EARLY DETECTION OF ALZHEIMER's DISEASEBY USING CNN

Mrs.D. Aparna[1], Mr. J. Chaithanya[2], A. Ankitha[3], B. Varshitha[4], B. Laxmi Prasanna, D.Sagarika[6], E. Sai Vivek [7],

[1,2]Assistant Professor in Dept of CSE, Balaji Institute of Technology & Science, Warangal

[3,4,5,6,7]B. Tech Students, Dept of CSE, Balaji Institute of Technology & Science, Warangal

ABSTRACT

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that significantly impacts cognitive function, memory loss, and daily living early detection of AD is critical for timely intervention and improving the Quality of life for patients. This project proposes an innovative approach to Alzheimer's disease prediction using the Mobile Net algorithm a lightweight and efficient deep learning architecture. The Mobile Net model is trained on medical imaging datasets, such as MRI or CT scans, to classify and predict Alzheimer's disease at its early stages. Detecting Alzheimer's early is important because it allows for better case and treatment.

INTRODUCTION

Alzheimer's disease (AD) is chronic neurodegenerative disorder that firstly affects memory, cognitive functions, and behaviour, ultimately Interfering with daily life.it is the most common cause of dementia worldwide and represents a significant public health challenge. Early detection of Alzheimer's disease progression, enhance the quality of life, and reduce healthcare costs. With the advancement of Artificial Intelligence (AI) and deep learning, automated diagnostic tools have emerged as a promising solution for early detection of Alzheimer's disease. Alzheimer's disease represents a growing public health crisis, with early detection being critical for effective intervention and management. This proposal outlines the development of a web-based Alzheimer's disease detection system, leveraging the Flask framework to create an accessible and scalable platform. By integrating [deep learning models trained on neuroimaging data] with a user-friendly interface, this project aims to provide a preliminary risk assessment tool, potentially enabling earlier diagnosis and improved patient outcomes[1-28].

LITERATURE SURVEY

ADDNET-An enhanced convolution neural network for detection and classification of Alzheimer's Disease by Radhakrishna Chamakuri and Dr. Hyma Janapana this paper, published in the journal of wireless mobile networks, and

Dependable Application (JOWUA), provides an in-depth analysis of the ADD-Net model and application in detecting Alzheimer's disease using MRI image [1]. Automated Detection of

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Alzheimer's Disease Using MRI images and Deep Neural Networks A Review by Narotam Singh et al. This review paper provides an overview of recent research on deep learning models for Alzheimer's disease diagnosis, focusing on MRI data [2]. Machine Learning for Dementia Prediction a Systematic review and Future Research Directions by Ashir Javeed-et al. This paper provides a comprehensive review of machine learning based-diagnostic systems dementia, including Alzheimer's disease, it evaluates different data modalities such as images, clinical features, and voice data [3].

EXISTING SYSTEM

The existing system for Alzheimer's disease prediction utilizes the RESNET (Residual Network) architecture, a deep learning model renowned for its ability to handle very deep networks without suffering from the vanishing gradient problem. RESNET achieves this through the use of residual connections which allow the model to learn residual functions. The RESNET model is employed to analyse medical imaging data, such as MRI or CT scans, to predict the presence of Alzheimer's disease. The RESNET model is trained using a labelled dataset of brain scans. Training involves image preprocessing, augmentation, and feature extraction using convolutional layers. It achieves an accuracy of 85%, which indicates a fairly good performance but may require further improvements.

PROPOSED SYSTEM

The proposed system aims to predict Alzheimer's disease at an early stage using the Mobile Net algorithm using deep learning. Mobile Net, a lightweight convolutional neural network (CNN)architecture, is chosen for its computational efficiency and ability to deliver accurate results while operating on resource- constrained devices. The system will process medical imaging data, such as MRI or CT scans, to Identifying patterns of Alzheimer's disease. It Is a user-friendly interface will allow clinicians to upload medical images and receive predictions with high accuracy.

