Chapter 7
Big Data Analytics:
NeuroDetect – AI-Driven Big Data Analytics for Alzheimer's Disease

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ABSTRACT

Medical difficulties like Alzheimer's Disease require improved biomarker finding research. Alzheimer's requires complex methods to find pre-symptomatic markers and improve early diagnosis. Machine Learning and Deep Learning methods like Recurrent Neural Networks (RNN) may help solve these problems. Due to data complexity and training efficiency, optimizing RNN models for Alzheimer's biomarker analysis remains difficult. This research optimizes training and model performance using Stochastic Gradient Descent (SGD) to address these issues. Clinical, genetic, neuroimaging, and digital biomarker data are integrated using Big Data Analytics methods, particularly Multi-Modal Data Fusion. This fusion technique improves accuracy and prediction by examining Alzheimer's biomarkers holistically. This study shows considerable Alzheimer's biomarker discovery advances. The ML, DL, RNN, SGD, and Multi-Modal Data Fusion technique improves early diagnosis models and risk assessment tools. This research sheds light on using sophisticated

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technologies to better understand and treat Alzheimer's.

INTRODUCTION

Alzheimer's Disease (AD) poses significant challenges in the medical field, necessitating advanced research for effective biomarker discovery. The complexities of Alzheimer's demand sophisticated methodologies to uncover pre-symptomatic indicators and improve early diagnosis. As a neurodegenerative disorder characterized by progressive cognitive decline, Alzheimer's impacts millions of individuals worldwide, placing a considerable burden on healthcare systems. Current diagnostic methods are often limited to symptomatic stages, underscoring the need for innovative approaches to detect Alzheimer's at an earlier, preclinical stage. Leveraging Machine Learning (ML) and Deep Learning (DL) techniques, particularly Recurrent Neural Networks (RNN), offers promising avenues for addressing these challenges. However, issues persist in optimizing RNN models for Alzheimer's biomarker analysis due to the complexity of data and the need for efficient training.

This research aims to address the challenge of optimizing RNN models for Alzheimer's biomarker analysis. The primary problem lies in the complexity of multimodal data, which includes clinical, genomic, neuroimaging, and digital biomarkers. The integration and efficient training of these diverse data sources are crucial for developing accurate and predictive models. To tackle these challenges, this study employs Stochastic Gradient Descent (SGD) as an optimization technique, aiming to enhance the training process and overall model performance. Additionally, the research explores the use of Big Data Analytics technologies, particularly Multi-Modal Data Fusion, to integrate various data types, providing a holistic view of Alzheimer's biomarkers.

The specific aims of this project are to optimize RNN models using SGD, improve the training efficiency and performance of RNN models in analyzing Alzheimer's biomarkers, and utilize Multi-Modal Data Fusion techniques to combine clinical, genomic, neuroimaging, and digital biomarkers. Furthermore, the research aims to develop advanced early diagnosis models for Alzheimer's Disease and create robust risk assessment tools. By leveraging the optimized RNN and integrated data, this study seeks to enhance the comprehensiveness and accuracy of the analysis, ultimately contributing valuable insights into the early diagnosis and management of Alzheimer's Disease.