# Chapter 11
# Harnessing Big Data for Early Detection and Progression Tracking of Alzheimer's Disease

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## ABSTRACT

*Early detection and monitoring of Alzheimer's disease (AD) are critical challenges in neurology. This research explores the transformative potential of big data analytics to address these challenges. By integrating extensive datasets from diverse sources—genomic data, electronic health records (EHRs), neuroimaging, and patient lifestyle information—we aim to identify early biomarkers and track disease progression with high precision. Advanced machine learning techniques, including deep learning and ensemble models, are applied to uncover hidden patterns and*

DOI: 10.4018/979-8-3693-6442-0.ch011

*correlations that traditional methods may overlook. Our models demonstrated high accuracy in identifying early biomarkers, with a diagnostic accuracy of 94% (AUC) and an ability to predict disease progression with 92% accuracy. The study also highlighted a 35% improvement in early diagnosis rates and a 20% slower progression rate in monitored patients. Additionally, the importance of data preprocessing, feature extraction, and model interpretability is emphasized to ensure reliable and actionable insights.*

## INTRODUCTION

### Background

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that predominantly affects the elderly, leading to cognitive decline, memory loss, and eventually, loss of independence (Harold et al., 2014). It is the most common form of dementia, accounting for approximately 60-70% of cases worldwide. Despite extensive research, the exact cause of AD remains unknown, but it is believed to result from a complex interplay of genetic, environmental, and lifestyle factors. Key pathological features of AD include the accumulation of amyloid-beta plaques and neurofibrillary tangles in the brain, which lead to neuronal damage and brain atrophy. As shown in Figure 1 Healthy VS Alzheimer.

*Figure 1. Healthy VS Alzheimer*