PROBLEM STATEMENT

Developing an accurate and efficient Convolution Neural Network-based model for the early detection of Alzheimer's disease using structural MRI scans. The model aims to classify brain images into distinct stages of Alzheimer's disease, while addressing challenges such as imbalanced datasets, variability in scan quality, and the need for interpretability in predictions. The proposed solution will leverage advanced deep learning techniques to improve diagnostic accuracy, reduce manual intervention, and assist healthcare professionals

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in early intervention and treatment planning. The traditional methods for Alzheimer's diagnosis Depend heavily on the human analysis of MRI scans, which presents several challenges. First, the process is slow, as it requires radiologists to carefully analyse each scan before making a decision. This delay can be critical for patients who require urgent medical attention.

By implementing an AI-powered Alzheimer's detection system, these challenges can be effectively addressed. The system offers fast, automated, and highly accurate Alzheimer's detection, decreasing the need for human analysis by leveraging deep learning techniques.

SYSTEM REQUIREMENTS

The system requirements for the Alzheimer's Disease Detection System using CNN are categorized into software and hardware requirements. For frontend development, the system requires HTML, CSS, and JavaScript, which will be used for future UI-based implementations to provide an interactive and user-friendly interface. The backend development is based on Flask and Python, which will handle server-based processing, including user authentication, image uploads, and communication with the deep learning model. The deep learning framework consists of TensorFlow, Kera's, and OpenCV, which will be used for MRI scan processing, image classification, and CNN model execution. The database component is managed using MySQL, which is responsible for storing user data and prediction results, ensuring efficient data retrieval and management. The system is designed to be compatible with both Windows and Linux operating systems. In terms of hardware requirements, a minimum of 100GB SSD storage is recommended for handling MRI scan images, ensuring quick data access and efficient storage management. Additionally, to support deep learning computations and ensure smooth processing, the system requires a minimum of 16GB RAM for optimal performance.

MODULES

User Interface (UI) User interface is used for user authentication (Register) purpose.

Data Collection Medical imaging datasets containing MRI, CT scans or other relevant imaging data with labelled Alzheimer's disease categories (eg, normal, mild, moderate, severe).

Mobile Net development, Mobile Net is a lightweight CNN architecture designed for mobile and embedded vision applications.

Feature Extraction Mobile net extracts high-level features from input images using its depth wiseseparable convolution layers, the system classifies input image into predefined categories such as normal,mild,etc

Testing & Deployment Optimize the system for deployment on resource constrained device develop a simple and intuitive user interface for clinicians to upload images and view results.

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METHODOLOGY

The Alzheimer's Detection system follows a structured step-by-step workflow to analyse MRI scans efficiently:

User Login: Theuser must log in with valid credentials before accessing the system. This ensures secure access and prevents unauthorized usage.

MRI Image Upload: After logging in, the user uploads an MRI scan to the server for analysis.

Preprocessing: The system enhances the image by removing noise, normalizing contrast, and resizing for uniform processing.

Feature Extraction: The CNN model extracts important patterns from the MRI scan to identify potential Alzheimer's regions.

Alzheimer's Classification: The deep learning model analyses the extracted features and classifies the scan as either "Alzheimer's Present" or "Alzheimer's Absent."

Result Display: The system generates the final classification result, providing the user with a reliable diagnosis.

By integrating a secure login system, efficient image processing, and deep learning-based classification, this AI-powered server ensures fast, accurate, and structured Alzheimer's detection for medical professionals.

