

Chapter 1

Bridging the Gap: Integrating Machine Learning With Biomarkers for Enhanced Alzheimer's Detection and Tracking

R. Ravi

J.J. College of Engineering and Technology

T. P. Sridevi

Aurora's PG College (MBA), India

N. Nirmala Devi

Aurora's Technological and Research Institute, India

Sowmya Mandadi

Aurora's Technological and Research Institute, India

ABSTRACT

Alzheimer's Disease (AD) is a relentless neurodegenerative disorder that profoundly affects cognitive abilities. Early detection and precise tracking of AD progression are pivotal for effective intervention and management. In this study, we introduce NeuroTrackNet, an innovative machine learning (ML) algorithm that seamlessly integrates a spectrum of biomarkers to enhance the detection and monitoring of Alzheimer's Disease. By leveraging a synergistic combination of imaging, genetic, and biochemical data, NeuroTrackNet significantly elevates diagnostic accuracy and offers robust tracking of disease progression. Our comprehensive validation on a robust dataset revealed NeuroTrackNet's impressive performance, achieving an overall accuracy of 92%, sensitivity of 90%, and specificity of 94%.

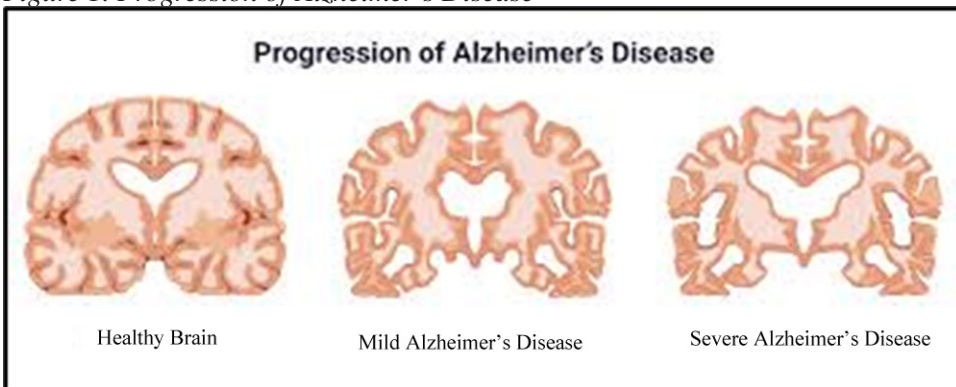
DOI: 10.4018/979-8-3693-6442-0.ch001

Copyright © 2025, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

INTRODUCTION

Alzheimer's Disease (AD) Fig:1 is a devastating and progressive neurodegenerative disorder that primarily affects the elderly, leading to severe cognitive decline, memory loss, and behavioral changes. It is the most common cause of dementia, accounting for 60-80% of cases. Alzheimer's Disease is characterized by the accumulation of amyloid-beta plaques and tau tangles in the brain, which disrupt neural communication and lead to the death of brain cells. This disease not only impacts the individual suffering from it but also places a significant emotional and financial burden on families, caregivers, and healthcare systems worldwide.

Figure 1. Progression of Alzheimer's Disease



Understanding Alzheimer's Disease

AD is a complex condition with multifaceted etiologies, involving genetic, environmental, and lifestyle factors. The exact cause of Alzheimer's Disease remains unknown, but several risk factors have been identified (Chudzik et al., 2024). Age is the most significant risk factor, with the likelihood of developing AD doubling approximately every five years after the age of 65. Other risk factors include a family history of the disease, the presence of the APOE ϵ 4 allele, cardiovascular conditions, diabetes, obesity, and a history of head trauma. The progression of AD is typically divided into three stages: preclinical, mild cognitive impairment (MCI), and Alzheimer's dementia.

24 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/bridging-the-gap/361246

Related Content

Multiple Description Coding for Multipath Video Streaming

Pedro Correia, Pedro A. Amado Assuncao and Vítor Silva (2017). *Biometrics: Concepts, Methodologies, Tools, and Applications* (pp. 836-891). www.irma-international.org/chapter/multiple-description-coding-for-multipath-video-streaming/164631

Using Grid Computing and Satellite Remote Sensing in Evapotranspiration Estimation

Cristina Serban and Carmen Maftai (2017). *Biometrics: Concepts, Methodologies, Tools, and Applications* (pp. 994-1016). www.irma-international.org/chapter/using-grid-computing-and-satellite-remote-sensing-in-evapotranspiration-estimation/164636

Chaotic Neural Networks and Multi-Modal Biometrics

(2013). *Multimodal Biometrics and Intelligent Image Processing for Security Systems* (pp. 130-146). www.irma-international.org/chapter/chaotic-neural-networks-multi-modal/76166

A Black-Box Model for Estimation of the Induction Machine Parameters Based on Stochastic Algorithms

Julien Maitre, Sébastien Gaboury, Bruno Bouchard and Abdenour Bouzouane (2015). *International Journal of Monitoring and Surveillance Technologies Research* (pp. 44-67). www.irma-international.org/article/a-black-box-model-for-estimation-of-the-induction-machine-parameters-based-on-stochastic-algorithms/146154

Application of Artificial Neural Networks to Reliable Nuclear Data for Nonproliferation Modeling and Simulation

Pola Lydia Lagari, Vladimir Sobes, Miltiadis Alamaniotis and Lefteri H. Tsoukalas (2016). *International Journal of Monitoring and Surveillance Technologies Research* (pp. 54-64). www.irma-international.org/article/application-of-artificial-neural-networks-to-reliable-nuclear-data-for-nonproliferation-modeling-and-simulation/180666