

# Chapter 9

## Artificial Intelligence– Powered Digital Twin Predictive Analytics Model for Smart Healthcare System: Leveraging Digital Twins' Potential to Improve Healthcare Outcomes

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### **ABSTRACT**

*Health monitoring systems and healthcare organizations produce vast amounts of complicated data, which present opportunities for creative research in medical decision-making. These data capture advances have opened unthinkable domains for AI and digital twin-related healthcare applications. AI-powered digital twin supports healthcare process automation, real-time health monitoring, enhanced medical decision-making, personalized healthcare, and predictive analytics. These applications can create AI-powered digital twin models that mimic human physiology using various advanced computing approaches. The potential of digital twins can be used to advance medical research and better healthcare outcomes. Hence, this chapter aims to provide an Artificial Intelligence-powered digital twin predictive analytics model for an innovative healthcare system. Integrating digital twins into the smart healthcare field can improve healthcare procedures, provide personalized treatment, and create a smart and intelligent healthcare ecosystem.*

DOI: 10.4018/979-8-3373-0538-7.ch009

## INTRODUCTION

Advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and other emerging technologies enhance patient outcomes and revolutionize healthcare delivery. AI-powered solutions revolutionize healthcare operations (Kumar et al., 2023) in disease detection procurement, production, logistics, and digital twin integration. Healthcare AI systems can forecast possible health concerns by examining current health data and patterns in a patient's medical history. The critical aspect of the disease diagnosis procedure is the diagnosis's correctness and precision. AI has demonstrated high accuracy in image-based disease detection and treatment outcome prediction (Ghaffar et al., 2023), including survival rate and response to treatment. For instance, AI systems can analyze CT scans in their early stages to find lung cancers (Cellina et al., 2023). Like breast cancer, 94% of lung cancer cases were identified in their early stages. Also, AI-based disease detection algorithms can distinguish between benign moles and malignant melanomas in skin cancer by examining photographs of the skin. Hence, AI is beneficial for predicting mortality risks in critical and palliative care situations.

Also, AI-powered predictive analytics (Dixon et al., 2024) allows doctors to tailor treatment strategies to each patient's requirements. Healthcare providers can use these predictive capabilities to provide proactive, preventative care, ultimately improving patient outcomes and saving healthcare costs. AI can predict health decreases and provide individualized therapeutic techniques by evaluating patient data. AI can learn from the digital twins' data (Sun et al., 2022) to find trends, forecast the course of diseases, and improve treatment strategies. This aligns with Industry 4.0's creative, personalized production objective while preserving efficiency and cutting labor costs.

Digital twins are one such technological advancement that has recently garnered much attention. Digital twins are simulation, data analysis, and real-time monitoring tools that are virtual representations of real-world systems (Saravanan et al., 2024). These technologies enable digital twins to increase bioproduct yields and quality. Digital twins have established a new home in the healthcare sector thanks to several opportunities to improve patient care and encourage innovation. Digital twin technologies in healthcare are a big step toward more individualized treatment in the healthcare industry, and they promise to revolutionize individualized treatment.

### AI-Powered Digital Twin Healthcare

Digital twins can potentially transform patient care and improve health outcomes (Jack McKenna, 2024) through their capacity to improve data-driven decision-making, therapies, remote monitoring, and patient participation. They can lower

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