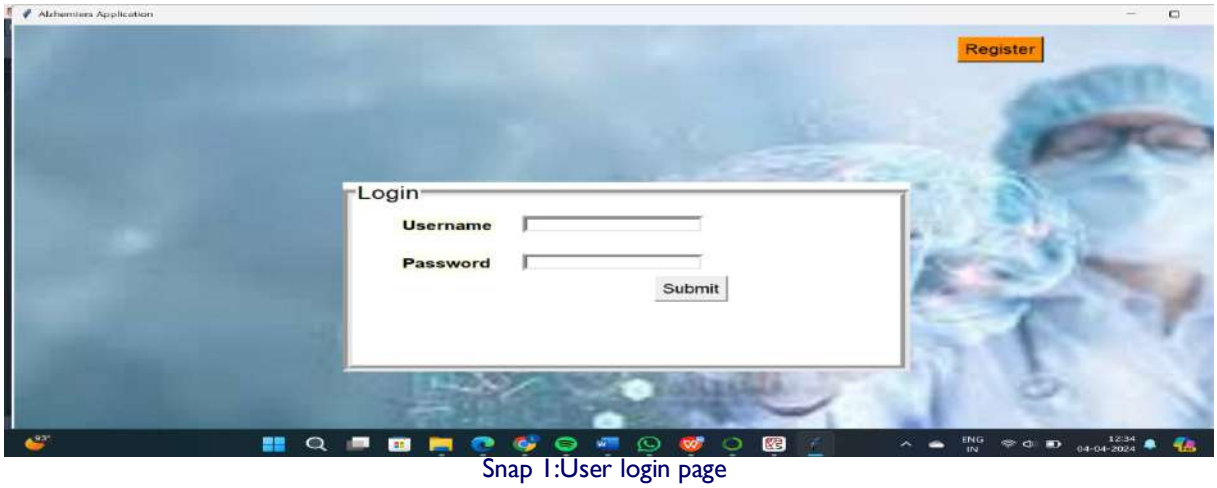
Output Layer:

- The output layer receives the probabilities computed by the softmax or logistic layer.
- In binary classification tasks, a single output neuron with a sigmoid activation function is used to output the probability of the input belonging to one of the two classes (e.g., 0 or 1).
- In multi-class classification tasks, multiple output neurons are used, each representing the probability of the input belonging to a specific class.

SCOPE OF FUTURE APPLI CATION

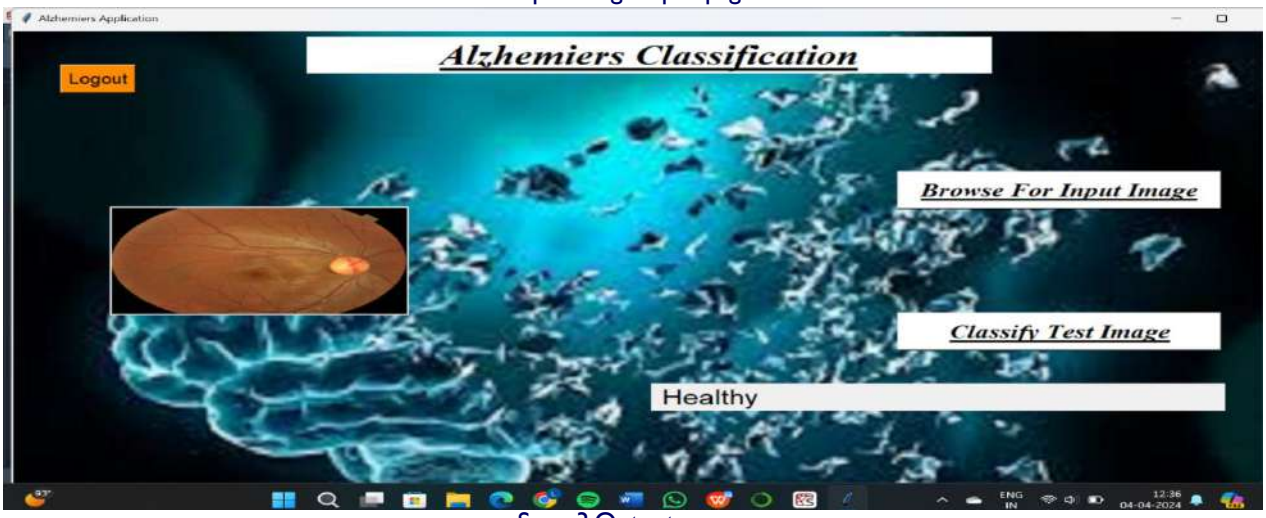
- The prediction of Alzheimer's disease (AD) using retinal images and deep learning techniques holds significant promise for various future applications. Some potential areas of application include:
- Early Diagnosis and Screening: The development of accurate deep learning models for AD prediction using retinal images could enable early diagnosis and screening of individuals at risk of developing the disease. Early detection allows for timely interventions and treatment strategies, potentially slowing down the progression of AD and improving patient outcomes.
- Population-Scale Screening Programs: Implementing population-scale screening programs utilizing retinal imaging and deep learning models could help identify individuals with early signs of AD within communities. Such programs could be integrated into routine healthcare practices, facilitating widespread screening efforts and early intervention initiatives.
- Telemedicine and Remote Monitoring: With advancements in telemedicine technologies, the integration of deep learning models for AD prediction with retinal imaging could enable remote monitoring of patients' cognitive health. Remote monitoring systems could provide valuable insights into disease progression, allowing healthcare providers to intervene promptly and adjust treatment plans as needed.
- Personalized Treatment Approaches: Deep learning models trained on retinal images could aid in the development of personalized treatment approaches for individuals with AD. By analyzing specific retinal biomarkers associated with disease progression, clinicians could tailor treatment strategies to individual patients, optimizing therapeutic outcomes and minimizing adverse effects.
- Clinical Trials and Drug Development: Deep learning models for AD prediction using retinal images could also play a crucial role in clinical trials and drug development efforts. These models could serve as valuable tools for patient stratification, enabling researchers to identify suitable candidates for clinical trials based on their risk profiles and disease progression patterns.
- Public Health Initiatives and Policy Planning: The deployment of deep learning-based AD prediction models in conjunction with retinal imaging could inform public health initiatives and policy planning efforts aimed at addressing the growing burden of AD. Insights gained from population-level screening data could guide resource allocation, healthcare infrastructure development, and policy interventions targeting AD prevention and management.

RESULTS



Snap 1:User login page

Snap 2:Image input page



Snap 3:Output page

Snap 4:Output page

CONCLUSION

The project marks a significant advancement in early detection methodologies for Alzheimer's Disease, harnessing deep learning to develop a robust model capable of discerning subtle retinal changes associated with disease onset. With a focus on interpretability through explainable artificial intelligence techniques, the model's transparency fosters trust among healthcare professionals, highlighting its clinical significance. Moreover, exploration into the feasibility of clinical integration positions the model as a valuable supplementary tool for early diagnosis, potentially enhancing patient outcomes and healthcare delivery. Ethical considerations surrounding patient privacy and responsible AI use are paramount, emphasizing the importance of aligning technological advancements with ethical principles. This research contributes to the evolving field of AI-assisted diagnostics and advocates for an informed, proactive approach to Alzheimer's Disease management, aiming to make a meaningful impact on patient care and public health.

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Deep Learning Based Deforestation Prediction and Classification

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Abstract: Human-induced deforestation has a major impact on forest ecosystems and therefore its detection and analysis methods should be improved. Where, this type of detection or classification helps us to degrade the deforestations in future. In this project we are mainly focusing on the problem of deforestation, performing the classification of deforestation and the healthy forests with the help of deep learning model. CNN is the algorithm that which are been using here for the classification process. We are preparing a dataset which is trained using the algorithm and classification will be performed in testing.

Keywords: Deforestation, Deep learning, Convolutional Neural Networks (CNN)

INTRODUCTION

Deforestation, clearance, clear cutting, or clearing is the removal of a forest or stand of trees from land that is then converted to non-forest use. Deforestation can involve conversion of forest land to farms, ranches, or urban use. The most concentrated deforestation occurs in tropical rainforests. About 31% of Earth's land surface is covered by forests. Between 15 million to 18 million hectares of forest, an area the size of Belgium, are destroyed every year, on average 2,400 trees are cut down each minute**.** The Food and Agriculture Organization of the United Nations defines deforestation as the conversion of forest to other land uses (regardless of whether it is human-induced). "Deforestation" and "forest area net change" are not the same: the latter is the sum of all forest losses (deforestation) and all forest gains (forest expansion) in a given period. Net change, therefore, can be positive or negative, depending on whether gains exceed losses, or vice versa. The removal of trees without sufficient reforestation has resulted in habitat damage, biodiversity loss, and aridity. Deforestation causes extinction, changes to climatic conditions, desertification, and displacement of populations, as observed by current conditions and in the past through the fossil record.
Deforestation also has adverse impacts on bio sequestration of atmospheric carbon dioxide, increasing negative feedback

cycles contributing to global warming. Global warming also puts increased pressure on communities who seek food security by clearing forests for agricultural use and reducing arable land more generally. Deforested regions typically incur significant other environmental effects such as adverse soil erosion and degradation into wasteland. The resilience of human food systems and their capacity to adapt to future change depends on that very biodiversity – including dry land-adapted shrub and tree species that help combat desertification, forest-dwelling insects, bats and bird species that pollinate crops, trees with extensive root systems in mountain ecosystems that prevent soil erosion, and mangrove species that provide resilience against flooding in coastal areas. With climate change exacerbating the risks to food systems, the role of forests in capturing and storing carbon and mitigating climate change is of ever-increasing importance for the agricultural sector

LITERATURE SURVEY

[1] Banskota, Kayastha, Falkowski, Wulder, Froese and White: Unique among Earth observation programs, the Landsat program has provided continuous earth observation data for the past 41 years. Landsat data are systematically collected and archived following a global acquisition strategy.

[2] With the successful launch of Landsat-8, the continuity of measures at scales of particular relevance to management and scientific activities is ensured in the short term. In particular, forest monitoring benefits from LTS, whereby a baseline of conditions can be interrogated for both abrupt and gradual changes and attributed to different drivers. Such benefits are enabled by data availability, analysis-ready image products, increased computing power and storage, as well as sophisticated image processing approaches. In this review, we present the status of remote sensing of forests and forest dynamics using LTS, including issues related to the sensors, data availability, data preprocessing, variables used in LTS, analysis approaches, and validation issues.

Summary: With the successful launch of Landsat-8, the continuity of measures at scales of particular relevance to management and scientific activities is ensured in the short term Such benefits are enabled by data availability, analysis-ready image products, increased computing power and storage, as well as sophisticated image processing approaches. In this review, we present the status of remote sensing of forests and forest dynamics using LTS, including issues related to the sensors, data availability, data preprocessing, variables used in LTS, analysis approaches, and validation issues.

[3] Liu, Zhan. Q, Gao. S, Yang: There has been a growing concern for the urbanization induced local warming, and the underlying mechanism between urban thermal environment and the driving landscape factors. However, relatively little research has simultaneously considered issues of spatial non-stationary and seasonal variability, which are both intrinsic properties of the environmental system. In this study, the newly proposed multi-scale geographically weighted regression (MGWR) is employed to investigate the seasonal variations of the spatial non-stationary associations between land surface temperature (LST) and urban landscape indicators under different operating scales. Specifically, by taking Wuhan as a case study, Landsat-8 images were used to achieve the LSTs in summer, winter and the transitional season, respectively. Landscape composition indicators including fractional vegetation cover (FVC), albedo and water percentage (WP) and urban morphology indicators covering building density (BD), building height (BH) and building volume density (BVD) were employed as potential landscape drivers of LST.

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[4] Wang. C, Myint S.W, Hutchins. M: Myanmar is rich in forest resources. Deforestation and forest degradation in Myanmar have recently attracted much attention worldwide. This Chapter explores spatio-temporal patterns of deforestation and forest degradation, and assesses forest carbon release in Myanmar between 2000 and 2010 using Moderate Resolution Imaging Spectroradiometer (MODIS) satellite imagery. Results suggest that the total deforestation area during the study period was 82,426 km2 with an annual deforestation rate of 2.07%. The total forest degradation area was 85.5 km2 with an annual degradation rate of 0.002%. Evergreen needle leaf forests had the highest degradation rate, and mixed forests had the largest degradation area. The total forest carbon release was 18.5 million tons with an annual rate of 0.45%. Mixed forests released the largest amount of carbon, and evergreen needle leaf forests had the highest carbon release rate. No carbon sequestration has been found for any type of forest in this study.

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[5] Dalponte. M, Bruzzone. L, Gianelle. D: In this paper, we propose an analysis on the joint effect of hyperspectral and light detection and ranging (LIDAR) data for the classification of complex forest areas. In greater detail, we present: 1) an advanced system for the joint use of hyperspectral and LIDAR data in complex classification problems;

2) an investigation on the effectiveness of the very promising support vector machines (SVMs) and Gaussian maximum likelihood with leave-one-out-covariance algorithm classifiers for the analysis of complex forest scenarios characterized from a high number of species in a multisource framework;

3) an analysis on the effectiveness of different LIDAR returns and channels (elevation and intensity) for increasing the classification accuracy obtained with hyperspectral images, particularly in relation to the discrimination of very similar classes.

Summary: In greater detail, we present: 1) an advanced system for the joint use of hyperspectral and LIDAR data in complex classification problems; 2) an investigation on the effectiveness of the very promising support vector machines (SVMs) and Gaussian maximum likelihood with leave-one- out-covariance algorithm classifiers for the analysis of complex forest scenarios characterized from a high number of species in a multisource framework; and 3) an analysis on the effectiveness of different LIDAR returns and channels (elevation and intensity) for increasing the classification accuracy obtained with hyperspectral images, particularly in relation to the discrimination of very similar classes.

[6] Frohn. R, McGwire. K, Dale. V, Estes. J: The effectiveness of an integrated socio-economic and ecological simulation model for estimating patterns and rates of deforestation in Rondônia, Brazil is evaluated using Landsat data and landscape pattern metrics. The Percent Cleared, Contagion, and Fractal Dimension of image classifications are compared to those determined from model outputs. Results indicate that rates and spatial patterns of deforestation are similar between model outputs and Landsat image analysis. Differences in clearing patterns between the model and Landsat data are due in part to topography, localized farming obstacles and the patchiness of clearings. The effects of varying spatial resolution on the metrics is also examined.

Summary: The effectiveness of an integrated socio-economic and ecological simulation model for estimating patterns and rates of deforestation in Rondônia, Brazil is evaluated using Landsat data and landscape pattern metrics. The Percent Cleared, Contagion, and Fractal Dimension of image classifications are compared to those determined from model outputs. Results indicate that rates and spatial patterns of deforestation are similar between model outputs and Landsat image analysis. Differences in clearing patterns between the model and Landsat data are due in part to topography, localized farming obstacles and the patchiness of clearings.

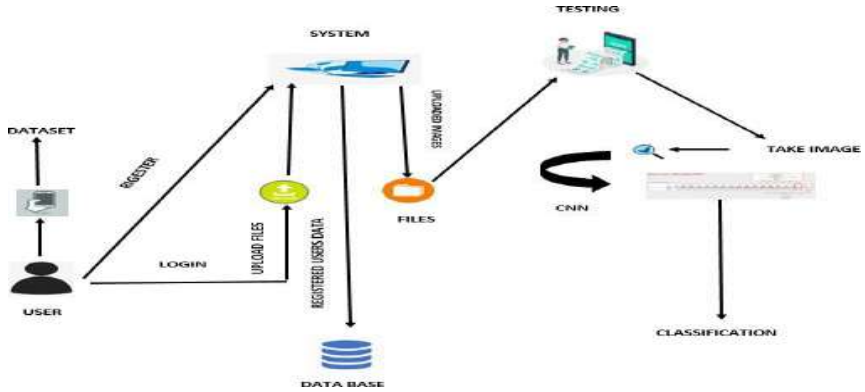
PROPOSED SYSTEM

In our proposed method we are performing the deforestation classification using convolution neural network (CNN) of deep learning. Human-induced deforestation has a major impact on forest ecosystems and therefore its detection and analysis methods should be improved. Where, this type of detection or classification helps us to degrade the deforestations in future. In this project we are mainly focusing on the problem of deforestation, performing the classification of deforestation and the healthy forests with the help of deep learning model. CNN is the algorithm that which are been using here for the classification process. We are preparing a dataset which is trained using the algorithm and classification will be performed in testing

Advantages:

- Accurate classification.
- Less complexity.
- High performance

SYSTEM ARCHITECTURE



SYSTEM MODULES

The system for the "Prediction and Classification of Deforestation Using Deep Learning" project can be divided into several modules, each serving a specific purpose in the overall workflow. Here are the key modules:

The model mainly consists of six modules which are as follows:

A) Gathering Data: Most of the data is gathered from different open source data sources through which we can extract data. We are using a Satellite Imagery Dataset from Kaggle website. We can also extract data from open resources like UCI Repository or Independent Research Data Websites.

B) The Data which we use approximately consists of 40,000 images. Identifying Deforestation is dependent on weather and land. Especially weather plays an important role in identifying the land because if the weather is extreme then we can't see the land properly. So our model should be trained robustly independent of the weather by using pre-trained models. We have various labels like agriculture, selective logging, road, cloudy, water, habitation and many more.

C) Data Preprocessing: The Data or Dataset which is collected should be preprocessed before using it to train the model as it might cause problems in optimization and mathematically we have to definitely follow a few preprocessing steps on Dataset. One of the most important things to do to a Dataset is Normalization.

D) Normally our images of data are in between 1 and 255 pixels. So we normalize them in between 0 and 1. It is done to reduce numerical computation. It is highly helpful for smooth optimization and greatly reduces the chances of over computation. As we are using Images as our data, we have to resize all of our images in the dataset because the matrices should be of the same batch size and pixel dimensions. It demands so because the model has a static design after modeling. Normally we resize rectangular matrices to square matrices. We need to resize images to any size but the image should be pretty clear after resizing.

E) Training: The Preprocess data is sent through data pipelines to feed the model. But before that we have to split the data into train and test data. It is our choice on how we split but the most widely used split is 90-10 split that is 90% of data is taken as train data and 10% of the data is taken as test data. A model is modelled to train. There are two options on choosing models like training from scratch and training using a pre-trained model. By Training from scratch, we acquire all the features of the data and it can be very rewarding as we might get high accuracy and precision. It also shows great performance when evaluated using other metrics. But there is a down side with this. We have to train the model for long hours to get good training accuracy. It requires a lot of compute power which is not accessible to everyone. Another downside is that we have to use a lot of data and it requires a lot of experimentation like finding hyperparameters like learning rate etc which is time consuming. By Training using a pre-trained model, we can train our model in weigh less time than training from scratch.

F) There are many pertained models which have been proposed in recent years. Some of those models include MobileNet, DenseNet, AlexNet, ResNet ,VGG19, Efficient Net and many more. So these models are already trained across many machines and they contain the representation and features of all the data on which they have trained in their weights. So we can make use of those features and adapt it in training our model. The pre-trained models are previously trained on one of the largest Image Datasets called ImageNet. We can do a method called Fine Tuning to train our model. Fine Tuning is a method where we preserve the layers of the pre-trained model and use our model's layers and a couple of the layers of the pre-trained model. The rest of the layers in the model are freeze. The other layers are trained on our data. The rest of the parameters in the model remain unchanged. Choosing which layers to choose for training can vary but most commonly we choose the last few layers. It is the best practice to use it like that. During Training there are many factors involved like choosing learning rate, choosing optimizer, choosing the loss function, epochs, batch size, bias-variance tradeoffs like under fitting and over fitting. Although there are many frameworks which make our work easy, we still have to manually choose a few hyper**3** parameters which are best for our model. For analyzing underfitting and overfitting we have to compare train and validation accuracies for analyzing variance and bias. Number of epochs indirectly depends on batch size. Batch size should be small unless you intend to use high compute equipment. Epochs should also be chosen by analysis. If we have any discrepancies in loss then we can use features like early stopping.

G) Testing: After training the model and if we get low variance and low bias then we can test it with a Test Dataset. The model should perform very well on the Test Dataset should have relatively less variance and low bias. If there is a problem then we have to use a different strategy to train the model. We have to keep doing this process until we achieve a robust model which can be deployed to the real world.

H) Deployment: After robustly training and testing the model, it is time for deployment. We have a couple of choices to deploy our models. Today's frameworks help us deploy our high storage models easily into mobiles, web, robots and electrical devices like Raspberry Pie etc. The models highly impact our choices if we want to deploy them. For Example, Using MobileNet is highly efficient than ResNet when it comes to deploying on Mobile.

SYSTEM IMPLEMENTATION

CNN Algorithm The first building block in our plan of attack is convolution operation. In this step, we will touch on feature detectors, which basically serve as the neural network's filters. We will also discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and how the findings are mapped out Maintaining the Integrity of the Specifications

Step (1b): ReLU Layer

The second part of this step will involve the Rectified Linear Unit or Relook. We will cover Relook layers and explore how linearity functions in the context of Convolutional Neural Networks. Not necessary for understanding CNN's, but there's no harm in a quick lesson to improve your skills.

Step 2: Pooling Layer

In this part, we'll cover pooling and will get to understand exactly how it generally works. Our nexus here, however, will be a specific type of pooling; max pooling. We'll cover various approaches, though, including mean (or sum) pooling. This part will end with a demonstration made using a visual interactive tool that will definitely sort the whole concept out for you.

Step 3: Flattening

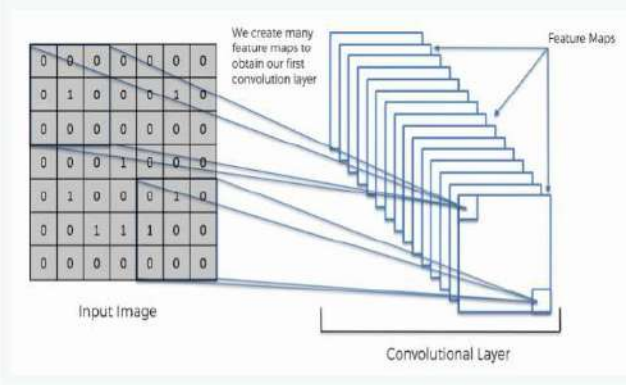
This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Network

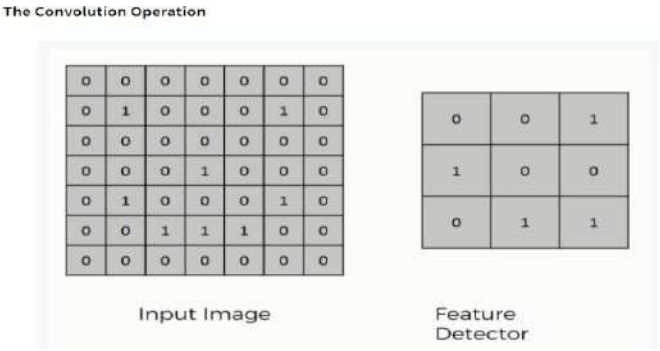
Step 4: Full Connection

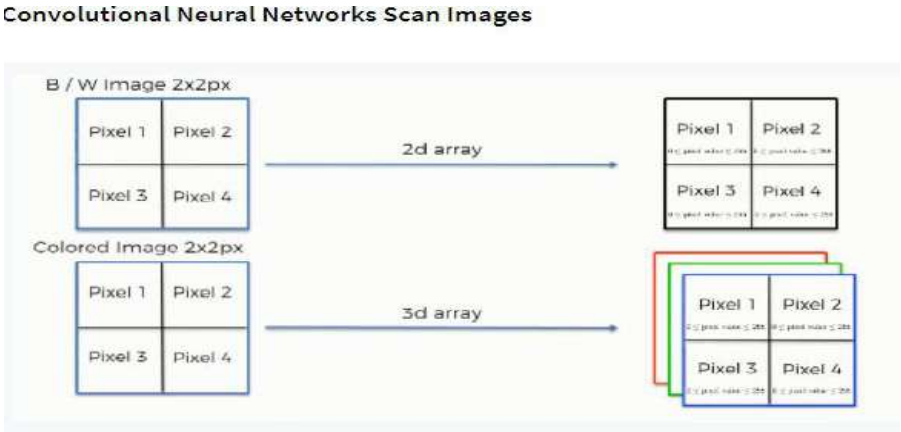
In this part, everything that we covered throughout the section will be merged together. By learning this, you'll get to envision a fuller picture of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.

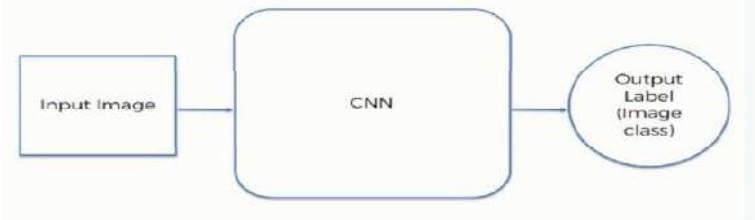
Summary

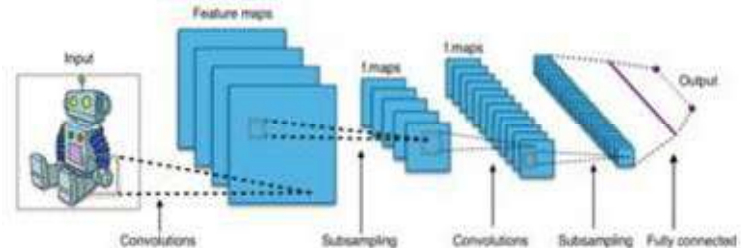
In the end, we will wrap everything up and give a quick recap of the concept covered in the section. If you feel like it will do you any benefit (and it probably will), you should check out the extra tutorial in which Soft ax and Cross-Entropy are covered. It's not mandatory for the course, but you will likely come across these concepts when working with Convolutional Neural Networks and it will do you a lot of good to be familiar with them.









