Chapter 7
AI and Digital Twins: A Breakthrough Approach to Mental Health Diagnosis and Therapy

Sanket Dan
https://orcid.org/0000-0002-7587-4285
JIS College of Engineering, India

Jayeeta Ghosh
https://orcid.org/0009-0002-8090-2495
JIS College of Engineering, India

Bikramjit Sarkar
https://orcid.org/0000-0002-6036-942X
JIS College of Engineering, India

Jayshree Bhattacharya
https://orcid.org/0009-0009-3118-132X
JIS College of Engineering, India

ABSTRACT

Artificial intelligence (AI) has significantly impacted healthcare, particularly through the use of digital twin technology. This innovative method creates virtual replicas of patient care, improving health and therapy reactions. The integration of AI with digital twins offers significant potential for mental health diagnosis and therapy, enabling personalized treatment plans and enhancing patient engagement. Digital twins use extensive patient data, including genetic, environmental, and lifestyle characteristics, to better understand each patient's needs. They can also predict patients' reactions to medications or procedures, enabling proactive treatment changes. As technolo-

DOI: 10.4018/979-8-3373-0538-7.ch007

gy advances, digital twins could detect early signs of mental health problems and track continuous changes in mental health status. The effectiveness of this strategy depends on data accessibility and quality, necessitating collaboration between data scientists, mental health specialists, and healthcare providers.

INTRODUCTION

Since the COVID-19 outbreak, mental health disorder rates have surged, with depression affecting over 280 million people and ranking as the second leading cause of disability globally, according to the World Health Organization, (Abilkaiyrkyzy, Laamarti, Hamdi, & El Saddik, 2024). A study revealed a 28% and 26% increase in major depressive and anxiety disorders globally in the year of 2020, resulting in tens of millions of additional problems. Depression, characterized by feelings of melancholy and lack of interest, can lead to feelings of anxiety, low worth, and loss of interest. Persistent feelings can escalate into more severe clinical cases. Mental health issues persist for longer, leading to chronic pain, stress, heart attack, obesity, difficulty coping with daily activities, and in extreme cases, suicide. Mental health conditions such as depression can be prevented from becoming severe, recovery can be facilitated, recurrence can be avoided, and the emotional and financial burden of the condition can be lessened with early detection, intervention, and appropriate care. In order to address this issue, conversational agents have been more and more popular recently, particularly in psychoeducation and various therapeutic treatments; yet, only few have been used to the thorough identification of mental health issues.

Artificial Intelligence (AI) and digital twins are revolutionizing mental health care by enabling more accurate diagnosis, treatment, and personalized care. These technologies use advanced data analytics and modeling techniques to simulate and understand individual patients' mental health profiles, providing insights previously unattainable. The ability to analyze vast patient data and replicate mental and physiological states in a virtual environment opens new possibilities for more effective treatment plans, potentially improving patient outcomes and revolutionizing mental health care delivery (Santomauro et al., 2021). One example using conversational AI technology, a chatbot system mimics a natural language discussion (or chat) with a user across a variety of platforms, including mobile applications, websites, and messaging apps. It uses rule-based language applications to conduct live chat operations in response to user inputs in real time. Natural language processing (NLP), natural language understanding (NLU), machine learning (ML), deep learning, and predictive analytics are some of the technologies used by the Conversational AI platform. Big data growth, data science advancements, and AI can expedite Digital Twins research and development by providing scientific expertise, essential