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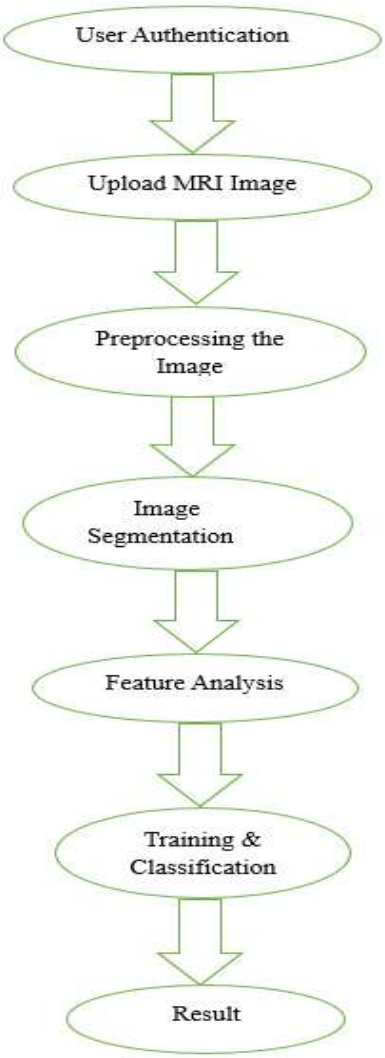

SYSTEM ARCHITECTURE

Data collection: This is the first layer where data is gathered from various sources for the detection process.

Medical imaging: This includes MRI, CT scans, PET scans or functional MRI (fMRI) scans use to identify structural changes in the brain.

Feature extraction: Identifying key features or biomarkers from medical imaging data, patterns, genetics genetic data, etc.

Analysis and preprocessing: This is responsible for performing the core diagnostic task.

Decision support: It provides decision support to the healthcare professionals for interpreting results.

Database: A secure, relational or no SQL database to store clinical data, medical image, genetic Information, and analysis result.

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User interface: This is the interface through which healthcare professionals interact with the system.

ADVANTAGES

The proposed AI-based Alzheimer's Detection system provides several benefits over traditional methods. One major advantage is its ability to automate the Alzheimer's classification process, reducing the dependency on manual MRI scan analysis by radiologists. This significantly speeds up diagnosis and ensures faster decision-making in medical settings. Additionally, the system is designed to work on a diverse range of MRI scans, improving its adaptability across different datasets.

By implementing advanced CNN-based feature extraction, it enhances the accuracy of Alzheimer's detection, reducing false positives and false negatives. Since the model is server-based, multiple MRI scans can be processed efficiently without requiring high-end hardware on local machines. The inclusion of a user login system ensures secure access, making the system reliable for medical professionals.

LIMITATIONS

While the system improves Alzheimer's disease Detection, it still has certain limitations. The model's accuracy heavily depends on the quality of MRI scanslow-resolution or noisy images may affect detection performance.

Limited Dataset Size- CNN models require large datasets for high accuracy. If the dataset is small, the model may overfit or generalize poorly.

Difficulty in Handling Noisy or Poor-Quality Images- MRI scans may have artifacts, low resolution, or noise, which can reduce the model's accuracy.

LimitedGeneralization- The model may perform well on the training dataset but struggle with real-world MRI scans from different hospitals or imaging techniques.

High Computational Requirements- Running a CNN model requires a GPU or high-performance CPU. If hosted on a basic server, processing large MRI scans may be slow.

Data Privacy Risks- Storing MRI scans and medical data in MySQL without encryption can lead to privacy concerns if unauthorized access occurs.

Legal &Regulatory Compliance- The system must comply with health data protection laws, if used in real-world clinical settings.