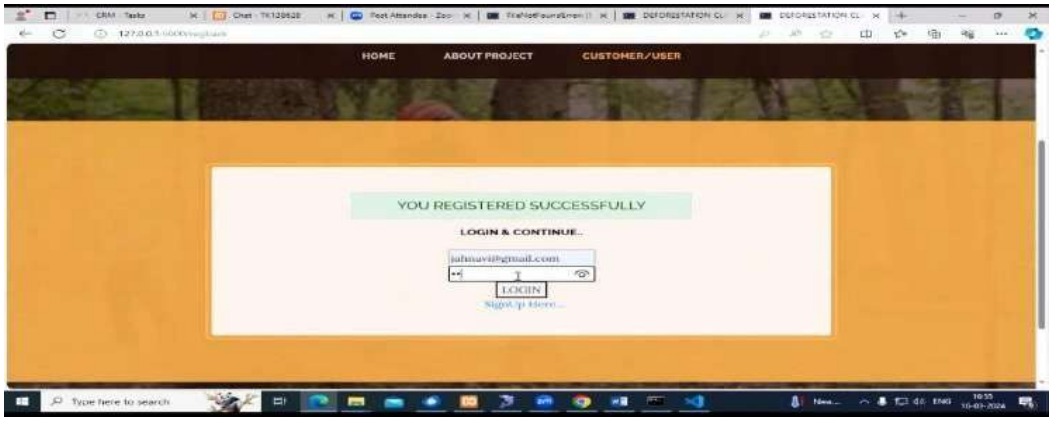


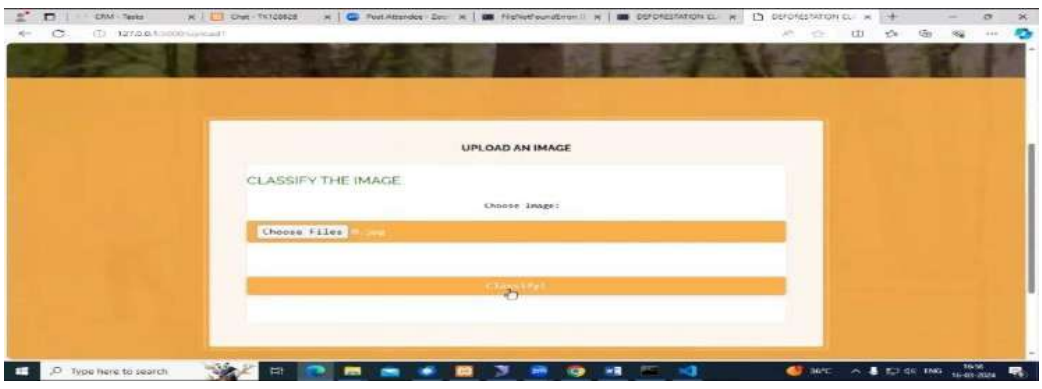
SCOPE OF FUTURE APPLICATION

The scope of this project encompasses the development and implementation of an automated handwritten signature verification system utilizing deep learning techniques, specifically Convolutional Neural Networks (CNN) and MobileNet. This system will be designed to detect and classify genuine signatures and identify fraudulent ones, thereby enhancing security and trust in legal and financial transactions. The project will involve tasks such as data collection, preprocessing, model selection, training, and evaluation, with the potential for further optimization and integration into real-world applications, including but not limited to banking, legal processes, and administrative authentication systems. It aims to provide a comprehensive solution to the ongoing challenge of signature fraud and document forgery, offering significant practical value and relevance. This work can further be implemented using various methods if needed. As we have seen that our work normally requires a considerably large dataset for training and getting a desired accuracy. In the future, we can implement models which require less data and robust algorithms with different ways of problem setting.

We can also reduce the size and number of parameters in the existing model by adapting different methods which reduce the size of our network which is highly memory efficient. Finally, If we can label the data properly then we can implement a segmentation model to identify the place using different colors where each color represents a unique thing. Another way of training the model is using various state-of-theart architectures and unsupervised methods. We can make use of less labels and train models but it requires robust design and understanding of the algorithm. We can make use of different API like Tensorflow Object Detection API etc to train and detect with higher accuracy and efficiency. This also saves us time and requires relatively less data. As we have seen pre-trained models have robust and better knowledge representation, it has become much easier to use them and fine tune them based on our interests. They have shown to have relatively less data requirement to converge to global optimum. We can extend all this to various deep learning methods like semantic segmentation, instance segmentation etc. Using segmentation models we can highly improve our understanding of satellite images by increasing the identification using colors. In the past few years there have been many robust segmentation models. We can use those models and implement them based on our requirements. Data preprocessing techniques like data augmentation can be applied to our data. Data Augmentation is a process of changing an image like rotating and flipping to increase the number of images in the dataset. It has proven to produce highly efficient results. There are various options for data augmentation. These days we have highly robust APIs in frameworks like Tensorflow,PyTorch which do these work for us . Another way of training is by using ensemble learning. It is normally called "caviar" learning. In this type of learning, we take a group of effective models and have different hyperparameters for different models. We train them together and in the end we will choose the best among all of those models. These methods require a large compute engine to train as it takes a long time to train and has large batch sizes. Another way of doing this is by tuning hyper-parameters using the recent research advances

RESULTS





CONCLUSION

In this project we have successfully classified the images of healthy forest and the one with deforestation using the convolution neural network of the deep learning. Here, we have considered the dataset of images with 2 classes which among one are not deforested and another are deforested and trained using CNN. After the training we have tested by uploading the image and classified it trained using CNN. Afte the training we have tested by uploading the image and classified it.

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Prediction of Air Quality Data with Feature Selection and Machine Learning Algorithms

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Abstract: Predicting air quality is essential for managing public health and the environment. This study looks into how well machine learning (ML) algorithms forecast air quality data and incorporates feature selection strategies for better model performance. Air pollution is one of the biggest issues facing humanity today. Every year, air pollution causes millions of deaths due to direct or indirect effects. These days, there is a critical need for effective measures to mitigate the negative impacts of air pollution. Usually, the answers to the issues with air pollution are hasty decisions that don't end up helping. It is vital to concentrate efforts on the pollutants that cause the majority of air pollution in order to create an efficient counter-strategy. In many industrial and urban regions today, monitoring and safeguarding air quality has emerged as one of the government's top priorities. The combustion of fossil fuels, traffic and weather conditions, and industrial parameters

Keywords: Air Quality Prediction, Feature Selection, Machine Learning, Random Forest, Support Vector machine, LSTM.

INTRODUCTION

One of the main issues facing the globe today is air pollution. While there have been notable improvements in air quality over the past year due to the widespread lockdowns and decreased activity levels caused by COVID-19, as the world's population begins to return to normal, air pollution levels have once again begun to rise to dangerous levels. 21 of the world's 30 most polluted cities are in India, and perhaps more concerningly, air pollution is thought to be a contributing factor in the deaths of approximately 2 million Indians each year, according to data released by the World Health Organization and State of Global Air. Due to a variety of industrial, agricultural, socioeconomic, and other variables, the various states of India experience differing amounts of pollution throughout the year. The different elements that affect air pollution in India are depicted, along with the different pollutants that are taken into account while determining the country's Air Quality Index (AQI). The surface-mounted sensors that are positioned at different points in cities around the nation report the concentrations of the pollutants. The AQI, which measures the amount of air pollution or air quality, is then calculated using the data. The Indian Air Quality Index (AQI) is a numerical value ranging from 0 to 500. Based on the concentrations of different pollutants and the impact of air quality on health, it is further classified into six levels: good, satisfactory, moderate, poor, very bad, and severe. Rapid population growth and urban economic expansion in emerging nations like India have resulted in a host of environmental issues, including noise, water, and air pollution.

Human health is directly impacted by air pollution. In our nation, people are becoming more aware of the same things. Acid showers, asthma cases rising, and global warming are a few of the long-term effects of air pollution. Accurate air quality forecasts can lessen the impact of extreme pollution on both individuals and the environment. Therefore, improving air quality forecasting is one of society's top priorities. A gas is sulfur dioxide. one of the main contaminants in the air. It smells awful and harsh, and it's colorless. It mixes readily with other substances to create dangerous compounds such as sulfurous acid and sulphonic acid. Inhaling sulfur dioxide has an impact on one's health. It irritates the throat, nose, and airways, leading to wheezing, coughing, dyspnea, and constriction in the chest area. The amount of sulfur dioxide present in the atmosphere has an impact on the suitability of habitats for both animal and plant groups. Predicting air quality data with feature selection and machine learning techniques is crucial for managing the negative impacts of air pollution[1][2][3][4][5]. Various models like Gaussian Process Regression (GPR), Seasonal Autoregressive Integrated Moving Average (SARIMA), linear regression, lasso regression, random forest regression, and K-nearest neighbor regression have been employed for this purpose.

These models help in capturing complex interactions among input variables and output variables, seasonal and trend patterns in air quality data, and predicting pollutant levels accurately. Feature selection techniques combined with machine learning algorithms enhance the accuracy of air quality predictions, aiding in effective air quality monitoring and management. The use of advanced data mining techniques like neural networks and intelligent optimization algorithms further improves the prediction accuracy, enabling the forecasting of air quality with over 90% accuracy.

LITERATURE SURVEY

[1] Proactive air pollution mitigation requires accurate long-term air quality trend prediction. The complicated non-linearity and numerous frequency components seen in air quality data sometimes pose challenges for traditional approaches. This review of the literature examines new developments in deep learning techniques to tackle these issues, with a particular emphasis on the strategy described in "Deep Hybrid Model Based on EMD with Classification by Frequency Characteristics for Long-Term Air Quality Prediction"Owing to their capacity to recognize intricate patterns and non-linear correlations, deep learning models—in particular, recurrent neural networks (RNNs) and convolutional neural networks (CNNs)—have demonstrated encouraging outcomes in the prediction of air quality. This study proposes a deep hybrid model that leverages Empirical Mode Decomposition (EMD) to address the challenge of multiple frequency components. EMD decomposes the air quality data into Intrinsic Mode Functions (IMFs) representing different frequency bands.

[2] Predicting PM2.5 (fine particulate matter) concentrations with accuracy is essential for controlling air quality and safeguarding human health. Neural networks with Long Short-Term Memory (LSTM) have become an effective method for capturing the intricate spatiotemporal dynamics of PM2.5 data. The use of LSTM-based models for PM2.5 forecasting is investigated in this survey.2.By preprocessing the data with a CNN layer, spatial information can be extracted from the positions of the monitoring stations. GCNs effectively capture spatial dependencies and are well-suited for representing relationships between stations on a geographical network: During predicting, attention mechanisms in the LSTM design can concentrate on pertinent data from nearby stations. A technique that shows promise for PM2.5 spatial temporal forecasting is LSTM neural networks. Through a variety of methods, LSTM-based models can incorporate spatial information and attain excellent prediction accuracy. Improved forecasting and mitigation techniques for air quality will result from ongoing research in this field.

[3] Predicting air quality is essential for protecting public health and the environment. However, due to the complicated nature of air quality data—which is frequently high-dimensional and contains duplicate or unnecessary information—careful feature selection and the use of potent machine learning techniques are required. These two crucial areas are examined in this literature review in order to enhance air quality prediction models. These techniques entail the training and assessment of several machine learning models using various feature subsets. The model's performance metric is used to determine which feature subset is optimal. These techniques incorporate feature selection into the training of the model. A well-known example is LASSO regression, which implicitly does selection by penalizing coefficients and essentially driving unnecessary features to zero ideal for managing nonlinear relationships and high-dimensional data. useful for forecasting particulate air pollutants, such as PM2.5 Reliable ensemble technique that generates several decision trees using arbitrary feature subsets. enhances generalization and manages missing-value data.

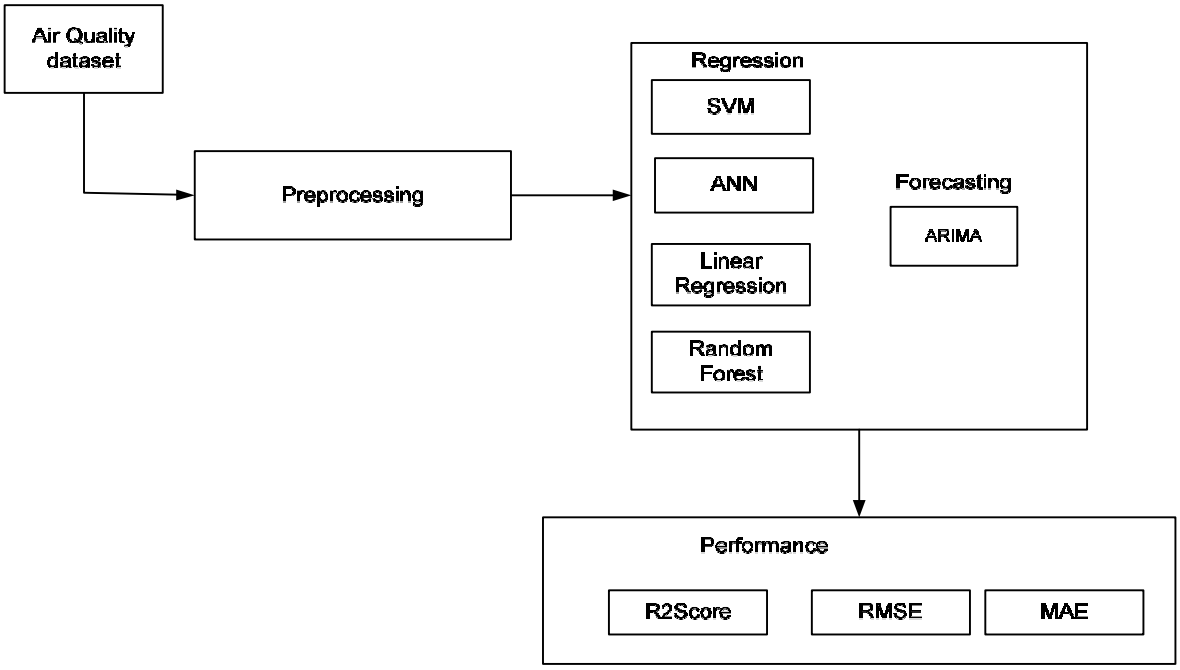
PROPOSED SYSTEM

This project suggests a novel feature selection and machine learning algorithm-based air quality prediction system. Our approach seeks to achieve high prediction accuracy for the Air Quality Index (AQI) and different types of air contaminants. When compared to other methods, the usage of Random Forest and Linear Regression can accurately determine if a data sample is contaminated or not. as well as machine learning methods for forecasting and evaluating air quality. In addition, we compute the predicted values for the next few days using the ARIMA model.Examine how deep learning architectures can be used to handle intricate spatiotemporal patterns in data on air quality. For more thorough forecasting, look at incorporating real-time data sources like satellite imaging or traffic data. Create comprehensible machine learning models to learn more about the variables influencing changes in air quality.

Advantages:

- Improved Prediction Accuracy
- Enhanced Generalizability
- Data-Driven Insights
- User-Friendly Interface

SYSTEM ARCHITECTURE



SYSTEM MODULES

Several essential modules can be separated out of the proposed air quality forecast system for effective development and execution.

1. Module for Data Acquisition:

The collection of air quality data from diverse sources is the main goal of this module.

Sub-modules:

Integration of Data Sources: retrieves information on pollutant concentrations (PM2.5, PM10, O3, etc.) and meteorological conditions (temperature, humidity, wind speed, etc.) by connecting to databases or APIs of air quality monitoring stations.

Data preprocessing: handles missing values, outliers, and ensures consistency (e.g., unit conversions) to clean and prepare the data.

2. Module for Feature Engineering and Selection:

Finding the most pertinent features for air quality prediction is the main goal of this module.

Sub-modules:

Feature engineering (optional): combines preexisting features to generate new ones in order to identify possible non-linear interactions affecting the quality of the air.

Feature selection uses a number of methods, such as correlation analysis to find redundant characteristics.

Acquire information to evaluate the characteristics' role in air quality prediction.

LASSO regression is used to choose features for the model's training.

3. Training and Evaluation Module for Machine Learning Models:

The training and assessment of machine learning models for prediction is the main topic of this session.

Sub-modules:

1. Model Training: This process teaches various machine learning algorithms, such as Support Vector Regression (SVR), to handle non-linear connections and high-dimensional data.
2. To handle missing values and ensure robustness, use Random Forest Regression.
3. Boost to achieve high accuracy and capture intricate interactions.
4. Model evaluation: To choose the best model, compare the performance of the model's using metrics like mean squared error (MSE) and R-squared (R^2).
5. Hyperparameter tuning: Enhances performance by fine-tuning the model's hyperparameters (such as learning rate and number of trees).

4. Module for Prediction and Visualization:

This module makes use of the trained model for forecasting and provides an understandable presentation of the outcomes.

Sub-modules:

Prediction: Forecasts future air quality values for different contaminants and the AQI using the selected machine learning model.

Visualization: Creates an intuitive user interface to show:

- Predicted long-term trends in air quality.
- Comparisons between the actual and anticipated values.
- Maps of air quality for geographical examination (if available data is geographical).

5. Optional User Interface (UI) Module:

An easy-to-use interface for communicating with the system is provided by this module (web application, mobile app).

Sub-modules:

Data Input: Enables users to provide desired contaminants for prediction, time periods, or places.
Interactive Visualization: Based on user input, this visualization dynamically presents forecasted air quality statistics.
Alert System (Optional): Notifies users when expected air quality falls below safe thresholds.
A well-organized foundation for creating the air quality forecast system is offered by these modules. Each module's individual features can be further tailored in accordance with project specifications and data accessibility.

SYSTEM IMPLEMENTATION

1.The SVM Regression Model Implementation Steps

1. Kernel Selection: The model's performance is greatly impacted by the kernel function selected. Try different RBF and linear kernels to see which one best fits your data.
2. Hyperparameter tuning: It's critical to determine the best hyperparameters for SVM regression. For effective hyperparameter space exploration, apply grid search or randomized search.
3. Scalability: When dealing with huge datasets, SVM regression can become computationally costly. If scalability starts to become an issue, take into account data sampling strategies or investigate substitute algorithms such as Boost.
4. You can put your air quality prediction system into practice by following these steps and concentrating on SVM regression within the larger feature selection and prediction/visualization framework. Don't forget to modify the implementation details according to the needs of the project and the tools you've selected.

2. The implementation steps for Multi-Layer Perceptron (MLP) Regression

To determine the most pertinent characteristics for air quality prediction, apply the same feature selection approaches, such as correlation analysis, information gain, and LASSO regression (if applicable with MLP). Try varying the MLP model's hyperparameters, including the batch size, learning rate, number of neurons per layer, and number of hidden layers. This may have a big effect on how well the model works. Employ techniques such as grid search or randomized search in order to identify the ideal hyperparameter setup. As with the earlier solution, optimizing performance requires careful consideration of data quality and hyperparameter adjustment. Known as "black-box" models, MLPs might be more difficult to understand than other algorithms, such as decision trees. To understand which features, contribute, think about methods such as feature importance analysis within the MLP framework.

3. The implementation steps for Linear Regression

Because of the intricate and frequently non-linear interactions between air pollutants and influencing factors, Linear Regression is generally not the most recommended model for air quality prediction, even though it can be used in your project for comparison purposes. Here's how your project pipeline might incorporate linear regression: Divided the preprocessed data into sets for testing and training. Utilizing the training set, train the linear regression model. Measures like MSE, R2 and MAE can be used to assess the model's performance on the testing set. To determine whether linear regression is appropriate for your data, compare its performance with other models you intend to use, such as SVR and Random Forest. Despite being a useful beginning point for comprehending the connections between air quality and influencing factors, linear regression may not be the most accurate model for prediction because of possible non-linearities. To investigate more sophisticated prediction capabilities, think about including other machine learning algorithms into your project, such as SVR, Random Forest, or Boost.

4. The implementation steps for Random Forest Regression

Employ feature selection strategies to find pertinent features for air quality prediction, such as information gain and correlation analysis. These methods can be applied to produce a subset of features that are intended only for the Random Forest Regression model's training. You may wish to compare the Random Forest Regression model's performance with that of other machine learning models, such as Support Vector Regression (SVR) or Boost, as detailed in the system implementation as a whole, after training and assessing it. Based on the assessment metrics, pick the model that performs the best overall on your particular dataset. A key component of Random Forest Regression is featuring selection. A well-chosen subset of features can greatly shorten training times and increase model performance. Try varying the hyperparameter settings until you discover the setup that works best for your data. Depending on the dataset and the particular air quality prediction task, other hyperparameters may work better.

SCOPE OF FUTURE APPLICATION

There are numerous potential future applications for the feature selection and machine learning algorithms-based air quality prediction system that can be advantageous to different stakeholders.

Environmental Organizations:

Improved Air Quality Monitoring: To give real-time forecasts and pinpoint locations that might have air quality problems, the system can be connected with already-existing networks for air quality monitoring.
Targeted Interventions: Agencies can take preemptive steps like issuing air quality advisories or putting in place temporary emission control measures by identifying regions with high expected pollution levels.

Identification of Emission Sources: By highlighting important variables affecting air quality, feature selection approaches help authorities pinpoint the main sources of pollution and create focused legislation.

Public health officials:

Protection of Vulnerable Populations: Timely issuance of air quality alerts, particularly for susceptible groups such as children, the elderly, and those suffering from respiratory ailments.

Public Health Risk Assessment: Forecasting changes in air quality can help public health professionals take preventative action by alerting them to possible health concerns linked to air pollution.

Individuals:

Personal Air Quality Awareness: The system's mobile applications can give users access to real-time air quality forecasts for their area, empowering them to plan outside activities with knowledge.

Personal Health Management: By using the forecasts, people with respiratory disorders can schedule their activities to reduce their exposure to air contaminants.

Extra Uses:

Urban Planning: Including air quality forecasts in the planning process can aid in creating cities that support sustainable growth and healthier air.

Smart Buildings: By utilizing air quality forecasts, buildings may enhance indoor air quality and maximize ventilation systems.

Precision Agriculture: By adjusting irrigation and pesticide applications in accordance with weather patterns and possible pollution hazards, air quality forecasts can be utilized to guide agricultural activities.

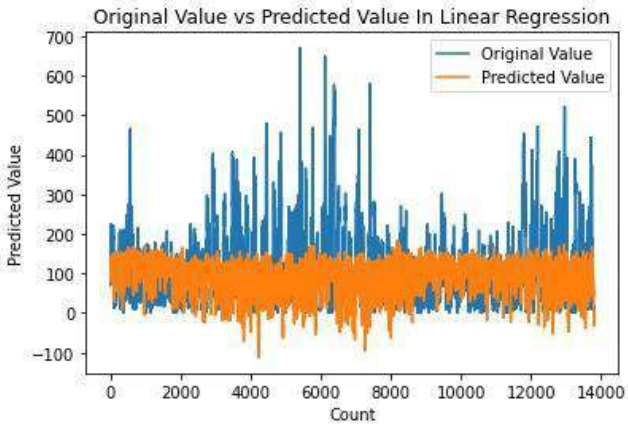
Upcoming Developments:

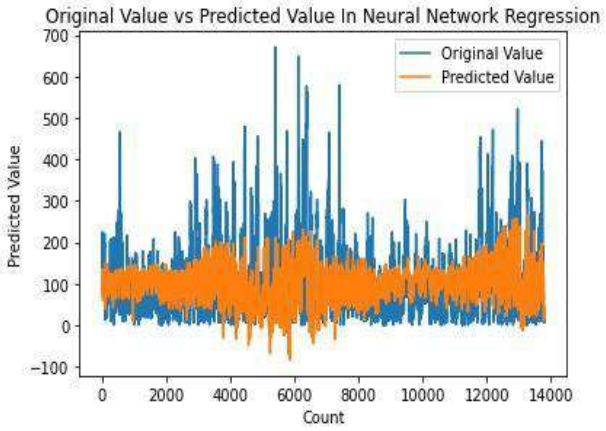
Real-time Integration: Using real-time data sources for more dynamic and thorough air quality predictions, such as satellite images or traffic data.

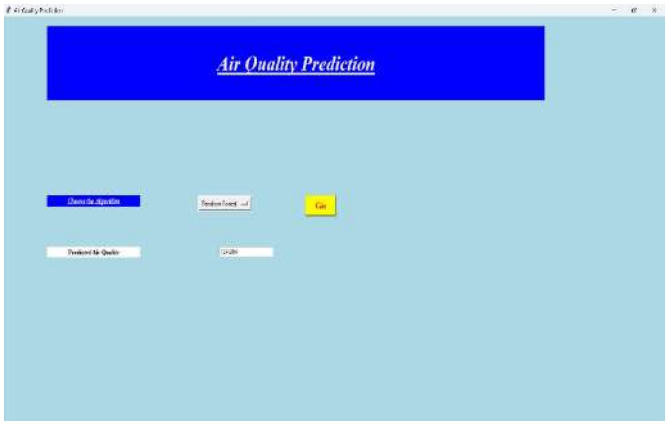
Spatiotemporal Modeling: Convolutional neural networks (CNNs), an advanced deep learning architecture, are capable of handling complicated spatiotemporal patterns to produce predictions that are particular to a certain region.

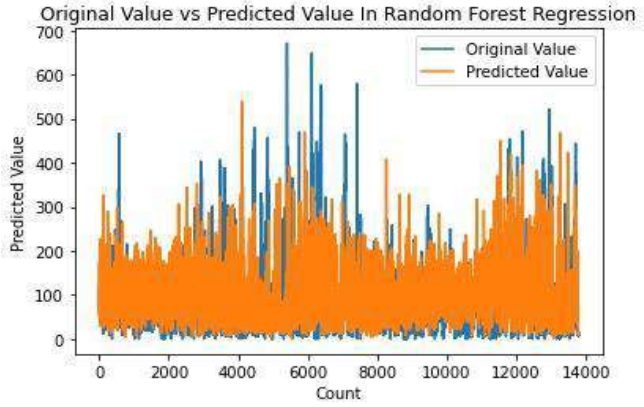
Citizen Science Integration: By including data from citizen science projects (such personal air quality monitors), the data set can grow.

