# ABSTRACT

Alzheimer's Disease (AD) is a progressive neurodegenerative disorder that significantly impacts cognitive function. Early detection is crucial for effective management and potential interventions. While traditional methods rely on clinical assessments and neuroimaging techniques like Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) offers unique advantages in visualizing brain metabolic changes associated with AD. This research proposes a deep learning-based framework to accurately classify AD stages using PET scans. By leveraging the distinctive metabolic patterns revealed by PET, the model aims to improve diagnostic accuracy and facilitate early intervention. The proposed framework incorporates a DenseNet architecture, a robust deep learning model known for its efficient feature extraction and reduced overfitting. Experimental evaluations on a comprehensive dataset demonstrate the superior performance of the proposed method compared to existing approaches, highlighting its potential for clinical application.

# INTRODUCTION

## 1.1 OVERVIEW

The increasing prevalence of Alzheimer's Disease (AD) necessitates the development of accurate and efficient diagnostic tools. While MRI has been widely used for brain imaging, PET scans offer a complementary perspective by visualizing metabolic activity. PET tracers, such as amyloid-β and tau, can detect specific pathological markers associated with AD, providing valuable insights into disease progression. This research focuses on leveraging PET scans and deep learning techniques to enhance AD diagnosis.

## 1.2 PROBLEM STATEMENT

The primary challenge in AD diagnosis lies in the early detection of subtle cognitive decline. Traditional methods often involve time-consuming clinical assessments and may not capture the early stages of the disease. PET scans, while informative, require expert interpretation and can be subject to inter-observer variability. To address these limitations, this study aims to develop an automated system capable of accurately classifying AD stages based on PET scan data.

## 1.3 EXISTING SYSTEMS

Previous research has explored the use of machine learning and deep learning for AD diagnosis using PET scans. However, these approaches often face limitations in terms of accuracy, computational efficiency, and interpretability. This research seeks to advance the state-of-the-art by proposing a novel deep learning framework that incorporates the unique characteristics of PET scans and addresses the challenges of existing methods.

## 1.4 PROPOSED SYSTEM

The proposed framework leverages a DenseNet architecture, a deep learning model known for its efficient feature extraction and reduced overfitting. The model is trained on a large dataset of PET scans from patients with varying stages of AD. By analyzing the metabolic patterns captured in the PET images, the model learns to discriminate between different AD stages. The output of the model is a probability distribution representing the likelihood of the patient belonging to each AD stage. This approach offers a quantitative assessment of disease severity and facilitates early intervention.