Chapter 4
Machine Learning-Based Big Data Analytics for IoT-Enabled Smart Healthcare Systems

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ABSTRACT

Machine learning (ML) and big data analytics (BDA) have emerged as powerful technologies for extracting valuable information from the large amount of data generated by IoT-enabled smart healthcare systems. This chapter provides an overview of the application of ML and BDA in the context of IoT-enabled smart healthcare systems. IoT-enabled smart healthcare systems consider interconnected medical devices, wearables, and sensors to collect real-time data, including patient records, medical imaging data, and sensor data. In the near future, ML algorithms can be applied to this data to perform tasks such as predictive modeling, anomaly detection, classification, and clustering. ML algorithms enable healthcare providers to make informed decisions, improve patient outcomes, and optimize resource allocation. On other side, BDA platforms are important for handling and processing the large amount of data generated by IoT devices.

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1. INTRODUCTION

In recent years, the healthcare industry has witnessed a significant transformation with the advent of IoT (Internet of Things) and the increasing availability of large volumes of healthcare data. This data includes patient records, medical imaging data, wearable device data, sensor data from medical devices, and more. The challenge lies in extracting meaningful information from this massive amount of data to improve healthcare outcomes and provide personalized care. Machine learning, a subset of artificial intelligence, has emerged as a powerful tool for analyzing and making sense of big data in healthcare. By applying machine learning algorithms to the large amount of data generated by IoT-enabled smart healthcare systems, valuable patterns, trends, and correlations can be discovered. This information can then be used to enhance clinical decision-making, improve patient care, optimize resource allocation, and drive medical research and innovation. Big data analytics plays an essential role in this process. With the ability to handle and process large volumes of data from various sources, big data analytics platforms provide the foundation for machine learning models to extract meaningful information (Ahmed et al., 2021). These platforms employ distributed computing techniques to manage the massive scale of data generated by IoT devices, enabling real-time analysis and decision-making. IoT-enabled smart healthcare systems add the interconnectedness of medical devices, wearables, and sensors to collect and transmit valuable data in real-time. For example, wearable devices can continuously monitor a patient's vital signs, activity levels, and sleep patterns, providing a wealth of data for analysis. When combined with electronic health records, medical imaging data, and other relevant sources, a comprehensive picture of a patient's health status can be formed.

Machine learning algorithms can be applied to this diverse set of data to perform tasks such as predictive modeling, anomaly detection, classification, and clustering. Predictive models can be developed to identify patients at risk of developing specific conditions, allowing healthcare providers to intervene early and prevent adverse events. Anomaly detection algorithms can identify unusual patterns in patient data, alerting healthcare professionals to potential issues or abnormalities. Classification algorithms can help in disease diagnosis and treatment recommendation, while clustering techniques can group similar patient profiles for targeted interventions and personalized care plans. The advantages of utilizing machine learning based big data analytics in IoT related applications within the smart/digital healthcare system is massive. Healthcare providers can consider these technologies to enhance patient outcomes, optimize resource utilization, and reduce costs. Real-time monitoring and analysis of patient data enable early detection and intervention, reducing hospital readmissions and