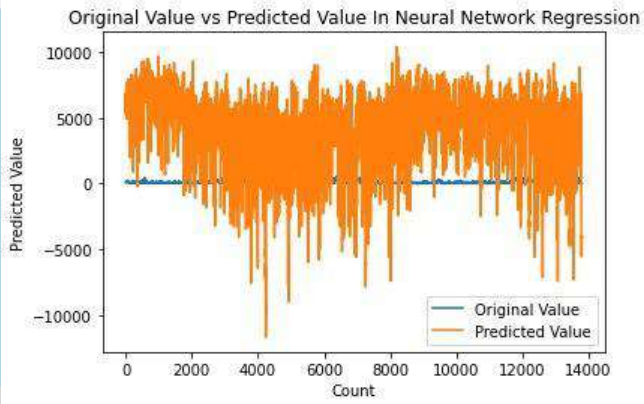
RESULTS











CONCLUSION

This work outlines a comprehensive approach to addressing air pollution concerns, particularly focusing on SO2 concentrations in cities like Pune and Mumbai. The use of various machine learning models, including ANN, Linear Regression, and Random Forest, along with ARIMA time series forecasting, demonstrates a multi-faceted strategy to predict Air Quality levels. Additionally, the exclusion of irrelevant features like locomotion monitoring station or station code highlights the importance of effective feature selection for model accuracy. The mention of future work suggests a forward-thinking perspective, identifying potential challenges and research needs related to other pollutants such as pm2.5 and AQI. This indicates an intention to expand the scope of the project and address broader air quality concerns. Furthermore, the proposal to integrate real-time sensors like MQ series sensor, Dust sensor, and DHT sensor using IoT concepts is a progressive step. This approach would enable the incorporation of up-to-the-minute data for more accurate and timely air quality predictions. The future work suggestions show a commitment to ongoing improvements, addressing additional pollutants, and incorporating emerging technologies like IoT for more dynamic and responsive air quality monitoring.

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Enhancing Agricultural Efficiency through Robotic Systems and AI Integration

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Abstract: Robotic systems have progressed and grown more available in recent years. They have been gradually but steadily integrated and used in several procedures and industries, particularly farming, as a consequence. Nowadays, agriculture machines are being developed to take the place of humans in labor-intensive, thing or hazardous activities. Depending on the kind of vehicle, its detectors, motors, and telecommunication networks, agro mobile robots provide a number of advantages. The most significant profession on the globe is gardening. The fundamental main objective of the task is to construct an automated multifunctional agricultural robot car. It is used to boost farming efficiency while decreasing the number of individuals who labor in fields and improving the accuracy of the task.
Keywords: labor intensive, hazardous, detectors, motors, telecommunication networks

I. INTRODUCTION

Many producers still use traditional techniques for tillage, planting, picking, and pest management. We must improve it by integrating IOT, computer vision, and machine learning into farming. Savings, an improvement in crop productivity, a decrease in the demand for labor and a number of other advantages may all result from implementing technology into farming. By putting these techniques into practice, wheat production would increase quicker than they would otherwise, and mankind will be spared from food in security, hunger-related mortality, and hunger. Smart farming, or crop monitoring, is the application of contemporary technologies for communication and information to increase agricultural production and output. Precision agriculture also minimizes the amount of cash and assets needed to grow crops, including arable, ground water, fertilizers, pesticides, pesticides, and other pesticides. Precision agriculture uses a variety of technologies, including communications satellites, NDVI and optical systems, weed detection systems, remote monitoring, and digital Weather forecasts. This research used several sensors to help farmers producer bust agricultural harvests.

Each sensor will carry out its task, and the farm will be given access to all of the data gathered. It will be alerted so when dirt becomes dehydrated, we might activate the water pump using IoT. The robots will traverse the fields, and a camera integrated inside the robot vehicle will allow us to keep an eye on it. When fertilizers are required, it will spray them, avoiding many individuals from acquiring respiratory conditions brought on by chemical blasting.

Advantages of Using Robots:

- Time and manual laborare both conserved.
- Better speeds and fewer errors.
- Used in a variety of industries, including mining, agriculture, medicine, and household research.
- It can operate around-the-clock and can be dispatched to any globe to understand it secological parameters.
- In a similar manner, removing the significant effort cost.
- The equipment should change course while operating close to obstacles like bushes, rocks, lakes, and other obstructions.

II. RELATED WORKS

In past years, many pasture bots have only been capable of dual or dual tasks by building a grass robot that can weed, trim, and spray rain, we may enhance the robot. Zigbee, Wi-Fi, and Wireless are used to transmit cross data. As the info is saved to the internet, real world data searching via an API is possible. Artificial intelligence (AI) and big dataAnalysis are utilized to investigate and calculate the costs of different farm commodities. The fume hood soil tester is used by smart agricultural techniques to collect and analyses 100 respondents per day without the need for lab expertise. Using a water supply design based here on Crop, the water Deficit Index boosts crop productivity yet further. Smart applications within field can precisely detect temperatures, humidity, pressurization, plant resistivity, and soil wetness. A versatile robot with the ability to level and close mud pits in addition to do irrigation, plough work and seeding tasks on its own. With a webcam and machines sight, several tasks including drainage, sowing, ploughs, and fertilizer spray can be accomplished. This robot uses GPS, Wi-Fi, as well as a remotely controlled device for movement.

III. SYSTEM DESIGN

The proposed surveillance system comprises a Raspberry Pi-based spying robot equipped with various sensors including GPS, Pi camera, temperature sensor, fire sensor, ultrasonic sensor, and a 5V buzzer, all interfaced with DC motors for maneuverability. The robot's motion can be controlled via a web application over Wi-Fi connectivity. The system is designed to stream live data over a virtual network, transmitting real-time videos and pictures with time stamped location information to the cloud. This enables efficient monitoring in perilous environments such as border areas for intrusion detection, crime rate reduction, and various other applications necessitating heightened security measures. Firstly, the skeleton of the robot is structured with a plastic chassis. A Raspberry Pi single-board computer is utilized as the fundamental component for processing and controlling functions. The Pi board is mounted above the chassis and underneath the structure, 4DC motors rated 150 rpm each is adhered. The motors are powered by a 9V battery source each and attached to wheels. A L293D Motor Driver is embedded with the RaspberryPi to drive the DC motors. RaspberryPi is coded with Python scripting language in relation to the circuit connections to control the robot in all directions. APi camera is interfaced with Raspberry Pi to give a live video feed. Furthermore, AMG8833 IR Thermal camera is deployed to add heat vision to the spy robot. The IR Thermal camera detects and converts the infrared radiations from the surroundings into visible images. The Raspberry Pi is programmed to compute the average of the 8X8 pixel array output of the thermal sensor. The threshold value for human body temperature is set to be 36°C. So whenever the average temperature Sensed is beyond the limit, the time stamp and location (obtained using GPS) are sent to the Fire base Real-time Database and images are stored in its storage.

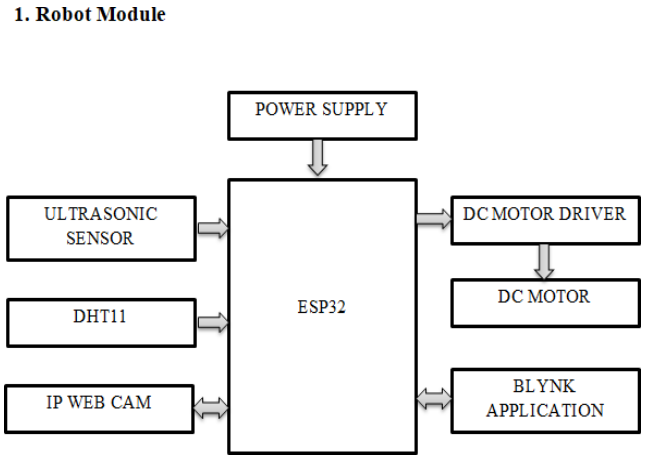

Fig1: Robot Module

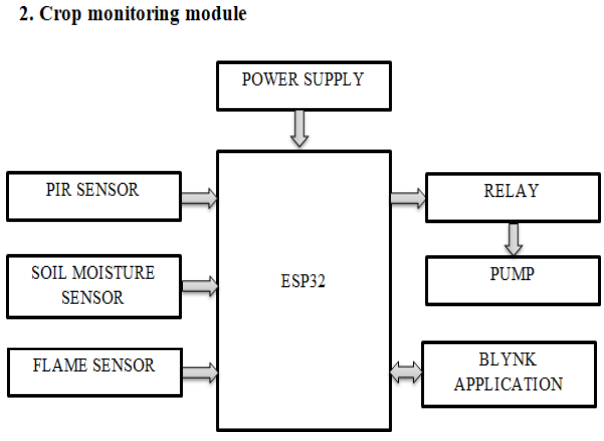

Fig G2: Crop monitoring Module

IV. HARDWARE REQUIREMENTS

I. ESP 32 Arduino: The ESP32 is a microcontroller-based development board that is part of the Espressif Systems ESP series. It is based on the Xtensa LX6 microprocessor and is commonly used for embedded systems, IoT (Internet of Things) projects, and applications that require low power consumption. The ESP32 is often programmed using the Arduino IDE, making it accessible to users familiar with Arduino development.

II. A PIR (Passive Infrared) sensor is like a heat-sensitive motion detector. It notices when something warm moves across its view, triggering actions like turning on lights or sounding an alarm. Instead of sending out signals itself, it reacts to the infrared energy emitted by objects in its surroundings, making it a handy tool for security systems, automatic lighting, and other applications where detecting movement is useful.

III. Soil Moisture Sensor: A soil moisture sensor measures the moisture content in the soil. It typically consists of two electrodes that are inserted into the soil. The sensor measures the electrical conductivity between these electrodes, which is influenced by the moisture level in the soil. Soil moisture sensors are commonly used in agriculture and gardening applications to monitor and control the watering of plants based on the soil's moisture content.

IV. Ultrasonic sensor: An ultrasonic sensor is a device that measures distance by sending out ultrasonic sound waves and then listening for them to bounce back. It works a bit like how bats use echolocation to navigate. When the sound waves hit an object, they bounce back to the sensor, and by measuring how long it takes for the waves to return, the sensor can calculate the distance to the object. Ultrasonic sensors are often used in robotics, parking assistance systems, and proximity detectors because they're reliable, accurate, and work well in various conditions.

V. ESP32 Camera: The ESP32 camera is a camera module designed to work specifically with the ESP32 microcontroller. It is often integrated into ESP32 development boards with a camera interface. It typically includes a small camera sensor and supporting components. The ESP32 camera is commonly used for IoT projects, surveillance, and other applications where a compact and integrated camera solution is needed.

VI. Driver IC L298N : The L298Nisa popular dual H-bridge motor driver integrated circuit (IC) used to control the speed and direction of DC motors and stepper motors. It acts like a traffic controller for motors, managing the flow of electricity to make them move forward, backward, or stop.

VII. Flame detector: A flame detector is a sensor designed to detect the presence of flames or fire. It works by sensing the specific wavelengths of light emitted by flames. When a flame is detected, the sensor triggers an alarm or activates a safety system to respond to the fire.

VIII. Infrared sensor: An infrared sensor is a device that detects infrared radiation emitted by objects. It works by measuring the intensity of infrared light within its field of view. When an object emits heat, it also emits infrared radiation, which the sensor can detect.

V. SOFTWARE REQUIREMENTS

1] Python: Python is a free and widely-used programming language that can run on a variety of platforms. Python is a programming language that can help you work more efficiently with your systems.

2] Opencv: Is an open-source computer vision library the library is written in C and C++ and runs under Linux, Windows and Mac OS X.

3] Embedded C: Embedded C is a variant of the C programming language tailored for embedded systems. It's optimized for resource-constrained environments, offering control over hardware features and real-time performance.

4] Arduinoide: The Arduino IDE is a user-friendly platform for programming Arduino microcontroller boards. It offers a simple interface and a vast library of pre-written code, making it accessible for beginners and experts alike in the field of electronics and embedded systems development.

5] Blynk App: Blynk is a mobile app that simplifies IoT development by providing a drag-and-drop interface to create custom smartp hone interfaces for controlling hardware remotely. It connects with popular development boards like Arduino, ESP8266, and Raspberry Pi, enabling rapid prototyping of smart devices and IoT applications.

VI. IMPLEMENTATION AND RESULTS

1] Microcontroller (ESP32)

ESP32 is a versatile Wi-Fi and Bluetooth-enabled microcontroller chip developed by Espress if Systems. It offers a powerful dual-core processor, ample memory, and a wide range of built-in peripherals, making it ideal for IoT projects, wearable devices, and industrial applications requiring wireless connectivity and high performance.

Fig3: Microcontroller (ESP32) Hardware.

2] Hardware Control

Blynk is a platform that allows you to easily build IoT (Internet of Things) applications for controlling hardware remotely using your smart phone.

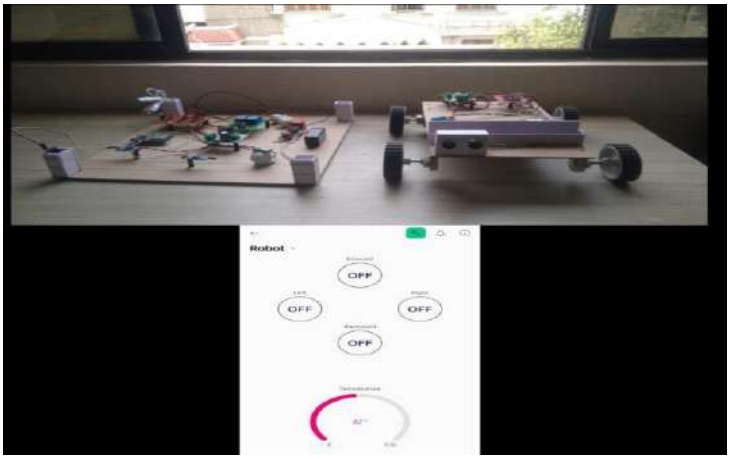

Fig4: Web application for robot motion control and live video feed

3] Setup Robot

The robot chassis is created with all the hardware and software tools mentioned earlier and the setup is shown in Fig. 5(a) and Fig. 5(b).

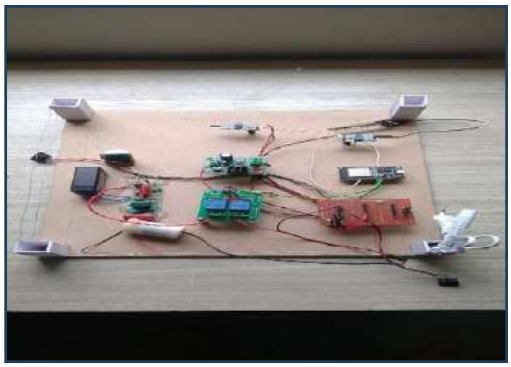

FIG:5(A) Crop model top view

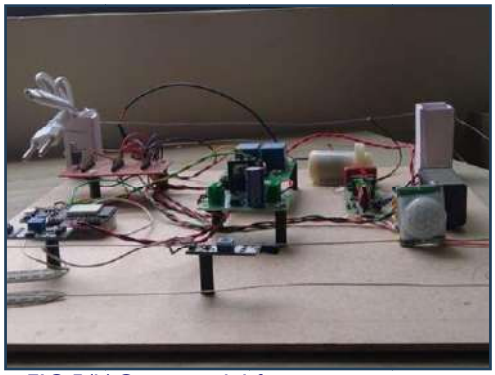

FIG:5(b)Crop model front view

4] Detecting objects

Ultrasonic sensors use sound waves with frequencies higher than the human audible range to detect objects and measure distances. They emit ultrasonic pulses and measure the time it takes for the sound waves to bounce back, providing accurate distance measurements for applications like robotics, automotive, and industrial automation.

Fig 6: ROBOT MODULE WITH ULTRASONIC SENSOR.

CONCLUSION

This project is primarily concerned with lowering both human and equipment costs. Instead of a traditional robotic automobile, the robot might be equipped with an open-source system. Automation is required in industries such as manufacturing, biotechnology, and surveying. Especially in the agricultural industry to increase crop output. An automated system has greater flexibility than a conventional system. Additionally, water waste will be decreased. This strategy offers the benefit of saving money and time on labor. In this study, a bot is built and programmed to carry out specific tasks, analyze crop irrigation, surface temps, and moisture, detect humans as well as animals entrance, and react to the existence of flames in a pasture. It is envisaged that the robot would assist farmers in enhancing the efficiency of their farm operations

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Two Level Security for Key Access Using Cloud Computing

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Abstract: In this work, the author constructs a key access management scheme that seamlessly transitions any hierarchical-like access policy to the digital medium. The proposed scheme allows any public cloud system to be used as a private cloud. We consider the data owner an entity consisting of several organization units. We provide a secure method for each user of this entity to access the public cloud from both inside and outside the company's network. The idea of the key access control scheme, which is based on Shamir's secret sharing algorithm and polynomial interpolation method, is suitable especially for hierarchical organizational structures. It offers a secure, flexible, and hierarchical key access mechanism for organizations utilizing mission-critical data.

Keywords: Cloud Computing, Hierarchical Access Controls, Shamir's secret algorithm, Secure Data Storage, Public Cloud Adoption, Role-Based Encryption (RBE),Shamir's Secret Sharing, Key Distribution.

I. INTRODUCTION

Digitizing several services increase demands on storage systems, large-scale computations, and hosting. In addition, advances in networking technology and administrative difficulties lead companies to outsource these services. A relatively new method called cloud computing enables users to access services from any location at any time. In this work, we design a novel scheme to access a cloud storage system that runs on third parties' cloud infrastructure. The proposed method provides a secure scheme so that organizations requiring a higher level of security can use any public cloud infrastructure. Cloud computing also includes various service models such as infrastructure as a service (IaaS), where a customer consumes a provider's computing, storage, and network resources; platform as a service (PaaS) where a customer uses the provider's ready-made environments to develop, run, applications. In this work, the author constructs

a key access management scheme that seamlessly transitions any hierarchical-like access policy to the digital medium.
The proposed scheme allows any public cloud system to be used as a private cloud. We consider the data owner an entity consisting of several organization units. We provide a secure method for each user of this entity to access the public cloud from both inside and outside the company's network. The idea of the key access control scheme, which is based on Shamir's secret sharing algorithm and polynomial interpolation method, is suitable especially for hierarchical organizational structures. It offers a secure, flexible, and hierarchical key access mechanism for organizations utilizing mission-critical data.

II. LITERATURE SURVEY

In 1979, Shamir proposed a (k, n) secret sharing threshold scheme which enables the construction of robust key management that can function securely and reliably [23] by using a (k, n) threshold scheme with n = 2k − 1. The secret key K is divided into n shares. If k −1 or fewer shares are available, the key cannot be constructed, and no information about K can be extracted. The idea of our proposed scheme is based on Shamir's secret sharing and is suitable for hierarchical organizational structures.

In 2002, Tzeng [20] proposed a time-bound cryptographic key access control scheme to prevent the key from being used by members of higher level class Ci continuously. It can be said that the scheme is the time period-based version of [10]. Any user of a class Ci can only be a member of Ci for a certain period of time and compute from secret Ki to Kj at that time t if and only if Cj ≤ Ci and t1 ≤ t ≤ t2. Note that t1 is the beginning, t2 is the end of time period. There are broadcasting data to authorize users in a hierarchical structure with optimal bandwidth, and unauthorized users cannot obtain any data by listening to the broadcasting. In addition, a user can keep encrypted data for a period of time, and a higher classified user can grant another user a privilege to disclose the encrypted data, which ensures flexibility. The scheme is independent of the number of classes in the hierarchy, unlike all previously proposed key access control schemes in the poset hierarchy. However, the scheme is not efficient since the users must always keep the keys in their hands to access the authorized data for a certain period of time. The scheme is storage efficient but computationally inefficient due to the need for a large number of public-key computations, overhead and implementation costs [21].

In 2004, Chien [21] proposed an efficient time-bound hierarchical key assignment scheme inspired by [10], [20]. The scheme proposes to improve the time-slot-based key assignment scheme [20] by assigning distinct cryptographic keys to solve both implementation cost and performance issues in the hierarchy. The scheme is based on a tamper-proof device that only performs simple arithmetic operations. It is computationally secure to derive the secret key from the public value. A user cannot derive any key except the authorized time slots. Users at lower clearance levels cannot obtain the key of higher clearance levels, so the scheme is collusion resistant. The scheme is more efficient and needs a low-cost tamper-proof device that supports small storage and simple operations without public-key cryptography, and has little computational complexity. However, Tzeng [20] the scheme has been proven to be insecure against a feasible and efficient collision attack if three users conspire to gain access to the keys [24], [25]. In addition, both schemes of Chien's [21] and Tzeng's [20] have been proven not to be resistant to collusion attacks if three users conspire to gain access to the keys [25].

In 2016, a hierarchical key access (HKA) scheme based on linear geometry was proposed [38]. To derive the key of the clearance level, the public vector of its own and the private vector of the ancestor clearance level are used together. Without the need for iterative computation, the key of the descendant can be directly derived by the ancestor. The scheme that ensures SKIs only needs to compute the vector multiplication and the values of the pseudorandom function, resulting in very little computational overhead. Although the size of the public information is slightly larger than the others, there is a trade-off between computation cost and storage. The scheme provides an efficient key management solution that can serve as flexible and fine-grained hierarchical access control to address potential changes in the hierarchy with light computations in a finite field. However, the ultimate overhead of every class is not tolerable and efficient. If there is a change in the hierarchy, the data owner must compute and publish a new public matrix. The matrix must be square to establish the relationship between the number of classes and the public information, especially for rekeying process.

TTS/ISO/IEC 17788:2020, Information Technology – Cloud Computing – Overview and Vocabulary: This National Standard provides an overview of cloud computing along with a set of terms and definitions. It is a terminology foundation for cloud computing standards. This National Standard is applicable to all types of organizations (e.g., commercial enterprises, government agencies, not-for-profit organizations).

III. PROPOSED SYSTEM

The proposed higher-level security scheme for key access in cloud computing addresses the limitations of existing systems by implementing: Hierarchical Key Management: Enables fine-grained access control based on organizational structures, departments, and roles, Distributed Key Storage: Eliminates single points of failure by splitting key shares and securely storing them across authorized users or cloud providers, Secure Collaboration and Data Sharing: Provides temporary access tokens for specific resources, minimizing long-term key exposure, Enhanced Public Cloud Adoption: Facilitates secure data storage and processing in public cloud environments with robust security mechanisms and compliance adherence.

Advantages:

- Improved data security and confidentiality
- Increased Efficiency.
- Cost-Effectiveness
- Less complexity

IV. SYSTEM ARCHITECTURE

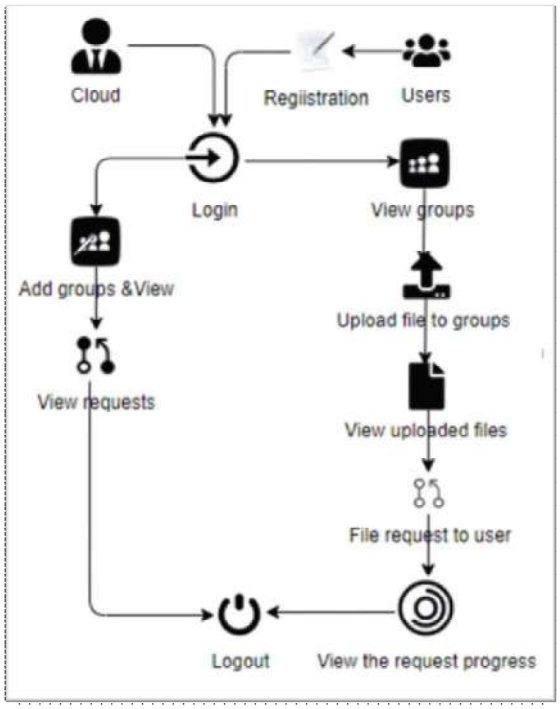


Figure 1: System Architecture

V. SYSTEM MODULES

The system for the "Two level security for key access using cloud computing" project can be divided into several modules, each serving a specific purpose in the overall work flow. Here are the key modules:

1. Key Generation Module:

Function: Generates the master key and securely splits it into multiple shares using Shamir's Secret Sharing algorithm.
Responsibilities:

- Employs a strong cryptographic random number generator for key creation.
- Implements Shamir's algorithm for secure key sharing.
- Distributes key shares to authorized users via secure channels.

2. Access Control Module:

Function: Enforces access policies based on user roles, attributes, and hierarchical structure.
Responsibilities:

- Manages user identities, roles, and access permissions.
- Maintains a hierarchical structure representing the organization's structure.

3. Key Storage Module:

Function: Stores key shares and access control information securely in the cloud.
Responsibilities:

- Encrypts key shares and access control data using robust encryption algorithms.
- Implements secure mechanisms for retrieving and reconstructing keys when needed

Provides a secure interface for users to request and manage access rights.

4. User Interface Module:

Function: Provides a secure and intuitive interface for users to interact with the system.
Responsibilities:

- Allows users to authenticate and access the system.
- Enables users to request access to keys and resources.

5. Cloud Integration Module:

Function: Interacts with cloud storage and computing services to store and process data.
Responsibilities:

- Integrates with cloud platforms using APIs and SDKs.
- Manages data encryption and decryption operations in the cloud.
- Handles key retrieval and access control enforcement for cloud-based data.

6. Security Module:

Function: Implements cryptographic algorithms and security protocols.
Responsibilities:

- Provides encryption and decryption functions using strong algorithms.
- Securely generates and manages cryptographic keys.

