Chapter 9
Predictive Precision Harnessing AI for Early Alzheimer's Detection

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ABSTRACT

The early detection of Alzheimer's disease (AD) remains a critical challenge in neurology and geriatrics, with significant implications for patient outcomes and healthcare systems. Recent advancements in artificial intelligence (AI) offer promising avenues for enhancing predictive precision in identifying early-stage AD through biomarker analysis. This paper explores the integration of AI methodologies with biomarker data to improve early detection rates of Alzheimer's disease. Utilizing the Alzheimer's Disease Neuroimaging Initiative (ADNI) dataset, which includes cerebrospinal fluid (CSF) biomarkers, neuroimaging data, and clinical assessments,

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we evaluate the performance of two AI algorithms: the Random Forest Classifier (RFC) and a novel deep learning model named NeuroCognitionNet (NCN). The RFC achieved an accuracy of 87%, sensitivity of 85%, and specificity of 89%, . In contrast, NCN achieved superior results with an accuracy of 92%, sensitivity of 90%, and specificity of 94%, highlighting its ability to effectively synthesize and interpret complex biomarker data.

INTRODUCTION

Alzheimer's disease (AD) fig:1 is a progressive neurodegenerative disorder characterized by cognitive decline, memory loss, and behavioral changes. It represents the most common cause of dementia, affecting millions of individuals worldwide. Despite extensive research, the early detection of Alzheimer's disease remains a formidable challenge, crucial for implementing timely interventions that can slow disease progression and improve patient outcomes. In our extensive research over the past months, we have focused on leveraging advanced artificial intelligence (AI) techniques to enhance the predictive precision of early AD detection through biomarker analysis. As shown in Figure 1 Alzheimer's Disease.

Figure 1. Alzheimer's Disease