

Chapter 13

Role of Artificial Intelligence in Modeling Psychometrics to Detect Neurodevelopmental Disorders: Use of AI to Understand Human Behavioral Aspects

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ABSTRACT

The objective of the present chapter is to highlight applications of machine learning and artificial intelligence (AI) in clinical diagnosis of neurodevelopmental disorders. The proposed approach aims at recognizing behavioral traits and other cognitive aspects. The availability of numerous data and high processing power, such as graphic processing units (GPUs) or cloud computing, enabled the study of micro-patterns hundreds of times faster compared to manual analysis. AI, being a new technological breakthrough, enables study of human behavior patterns, which are hidden in millions of micro-patterns originating from human actions, reactions, and gestures. The chapter will also focus on the challenges in existing machine learning techniques and the best possible solution addressing those problems. In the future, more AI-based expert systems can enhance the accuracy of the diagnosis and prognosis process.

INTRODUCTION

The use of Machine Learning (ML) for clinical diagnosis of different diseases such as cancer or cardiovascular diseases in modern day is rapidly increasing. Various other health domains utilizes ML and Artificial Intelligence (AI) techniques for rapid and accurate clinical diagnosis (Brinker et al., 2018). AI-based systems seems very promising, but poses numerous challenges in the clinical diagnosis of neurodevelopmental disorders (Faghri et al., 2017; Mannini & Sabatini, 2010). The core of modern-day ML applications is the ability of machines to classify and recognize the input data with the correct label at scale. The ML based systems learn from patterns and predict the correct class to assist clinicians for early and efficient detection of Neurodevelopmental disorders.

If we have to differentiate one person from another, in general terms their behavior is one of the most important aspects to look into. There are numerous studies available on this topic that are conducted in the last few decades analyzing the psychological and emotional state of human beings to identify their behavioral traits and the behavioral shift. The detection of the disorder on the basis of behavioral traits sounds very promising, but at the same time it is very challenging. The major roadblock is the mapping of the statistical approaches to real-life scenarios such as scalability requirement. Some of the other challenges are:

- Identifying contextually suitable implementation of algorithms is not explicitly explored and defined (Nathalia et al., 2018).
- Very few examples of successfully scalable machine learning implementations and generalization of models (Wadhera & Kakkar, 2019).
- Consuming nontraditional sources of structured and unstructured data for robust machine learning solutions.
- Digitizing information without human bias is messy.
- Building real-time ML solutions using scalable data pipelines need a multi-domain understanding which makes it a difficult process (Li et al., 2016).

Through this chapter, we will learn and explore the most advanced ways i.e., data-driven and ML based approaches to solve the above-mentioned challenges. Additionally, we will also focus on the introduction to relevant ML algorithms and their methodology for disorder detection. Afterward, the impact of different channels of collecting and processing information on the accuracy is detailed to improve the bottom-line performance extraordinarily. Finally, towards the end of this chapter, we will propose a solution on how to weigh different aspects of processed information and use them temporarily for practical scenarios to address the existing challenges in a better way.

Background of Artificial Intelligence and Machine Learning

As the name suggests, AI is a means of incorporating human intelligence into machines. The act of machines performing tasks without being explicitly coded for that particular task only, but trained on general-purpose scenarios using labeled data on those scenarios is called artificial intelligence (Tanu & Kakkar, 2018). Inside AI, ML is a field of study, which gives computers an extraordinary ability to learn micro-patterns through algorithms which otherwise cannot be processed manually. This ability to understand micro-patterns enables machines to perform certain tasks without being explicitly instructed

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