VI. SYSTEM IMPLEMENTATION

1. Requirements Gathering:

Begin with a comprehensive requirement gathering phase to understand the specific security needs of the project, including compliance requirements, user access patterns, and data sensitivity levels.

2. Security Assessment:

Conduct a thorough security assessment, including risk analysis and threat modeling to identify potential security vulnerabilities and threats that need to be addressed.

3. Cryptographic Protocol Selection:

Based on the project's security requirements, select appropriate cryptographic protocols and algorithms. In this case, Shamir's Secret Sharing Algorithm may be chosen for key management and protection.

4. Testing and Validation:

Rigorously test the security scheme to ensure that it meets the specified security requirements. This includes testing the resilience of the system against known attack vectors

5. Key Management and Shamir's Secret Sharing:

Implement key management procedures, including the use of Shamir's Secret Sharing Algorithm for secure key distribution and management.

VII. RESULTS

Figure2: Home Page

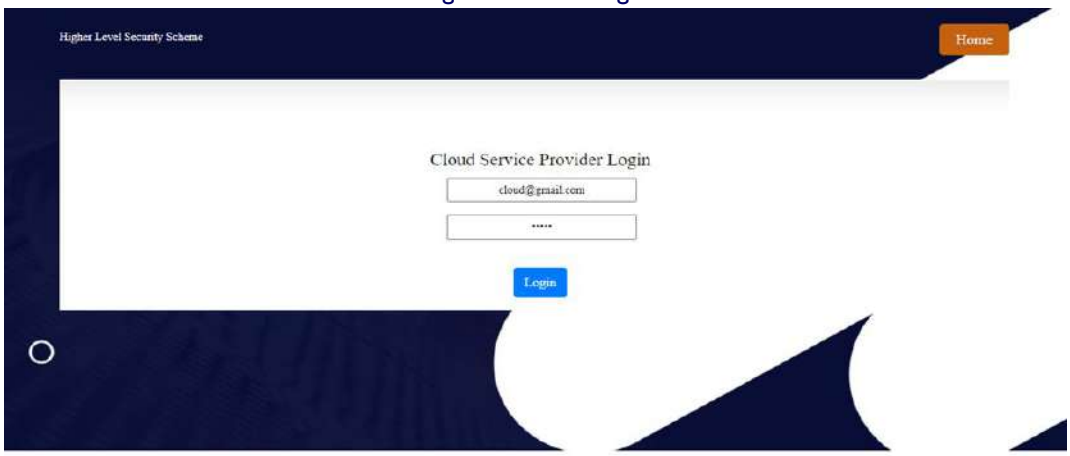
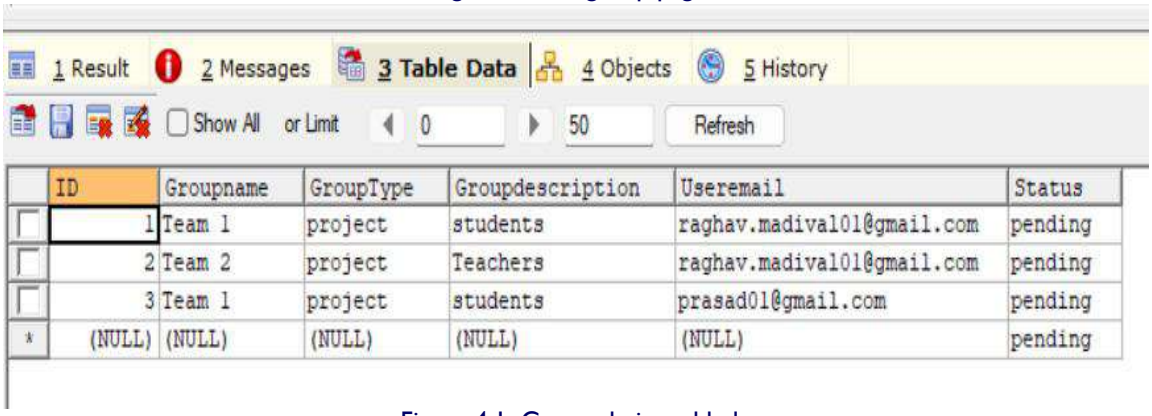


Figure3: CSP login page

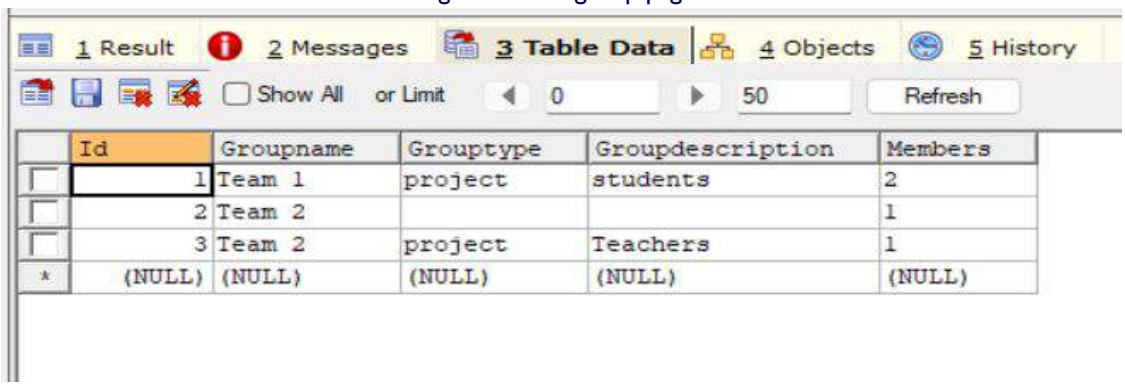
Figure 4: Add group page



	ID	Groupname	GroupType	Groupdescription	Useremail	Status
	1	Team 1	project	students	raghav.madival01@gmail.com	pending
	2	Team 2	project	Teachers	raghav.madival01@gmail.com	pending
	3	Team 1	project	students	prasad01@gmail.com	pending
*	(NULL)	(NULL)	(NULL)	(NULL)	(NULL)	pending

Figure 4.1: Groups being added

Figure5: View group page



	Id	Groupname	Grouptype	Groupdescription	Members
	1	Team 1	project	students	2
	2	Team 2			1
	3	Team 2	project	Teachers	1
*	(NULL)	(NULL)	(NULL)	(NULL)	(NULL)

Figure5.1: View group

Figure 6: User request page

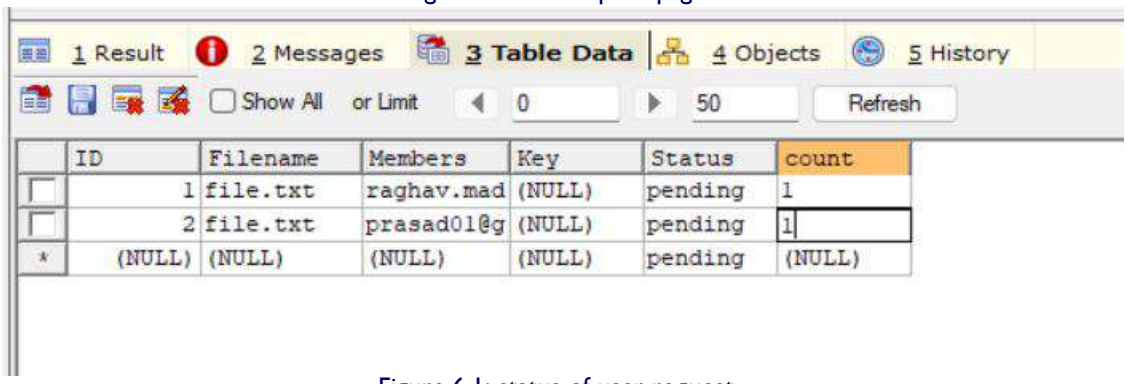
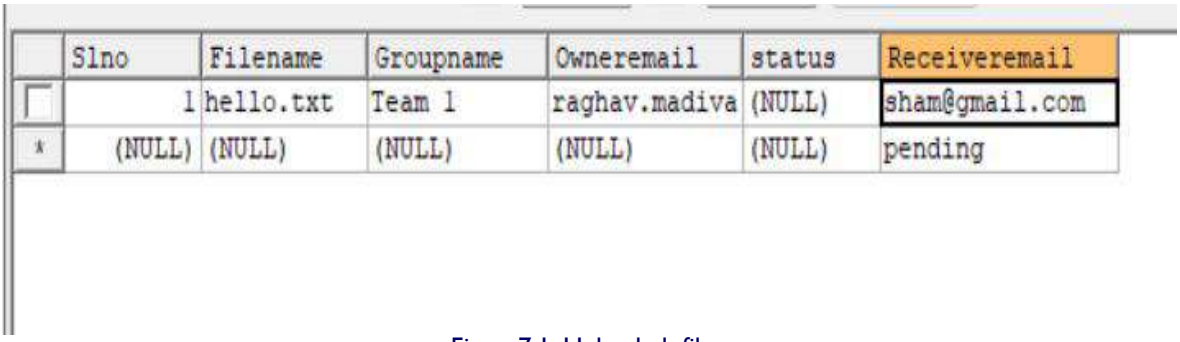


Figure 6.1: status of user request

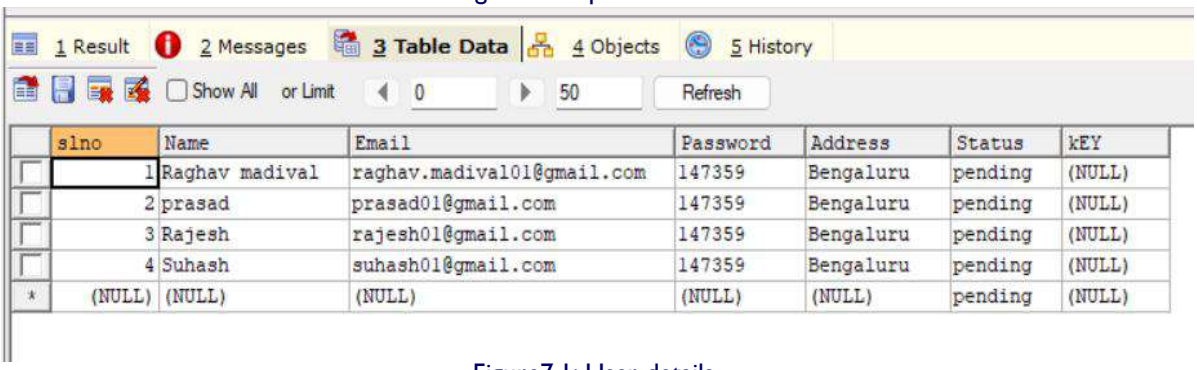
Figure 6: Interface: User login page

Figure7: Upload files page



	Slno	Filename	Groupname	Owneremail	status	Receiveremail
	1	hello.txt	Team 1	raghav.madiva	(NULL)	sham@gmail.com
*	(NULL)	(NULL)	(NULL)	(NULL)	(NULL)	pending

Figure7.1: Uploaded files



1 Result | 2 Messages | 3 Table Data | 4 Objects | 5 History

Show All or Limit 0 50 Refresh

	slno	Name	Email	Password	Address	Status	kEY
	1	Raghav madival	raghav.madival01@gmail.com	147359	Bengaluru	pending	(NULL)
	2	prasad	prasad01@gmail.com	147359	Bengaluru	pending	(NULL)
	3	Rajesh	rajesh01@gmail.com	147359	Bengaluru	pending	(NULL)
	4	Suhash	suhash01@gmail.com	147359	Bengaluru	pending	(NULL)
*	(NULL)	(NULL)	(NULL)	(NULL)	(NULL)	pending	(NULL)

Figure7.1: User details

VII. SCOPE OF FUTURE APPLICATION

1. Revocation of Access:
The current scheme might benefit from incorporating mechanisms for efficient user revocation. This would allow administrators to quickly remove access privileges if a user leaves the organization or their role changes.

2. Multi-Cloud Integration:
As organizations increasingly adopt hybrid or multi-cloud environments, the scheme could be extended to seamlessly manage key access across different cloud providers. This would require secure communication protocols and potentially key escrow services for disaster recovery purposes.

3. Advanced Threat Detection:
Integrating the scheme with anomaly detection systems could provide an extra layer of security. By monitoring user access patterns and identifying suspicious activity, the system could trigger alerts or even temporarily restrict access in case of potential breaches.

4. Leveraging Blockchain Technology:
Blockchain's tamper-proof ledger could be a valuable addition for managing key access logs and enforcing access control policies in a decentralized manner. This could enhance transparency and potentially improve fault tolerance.

5. User-Centric Authentication:
Exploring multi-factor or biometric authentication methods could add another layer of security for accessing cloud storage. This would move beyond traditional password-based systems and potentially reduce the risk of unauthorized access.

6. Performance Optimization:
While the current scheme is claimed to be computationally efficient, further research could explore techniques for optimizing key generation, distribution, and revocation processes, especially as the number of users and data volume grows.

7. Standardization and Interoperability:
Developing standardized protocols for key access control in the cloud would enable easier integration with different cloud platforms and security solutions. This would foster a more interoperable ecosystem for secure cloud storage.

IX. CONCLUSION

The proposed key access control scheme provides a computationally efficient method for key derivation. The proposed scheme provides both the private cloud security and the functionality, accessibility, and cost savings of the public cloud. With the use of the public cloud by companies, other advantages such as the reliability of the public cloud and the minimum maintenance and management requirements are obtained.

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Enhancing Signature Forgery Detection System Using CNN-SVM

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Abstract: Handwritten signatures are widely used as a means of personal identification and authentication. Many documents like bank cheques and legal transactions require signature verification. But considering a large number of documents, it is a very difficult and time-consuming task. Therefore, ensuring the necessity for a robust automatic signature verification tool that aims to reduce fraud in all related financial transaction sectors. The current visual verification depends mainly on the experience, mood, and working environment of the verifier which ultimately wastes both time and money. Moreover, it is difficult for the eyes of any experts to precisely verify the ratios between lines and angles of a genuine signature to a fraud signature. Therefore, we propose an automatic signature verification technique using the recent advances in image processing and machine learning.

INTRODUCTION

Signature verification and forgery detection systems are used to verify a person's identity by verifying a signature. These systems can be used both online and offline. Online signature verification and forgery detection systems are used to verify a person's identity by verifying a signature in an online environment. A reference signature is usually stored in a secure database and is used to compare a person's signature to ensure its authenticity. The system can also detect possible fake attempts by comparing the signature with a reference signature. Offline signature verification and forgery detection systems are used to verify a person's identity by verifying a signature in an offline environment. These systems use several methods to capture a person's signature and compare it to a reference signature. Both online and offline signature verification and forgery detection systems are important tools for authenticating a person's identity. These systems are used in a variety of industries, including banking, healthcare and government. They are also used to protect against fraud and identity theft.

LITERATURE SURVEY

[1] Automated bank cheque verification using image processing and deep learning methods Description: Our innovative tool utilizes image processing and deep learning methods to accurately verify key components of bank cheques, such as the branch code, cheque number, legal and courtesy amounts, account number, and signature patterns. Using the IDRBT cheque dataset and convolutional neural networks, we achieved a 99.14% accuracy for handwritten numeric character recognition and 97.7% accuracy for machine-printed script using MATLAB's OCR

[2] Deep Learning Recurrent Attention Optical Character Recognition Network with Data Augmentation for Cheque Data Extraction

Description: In this study, a recurrent attention optical character recognition network (RA_OCRN) was employed to extract legal information from images of bank cheques, aiming to improve accuracy in check verification processes. The research utilized deep learning for data pretreatment and augmentation, showcasing improved results compared to existing methods when tested on the Kaggle cheque detection dataset.

[3] Use of Digital Signature Verification System (DSVS) in Various Industries: Security to Protect against Counterfeiting : Research Description: The study proposes a method for handwritten signature verification, combining dynamic and static features to enhance authenticity and protect customer property in the banking industry. The traditional approach to signature verification relies on human judgment, which can lead to misunderstandings, insults, and financial losses.

[4] Signature Verification of Bank Cheque

Description: Signature verification is widely used for biometric identification, particularly in banking and financial transactions. Various methods such as Hopfield neural network, Back-propagation algorithm, Support vector machine, Hidden Markov Model, and Artificial Neural Network (ANN) have been utilized for this purpose.

[5] Signature Extraction and Recognition from Bank Cheque Image

Description: A three-layer signature verification system has been proposed for bank cheque images, utilizing writer-independent and offline verification. It employs graphometrical and FAST features extracted from signatures as inputs for classification algorithms.

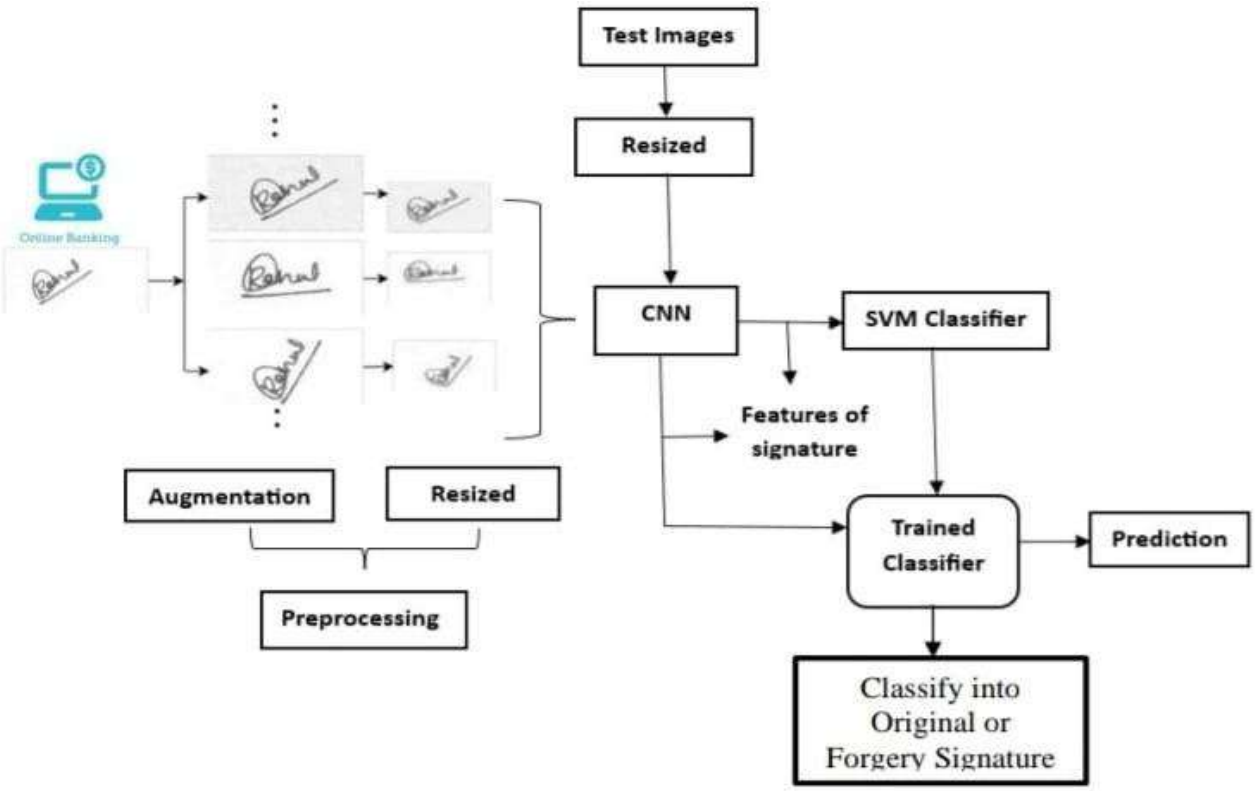
PROPOSED SYSTEM

After the images have been cropped by OCR technique, we will use the Connected Components Algorithm to extract the signature from the image.

Following are the Signature Verification Approaches:

- The OCR Approach: Identify the signatures and crop the images
- The Line Sweep Algorithm: Use OCR result images and do rectangle fitting across the signature.
- And verification of the signature done that belongs to fake or original using SVM and CNN models.

SYSTEM ARCHITECTURE



SYSTEM MODULES

The system modules of the project can be organized into several key components:

1. Data Augmentation

The following code is the implementation of the data augmentation process used to create images and increase the size of the dataset artificially. Here, Image Data Generator is used to produce new images. The rotation range is set to 360 as the images are spiral and can be rotated any number of degrees without changing the image's meaning. You can try other image transformations available under Image Data Generator class. But be careful while applying any augmentation as certain transformations may lower the CNN model's lower accuracy.

2. OCR Component:

Let's denote the OCR process as a function that takes an input image of a bank cheque and produces extracted textual information: OCR (image) Textual Information

Here, the OCR function analyzes the input image and outputs relevant textual details such as account numbers, payee names, and other relevant information

3 Line Sweep Component:

The Line Sweep technique involves systematically scanning and extracting features from signatures. Let's define the Line Sweep process as follows:

Line Sweep (signature)

Extracted Features

The Line Sweep function takes a signature image as input and performs a line-by-lines can, extracting features such as stroke directions, lengths, and angles. The output is a set of features that represent the signature's characteristics

4 CNN Model Architecture

- The model contains four Convolutional Layers with 128, 64, 32, and 32 filters, respectively.
- The convolutional layers contain filters with varying filter sizes.
- A MaxPool 2D layer follows each convolutional layer.
- Two Fully Connected layers follow the convolutional block.

5. Training the Model

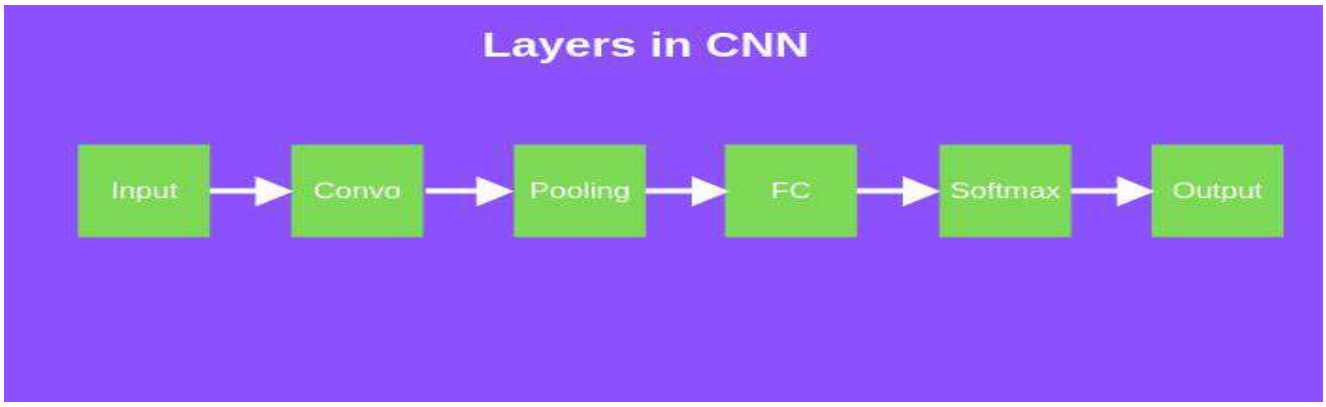
The model is trained with a learning rate of 3.15e-5 using Adam optimizer. The epochs and batch size are set to 70 and 128, respectively

6. Performance of the Model

The Loss and Accuracy Plots, Classification Report and Confusion Matrix, are used as performance metrics for the model.

SYSTEM IMPLEMENTATION

CNN Algorithm: CNN stands for Convolutional Neural Network, which is a class of deep neural networks primarily designed for processing structured grid-like data, such as images or video. CNNs have been particularly successful in tasks like image classification, object detection, and image segmentation.



Input Layer:

- The input layer represents the raw input data, typically an image or a set of images. Each image is represented as a grid of pixel values, with each pixel representing a feature.
- In order to prepare the input data for the Convolutional Neural Network (CNN), it is necessary to reshape the images into a single column format. For instance, if the images have dimensions of 28 x 28, totaling 784 pixels, they must be transformed into a column vector of size 784x1before being fed into the network.
- If there are "m" training examples, then the dimension of the input data will be (784, m). This reshaping ensures that each pixel value of the images is represented as a single input feature, facilitating the training process of the CNN.

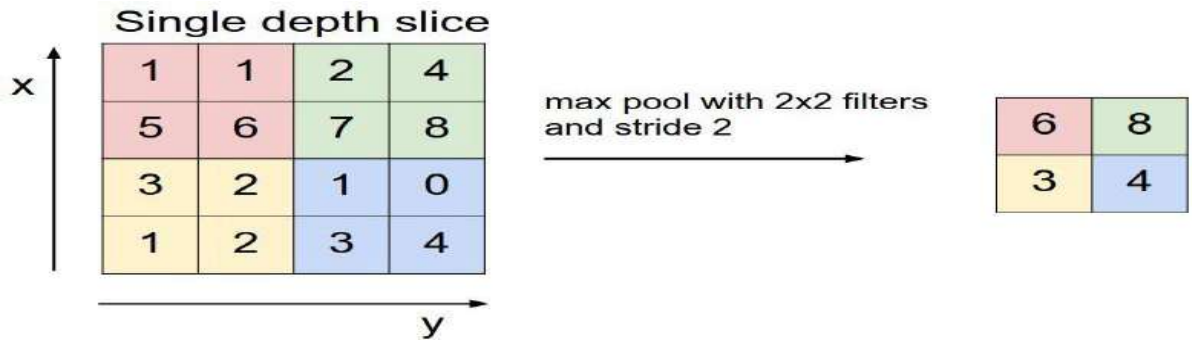
Convo Layer:

- In the convolutional layer, a set of learnable filters (also known as kernels) is applied to the input image through convolution operations.

- Convolution involves sliding each filter across the input image and computing the dot product between the filter and the local region of the input.
- The ReLU(Rectified Linear Unit) activation function is applied element-ise to the output of the convolution operation. ReLU introduces non-linearity, allowing the network to learn complex patterns and relationships in the data.

