Chapter 6
Natural Language Processing of Electronic Health Records for Predicting Alzheimer's Disease

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ABSTRACT

This chapter explores the use of Natural Language Processing (NLP) to analyze Electronic Health Records (EHRs) for early prediction of Alzheimer's disease. It delves into NLP techniques that enhance diagnostic accuracy by extracting insights from unstructured data within EHRs. The potential of NLP to revolutionize early detection and improve patient outcomes through precise, real-time data analysis is highlighted, emphasizing advancements in healthcare technology. The integration of NLP with EHR systems promises to advance personalized medicine, allowing for earlier interventions that can significantly alter the course of Alzheimer's disease. By enabling a deeper understanding of nuanced patient data, NLP fosters a proactive approach to healthcare that prioritizes prevention and precise treatment strategies.

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INTRODUCTION

Purpose of the Chapter

The escalating prevalence of Alzheimer's disease (AD) poses significant challenges to global healthcare systems, underscoring the urgent need for innovative diagnostic and treatment strategies. This chapter explores the transformative potential of Natural Language Processing (NLP) in harnessing the rich yet underutilized data embedded within Electronic Health Records (EHRs) to predict Alzheimer's disease at an early stage. The theoretical framework, rooted in linguistic computational models, is supported by empirical studies that demonstrate NLP's efficacy in early diagnosis, as evidenced by studies (Penfold & Stang 2022), where NLP tools identified early symptoms overlooked in traditional screenings. The objectives of this chapter are twofold: firstly, to provide a comprehensive overview of current NLP methodologies applied to EHRs for extracting clinical insights relevant to Alzheimer's disease, and secondly, to assess the impact of these technologies on enhancing early diagnosis and improving patient outcomes. By integrating NLP into the analysis of EHRs, healthcare professionals can identify subtle patterns and indicators of Alzheimer's disease much earlier than traditional methods allow, potentially leading to more effective intervention strategies and improved patient prognosis.

Background on Alzheimer's Disease

Alzheimer's disease is a progressive neurodegenerative disorder characterized by the deterioration of cognitive function and the decline in the ability to perform everyday activities. As the most common cause of dementia, Alzheimer's has a profound impact on individuals, families, and healthcare systems worldwide (World Health Organization. 2021). According to the World Health Organization, over 55 million people live with dementia globally, with Alzheimer's disease accounting for 60-70% of these cases (Wise & Lyketsos, 2022). The burden on healthcare systems is substantial, with costs associated primarily with long-term care and hospitalization.

Early detection of Alzheimer's disease is crucial yet challenging. The disease often progresses subtly and is typically diagnosed through clinical evaluations, which are effective only after significant cognitive decline has occurred (Porsteinsson, & Rubino, 2021). This limitation highlights the necessity for early diagnostic tools that can detect the onset of Alzheimer's before severe impairment takes place. Such early detection is pivotal, not only for better management of the disease through timely interventions but also for the planning and provision of healthcare services and support systems (Ginsburg & Anderson, 2020).