

Deep Learning-Based Early Alzheimer's Detection from MRI Scans

Abstract :-

Alzheimer's disease is a progressive neurodegenerative disorder marked by cognitive decline and memory loss. Early diagnosis is essential for timely intervention and improved patient outcomes. This project presents an AI-powered system for early Alzheimer's detection using Magnetic Resonance Imaging (MRI) scans. The system employs a deep learning approach based on a Convolutional Neural Network (CNN) built on the ResNet50 architecture, pre-trained on ImageNet. By leveraging transfer learning, the model is fine-tuned on MRI data to identify subtle structural changes in the brain associated with different stages of Alzheimer's, including Non-Demented, Very Mild Demented, Mild Demented, and Moderate Demented categories.

To address challenges such as limited data and overfitting, extensive data augmentation techniques are employed. Methods including rotation, translation, shearing, zooming, and horizontal flipping enrich the training dataset, thereby enhancing model robustness and generalization. The dataset is meticulously partitioned into training, validation, and testing subsets to ensure reliable performance evaluation and to mitigate bias. In addition, the Grad-CAM technique is integrated to provide visual explanations for the model's predictions by highlighting critical brain regions influencing the classification decision. An automatic report generation module produces comprehensive PDF reports summarizing patient data, prediction outcomes, and confidence scores, while real-time inference capabilities facilitate rapid diagnosis in clinical settings.

Overall, this project offers a promising, accurate, and interpretable tool that supports healthcare professionals in making informed diagnostic decisions for the early detection and management of Alzheimer's disease

Key Words :-

Alzheimer's Disease Detection , Deep Learning ,MRI Scans , Convolutional Neural Networks, ResNet50 , Automated Diagnostics