Pooling Layer:

- The pooling layer reduces the spatial dimensions of the feature maps generated by the convolutional layer while retaining the most important information.
- Common pooling operations include maxpooling, where the maximum value in each local region is retained, and average pooling, where the average value is computed.
- Pooling helps in reducing computation and controlling over fitting by providing translational in variance.



We have applied max pooling in single depth slice with Stride of 2. The 4x4- dimension input is reduced to 2x2 dimensions. There is no parameter in pooling layer but it has two hyper parameters — Filter (F) and Stride(S). In general, if we have input dimension W1xH1xD1, then W2 = (W1−F)/S+1H2 = (H1−F)/S+1D2=D1
Where W2, H2 and D2 are the width, height and depth of output.

Fully Connected Layer (FC):

- The fully connected layer receives the flattened output from the preceding layers and consists of densely connected neurons.
- Each neuron in the fully connected layer is connected to every neuron in the previous layer.
- The fully connected layer performs classification based on the learned features from the convolutional and pooling layers.

Soft Max / Logistic Layer:

- In classification tasks, a softmax or logistic layer is typically added after the fully connected layer.
- The softmax function converts the raw scores (logits) from the previous layer into class probabilities.
- Each output neuron represents the probability of the input belonging to a particular class.

Output Layer:

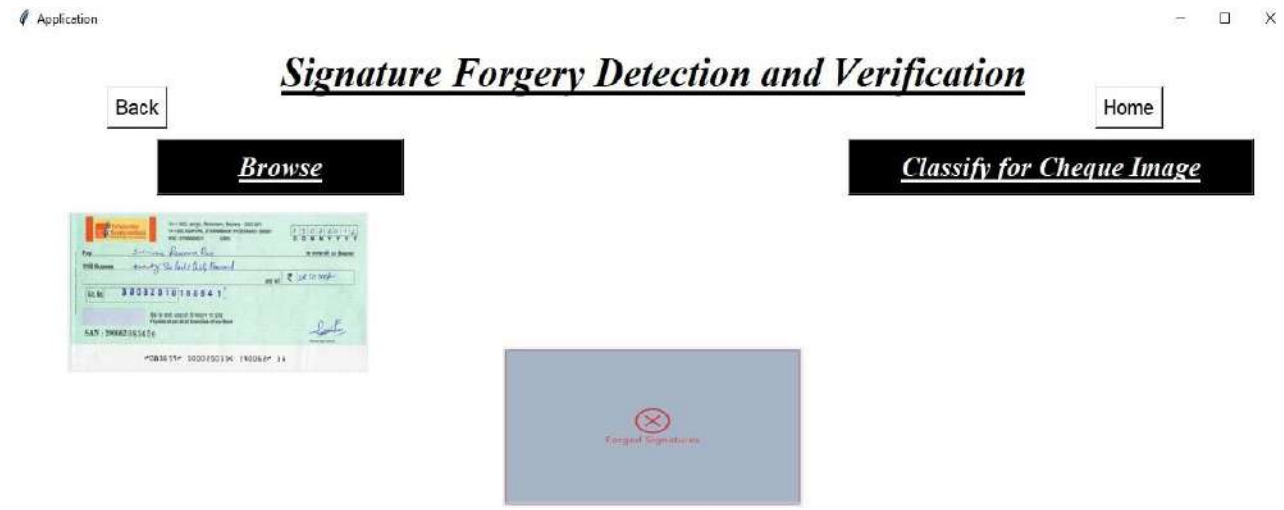
- The output layer receives the probabilities computed by the softmax or logistic layer.
- In binary classification tasks, a single output neuron with a sigmoid activation function is used to output the probability of the input belonging to one of the two classes (e.g.,0 or1).
- In multiclass classification tasks, multiple output neurons are used, each representing the probability of the input belonging to a specific class.

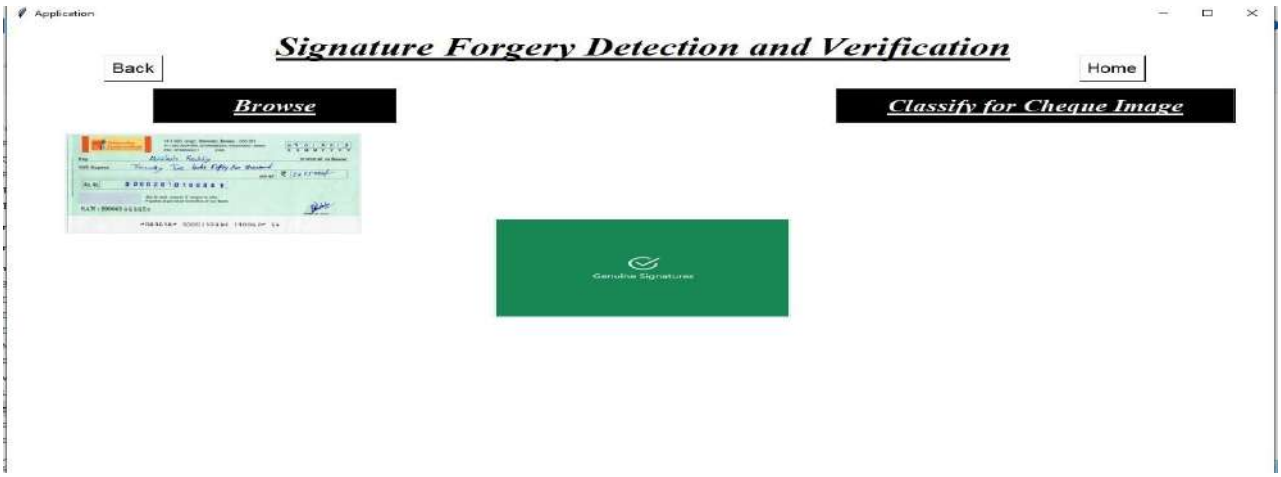
SCOPE OF FUTURE APPLICATION

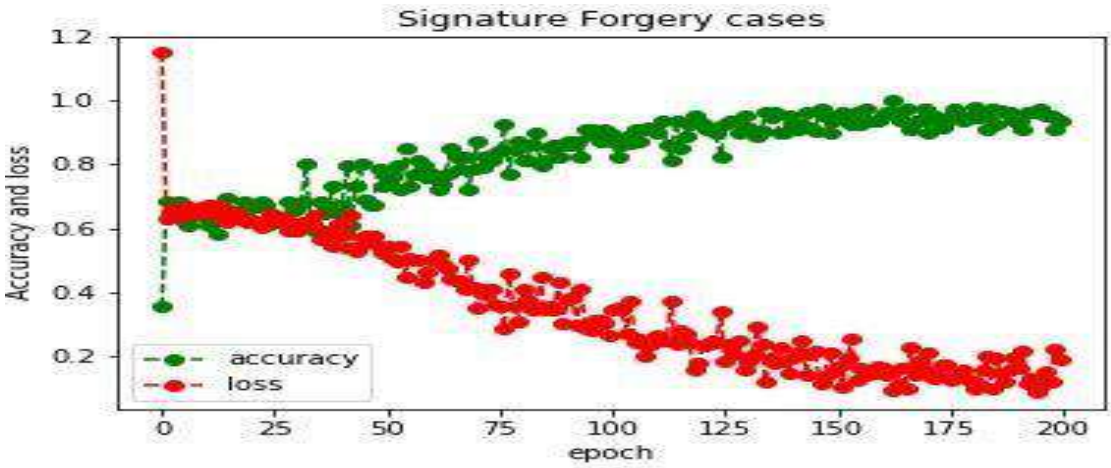
- Data collection and preprocessing: gathering a diverse datasets of genuine and forged signatures followed by preprocessing steps like normalization and augmentation.
- Model Architecture Selection: Designing a Convolutional Neural Network (CNN) architecture suitable for signature image classification, potentially in corporating techniques like transfer learning for improved performance.
- Training and Validation: Training the CNN model on the prepared dataset and validating its performance using appropriate evaluation metrics such as accuracy, precision, recall, and F1-score.
- SVM Integration: Integrating a Support Vector Machine (SVM) classifier to enhance the classification results obtained from the CNN model, possibly through techniques like ensembling or stacking.
- Hyper parameter Tuning: Optimizing hyper parameters for both CNN and SVM models to achieve the best possible performance.
- Evaluation and Testing: Evaluating the combined CNN-SVM system on an independent test set to assess its generalization ability and robustness.
- Deployment and Integration: Deploying the final model into a practical application environment, ensuring compatibility and usability with existing signature forgery detection systems.

- Performance Comparison: Comparing the performance of the enhanced system with existing methods to demonstrate its effectiveness in improving signature forgery detection accuracy and reliability.
- Documentation and Reporting: Documenting the entire process, including methodology, results, and any challenges encountered, in a comprehensive report or research paper.
- Future Extensions: Discussing potential avenues for further improvement or extension of the system, such as in corporating additional features or exploring different machine learning algorithms.

RESULTS







CONCLUSION

This project represents a significant step forward in the field of signature verification and document authentication. The suggested system can make forecasts for forgery detection by learning from signatures. The project has provided valuable insights and contributions to the domain of signature verification. Wherever a signature is used as a form of authentication, including banks and educational organizations, the system can be used. Because they can solve some issues comparatively easily, neural networks have proven successful in a variety of applications. With the rapid development of technology, the old rules are becoming obsolete. As a result, new technologies are being developed to fight fraud and crime, and tools are updated as people discover vulnerabilities. Signature verification and forgery detection systems have been developed to deal with forged and rewritten signatures to provide clear and accurate disclosure of a person's identity and prevent any type of identity crime. When given access to examples of real and fake signatures of the same individuals whose signatures were previously seen during training, CNN and SVM does a great job of verifying signatures and it may give the result that signature is genuine or not.

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Content Based Image Retrieval Using Support Vector Machine

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Abstract: A significant issue in multimedia systems is image retrieval. It is identified as the procedure for looking through and obtaining pictures from a dataset. One important and difficult area of study in digital image processing is content-based image retrieval (CBIR). Retrieving pertinent data from a vast picture database after a query image with better system output is a fundamental requirement of the CBIR system. Regretfully, not all techniques can be applied to achieve high retrieval accuracy. Thus, the purpose of this research is to use Support Vector Machine (SVM) to classify query picture data with image database data in order to get similar images. Based on the classification, the accuracy of the image retrieval will be verified.

Keywords: SVM,CBIR, Image Retrieval, Accuracy.

I. INTRODUCTION

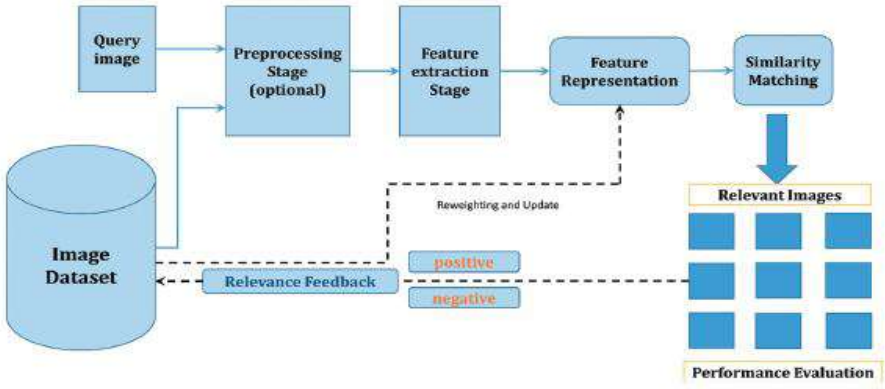
A vast quantity of picture databases has been produced by industrial, medical, and educational, social and other amenities of daily living. A robust picture search engine is necessary for each of these image libraries. There are two typical ways to search. The first approach is keyword-based. Utilized for image annotation; this technique is referred to as text-based image retrieval (Y. Liu et al., 2007). This approach has numerous drawbacks: Large datasets cannot be manually annotated;2) annotations must be made by the end user, subjecting the method to human perception; and3) the annotations are limited to a single language. The second approach, known as "content-based image retrieval" (CBIR), is strongly advised in order to get beyond the drawbacks of text-based image retrieval techniques (Raghu Nathan & Acton, 1999). Feature extraction is the first process in CBIR that aims to convert human perception into a numerical description that can be manipulated by machines. The extracted features have a significant impact on the retrieved images' correctness (Piras & Giacinto, Citation 2017). But the criteria for this choice are those of the user. According to D. Zhang et al. (2012), CBIR performance can be enhanced by feeding extracted characteristics into supervised or unsupervised machine learning algorithms. Recent advances in image retrieval research have focused on using deep learning to increase accuracy at the expense of longer processing times (Markowska- Kaczmar & Kwaśnicka, Citation 2018). The high-dimensional characteristics that are typically produced when attempting to translate are another issue that negatively impacts CBIR performance (i.e., memory utilization, scalability, speed, accuracy).

As seen in Figure 1 the overall CBIR architecture has some required stages and other optional stages. The user submits the query image as the initial step in the CBIR process. Every operation applied to the query image will be applied, in the same order, to every image in the database (Kokare et al., Citation 2002). These procedures are generally carried out on the query image at the time of user submission and are referred to as online procedures. Alternatively, the same procedures may be used on dataset images before the query is submitted and are referred to as offline procedures. The architecture of the framework may incorporate an optional pre-processing step that entails resizing, segmentation, denoising, rescaling, and other operations. The most crucial stage, feature extraction, comes after this optional one and involves translating a visual concept into a numerical form. Local descriptors or low-level features, such as color, shape, texture, and spatial information, are examples of extracted features. Normalization or categorization is an additional optional preprocessing step that comes after feature extraction. Finding the most relevant photos in the dataset requires comparing the extracted features from the query image to every other image in the dataset.

This is the last step in the process. By selecting pertinent and irrelevant returning photos, relevance feedback is an additional stage that can be used to improve the results through user interaction.

II. CBIR FRAMEWORK

Figure 1. General framework of the CBIR system



Numerous methods have been put forth to provide relevance feedback in order to improve CBIR performance (Ciocca&Schettini, Citation 1999; Dacheng).

III. COLOR FEATURE

Color is first and most straightforward visual feature for indexing and retrieval of images. They are usually robust in noise, resolution, and orientation and resizing. Because of their little semantic meaning and its compact representation, color feature tend to be more domain independent compared to other features. The image retrieval process can be divided in two steps:

- Indexing for each image in database a set or a vector of features summarizing. Its content properties is computed and stored in metadata database.
- Retrieval given a query image, its features are extracted and compared to others in database. Database images are then ordered following a similarity criterion.

In color indexing, given a query image, goal is to retrieve all images whose color compositions are similar to color composition of query image. Typically, color content is characterized by color histograms, which are compared using histogram distance measure. A color histogram can be constructed in 3D color space. This proposed method for extending use of image histograms to characterize local and global color properties of images. This method is based on two types of color representations:

• Color Descriptor to represent global color features of images.
• Color Descriptor Matrix to represent spatial color features of images.

The color descriptor is defined to be: Color Descriptor ={ {ci, pi}, i=1…M}…….(1)

Where M is total number of color clusters in image, ci is an Arabic number corresponding to color, pi is its percentage, and ∑pi=1. Note that M can vary from image to image. First, most dominant color in image is added and then less dominant color follows. As each pair {ci, pi} is added, color descriptor becomes more expressive representation of color distribution of an image. Currently, there are ten colors in the definition of color code book, color code is changed as image. Try to combine image quantization and perceptual color model to represent spatial color information in images and define 2-D vector Color Descriptor Matrix.

Color Descriptor Matrix = {Ci,j,i=0...N,j=0...N}……...(2)

In order to create this structure whole image is divided into NxN (where N=4, 8, 16, 32) equal parts. This matrix stores dominant colors for image blocks. Original images were NxN quantized and were represented as NxN blocks (or sub images). Original images are 16X16 quantized and represented as 16X16 color blocks (as Fig. 2).

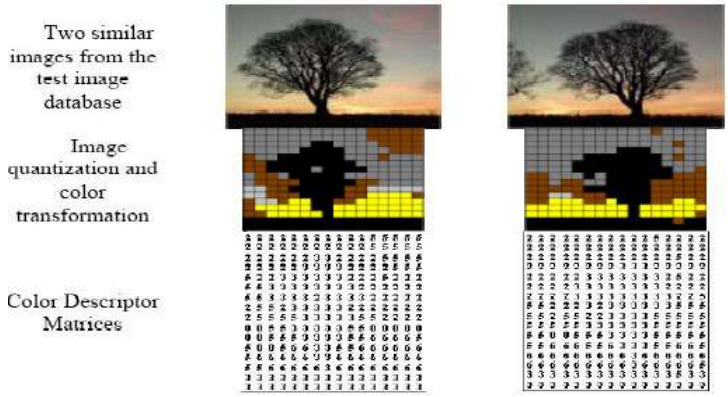


Fig. 2: The process of color descriptor matrix

Quantized image [2] is divided into 5x5 matrix and 16 bin histogram is calculated for each sub image and most dominant color is new replacement of small block and hence 125x83 images are reduced to 25x16.

IV. SUPPORT VECTOR MACHINE

Support Vector Machines (SVM) is an approximate implementation of structural risk minimization (SRM) principle. It creates a classifier with minimized Vapnik-Chervonenkis (VC) dimension. SVM minimizes an upper bound on generalization error rate. Error rate is bounded by sum of the training vectors. Consider problem of separating set of training vectors belonging to two classes, e.g., image retrieval problem, +1 denotes positive example, -1 denotes negative example.

$$\{xi, yi\}Ni=1,\ yi =+1/-1 \quad \text{.....(3)}$$

Where $\vec{x}$ is an input pattern, e.g., feature vector in image retrieval, for ith example and yi is label. If two classes are linearly separable, hyper plane that does separation is:

$$wT\vec{x} + b = 0 \quad \text{.....(4)}$$

Where $\vec{x}$ an input vector, w is a weight vector, and b is a bias. The goal of a support vector machine is to find parameter wo and bo for a optimal hyper plane to maximize the distance between the hyper plane and the closest data point:

$$woT\vec{x} + bo \geq 0 \text{ for } yi = +1 \quad \text{.....(5)}$$

$$woT\vec{x} + bo \leq 0 \text{ for } yi = -1 \quad \text{.....(6)}$$

For a given wo, and bo, distance of a point $\vec{x}$ from optimal hyper plane defined in equation (5) and (6) is d(wo, bo, $\vec{x}$) $=|woT\vec{x} + bo| \ / \ ||wo|| \quad \text{.....(7)}$

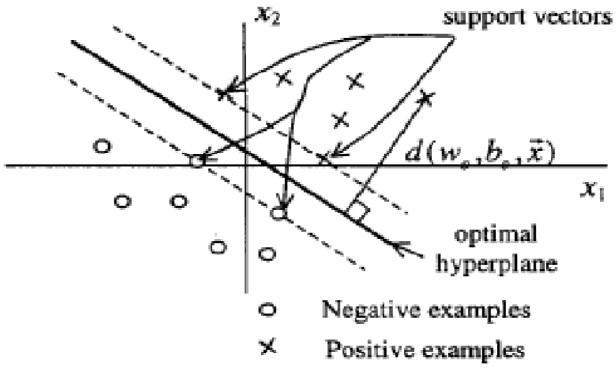


Fig. 3: Illustration of the idea of an optimal hyper plane for linearly separable patterns and definition of distance

A linear separable example in 2D is illustrated in Figure 3. If two classes are non-linearly separable, input vectors should be nonlinearly mapped to a high dimensional feature space by an inner-product kernel function. This hyper plane is optimal in sense of being a maximal margin classifier with respect to training data. Distance from hyper plane determined by support vectors can be used to measure how much an example belonging to one class is different from other class. This motivates us to use SVM for automatically generating preference weights for relevant images.

V. EXPERIMENTAL RESULTS

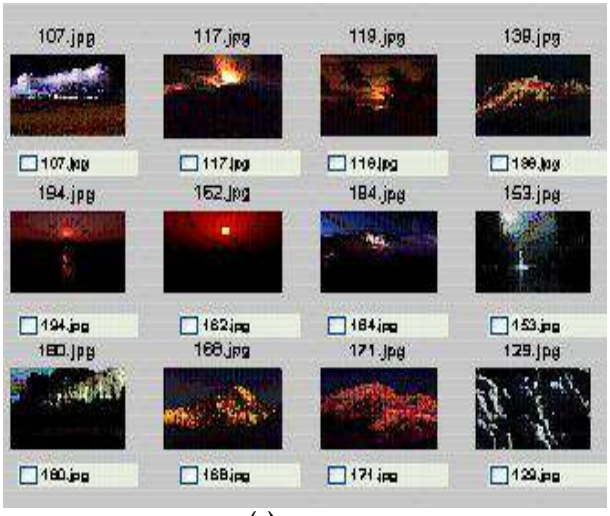
Using of MATLAB 2007b and Postgre SQL 8.3, experimental results are as shown below: First Query is given by example image which is selected from list box or allocated path, i.e. user select cloudy image as Fig. 4. Based on this example image, total 36 images using color feature are retrieved. Here, user has given 10 positive feedbacks for relevant images. Based on these relevance feedback images (SVM is used), total relevant images are 21 as user perception from 31 images. Total cloudy images are 30 in a 100 images database. Color based image retrieval's relevant images efficiency is (10/30) 33.33% (see Fig. 5(a)(b)(c)) and relevant images based on SVM is (21/30) 70% (see Fig 6(a)(b)(c)).

Fig. 4. Query by example

Different users select same 107.jpg example image and results are as TABLE I and Fig. 7. Efficiency of relevant images using SVM is also better than content based relevant images in 1000 images database (119.jpg, 441.jpg, 464.jpg, 762.jpg examples of TABLE II). Survey of 25 users, average relevant images efficiency using SVM is 78.6% which is better than content based relevant image using color feature (51.13%) as TABLE II.

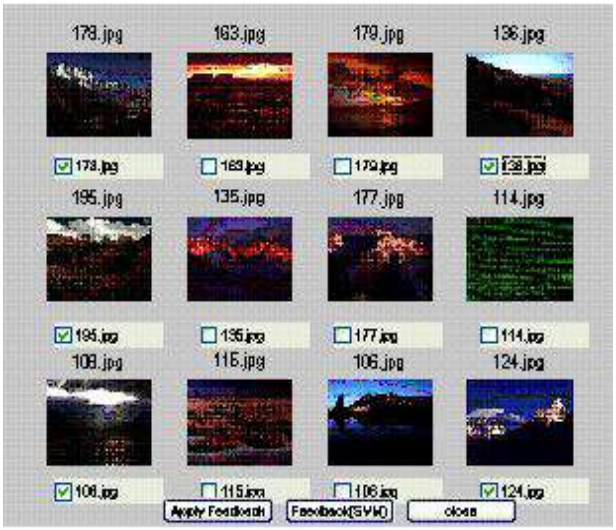
VI. CONCLUSION

The experiments were conducted with color database images. Images retrieved based on color feature. But the semantic gap in user perception and obtained output is quite usable.

