

Chapter 4

Integration of AI With ML for Neuropsychological Applications

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ABSTRACT

This chapter examines how Artificial Intelligence (AI) and Machine Learning (ML) are being used in neuropsychology, focusing on how they can significantly improve the study and treatment of cognitive issues like Mild Cognitive Impairment (MCI) and Alzheimer's Disease (AD). Traditional methods in neuropsychology often depend on subjective evaluations, which can reduce the accuracy of diagnoses and delay necessary treatments. AI and ML use large amounts of data to find early signs of cognitive problems and provide better predictive analysis, helping with early detection and more accurate treatment. From a research standpoint, AI offers new tools to examine complex data from brain scans, genetic information, and behaviour tests. Machine learning can identify patterns that suggest how diseases might progress,

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which could lead to important discoveries in finding markers for diseases and creating treatments tailored to individual patients. The chapter indicates that more research should focus on making AI systems fair and easy to understand and using them in many medical situations.

INTRODUCTION

Integrating AI and ML into neuropsychology opened a more comprehensive ground in diagnosing and treating CNS disorders like MCI and AD (Haraldsen et al., 2024). During the current aspiration to cater to different market needs because of the rapidly aging population worldwide, The growth of these systems' accessibility means that the identification and subsequent handling of these conditions will prove to be difficult on a massive scale (Aboukadri et al., 2024). These assessments may also be slow processes and laborious and can differ from one clinician to another. Modern approaches using AI and ML capabilities can disrupt the existing approaches to diagnostic accuracy enhancement, assessment solutions, and personalised treatment (Zahra et al., 2024). The importance of innovation in neuropsychological science conditions such as MCI and Alzheimer's disease presents many complexities to healthcare systems (Ali et al., 2024). MCI is thought to be a prodromal form of dementia and is characterized by a clear-cut cognitive deficit that fails to cause substantial loss of independence. On the other hand, AD is a progressive neurodegenerative disease that propagates pain in memory. It affects the thought process and the ability to carry out mundane activities independently. These conditions must be identified early since early stages mean treatment could help slow the advancement of such diseases or improve patients' lives. However, surprisingly, it seems that it often lacks rationality to diagnose them through the standardized objective criteria since they seem to suffer from periodically subjective assessment and clinical discretion, making it rather sporadic and delayed. These studies have provided evidence that widely used and standardized neuropsychological screening measures allow for a limited understanding of cognitive decline. For instance, the current commonplace standard assessment, namely Mini-Mental State Examination-MMSE, might omit primary relatively minor variations that predict MCI or AD onset. This makes it necessary to have a better diagnostic tool capable of discriminating the patients' cognitive health status from various patterned data.

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