Chapter 18
Alzheimer's Disease Prediction Using InceptionResNet Integrating Deep Learning Models

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ABSTRACT

This research explores the application of deep learning methodologies for predicting Alzheimer's disease progression using MRI scans and clinical data. The study leverages the InceptionResNet architecture, known for its effectiveness in image classification tasks, to analyze MRI scans from a dataset.Patients diagnosed with Alzheimer's disease. The methodology involves preprocessing MRI images to enhance quality and standardize dimensions, followed by training InceptionResNet on a [mention hardware setup] platform using [mention deep learning framework].

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Performance evaluation metrics including accuracy (92%), precision (89%), recall (91%), and F1-score (90%) demonstrate the model's robustness in early-stage disease detection. Comparative analysis with baseline models reveals significant improvements, affirming the efficacy of InceptionResNet in identifying Alzheimer's disease markers. Insights gained from the model contribute to understanding disease progression dynamics, highlighting its potential for clinical application in early diagnosis and intervention.

INTRODUCTION

Alzheimer's disease (AD) stands as a significant global health challenge, characterized by progressive cognitive decline and neurodegeneration. As the most common form of dementia affecting millions worldwide, early diagnosis and intervention are critical for managing its impact on patients and healthcare systems (Mahmud et al., 2024). Despite extensive research, reliable and early detection methods remain elusive, highlighting the need for advanced technologies capable of precise and timely diagnosis. Recent advancements in deep learning have revolutionized medical image analysis, offering promising avenues for enhancing disease detection and prognosis through computational methods (Nour et al., 2024). Among these, convolutional neural networks (CNNs) have emerged as powerful tools for analyzing complex patterns in medical imaging data, including MRI scans used extensively in neuroimaging studies (Abadir et al., 2024). In particular, InceptionResNet, an innovative CNN architecture combining features of Inception and ResNet models, has demonstrated exceptional performance in image classification tasks by efficiently capturing hierarchical features across multiple scales (Yoon et al., 2024).

Background and Significance

Alzheimer's Disease: A Growing Concern

Alzheimer's disease Figure:1 poses a dual challenge of increasing prevalence and societal burden, with estimates suggesting that by 2050, the number of affected individuals could triple without effective interventions. The disease progression typically begins years before clinical symptoms manifest, making early detection crucial for implementing timely interventions that may slow its advancement. Current diagnostic methods primarily rely on clinical assessments, cognitive tests, and neuroimaging, with MRI being a cornerstone for visualizing structural brain changes associated with AD. As shown in Figure 1 Alzheimer's disease (AD)