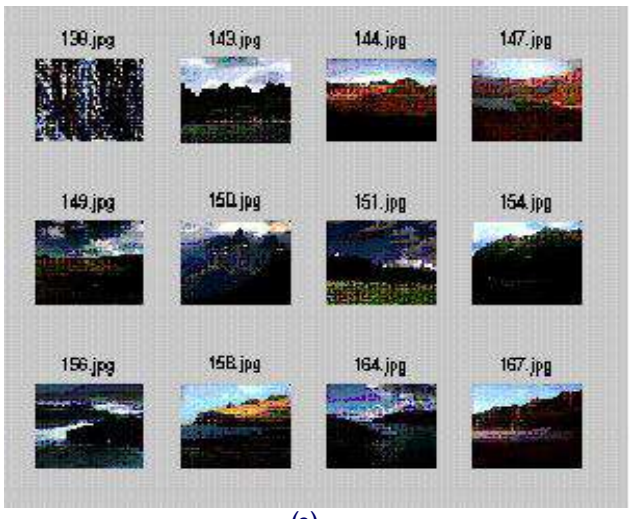


(a)

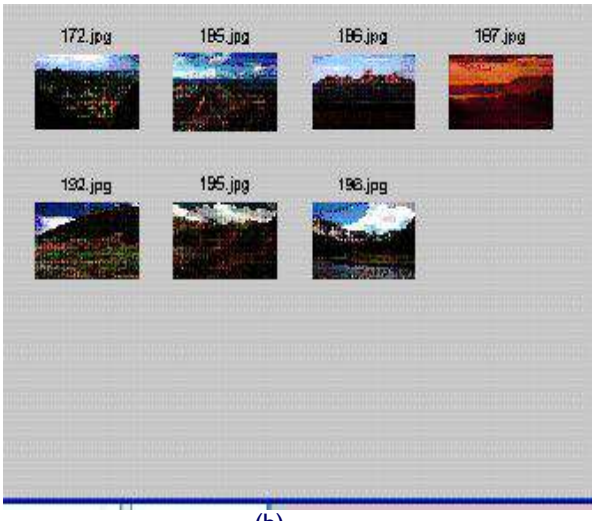
(b)



(c) Fig. 5 (a), (b) (c) Images are retrieved based on color feature



(a)



(b)

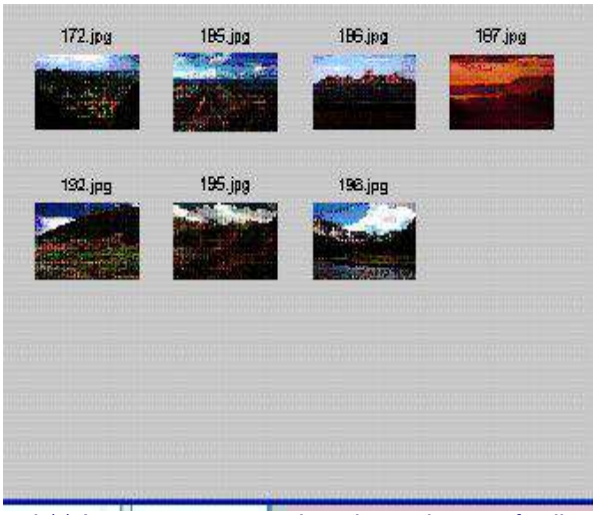


Fig. 6.(a),(b) and (c) Images are retrieve based on relevance feedback using SVM

TABLE I Different user select same 107.jpg example image

User	Example Image	Feature based image retrieve	Relevance Feedback Images using SVM	Total relevant images as example images
User 1	107.jpg	10 (33.33%)	21 (70.0%)	30
User 2	107.jpg	6 (50%)	9 (75%)	12
User 3	107.jpg	21 (52.5%)	35 (87.5%)	40
User 4	107.jpg	19 (73.07%)	22(86.41%)	26
User5	107.jpg	3 (42.85%)	5 (71.42%)	7
User 6	107.jpg	9 (60%)	12 (80%)	15
User 7	107.jpg	3 (30%)	7 (70%)	10
User 8	107.jpg	6 (30%)	15 (75%)	20
User 9	107.jpg	9 (30%)	25 (83.33%)	30
User 10	107.jpg	11 (36.67%)	25 (83.33%)	30
User 11	107.jpg	10 (33.33%)	27 (90%)	30

Table II - average Efficiency of relevant images (%) based on color feature and RF (SVM)

User	Example Image	Feature based image retrieve	Relevance Feedback Images using SVM	Total relevant images as example images
User1	107.jpg	10(33.33%)	21(70.0%)	30
User2	100.jpg	9(47.36%)	15(78.94%)	19
User3	441.jpg	7(20.58%)	22(64.7%)	34
User4	119.jpg	5(38.46%)	12(92.30%)	13
User5	464.jpg	10(50%)	15(75%)	20
User6	762.jpg	7(41.17%)	14(82.35%)	17
User7	Brick_1.jpg	11(84.6%)	12(92.3%)	13
User8	Water_6.jpg	5(41.66%)	11(91.66%)	12
User9	100.jpg	17(37.7%)	23(51.11%)	45
User10	100.jpg	7(70%)	8(80%)	10
User11	100.jpg	12(80%)	13(86.66%)	15
User12	100.jpg	5(62.5%)	6(75%)	8
User13	100.jpg	7(31.8%)	19(86.36%)	22
User14	107.jpg	6(50%)	9(75%)	12
User15	107.jpg	21(52.5%)	35(87.5%)	40
User16	107.jpg	15(57.69%)	22(86.41%)	26
User17	107.jpg	3(42.85%)	5(71.42%)	7
User18	107.jpg	9(60%)	12(80%)	15
User19	107.jpg	3(30%)	7(70%)	10
User20	107.jpg	6(30%)	15(75%)	20
User21	107.jpg	9(30%)	25(83.33%)	30
User22	100.jpg	9(47.36%)	13(68.42%)	19
User23	107.jpg	11(36.67%)	25(83.33%)	30
User24	107.jpg	10(33.33%)	27(90%)	30
User25	100.jpg	5(30%)	11(73.33%)	15
Average		51.23%	78.60%	

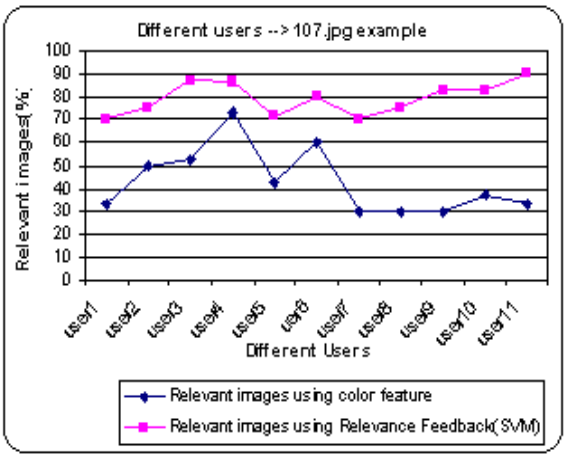


Fig. 7. Graph for different user → same example image

Using of relevance feedback with SVM, results are more efficient as user perception. SVM classification can be even better if the feature vector used in more relevant to images.

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The Synergy of Artificial Intelligence and the Internet of Things: Transforming Connectivity and Intelligence

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Abstract: Artificial Intelligence (AI) and the Internet of Things (IoT) represent two powerful technological forces that, when combined, have the potential to revolutionize numerous aspects of our daily lives. This research article explores the transformative impact of AI on the IoT domain, examining how AI techniques enhance connectivity, intelligence, and decision-making capabilities within IoT systems. Through a comprehensive analysis of current research, applications, and future trends, this article illuminates the synergistic relationship between AI and IoT, offering insights into its implications for various industries and society as a whole.

I. INTRODUCTION

The convergence of AI and IoT has paved the way for a new era of connected intelligence, where devices can autonomously collect, analyze, and act upon vast amounts of data in real-time. This section provides an overview of AI and IoT technologies, highlighting their respective capabilities and discussing the potential benefits of their integration.

IoT and AI

The IoT ecosystem encompasses a vast network of interconnected devices embedded with sensors, actuators, and software, enabling them to collect, exchange, and act upon data in real-time. These devices span a wide array of applications, including consumer electronics, industrial machinery, healthcare equipment, agricultural sensors, smart infrastructure, and more. AI, on the other hand, refers to a set of technologies that enable machines to simulate human intelligence, encompassing machine learning, natural language processing (NLP), computer vision, robotics, and other cognitive computing techniques. AI algorithms can analyze vast amounts of data, recognize patterns, make predictions, and even learn from experience, thereby enabling intelligent decision-making and automation.

Synergies between AI and IoT

The integration of AI with IoT creates synergies that amplify the capabilities of both technologies. IoT devices generate massive volumes of data, but without intelligent processing, this data may remain underutilized. AI algorithms can analyze IoT data streams in real-time, extracting valuable insights, detecting anomalies, predicting trends, and triggering automated responses. Conversely, IoT provides AI with rich sources of data for training and continuous learning, enhancing the accuracy and efficacy of AI models. The symbiotic relationship between AI and IoT enables smarter, more autonomous systems that can adapt and respond to changing environments and user needs dynamically.

II. TRANSFORMING INDUSTRIES

1. Smart Homes:

AI-powered IoT devices are revolutionizing how people interact with their homes. Smart assistants like Amazon Alexa, Google Assistant, and Apple's Siri utilize AI to understand natural language commands, control connected devices, and provide personalized recommendations. Smart home ecosystems encompass a diverse range of devices, including smart thermostats, lighting systems, security cameras, appliances, and entertainment systems, all interconnected and controllable through centralized hubs or voice commands. AI algorithms analyze user preferences, habits, and environmental data to optimize energy usage, enhance comfort, and improve security. For example, smart thermostats can learn users' schedules and preferences, adjusting temperature settings accordingly to maximize energy efficiency. Similarly, AI-powered security cameras can distinguish between intruders, pets, and false alarms, reducing the incidence of false alerts and enhancing home security.

2. Industrial Automation:

In industrial settings, AI-driven IoT solutions are driving unprecedented levels of automation, efficiency, and predictive maintenance. IoT sensors embedded in machinery and equipment collect real-time data on performance, temperature, vibration, pressure, and other parameters. AI algorithms analyze this data to detect anomalies, predict potential failures, and optimize maintenance schedules, thereby minimizing downtime, reducing operational costs, and maximizing productivity. AI-powered predictive maintenance enables proactive equipment maintenance based on data-driven insights, rather than reactive repairs after breakdowns occur. By predicting equipment failures before they happen, organizations can schedule maintenance activities during planned downtime, avoid costly unplanned outages, and extend the lifespan of critical assets.

3. Healthcare:

In the healthcare sector, AI-powered IoT devices are transforming patient care, diagnosis, treatment, and healthcare delivery. Wearable devices equipped with biosensors can continuously monitor vital signs, detect abnormalities, and transmit real-time data to healthcare providers for remote monitoring and intervention. AI algorithms analyze this physiological data to identify patterns indicative of health risks or disease progression, enabling early diagnosis, personalized treatment plans, and timely interventions. Remote patient monitoring systems powered by AI and IoT enable patients with chronic conditions to receive continuous care and support outside traditional healthcare settings. These systems can alert healthcare providers to potential health issues, enable timely interventions, and empower patients to take proactive measures to manage their health effectively.

4. Transportation and Logistics:

In the transportation and logistics industry, AI-powered IoT solutions are optimizing fleet management, route optimization, predictive maintenance, and supply chain visibility. IoT sensors installed in vehicles, shipping containers, warehouses, and distribution centres collect real-time data on location, speed, fuel consumption, cargo condition, and environmental factors. AI algorithms analyze this data to optimize route planning, reduce fuel consumption, minimize delivery times, and enhance overall operational efficiency. Predictive maintenance algorithms can identify potential issues with vehicles or equipment before they lead to breakdowns, enabling proactive maintenance and minimizing disruptions to transportation operations.

5. Agriculture:

In agriculture, AI-driven IoT solutions, often referred to as precision agriculture or smart farming, are revolutionizing crop monitoring, irrigation management, pest control, and yield optimization. IoT sensors deployed in fields collect data on soil moisture, temperature, humidity, nutrient levels, and crop health. AI algorithms analyze this data to generate actionable insights for farmers, enabling them to make data-driven decisions about planting, irrigation, fertilization, and pest management. For example, AI-powered drones equipped with cameras and sensors can survey large agricultural fields, identify areas of stress or disease in crops, and target interventions more precisely, reducing the need for chemical inputs and improving crop yields.

III. ADDRESSING CHALLENGES AND CONCERNS

While the convergence of AI and IoT offers immense opportunities for innovation and efficiency, it also raises significant challenges and concerns that must be addressed:

1. Data Privacy and Security:

The proliferation of IoT devices generates vast amounts of sensitive data, raising concerns about data privacy, security, and confidentiality. Unauthorized access to IoT devices or data breaches could compromise personal privacy, intellectual property, or critical infrastructure.

2. Interoperability:

The IoT landscape is fragmented, with numerous proprietary protocols, standards, and communication protocols, leading to interoperability challenges. AI-powered IoT solutions must seamlessly integrate with existing systems and platforms to unlock their full potential and deliver value across diverse use cases.

3. Ethical Considerations:

The use of AI algorithms in IoT systems raises ethical considerations related to algorithmic bias, transparency, accountability, and fairness. AI-driven decision-making processes must be transparent, explainable, and accountable to ensure that they align with ethical principles and societal values.

4. Regulatory Compliance:

The rapid evolution of AI and IoT technologies outpaces the development of regulatory frameworks and standards, posing challenges for compliance, governance, and risk management. Policymakers, regulators, and industry stakeholders must collaborate to develop robust governance frameworks, standards, and best practices to ensure the responsible and ethical deployment of AI-powered IoT solutions.

5. Skills Gap and Workforce Displacement:

The integration of AI with IoT requires specialized skills in data science, machine learning, cybersecurity, and IoT technologies. Addressing the skills gap and workforce displacement requires investments in education, training, and upskilling programs to equip individuals with the necessary competencies to thrive in the AI-driven economy.

Enhancing Connectivity with AI: AI algorithms play a crucial role in optimizing connectivity within IoT ecosystems. This section explores how AI-driven approaches such as machine learning and deep learning enable devices to communicate more efficiently, adapt to dynamic network conditions, and self-organize in complex environments. Examples from smart cities, transportation systems, and industrial IoT illustrate the impact of AI on enhancing connectivity and scalability.

Empowering Intelligence in IoT Systems: AI empowers IoT devices with advanced intelligence, enabling them to perform complex tasks, make informed decisions, and learn from experience. This section examines how AI techniques such as natural language processing, computer vision, and predictive analytics enable IoT devices to perceive and understand their surroundings, anticipate user needs, and autonomously respond to changing conditions. Case studies from healthcare, agriculture, and home automation demonstrate the transformative potential of AI-driven intelligence in diverse IoT applications.

Enabling Data-driven Decision Making: AI algorithms extract actionable insights from IoT-generated data, enabling data-driven decision-making processes across various domains. This section explores how AI-powered analytics platforms process and analyze massive datasets in real-time, uncovering hidden patterns, trends, and anomalies to support predictive maintenance, resource optimization, and risk management initiatives. Examples from energy management, retail, and environmental monitoring showcase the role of AI in driving informed decision-making and operational efficiency in IoT deployments.

Challenges and Future Directions: Despite the significant progress made in AI-enabled IoT systems, several challenges remain, including privacy concerns, security vulnerabilities, and interoperability issues. This section discusses these challenges and proposes potential solutions to address them. Furthermore, it outlines emerging trends and future directions in AI-driven IoT research, such as edge computing, federated learning, and autonomous IoT systems.

Implications for Industry and Society: The integration of AI and IoT has far-reaching implications for various industries, including healthcare, manufacturing, agriculture, and smart cities. This section examines the potential benefits of AI-driven IoT solutions, such as improved operational efficiency, enhanced safety, and personalized user experiences. Moreover, it discusses the societal impact of AI-enabled IoT applications, including job displacement, ethical considerations, and digital divide concerns.

IV.CONCLUSION

In conclusion, the convergence of AI and IoT presents a paradigm shift, not just in the technological landscape, but in how we interact with the world around us. AI's analytical muscle, when combined with the vast data streams of IoT devices, becomes a powerful brain for our increasingly connected infrastructure. This translates to real-world benefits, like optimized traffic flow in smart cities or predictive maintenance in industrial settings. The potential applications extend far beyond these initial examples, promising a future brimming with innovation and sustainable practices. As AI and IoT continue to evolve, we can expect a wave of advancements that not only make our world smarter but also more efficient and environmentally responsible. The limitations lie not in the technology itself, but in our imagination to harness its potential for a better future.

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Securing IoT Healthcare Data Using Machine Learning Techniques

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Abstract: The internet of Things has become a crucial technology, enabling the interconnection of everyday devices like home appliances, medical equipment and vehicles. However, the sensitive data handled by IoT systems, particularly in the healthcare sector, requires robust security measures to prevent tampering or theft. Detecting security threats in IoT environments requires sophisticated techniques. Different machine learning algorithms are used to identify the attacks in IoT network traffic and predict snooping behavior based on unidentified patterns. This paper proposed a method to identify network traffic attacks by employing different strategies utilizing the NT-ToN-IoT dataset. The classifier utilized Naïve Bayes(NB), Random Forest(RF), Support Vector Machine, Artificial Neural Network. These algorithms favoured over centralized methods to construct streamlined security system for IoT devices. Prior to analysis the dataset underwent preprocessing to eliminate irrelevant or missing data. Following this, a feature engineering approach is applied to extract crucial features. The results from applying each classifier demonstrated a significant maximum classification accuracy of 98% achieved by the RF model.

Keywords: IoT (Internet of Things), ML (Machine Learning), RF(Random Forest), ANN (Artificial Neural Network)

I. INTRODUCTION

Integration of the Internet of Things (IoT) in healthcare significantly improved monitoring of patient, cost reduction and innovation in the patient care i,e it has provide various numerous opportunities. However the security and privacy of healthcare data remain critical concerns due to the complexity and heterogeneity of IoT devices, networks and systems. Some of the key challenges are

1. Data Privacy and Confidentiality: Though there is a need to protect massive health data generated by IoT devices from unauthorized access, misuse or breach, it's difficult to ensure compliance with data privacy regulations such as GDPR and HIPAA while simultaneously allowing for data sharing and analysis in healthcare applications.
2. Distributed and Heterogeneous Nature of IoT: Healthcare systems' entire ecosystem has many IoT devices that are decentralized and heterogeneous in nature hence security policies that are constant across all these different IoT devices poses a challenge.
3. Vulnerability to Cyber Attacks: The presence of limited computational resources in IoT devices makes them susceptible to a variety of cyber threats including malware, DDoS attacks and man-in-the-middle attacks. However, ensuring the safety of these devices along with their communication channels can be tough.
4. Data Integrity and Authenticity: Health data gathered from IoT gadgets must be both authentic and have integrity to facilitate reliable decision-making processes as well as patient care. Nevertheless, the integrity of the information may be compromised through tampering with data, spoofing or injection attacks.
5. Scalability and Interoperability: In addition to scalable solutions for security that can handle increased number of Internet of Things (IoT) devices as well as growing volumes of information being generated.

6. Machine Learning Vulnerabilities: ML algorithms used for security and data analysis in healthcare can be susceptible to adversarial attacks, data poisoning, and model extraction attacks, which can compromise their effectiveness and lead to incorrect decisions or data breaches.

In [1], the author presents a model for the Secured Big Data analytics using Edge–Cloud architecture (SBD-EC), which aims to provide distributed and timely computation of a decision-oriented medical system. In order to improve trust levels for integrated health sensors, a model of the IoMT with Big Data Analytics using Edge Cloud architecture has been developed. The computed cost function using greedy heuristics decreases the data retrieval rate based on mobile edges and improves the management of big data analytics. In addition, it is using cost effective security calculations to reduce overheads at the edge of the Internet of Things network for sinks and mobile phones. However, it lacks with the scalability as the number of mobile users increases and connects to multiple clouds.
In order to ensure the security of medical data, [2] the authors propose a decentralized cloud environment using blockchain technology. It provides electronic signature systems for the processing of data. Moreover, the technology of Blockchain allows for data to be divided in blocks and timestamps are created with observation data that has been kept or updated. For the handling of data, it offers digital signature systems. Compared to existing schemes, the proposed work shall improve performance in terms of cost and time.When crafting and deploying IoT solutions, it's essential to prioritize the management of data and information to mitigate potential security risks. Safeguarding data is a primary focus for network devices. Security takes precedence in the IoT domain because unauthorized access or tampering with IoT devices, especially in critical applications, poses significant risks to human life [4].

The IoT environment deals with many private and sensitive health data that must be kept safe from tampering or theft. If safety precautions are not implemented, these dangers and assaults against IoT devices in the health sector might completely destroy this industry. Detecting security threats to an IoT environment requires sophisticated technology; these attacks can be identified using machine learning (ML) techniques, which can also predict snooping behavior based on unidentified patterns. The contributions of our technology are outlined below, as previously elaborated:

The paper proposes a machine learning based approach to detect attacks on IoT network traffic. The researchers utilized the NF-ToN-IoT dataset which contains 1,379,274 network flow samples with 80.4% being attack samples and 19.6% benign. Proposing an optimal Machine Learning (ML) model for intrusion detection in cyber-attacks entails utilizing the NF-ToN-IoT dataset and applying classification techniques such as Random Forest (RF), Support Vector Machine (SVM), Artificial Neural Network (ANN), and Naive Bayes (NB) algorithms.

The subsequent sections of this research are structured as follows: Literature Review: Section II summarizes the existing literature on intrusion detection utilizing machine learning and deep learning techniques with diverse datasets. Model Architecture: Section III offers a detailed explanation of the proposed methodology and architecture. Implementation and Result: Section IV presents the implementation and Results of the machine learning algorithms utilized in this study, along with the results obtained from each. Results and Discussion: Finally, Sections V present the conclusion drawn from this research and outline potential directions for future work.

II. LITERATURE REVIEW

The study [5] primarily investigated the impact of machine learning on flow-based anomaly detection in Software-Defined Networking (SDN). The authors introduced two distinct approaches to intrusion detection systems, leveraging deep neural networks (DNN) and machine learning. In the first approach, the NSL-KDD dataset was utilized, and feature selection using the Random Forest (RF) classifier yielded an accuracy rate of 82%. Conversely, in the second approach, when combined with DNN-based IDS, the accuracy increased to 88%.

In [6] the authors introduce a novel deep learning-based intrusion detection system tailored for IoT networks and devices. The [7] authors proposed a framework for Structural Health Monitoring (SHM) utilizing IoT technologies with intelligent and consistent observation. Additionally, they outlined a strategy for data routing in collaboration with big data analytics. This framework demonstrated improved scalability and low latency performance. In the realm of smart medical systems, the Internet of Medical Things (IoMT), a subset of IoT, serves various functions including patient remote monitoring, medication management, and treatment assessment. However, ensuring the confidentiality of patient records within medical systems is critical within an IoMT environment. Thus, safeguarding confidential health information (PHI) stands as a vital aspect of healthcare data protection. The authors of [8] presented LPME, a lightweight privacy-preserving medical diagnosis mechanism designed for edge computing. LPME remains the Extreme Gradient Boosting (XGBoost) model within an edge-cloud framework and leverages encrypted model parameters rather than local data to reduce computational burdens. Additionally, this approach ensures secure diagnosis at the edge, safeguarding sensitive data while enabling prompt detection.

The authors of [9] proposed an algorithm designed to forecast patients' present health condition while maintaining continuous professional monitoring. They explored additional parameters and methodologies, such as K-nearest neighbor, logistic regression, support vector machines, random forests, and Adaboost classifiers, employing the UCI heart disease dataset. Their endeavor led to the creation of a tool beneficial for patients, healthcare professionals, and the healthcare system overall. This decision-making method achieved an impressive accuracy level of 93%.

In [10], IoMT systems are characterized by their management of substantial data volumes crucial for illness diagnosis, prediction, and monitoring. Due to limited storage and processing capabilities of certain IoMT devices, medical data regarding patients often requires transmission to cloud storage and external computer devices. However, such an

approach introduces security and privacy risks. To mitigate these challenges, a solution is proposed employing a swarm neural network-based approach for intruder identification within IoMT. This model aims to effectively evaluate healthcare data and detect intruders during data transmission. Performance evaluation conducted using the NF-ToN-IoT dataset revealed an accuracy rate of 89.0% for the proposed model.

III. MODEL ARCHITECTURE

In this phase, the models were trained using chosen features that depicted attack behaviors. Afterwards, these models were tested by comparing test data with the training data to gauge their accuracy. A model was considered ready only if the accuracy test produced satisfactory results; otherwise, it underwent retraining until an acceptable level of accuracy was attained. To compare performance, algorithms such as Artificial Neural Network (ANN), Random Forest (RF), Support Vector Machine (SVM), and Naive Bayes (NB) classification techniques were employed.

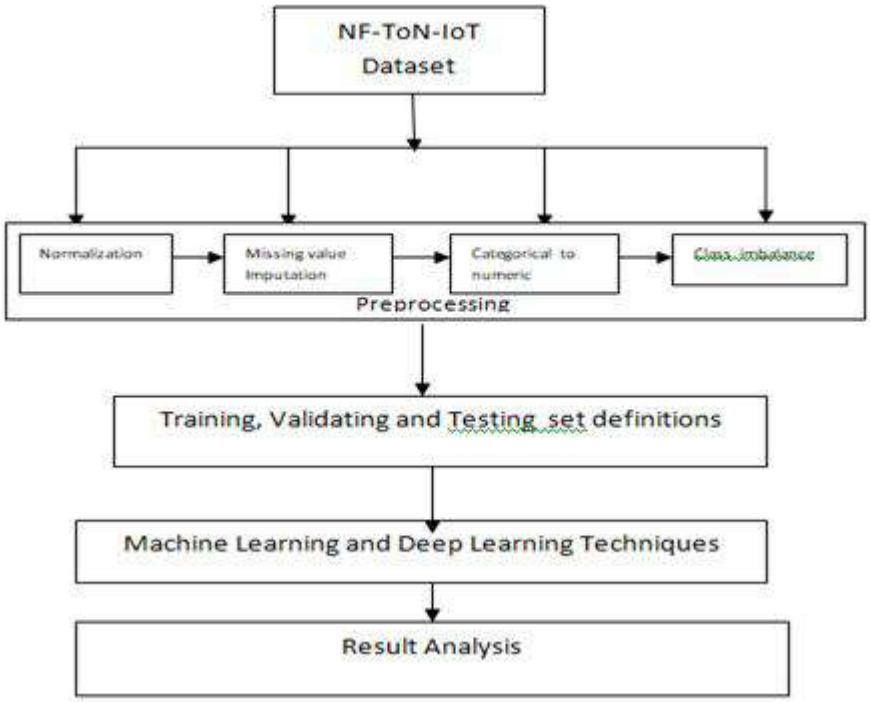

Fig 1. Architecture of the proposed framework

As illustrated in Fig.1, our framework initiates with the acquisition of the NF-ToN-IoT dataset. Subsequently, a crucial step involves data pre-processing, which encompasses normalization, imputation of missing values, conversion of categorical attributes to numerical ones, and addressing class imbalance. Following pre-processing, the dataset is divided into three distinct sets: a training set (70%), a validation set (15%), and a testing set (15%). The training set is utilized for training the ML models (namely, NB, RF, ANN, and SVM). Post-training, the models carry out predictions on the testing set to ascertain their accuracy in generating results. Various evaluation parameters such as accuracy, precision, recall, and F1 score are employed for assessment. Data Pre-processing is a process of converting unprocessed data into a format that can be read, accessed and analyzed. Prior to employing ML and DL algorithms, pre-processing plays a crucial role in ensuring or enhancing the overall performance or accuracy of any system. During the pre-processing phase, data is cleaned to serve a variety of purposes. Some ML algorithms require data to be in a specific format to ensure compatibility with various algorithms. To tackle these issues, the following pre-processing steps were undertaken:

i. The NF-ToN-IoT dataset utilized in this research posed several challenges, including missing values, categorical attributes, and class imbalance.
ii. Upon examination, it was determined that the NF-ToN-IoT dataset did not contain any missing values. Consequently, the dataset was affirmed to be of high quality and value.
iii. The NF-ToN-IoT dataset includes various categorical features, necessitating the conversion of these categorical attributes into numerical values. This conversion process was executed using Label Encoder
iv. Class imbalance occurs when certain classes are significantly more prevalent than others. In such cases, standard classifiers often neglect the minority classes as they are overshadowed by the abundance of the majority classes.
To tackle this issue, the SMOTENN (Synthetic Minority Over-sampling Technique and Edited Nearest Neighbors) method was implemented to balance the classes within the dataset. The selected features play a crucial role in enhancing the performance of the intrusion detection task. Therefore, the seven features outlined in Table IV were carefully chosen as they were deemed most influential in facilitating the classification process. Increasing the number of features beyond these would not significantly impact the classification process. By removing non-essential features, the risk of over fitting is reduced, computational speed is improved, and model accuracy is enhanced.

