Chapter 7
AI Algorithms for Early Detection of Cognitive Impairments

Rupam Hazra
Global Institute of Management and Technology, Krishnanagar, India

Parag Chatterjee
Global Institute of Management and Technology, Krishnanagar, India

Yash Singh
Global Institute of Management and Technology, Krishnanagar, India

Gopal Podder
Global Institute of Management and Technology, Krishnanagar, India

Titli Das
Global Institute of Management and Technology, Krishnanagar, India

ABSTRACT

The rapid advancement of Artificial Intelligence (AI) and Machine Learning (ML) has introduced transformative capabilities in the detection and management of cognitive impairments. These impairments represent significant challenges in healthcare, characterized by complex symptoms and progressive deterioration. Traditional diagnostic and management methods often face limitations due to the subtleties in early symptom detection and the need for comprehensive data analysis. AI algorithms offer powerful tools to address these challenges. The integration of these AI algorithms into clinical practice provides several advantages: enhanced diagnostic accuracy through sophisticated data analysis, personalized treatment

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plans tailored to individual patient profiles, and predictive models that forecast disease progression. This chapter highlights the potential of artificial intelligence to transform the management of mental retardation and shows how these technologies can be used to overcome the limitations of traditional and advances in the field of mental health.

INTRODUCTION

Cognitive impairment, including conditions such as Alzheimer's disease, Parkinson's disease and other forms of dementia, is a major challenge for health systems worldwide. Early detection of these conditions is important, as interventions are more effective and patient outcomes are better. In the past, the diagnosis of mental disorders has relied heavily on clinical assessments, neuropsychological tests and neuroimaging techniques. Recent advances in AI offer early new opportunities for early detection. Artificial intelligence algorithms, especially those related to machine learning and deep learning, have demonstrated the ability to analyse complex patterns in data that may indicate early cognitive decline. These algorithms can quickly process large amounts of data and detect subtle changes that conventional methods might miss.

Overview of Cognitive Impairments

Cognitive impairment covers many conditions that affect memory, thinking, inference, and other mental functions. These disorders may vary depending on the severity and progress of mild cognitive impairment (MCI), from more serious forms, such as Alzheimer's disease and other types of dementia.

Types of Cognitive Impairments

A. **Alzheimer's Disease:** Alzheimer's disease is the most common form of dementia and is characterized by progressive memory loss, confusion, and behavioral changes. Early symptoms often include difficulty remembering recent events and performing everyday tasks (Alzheimer's Association, 2023).
B. **Vascular dementia:** This type of dementia occurs due to cerebrovascular problems, such as a stroke, and causes problems with reasoning, planning, and judgment. Symptoms may vary depending on the location and extent of the brain damage (O'Brien & Thomas, 2015).