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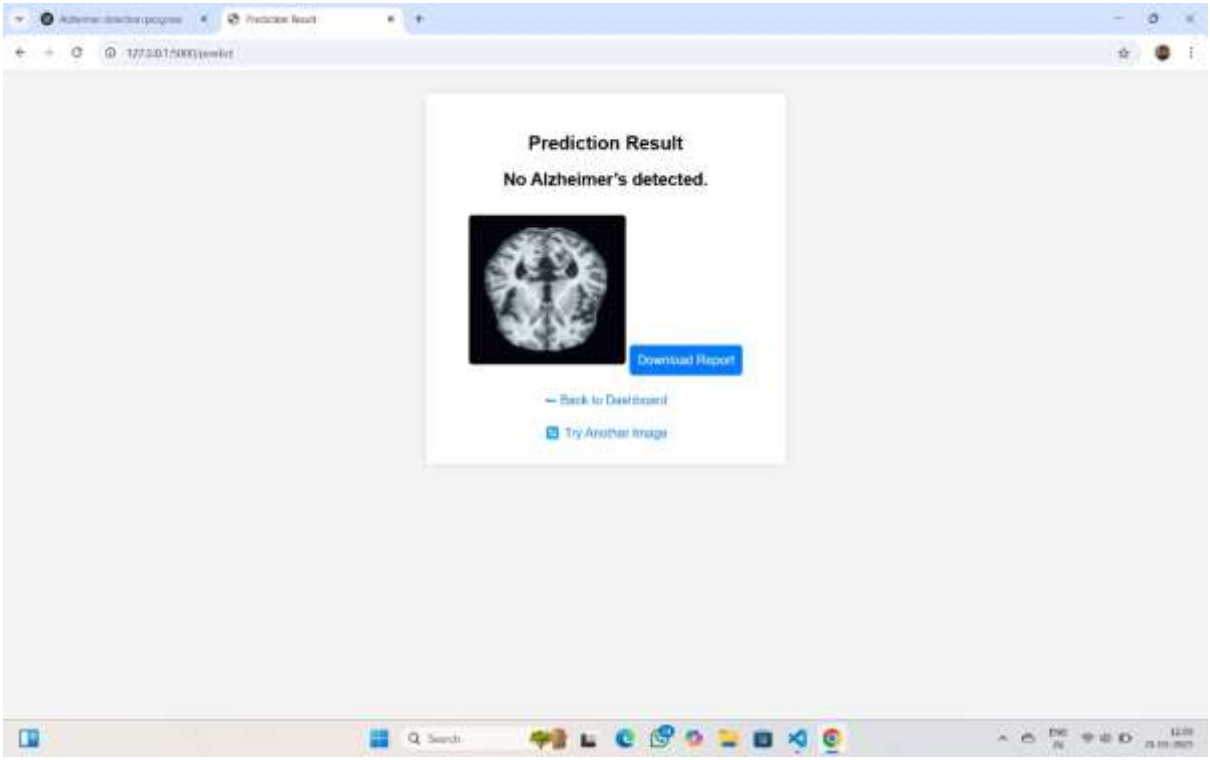
FUTURE SCOPE

To enhance the system's effectiveness, several improvements can be introduced in the future. One of the key areas for development is multi-class classification, where the model can not only detect Alzheimer's but also identify different Alzheimer's types, such as benign or malignant. Additionally, real-time processing optimization can be implemented to further reduce diagnosis time and allow instant MRI scan analysis. Integration with hospital databases can also improve usability by allowing medical professionals to store and retrieve scan results seamlessly. Enhancing security features in the login system and improving model training with even larger datasets will ensure greater accuracy and robustness.