IV. IMPLEMENTATION AND RESULT

In this paper, the models utilized were trained on an NF-TON-IoT dataset. Subsequently, a set of data extracted from these models was employed to evaluate the accuracy of the trained models by accurately categorizing all data into its

respective labels. Accuracy, Precision, F1-Score, and Recall are the metrics employed to assess the effectiveness of the algorithms. Each metric can be defined as follows:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

$$\text{Precision} = \frac{TP}{TP + FP}$$

$$\text{Recall} = \frac{TP}{TP + FN}$$

$$\text{F1 Score} = \frac{2 \times (\text{Precision} \times \text{Recall})}{\text{Precision} + \text{Recall}}$$

Table 1: Comparison of the performance of the 5 different classifier on the NF-ToN Dataset

Classifier	Accuracy	Precision	Recall	F1 Score
SVM Classifier	0.8234	0.8943	0.8234	0.8027
NB Classfier	0.7825	0.8027	0.7925	0.7751
RF classifier	0.9839	0.9838	0.9839	0.9838
ANN classifier	0.9299	0.9302	0.9299	0.9298

Table 1 illustrates that the Random Forest (RF) classifier achieved the highest accuracy (0.98), followed by the Artificial Neural Network (ANN) model (0.93). Conversely, the Support Vector Machine (SVM) model exhibited a lower accuracy of 0.82, while the Naïve Bayes (NB) classifier achieved the lowest accuracy at 0.78. In terms of other metrics such as precision and recall, they are summarized by the F1 score. The Random Forest (RF) Model obtained the highest F1 score (0.98), followed by the Artificial Neural Network (ANN) 0.93, respectively. The Support Vector Machine (SVM) model yielded a lower F1 score (0.80), whereas the Naïve Bayes (NB) classifier achieved the lowest F1 score at 0.77.Fig. 2 depicts a visual representation of the performance of the classifiers in terms of accuracy, precision, recall, and F1 score.

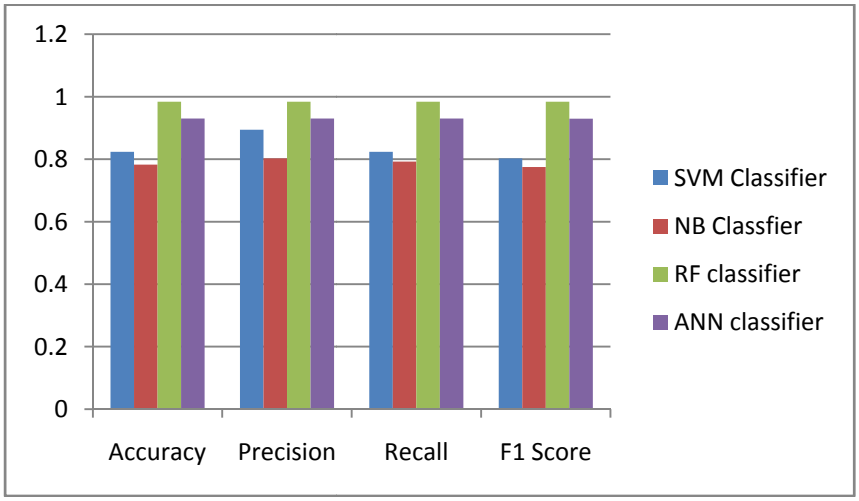

Fig 2: Comparison of performance of the different classifiers on the NFToN-IoT dataset.

V. CONCLUSION

The Internet of Things (IoT) environment encompasses a vast amount of private and sensitive health data that must be safeguarded against tampering or theft. Without adequate safety measures, these threats and attacks against IoT devices within the healthcare sector could potentially devastate the industry. Such attacks are often motivated by financial gain, whether through the sale of stolen data or by holding victim data hostage for ransom. Embracing technology, particularly IoT, in the healthcare sector represents a significant step forward in providing enhanced services for patients and facilitating communication and the sharing of crucial files or tasks. Hence, the implementation of IoT in healthcare is imperative. Indeed, the utilization of IoT presents various privacy and security concerns. Without proper safety measures, threats and attacks against IoT devices within the healthcare sector pose a significant risk to the industry's integrity. These attacks often aim for financial gain, either through the sale of stolen data or by extortion. Therefore, implementing a robust security system alongside IoT deployment becomes paramount. In this study, five different classifiers were employed to forecast potential attacks within IoT services. The NF-ToN-IoT dataset was chosen for this purpose, and underwent pre-processing before being partitioned into training and testing data sets. Upon evaluation, it was observed that the Random Forest (RF) model outperformed others, achieving the highest accuracy (0.98) and F1 score (0.98). Following with the Artificial Neural Network (ANN) model ranking second in performance. Future endeavors will focus on experimenting with models employing diverse algorithms and datasets. Additionally, there are plans to explore combinations of multiple deep and machine learning algorithms to develop models yielding the highest accuracy rates and minimizing loss rates. This pursuit aims to achieve optimal results in classifying attacks on IoT devices within the electronic health sector. Furthermore, there will be a comparison between different datasets and algorithms to assess their effectiveness.

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Detecting Diabetic Foot Ulcer with CNN and CapsNet: A Comparative Investigation of Model Performance

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Abstract: Diabetic foot ulcer (DFU) poses a substantial health risk to patients and healthcare resources, necessitating accurate and efficient diagnosis. This study harnesses the power of convolutional neural networks (CNNs) and capsule networks (CapsNets) to redefine DFU classification, aiming for enhanced accuracy and efficiency. By integrating state-of-the-art deep learning architectures, we address the limitations of existing diagnostic methodologies. Through comprehensive data pre-processing, feature extraction, and classification, our system seeks to improve diagnostic precision and contribute to better patient outcomes. A comparative analysis between CNNs and CapsNets evaluates key performance metrics, guiding future advancements in medical image diagnosis. Furthermore, computational timing assessments ensure practicality in medical settings. This research underscores the potential of deep learning in revolutionizing medical image diagnosis and emphasizes the critical role of accurate DFU detection in diabetic care.
Keywords: Diabetic Foot Ulcers (DFUs), Deep Learning, Convolutional Neural Networks (CNNs), Capsule Networks (CapsNets), Medical Image Diagnosis.

I. INTRODUCTION

Diabetic foot ulcers (DFUs) present a pressing challenge at the intersection of healthcare and technology, demanding precise and efficient diagnostic solutions. This study endeavours to redefine the accuracy and efficiency of DFU classification by integrating Convolutional Neural Networks (CNNs) and Capsule Networks (CapsNets). In contemporary medical image diagnosis, DFUs stand as a focal point where technological innovation meets healthcare imperatives. Timely and accurate diagnosis of DFUs is imperative to mitigate risks and facilitate effective treatment interventions.

Presently, diagnostic methodologies rely on sophisticated deep learning models like Mask Region-based Convolutional Neural Networks (Mask R-CNN), tailored for semantic segmentation of DFU wounds. However, these models are beset by inherent limitations, including susceptibility to misinterpretations leading to false positives and false negatives. This research responds innovatively to the shortcomings of existing DFU diagnostic approaches, prioritizing both accuracy and efficiency. Through the adept utilization of advanced neural network architectures, the study seeks to surmount the challenges posed by the current diagnostic paradigm, offering a nuanced and precise approach to DFU diagnosis. A comparative analysis between CNNs and CapsNets not only aims to enhance accuracy but also delves into the intricate differences in their performance. The overarching objective is to significantly contribute to the advancement of medical image diagnosis, particularly within the realm of DFUs, by presenting a comprehensive and evaluative framework that effectively addresses the complexities of this critical healthcare challenge.

II. RELATED WORD

In recent years, the intersection of deep learning and medical image analysis has garnered significant attention, leading to advancements in disease diagnosis and treatment planning. Various studies have explored the application of convolutional neural networks (CNNs) and other deep learning techniques in medical image analysis, aiming to improve accuracy and efficiency. For instance, the study by [1] introduces DFUC2022, a comprehensive dataset for diabetic foot ulcer (DFU) segmentation, demonstrating the effectiveness of deep learning models in interpreting clinical delineations for accurate DFU segmentation. Similarly, [2] proposes a nested segmentation and multi-level classification approach for DFUs using Mask R-CNN, achieving superior performance in segmenting wounds of different severity levels. Furthermore, [3] conducts a comparative evaluation of CapsNet, CNN, and FCN for image classification tasks, shedding light on the strengths and limitations of each approach. These studies collectively highlight the growing interest and diverse methodologies employed in leveraging deep learning for medical image analysis.

Moreover, recent reviews have provided insights into the state-of-the-art techniques and challenges in medical image analysis using CNNs. For example, [4] presents a comprehensive review of CNN-based techniques for various tasks such as detection, segmentation, and classification in medical image analysis. The review emphasizes the transformative impact of deep learning in enhancing computer-aided diagnosis systems and underscores the potential for further advancements in the field. Additionally, [5] addresses the challenge of dealing with small annotated datasets in medical imaging by evaluating self-supervised pre-training methods. The study compares contrastive learning with masked autoencoder approaches, providing valuable insights into the effectiveness of different pre-training strategies for downstream tasks with limited annotated data. These reviews contribute to the understanding of the current landscape and future directions in deep learning-based medical image analysis. Furthermore, investigations into specific applications of CNNs in medical imaging have yielded promising results. For instance, [6] explores the application of CNN-based algorithms for disease diagnosis using chest X-ray images, comparing transfer learning, support vector machine classifiers, and capsule networks. The study demonstrates the efficacy of CNN-based transfer learning in handling small datasets and emphasizes the importance of network complexity and feature selection in achieving high accuracy. These findings underscore the potential of CNN-based methods in addressing the challenges of medical image classification, paving the way for improved clinical decision-making and treatment planning. Overall, the body of related work highlights the growing adoption of deep learning techniques in medical image analysis and underscores the need for further research to address existing challenges and propel the field forward.

III. DATASET

The dataset utilized in this study was sourced from publicly available repositories, including Kaggle and GitHub, ensuring accessibility and transparency in research. This dataset comprises a comprehensive collection of diabetic foot ulcer (DFU) images, facilitating the training and evaluation of Convolutional Neural Networks (CNNs) and Capsule Networks (CapsNets). The dataset encompasses a diverse array of DFU images captured under varying conditions, encompassing different lighting conditions, angles, and resolutions. This diversity ensures the robustness and generalizability of the developed models across real-world DFU scenarios. Prior to model training, meticulous curation and pre-processing of the dataset were conducted to ensure consistency and quality. Tasks such as image resizing, normalization, and augmentation were performed to enhance the models' learning capabilities and mitigate potential biases. Leveraging openly available datasets from reputable sources fosters transparency and reproducibility, laying a foundation for future research endeavours and facilitating comparisons on a standardized basis.

IV. WORKFLOW

The workflow for the proposed diabetic foot ulcer (DFU) classification system as shown in Fig. 1comprises of five stages. Firstly, in the Data Pre-processing Module, the collected dataset undergoes augmentation to enhance its diversity, encompassing random cropping, flipping, rotations, and color jittering within specified ranges. Additionally, normalization techniques are applied to standardize image sizes and handle any missing data. Subsequently, the Feature Extraction Module employs Capsule Networks (CapsNets) to capture intricate spatial relationships and pose information. This is followed by an explanation of CapsNets' routing mechanisms, elucidating how dynamic routing determines class probabilities. Moving on to the Classification Module, a detailed account of dynamic routing mechanisms within CapsNets is provided, shedding light on routing-by-agreement principles or similar techniques employed. In the Performance Evaluation Module, key metrics such as Mean Average Precision (MAP), Precision, Recall, and F1-score are succinctly explained to offer context to readers unfamiliar with these measures.

Lastly, the Visualization and Reporting Module leverages t-SNE dimensionality reduction to visualize high-dimensional data effectively, aiding in the interpretation of learned features. Furthermore, a concise overview of GRAD-CAM is provided, elucidating its role in highlighting regions of input images contributing to predicted classes.

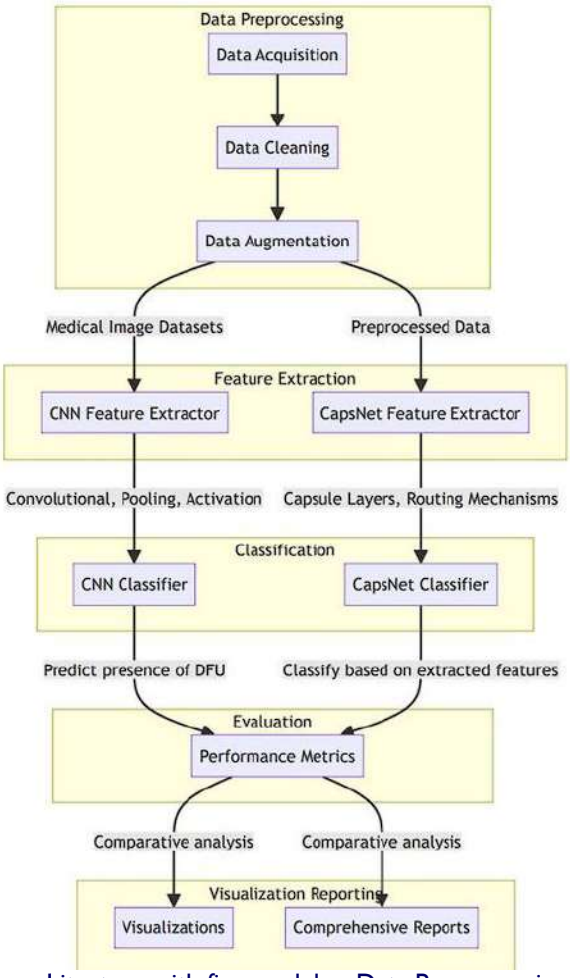

Fig. 1 The figure depicts the system architecture with five modules: Data Preprocessing, Feature Extraction, Classification, Evaluation, and Visualization Reporting.

V. METHOD

The methodology employed in this study comprises five key modules, each serving a distinct function in the development and evaluation of the Convolutional Neural Networks (CNNs) and Capsule Networks (CapsNets) for diabetic foot ulcer (DFU) classification.

A. Data Preprocessing Module

This module encompasses data augmentation and normalization procedures to enhance the robustness and generalizability of the models. Data augmentation techniques, including random cropping, flipping, rotations, and color jittering, were employed to augment the dataset and mitigate overfitting. Additionally, normalization techniques were applied to preprocess the data, ensuring consistency and facilitating model convergence.

B. Feature Extraction Module

The feature extraction module focuses on elucidating the Capsule Network (CapsNet) mechanism for capturing spatial relationships and pose information. CapsNets differ from traditional CNNs by utilizing capsules to encode various attributes of an object, facilitating better representation learning. Dynamic routing mechanisms, such as routing-by-agreement, play a crucial role in determining class probabilities by iteratively refining predictions based on agreement between capsules.

C. Classification Module

This module elaborates on dynamic routing mechanisms within CapsNets, detailing how capsules communicate and reach a consensus on class probabilities. The process involves iterative routing-by-agreement, where capsules adjust their weights based on agreement with capsules in the subsequent layer, leading to refined class predictions.

D. Performance Evaluation Module

Performance evaluation is conducted using standard metrics, including Mean Average Precision (MAP), Precision, Recall, and F1-score. These metrics provide insights into the models' effectiveness in classifying DFUs and enable comparison with existing approaches. Mathematically, these metrics are defined as follows:

1) Mean Average Precision (MAP):

$$\text{MAP} = \frac{1}{n}\sum_{k=1}^{n} P(k) \times \text{rel}(k)$$

2) Precision:

$$\text{Precision} = \frac{TP}{TP + FP}$$

3) Recall:

$$\text{Recall} = \frac{TP}{TP + FN}$$

4) F1-score:

$$\text{F1 Score} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

E. Visualization and Reporting Module

This module employs techniques such as t-SNE (t-distributed Stochastic Neighbor Embedding) for dimensionality reduction to visualize high-dimensional data and interpret learned features effectively. Additionally, Grad-CAM (Gradient-weighted Class Activation Mapping) is utilized to visualize regions of input images contributing to predicted classes, aiding in model interpretation and validation.

VI. DISCUSSIONS

This study underscores the potential of integrating Convolutional Neural Networks (CNNs) and Capsule Networks (CapsNets) for diabetic foot ulcer (DFU) classification. Comparative analysis between these architectures provides insights into their strengths and weaknesses.CNNs excel at extracting low-level features crucial for identifying DFU characteristics, leveraging hierarchical representations to capture salient patterns in images. Conversely, CapsNets encode spatial relationships and pose information effectively; enhancing DFU diagnosis by differentiating genuine cases from potential misinterpretations.The hybrid CNN-CapsNet approach showcases promise, leveraging CNNs' feature extraction and CapsNets' spatial awareness for nuanced DFU representation. Computational analysis highlights trade-offs between model efficiency and performance, with CapsNets demonstrating superior spatial relationship capture despite slightly higher computational demands.Implications extend beyond DFU diagnosis, informing hybrid architecture development for broader medical image classification. Utilizing publicly available datasets promotes transparency and encourages further research, facilitating benchmarking and driving advancements in medical image diagnosis for improved patient outcomes and healthcare delivery.

VII. CONCLUSION

This study advances medical image diagnosis, notably in diabetic foot ulcer (DFU) classification, by integrating Convolutional Neural Networks (CNNs) and Capsule Networks (CapsNets). Comparative analysis reveals CNNs' proficiency in low-level feature extraction and CapsNets' effectiveness in encoding spatial relationships. The proposed hybrid approach shows promise for improved DFU classification accuracy and efficiency. Utilizing publicly available datasets fosters transparency and drives advancements in medical image diagnosis. This research offers a promising framework for addressing critical healthcare challenges.

FUTURE ENHANCEMENT

Leveraging more sophisticated deep learning architectures, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs), could enhance the model's ability to extract intricate features from medical images, thereby improving DFU classification accuracy. Developing models capable of predicting DFU risk in specific populations, such as different ethnic, racial, and age groups, could enable tailored treatment plans, enhancing patient outcomes and reducing healthcare disparities. Exploring the integration of diverse data sources, such as electronic health records (EHRs) and wearable sensor data, could provide comprehensive insights into DFU development and progression, leading to more accurate predictive models and better-informed clinical decisions. Additionally, developing models capable of predicting disease progression and complications risk, alongside DFU classification, could enable early intervention and preventive measures, ultimately improving patient management and reducing healthcare costs. Investigating the use of federated learning and other privacy-preserving techniques could facilitate collaborative model training across multiple healthcare institutions, ensuring patient data privacy and security while leveraging larger and more diverse datasets for model development without compromising confidentiality.

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Survey on MapReduce Scheduler Algorithms in Hadoop Framework

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Abstract: Hadoop serves as a robust framework tailored for the storage and processing of vast data volumes across clusters. Its foundation lies in the Hadoop Distributed File System (HDFS) for data storage, complemented by the MapReduce paradigm for data processing. MapReduce, functioning as a parallel computing framework, operates adeptly on distributed clusters to manage large-scale data processing tasks. Within this framework, scheduling emerges as a pivotal aspect, influencing the overall system's performance and efficiency. The essence of scheduling in MapReduce lies in enhancing performance, minimizing response times, and optimizing resource allocation. This paper undertakes a systematic exploration of existing scheduling algorithms, offering a fresh classification and detailed examination of each category. Furthermore, the analysis delves into the core principles, objectives, as well as the strengths and weaknesses of these scheduling algorithms.

Index Terms: Hadoop Map reduce, Scheduling Algorithms, Resource Allocation, HDFS, Parallel Computing

I. INTRODUCTION

The Explosion of data from social media, transactions, sensors, and mobile devices is overwhelming traditional data management tools [1, 2]. This surge, characterized by volume, velocity, and variety, creates complexities in processing data for accuracy, transformation, and analysis [3]. To tackle this challenge, new platforms are needed to efficiently store, transmit, and analyze these massive and often unstructured datasets. The answer lies in parallel and distributed processing, which breaks down large tasks across multiple computers (clusters) for faster results [4]. To make this complex system user-friendly, various frameworks have been developed, simplifying big data processing for businesses and organizations. MapReduce is a programming pattern that is popular among all frameworks. Using the Map and Reduce functions of MapReduce, users do not have to worry about the details of parallelism when defining parallel processes, such as data distribution, load balancing, and fault tolerance [6]. MapReduce is used to process high volumes of data concurrently. Map and Reduce are the two functions of MapReduce. In this framework, the first step in parallel computing is to assign map tasks to various nodes and perform them on input data. Then, the final results are generated by combining the map outputs and applying the reduce function [7, 8].MapReduce is in competition with other program paradigms like Spark and Data MPI. The choice of MapReduce for investigation is based on the fact that it is high-performance open source, utilized by many large companies to process batch jobs [9,10], and is our future research area. Scheduling is the process of assigning tasks to the nodes, which is a critical factor for improving system performance in MapReduce. There are many algorithms to solve scheduling issues with different techniques and approaches. The main goal of scheduling is to increase throughput while reducing response time and improving performance and resource utilization [11,12].

Our research provides a comprehensive and up-to-date survey of MapReduce scheduling algorithms, building upon the previous systematic review conducted [13]. We employed rigorous selection criteria to analyze relevant articles published between 2017 and June 2023. This survey fills the gap in existing literature. Key objectives of this study are review existing scheduling algorithms: We analyze current algorithms, compare their functionalities, and delve into specific details of several prominent ones and Identify trends and challenges: This survey explores the current landscape of MapReduce scheduling, pinpointing both established practices and areas needing further exploration. The paper is structured as Background and Research Method: This section provides an architectural overview of MapReduce and Hadoop (Part 1) followed by a detailed explanation of our research methodology (Part 2).Regular Surveys: This section discusses and categorizes existing schedulers within Hadoop MapReduce. We also present a comparative analysis of selected algorithms. Schedulers in Hadoop MapReduce: Here, we delve deeper into the discussed schedulers and analyze the obtained results. Discussion: This section concludes the paper by summarizing our findings and highlighting potential future directions for research.

2. BACKGROUND

Hadoop, an open-source project inspired by Google's MapReduce approach, is specifically designed for distributed processing of large datasets [14]. It comprises two key components: Hadoop Distributed File System (HDFS): This acts as the storage layer for Hadoop, using a master-slave architecture with a central Name Node managing data location and multiple Data Nodes storing the actual data in a distributed fashion [15, 16].MapReduce: This is the processing engine of Hadoop. It breaks down large jobs into smaller tasks (Map and Reduce) that can be executed in parallel across multiple machines (Task Trackers) overseen by a Job Tracker [17, 18]. Figure 1 illustrates this architecture. MapReduce follows a specific execution flow (detailed in Figure 2): Map Tasks: Input data is split and processed in parallel by Map tasks, generating intermediate key-value pairs. Shuffle and Sort: These key-value pairs are shuffled and sorted based on the key.

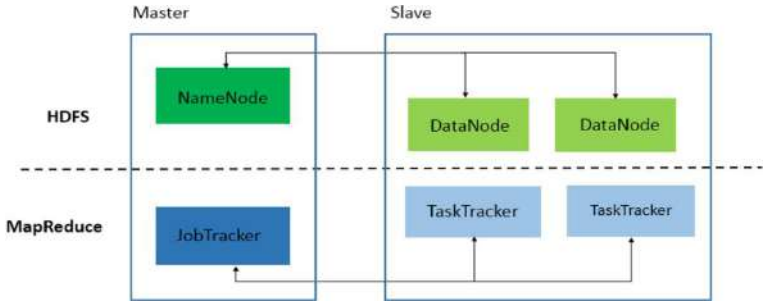

Fig 1. Hadoop Architecture

3. REGULAR SURVEYS

Our analysis aims to provide a holistic understanding of job scheduler surveys by comprehensively examining and summarizing existing literature. Ghazalietal.[23] presented an ovel classification sys-tem for job schedulers, categorizing them into three distinct groups: job schedulers for mitigating stragglers, job schedulers for enhancing data locality, and job schedulers for optimizing resource utilization. For each job scheduler within these groups, they provided a detailed explanation of their performance-enhancing approach and conducted evaluations to identify their strengths and weaknesses. Additionally, the impact of each scheduler was assessed, and recommendations were offered for selecting the best option in each category. Finally, the authors provided valuable guidelines for choosing the most suitable job scheduler based on specific environmental factors. However, the survey is not systematic and the process of selecting articles is not clear. Moreover, there is no information about the environment and the platform for implementation or simulation of the surveyed articles.

Abdallat et al. [24] focused on the topic of job scheduling algorithms in BigData Hadoop environment. The authors emphasize the importance of efficient job scheduling in processing large amounts of data in real-time, considering the limitations of traditional ecosystems. The paper provides background information on the Hadoop MapReduce framework and con-ducts a comparative analysis of different job scheduling algorithms based on various criteria such as cluster environment, job allocation strategy, optimization strategy, and quality metrics. The authors present use cases to illustrate the characteristics of selected algorithms and offer a comparative display of their details. The paper discusses popular scheduling considerations, including locality, synchronization, and fairness, and evaluates Hadoop schedulers based on metrics such as locality, response time, and fairness. However, the survey is not systematic and the process of selecting articles is not clear. Also, there is no comparison between these studies' advantages and disadvantages, and there is no information about the environment and the platform for implementation or simulation of the surveyed articles.

Hashem et al. [25] conducted a comprehensive comparison of resource scheduling mechanisms in three widely-used frameworks: Hadoop, Mesos, and Corona. The scheduling algorithms within MapReduce were systematically categorized based on strategies, resources, workload, optimization approaches, requirements, and speculative execution. The analysis encompassed two aspects: taxonomy and performance evaluation, where they thoroughly reviewed the advancements made in MapReduce scheduling algorithms.

