# ABSTRACT

The integration of machine learning techniques in imaging domain is experiencing a deep transformation. It enables systems to analyze massive amount of data, distinguish patterns, and make forecasts with minimal human intervention. Machine Learning is applied to various domains in healthcare sector like disease diagnostics, treatment planning, drug detection and patient management. The machine learning models impact the complex and data exhaustive fields like oncology, cardiology, and neurology. In medical imaging machine learning models can examine MRIs, X-rays to identify irregularities like lumps, fractures, or organ deformities with high accuracy, regularly beating the capabilities of human clinicians.

This present study focuses on the brain neuron images in classifying the Alzheimer's Disease (AD) stages, which aids neurologists to understand complex changes in the brain. Through brain imaging analysis, the study strives to diagnose AD in its premature stages. AD is a deteriorating brain ailment caused by brain cells degeneration that impairs memory and intellectual damage that disturbs lots of old age individuals across the globe. Its a permanent brain ailment that steadily wear away thinking and memory skills which finally disturbs even the basic tasks. The memory and cognitive functions are affected in AD which is the reason for dementia in older population. These computational techniques use algorithms to analyze the brain images to classify patterns and features related to AD. To evaluate medical pictures and to discover neurological ailments like AD computational techniques like Machine Learning (ML) and Deep Learning (DL) techniques are applied in recent times.

The objectives are to develop the classification potential of AD stages using ML and DL methods derived from ensemble classification framework. The contributions of this research work primarily focus on the preprocessing framework to eradicate the noises in the brain neuron MRIs by applying various de-noising filters to enhance the image deviations and to attain upgraded classification performance. The segmentation process is performed to for skull removal from the brain neuron image by applying thresholding methods to obtain a perfect image of the brain structure. To address the

imbalance problems, a transfer learning approach is used for feature extraction. The first layer is transmitted, followed by the retrieval of features from Convolutional Neural Network using AlexNet model for feature retrieval.

Lastly, classification is achieved from the extracted features using ML algorithms such as Decision Tree (DT), K-Nearest neighbor (KNN), Support Vector Machine (SVM), Neuro Evolution of Augmenting Topologies (NEAT), and BAGGING for AD stage classification. This study proposed two hybrid classification techniques like BAGGING_SVM and BAGGING_NEAT. The first hybrid classification technique combines BAGGING and SVM approaches to classify brain neuron images. The second hybrid classification technique combines the BAGGING and NEAT approaches to classify brain neuron images.