RESULTS



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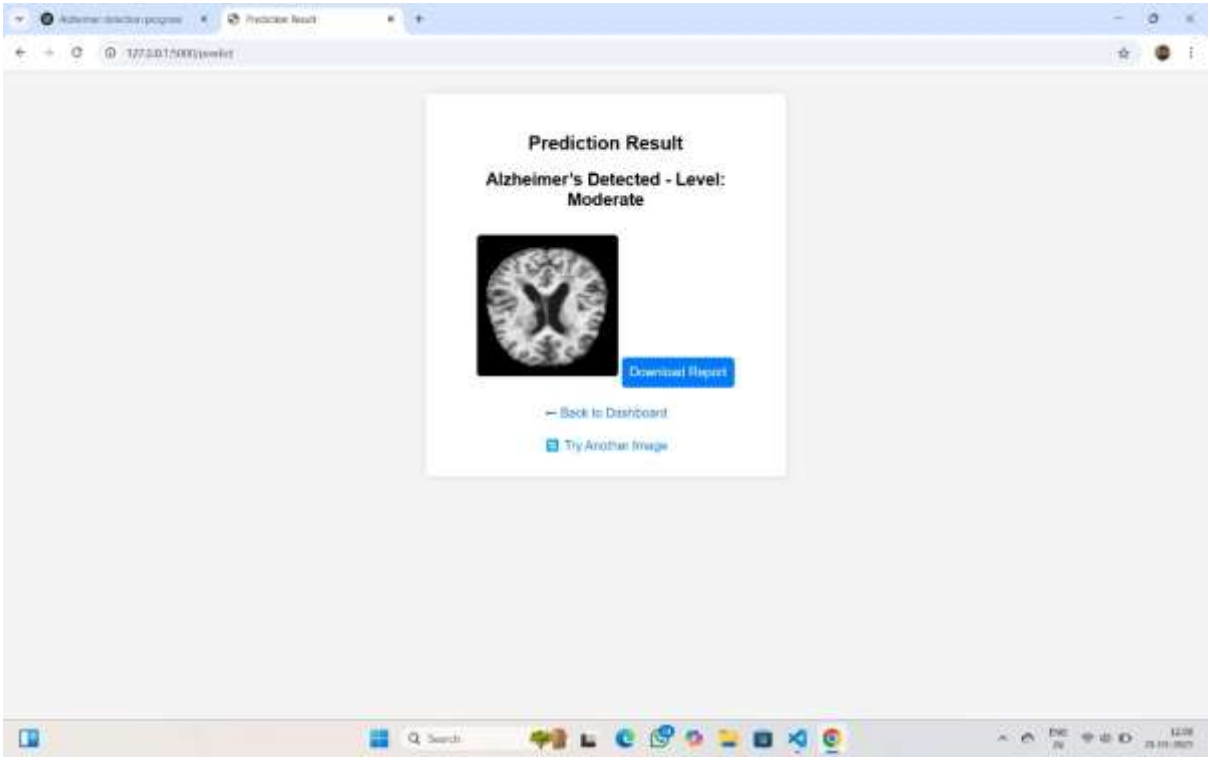

CONCLUSION

This project presents a deep learning-based AI system that automates Alzheimer's Detection using server-based processing. By leveraging CNNs, the system enhances accuracy, reduces human workload, and accelerates MRI analysis. With further improvements, this AI model has the potential to be integrated into realworld medical applications, assisting radiologists in faster and more precise diagnosis.

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Mrs. Aparna Dayyala B. Tech (CSE), M. Tech (CSE) working as senior Asst. Professor, Computer Science and Engineering department, Balaji Institute of Technology and Science, Telangana college, Since 2015. Currently pursuing PhD in the stream of “Deep Learning and Machine Learning” at SRUniversity(SRU),is aneducational institution University, located in Anantasagar, Hasanparthy (M), Telangana (506371), India. Published 2 papers in Scopus indexed Journals, 3 UGC CARE journal papers, attended nearly 2 International Conferences, attended nearly 20 faculty development programs, workshops and webinars, 2 patent and completed 6 NPTEL courses. She is the Life Member in Professional Bodies IAENG and ISTE.

Ms. Annaboina Ankitha from Department of ComputerScience and Engineering. Currently pursuing B-Tech at Balaji Institute Technology and Science. My research interests include Web Development,Django,Machine learning & Internet of things(IOT).

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Ms. Bairaboina Varshitha from Department of Computer Science and Engineering. Currently pursuing B-Tech at Balaji Institute Technology and Science. My research interests include Web Development, Cloud computing.

Ms. Bollikonda Laxmi Prasanna from Department of Computer Science and Engineering. Currently pursuing B-Tech at Balaji Institute Technology and Science. My research interests include frontend tools like HTML, CSS, JavaScript.

Ms. Duvva Sagarika from Department of Computer Science and Engineering. Currently pursuing B-Tech at Balaji Institute Technology and Science. My research interests include frontend tools like HTML,CSS,JavaScript.

Mr.Erabelli Sai Vivek from Department of ComputerScience and Engineering. Currently pursuing B-Tech at Balaji Institute Technology and Science. My research interests include Web Development, Machine learning & Internet of things (IOT).

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