Additionally, the authors highlighted existing limitations and identified potential areas for future research in this domain. However, the survey is not systematic and the process of selecting articles is not clear. Also, there is no information about the environment and the platform for implementation or simulation of the surveyed articles.

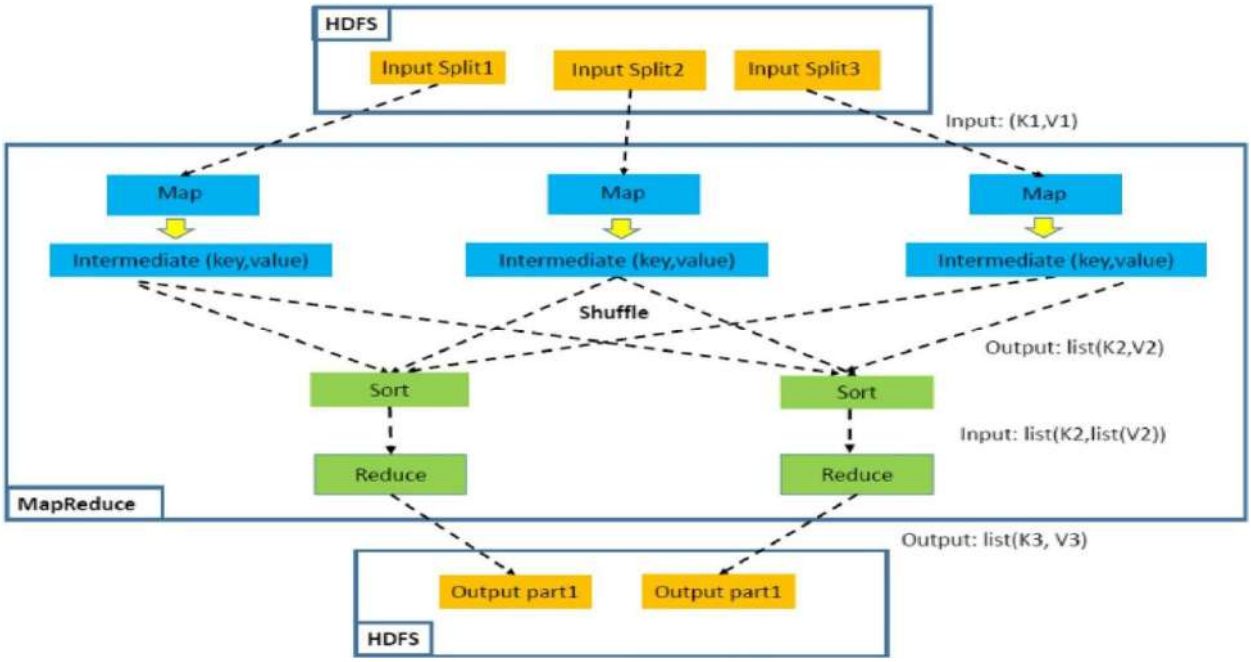

Fig 2 Map Reduce Job execution flow

Hashem et al. [25] conducted a comprehensive comparison of resource scheduling mechanisms in three widely used frameworks: Hadoop, Mesos, and Corona. The scheduling algorithms within MapReduce were systematically categorized based on strategies, resources, workload, optimization approaches, requirements, and speculative execution. The analysis encompassed two aspects: taxonomy and performance evaluation, where they thoroughly reviewed the advancements made in MapReduce scheduling algorithms. Additionally, the authors highlighted existing limitations and identified potential areas for future research in this domain

4. MAP REDUCE SCHEDULER ALGORITHMS

4.1 Schedulers in Hadoop MapReduce

We classified the schedulers into six categories:

1. Deadline-aware scfledulers;
2. DataLocality-aware scfledulers;
3. Cost-aware scfledulers;
4. Resource-aware scfledulers;
5. Makes pan-aware scfledulers;
6. Learning-aware Scfledulers

The idea of each paper has been validated by comparing the performance against existing solutions and benchmarks.

4.1.1 Deadline aware schedulers

Some Map Reduce jobs on big data platforms have dead-lines and need to be completed within those deadlines. When a job has a dead line, the proper resources must be allocated to the job; otherwise, the deadline cannot be satisfied. Therefore, meeting the job deadline is crucial in MapReduce clusters. We classify deadline-aware schedulers into two categories: deadline-aware schedulers in heterogeneous Hadoop Clusters and deadline-aware schedulers in homogeneous Hadoop clusters. In this section, we first survey and review the most popular deadline-aware schedulers, which minimize job deadline misses. Finally, the reviewed schedulers are compared and summarized.

4.1.2 Data locality aware schedulers

In data locality-aware schedulers, tasks are allocated to the node where the task's input data is stored; otherwise, they are assigned to the node closest to the data node[5]. Researchers proposed several scheduling algorithms to improve data locality because it minimizes data transfer over the network and mitigates the total execution time of tasks, thus improving the Hadoop performance[4]. Therefore, improving data locality is a crucial problem in MapReduce clusters. In this section, we review several important data locality-aware schedulers.

4.1.3 Cost aware schedulers

In big data platforms, data centers store a huge amount of data. Processing this data requires thousands of nodes in Hadoop clusters. Such large clusters consume enormous amounts of power and increase the cost of datacenters. Therefore, we face a big challenge in minimizing cost in MapReduce clusters[31].

In this section, we survey and review several important cost-aware schedulers that reduce the cost of MapReduce systems. Finally, the reviewed schedulers are compared and summarized.

4.1.4 Resource aware schedulers

In big data applications, datacenters are deployed on large Hadoop clusters. The nodes in these clusters receive a large number of jobs and require more resources to execute them. As a result, race condition arises among the jobs that demand resources like CPU, memory, and I/O [9]. Therefore, improving cluster resource utilization has become a major concern in MapReduce clusters. This section presents some of the most popular resource-aware schedulers which increase resource utilization

4.1.5 Make span aware schedulers

The make span (total completion time) of a set of jobs is the total amount of time it takes to complete jobs. In order to increase the cluster's performance, make span needs to be minimized by distributing the data across the nodes. Also, low make span is a major factor for any scheduler[4]. Therefore, minimizing the make span has become an important issue in MapReduce clusters. In this section, we first review several important make span-aware schedulers. Then, the reviewed schedulers are compared and summarized.

4.1.6 Learning aware schedulers

In this section, we first review several important learning-aware schedulers. Then, the reviewed schedulers are compared and summarized. Ghazali et al. [8] focused on the scheduling of Map Reduce jobs in Hadoop and specifically addresses the importance of data and cache locality in improving performance

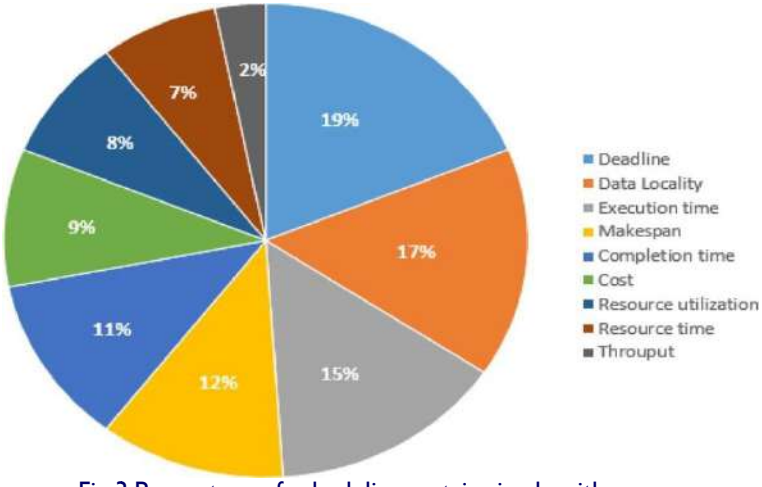

Fig 3.Percentage of scheduling metrics in algorithms

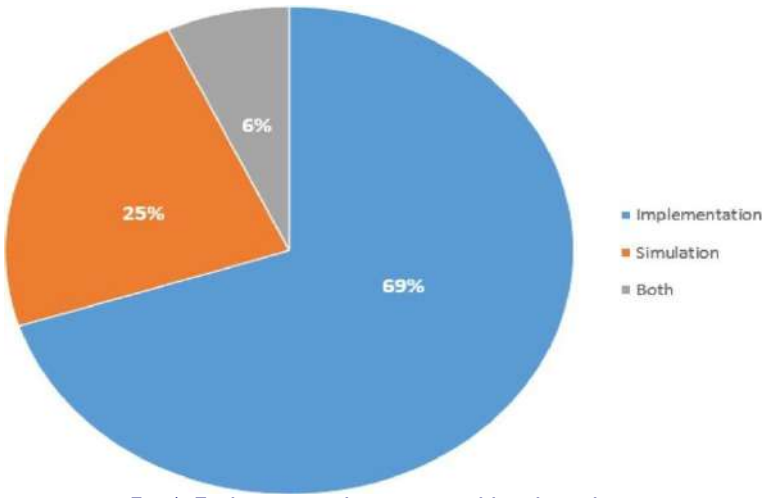

Fig 4. Evaluation techniques used by algorithms

5. DISCUSSION

A comparative analysis of different scheduling metrics in HadoopMap Reduce is presented in this section. We showed how the selected studies addressed the scheduling metrics. Figure3 demonstrates that 19% of the algorithms studied used the deadline metric,17% used the data locality metric, 15% addressed the execution time metric, 12% addressed the make span metric,11% used the completion time metric, 9% used the cost metric, 8% used the response time metric, 7% used the resource utilization metric, and 2% addressed the throughput. It is shown that the majority of algorithms have focused on the dead-line and data locality metrics.

Figure 4 shows the evaluation techniques used in the selected studies. A scan be seen,69% of the studies used implementation, which is the highest; 6% of them used simulation, and 25% of them used both implementation and simulation.

6. CONCLUSION

Scheduling in Hadoop MapReduce is an important challenge that Hadoop systems are facing. In this paper, we provided a comprehensive systematic study in HadoopMapReduce. First, an overview of Hadoop major components is presented. We thoroughly reviewed and analyzed individually the selected MapReduce scheduling algorithms. Based on our research method, we classify these into six categories: deadline-aware schedulers, data locality-aware schedulers, cost-aware schedulers, resource-aware schedulers, make spanaware schedulers, and learning-aware schedulers. We compared the studies in terms of key ideas, main objectives, advantages, disadvantages, comparison algorithms, and evaluation techniques. We concluded that Makespan aware scheduler algorithm is most suitable for parallel processing environment to process huge amount of data sets.

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Computational Tracking and Estimating the Covid-19 Dynamic Broadcast Based on Machine Learning Model

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Abstract: The COVID-19 pandemic has reshaped global health and societal norms, necessitating effective tracking and forecasting methods. We propose a novel machine learning model that integrates diverse datasets, including epidemiological, demographic, and environmental variables. By employing advanced techniques such as deep learning and time-series analysis, our model accurately predicts the pandemic's trajectory, considering factors like non-pharmaceutical interventions and variant emergence. Through comprehensive data integration and feature engineering, our approach provides actionable insights for policymakers, aiding in proactive response strategies and adaptive tracking of COVID-19 propagation dynamics.

Keywords : COVID-19 pandemic, Machine learning model, Diverse datasets, Epidemiological, Demographic, Time series analysis, non-pharmaceutical interventions, Data integration, Feature engineering, Adaptive tracking, Propagation dynamics

I. INTRODUCTION

The COVID-19 pandemic, stemming from the novel coronavirus SARS-CoV-2, has profoundly reshaped global dynamics since its emergence in late 2019. With its rapid spread and widespread impact on healthcare systems, economies, and societies, precise tracking and forecasting of virus propagation have become imperative. Consequently, data-driven approaches have gained prominence, with machine learning emerging as a potent tool in this pursuit. This introduction paves the way for an in-depth exploration of an advanced machine learning model tailored for tracking and forecasting COVID-19 propagation dynamics. Leveraging artificial intelligence and diverse data sources, this model promises invaluable insights for healthcare professionals, policymakers, and the public. Amidst the complex transmission dynamics of COVID-19, characterized by evolving variants and diverse intervention strategies, traditional epidemiological models face limitations, making machine learning an attractive alternative for comprehensive modelling and prediction.

II. LITRATURE SURVEY

The study (reference [1]) is dedicated to enhancing the predictive capabilities of existing models concerning the spread of COVID-19 in the top five worst-hit countries: Brazil, India, Peru, Russia, and the USA. Researchers propose a novel approach known as the wavelet-coupled RVFL (WCRVFL) model, which integrates the random vector functional link (RVFL) network with 1-D discrete wavelet transform. Evaluation of the WCRVFL model is conducted against both the support vector regression (SVR) model and the conventional RVFL model. Empirical findings underscore the promising potential of the WCRVFL model in accurately forecasting COVID-19 spread up to 60 days in advance. Nevertheless, it is essential to acknowledge the limitations inherent in this study, including constraints related to data availability and accuracy, as well as the dynamic nature of the pandemic situation.

The study (reference [2]) examines time series data pertaining to COVID-19 cases in the top five affected countries: the US, Brazil, India, Russia, and Spain. Utilizing the ARIMA model, the study endeavours to forecast the future trajectory of virus spread. The forecast indicates that Russia and Spain have reached an inflection point, while the US, Brazil, and India continue to experience exponential growth. By July 31st, India and Brazil are projected to accumulate 1.38 million and 2.47 million cases, respectively, while the US is expected to report 4.29 million cases. However, it is imperative to acknowledge limitation inherent in the analysis, The accuracy of the forecast hinges heavily on the quality and reliability of the underlying data. The study (referenced [3]) employed a straightforward mathematical model and utilized a restricted set of epidemiological data to forecast the 2019-nCoV outbreak in China. Predictions from the model suggested a potential range of cumulative cases spanning from 76,000 to 230,000, with an anticipated peak of unrecovered infectives projected between 22,000 and 74,000 from late February to early March. After this peak, a swift decline in case numbers was anticipated until the outbreak subsided, expectedly occurring between early May and late June. It is imperative to acknowledge the limitations of this study, as the predictions rely on a simplistic model and a constrained dataset, potentially impacting the accuracy of the projections.

III. SYSTEM ARCHITECTURE

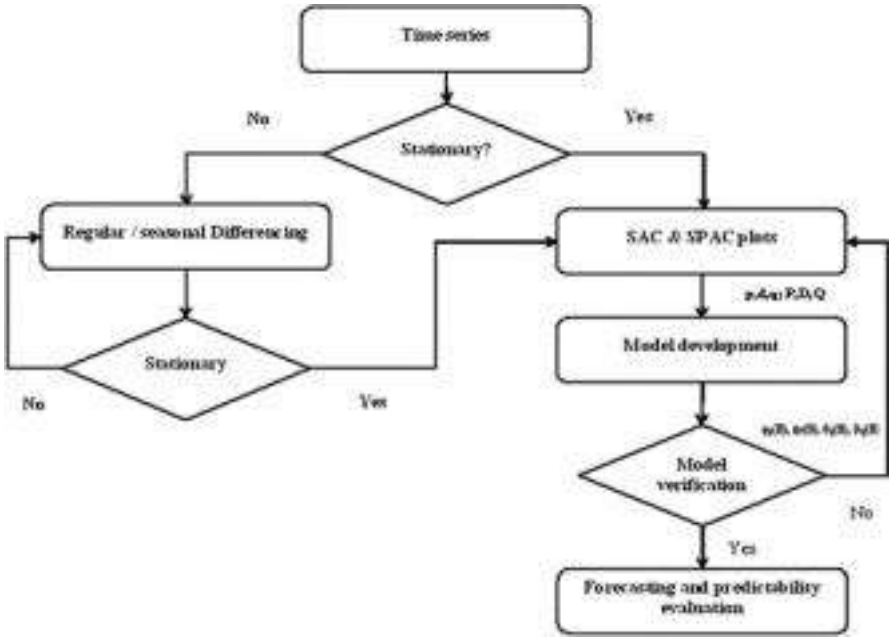

Fig 1: System Architecture

IV. SYSTEM MODULES

The project's development may entail numerous interconnected modules to ensure the establishment of a comprehensive and efficient system. Below are potential modules for consideration:

1. Data Collection and Preprocessing:

This module involves collecting diverse and reliable datasets related to COVID-19, encompassing infection rates, demographic information, testing data, and geographical details. Subsequently, the collected data is preprocessed to handle missing values, outliers, and standardize formats for consistency.

2. Exploratory Data Analysis (EDA):

Within this module, exploratory data analysis is conducted to discern trends, correlations, and patterns in the COVID-19 data. Visualization techniques, including charts and graphs, are employed to gain insights into the dynamics of virus spread.

3. Feature Engineering:

This module focuses on selecting and engineering pertinent features that can enhance the model's accuracy and effectiveness.

4. Machine Learning Model Development:

The development of a predictive model is carried out using machine learning algorithms such as regression, time series analysis, or deep learning. The model is trained on historical data to discern patterns and relationships.

5. Validation and Evaluation:

In this module, the dataset is split into training and testing sets to validate the model's performance. The model's accuracy, precision, recall, and other relevant metrics are evaluated to ensure its reliability. Integration of these modules enables the project to provide a comprehensive solution for tracking and forecasting the dynamic propagation of COVID-19.

V. SYSTEM IMPLEMENTATION

The implementation of the ARIMA (Auto Regressive Integrated Moving Average) model, a widely used time series forecasting method, involves several key steps:

1. Data Understanding:

Begin by thoroughly analyzing and understanding the time series data, including identifying trends, seasonality, and any other patterns that may influence the data.

2. Stationary Check:

Ensure that the time series data exhibits stationary, where its statistical properties remain constant over time. Stationary is essential for ARIMA models. If the data lacks stationary, apply differencing to achieve it by subtracting the previous observation from the current one.

3. Order of Differencing (d):

Determine the order of differencing (d) required to achieve stationary. This represents the number of times differencing is performed, with a value of 0 indicating stationary data.

4. Autocorrelation and Partial Autocorrelation Analysis:

Examine the autocorrelation function (ACF) and partial autocorrelation function (PACF) plots to identify suitable values for the autoregressive (AR) and moving average (MA) parameters. The ACF plot aids in determining the MA order, while the PACF plot assists in determining the AR order.

5. Identification of AR and MA Orders (p, q):

Based on the ACF and PACF plots, determine the appropriate orders for the AR (p) and MA (q) components of the ARIMA model.

6. Model Fitting:

Fit the ARIMA model to the training data using the determined values of p, d, and q. This involves estimating the coefficients of the AR and MA terms and finding optimal values.

7. Model Evaluation:

Evaluate the performance of the model on the validation or test dataset using suitable metrics such as Mean Squared Error (MSE) or Root Mean Squared Error (RMSE). Adjust the model parameters as needed to enhance performance.

8. Forecasting:

Utilize the trained and validated model to generate future predictions on new, unseen data. Create forecast intervals and visualize predicted values against actual values.

9. Model Refinement (if necessary):

Fine-tune the model based on its forecasting performance, adjusting orders (p, d, q) or considering additional factors influencing the time series.

10. Final Model Deployment:

Deploy the refined ARIMA model for real-world predictions, facilitating practical applications in forecasting future trends.

VII. SCOPE OF FUTURE APPLICATION

The scope of future application for this model encompasses a wide array of domains within the purview of public health and epidemiology. It offers the potential for real-time monitoring and forecasting of COVID-19 spread patterns, facilitating timely and targeted interventions aimed at curbing transmission rates and mitigating the impact of the pandemic. Through sophisticated data analytics and predictive capabilities, the model can inform decision-making processes at local, national, and global levels, enabling policymakers to allocate resources effectively and implement evidence-based public health measures. Moreover, the adaptable framework of the model enables its seamless integration into existing public health systems, fostering collaboration and coordination among stakeholders involved in pandemic response efforts. By harnessing advanced machine learning techniques and leveraging comprehensive datasets, it has the capacity to enhance situational awareness and provide invaluable insights into epidemiological trends and dynamics. This, in turn, empowers authorities to proactively address emerging challenges and adapt strategies in accordance with evolving circumstances. Looking ahead, the model's versatility extends beyond its application in addressing the COVID-19 pandemic. Its robust methodology and predictive capabilities render it applicable to other infectious diseases, offering a valuable tool for pre-emptive surveillance and response planning. Furthermore, the insights garnered from its implementation can contribute to the development of evidence-based policies and interventions aimed at safeguarding public health against future health threats. In essence, the model represents a significant advancement in epidemiological research and public health practice, poised to play a pivotal role in shaping the trajectory of pandemic management and preparedness efforts. As the global community continues to navigate the complexities of infectious disease outbreaks, the adoption and refinement of such innovative approaches hold promise for enhancing our collective resilience and capacity to respond effectively to emerging health challenges.

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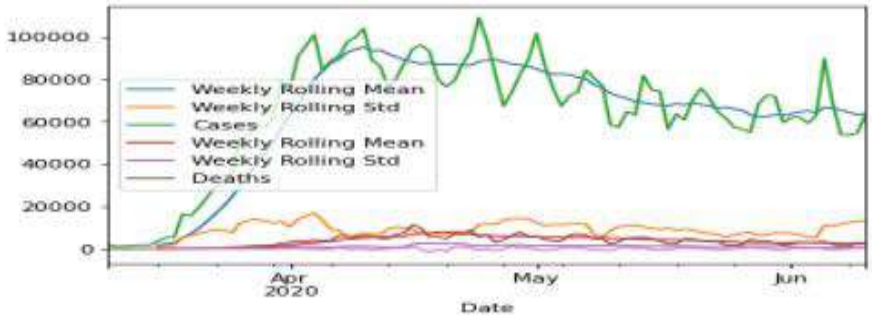
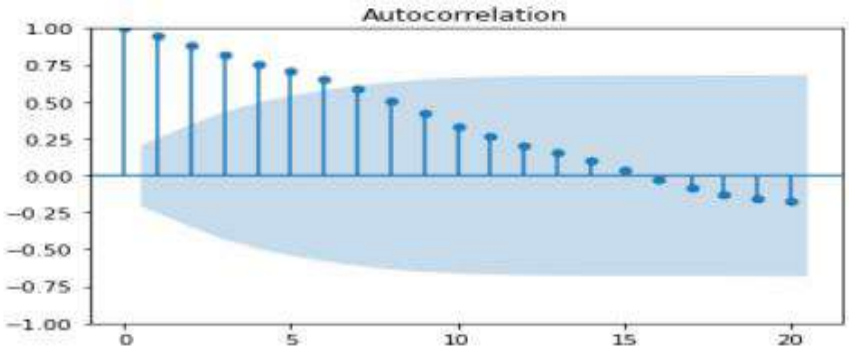
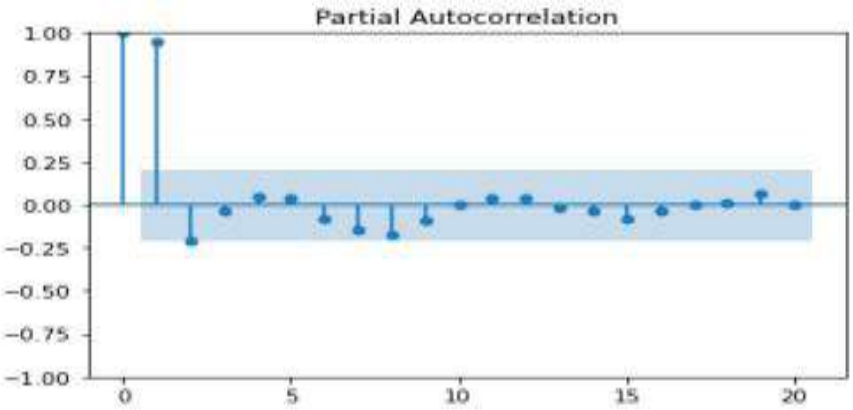
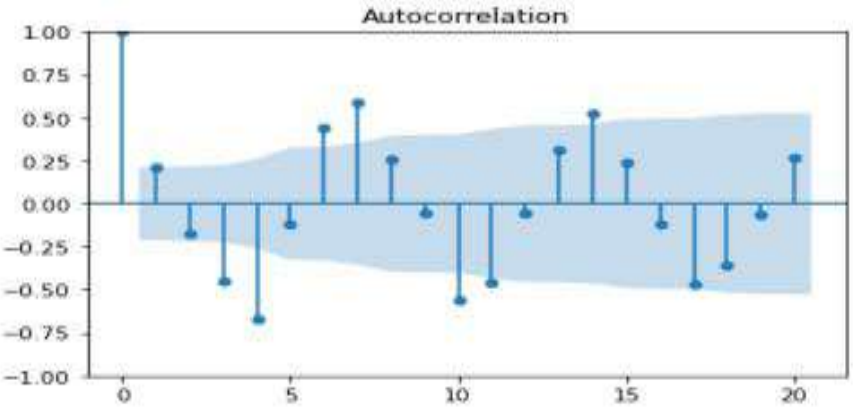
VIII. RESULTS









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IX. CONCLUSION

In summary, the presented work constitutes a notable advancement in our collective endeavors to combat the COVID-19 pandemic and enhance readiness for future health crises. Leveraging advanced machine learning techniques, extensive datasets, and real-time data updates, the model addresses critical challenges posed by the pandemic. Amidst uncertain and swiftly evolving circumstances, this work underscores our capacity to utilize technology, data, and collaboration to confront global challenges. It offers a beacon of hope amidst the crisis, furnishing a more informed and efficient approach to pandemic management and preparedness for an uncertain future. As the battle against COVID-19 progresses, steadfast dedication to innovative, data-driven solutions remains paramount to safeguarding the health and well-being of individuals and communities worldwide. The development and deployment of this model signify a significant stride forward in this ongoing endeavour.

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