ADVANCES IN LEARNING ANALYTICS FOR INTELLIGENT CLOUD-IOT SYSTEMS

INTERNET OF MEDICAL THINGS (IOMT)

HEALTHCARE TRANSFORMATION

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The Internet of Medical Things (IoMT)

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Advances in Learning Analytics for Intelligent Cloud-IoT Systems

Series Editors: Dr. Souvik Pal and Dr. Dac-Nhuong Le

Scope: The role of adaptation, learning analytics, computational Intelligence, and data analytics in the field of Cloud-IoT Systems is becoming increasingly essential and intertwined. The capability of an intelligent system depends on various self-decision making algorithms in IoT Devices. IoT based smart systems generate a large amount of data (big data) that cannot be processed by traditional data processing algorithms and applications. Hence, this book series involves different computational methods incorporated within the system with the help of Analytics Reasoning and Sense-making in Big Data, which is centered in the Cloud and IoT-enabled environments.

The series seeks volumes that are empirical studies, theoretical and numerical analysis, and novel research findings. The series encourages cross-fertilization of highlighting research and knowledge of Data Analytics, Machine Learning, Data Science, and IoT sustainable developments.

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Preface

It is a pleasure for us to put forth this book, *The Internet of Medical Things (IoMT): Healthcare Transformation*. Digital technologies have come into effect in various sectors of our daily lives and it has been successful in influencing and conceptualizing our day-to-day activities. The Internet of Medical Things is one such discipline which seeks a lot of interest as it combines various medical devices and allows these devices to have a conversation among themselves over a network to form a connection of advanced smart devices. This book helps to know about IoMT in the health care sector that involves the latest technological implementation in diagnostic level as well as therapeutic level. The security and privacy of maintaining the health records is a major concern and several solutions for the same has been discussed in this book. It provides significant advantages for the wellbeing of people by increasing the quality of life and reducing medical expenses. IoMT plays a major role in maintaining smart healthcare system as the security and privacy of the health records further leads to help the health care sector to be more secure and reliable. Artificial Intelligence is the other enabling technology that helps IoMT in building smart defensive mechanisms for a variety of applications like providing assistance for doctors in almost every area of their proficiencies such as clinical decision-making. Through Machine Learning and Deep Learning techniques, the system can learn normal and abnormal decisions using the data generated by the health worker/professionals and the patient feedback. This book demonstrates the connectivity between medical devices and sensors is streamlining clinical workflow management and leading to an overall improvement in patient care, both inside care facility walls and in remote locations. This book would be a good collection of state-of-the-art approaches for applications of IoMT in various health care sectors. It will be very beneficial for the new researchers and practitioners working in the field to quickly know the best methods for IoMT.

- Chapter 1 concentrates on the study of the three-dimensional (3-D) models of lung cancer cell line proteins (epidermal growth factor (EGFR), K-Ras oncogene protein and tumor suppressor (TP53)). The generation and their binding affinities with curcumins, ellagic acid and quercetin through local docking were assessed.
- Chapter 2 focuses on cloud computing and electronic health record system service EHR used to protect the confidentiality of patient sensitive information and must be encrypted before outsourcing information. This chapter focuses on the effective use of cloud data such as search keywords and data sharing and the challenging problem associated with the concept of soft computing.
- Chapter 3 elucidates the study of cloud computing concepts, security concerns in clouds and data centers, live migration and its importance for cloud computing, and the role of virtual machine (VM) migration in cloud computing. It provides a holistic approach towards the pre-copy migration technique thereby explore the way for reducing the downtime and migration time. This chapter compares different pre-copy algorithms and evaluates its parameters for providing a better solution.
- Chapter 4 concentrates on Deep Learning that has gained more interest in various fields like image classification, self-driven cars, natural language processing and healthcare applications. The chapter focuses on solving the complex problems in a more effective and efficient manner. It elaborates for the reader how deep learning techniques are useful for predicting and classification of the brain tumor cells. Datasets are trained using pre-trained neural networks such as Alexnet, Googlenet and Resnet 101 and performance of these networks are analysed in detail. Resnet 101 networks have achieved highest accuracy.
- Chapter 5 illustrates an intelligent healthcare monitoring system for coma patients that examines the coma patient's vital signs on a continuous basis, detects the movement happening in the patient, and updates the information to the doctor and central station through IoMT. Consistent tracking and observation of these health issues improves medical assurance and allows for tracking coma events.

- Chapter 6 details the Deep Learning process that resembles the human functions in processing and defining patterns used for decision-making. Deep learning algorithms are mainly designed and developed using neural networks performing unsupervised data that are unstructured. Biomedical data possess time and frequency domain features for analysis and classification. Thus, deep learning algorithms are used for interpretation and classification of biomedical big data.
- Chapter 7 discusses how the electronic health records automates and streamlines the clinician's workflow and makes the process easy. It has the ability to generate the complete history of the patient and also help in assisting for the further treatment which helps in the recovery of the patient in a more effective way. The electronic health records are designed according to the convenience depending on the sector it is being implemented. The main aim of electronic health records was to make it available to the concerned person wherever they are, to reduce the work load to maintain clinical book records and use the details for research purposes with the concerned persons acknowledgement.
- Chapter 8 elaborates technical architecture of IoMT in relation to biomedical applications. These ideologies are widely used to educate people regarding the medical applications using IoMT. It also gives a detailed study about the future scope of IoMT in healthcare.
- Chapter 9 provides knowledge on the different performance assessment techniques and types of protocols that suits best data transfer and increases safety. The chapter provides the best protocol which helps in saving energy and is useful for the customer. It will help the researchers to select the best IoT protocol for healthcare applications. Testing tools and frameworks provide knowledge to assess the protocols.
- Chapter 10 addresses the issue of a Health Monitoring Centre (HMC) in rural areas. The HMC monitors and records continuously the physiological parameters of the patients in care using wearable biosensors. The elderly suffering from chronic diseases is monitored periodically or continuously under the care of the physician. To enhance the performance of the system a smart and intelligent mesh

backbone is integrated for fast transmission of the critical medical data to a remote health IOT cloud server.

- Chapter 11 concentrates on Diabetes Mellitus (DM) which is one of the most widely recognized perilous illnesses for all age groups in the world. The patients need to settle on the best-individualized choices about day-by-day management of their diabetes. Noninvasive glucose sensor used to find out the glucose value of patients from its fingertip and other sensors also connected to the patient to get relevant data. A completely useful IoT-based eHealth stage that wires humanoid robot help with diabetes and planned successfully. The created platform encourages a constant coupled network among patients and their caretakers over physical separation and, in this manner, improving patient's commitment with their caretakers while limiting the cost, time, and exertion of the conventional occasional clinic visits.
- Chapter 12 explores the concepts of wearable health monitoring systems using IoMT technology. Additionally, this chapter also provides a brief review about challenges and applications of customized wearable healthcare system that are trending these days. The basic idea is to have a detailed study about the recent developments in IoMT technologies and the drawbacks, as well as future advancements related to it. The recent innovations, implications and key issues are discussed in the context of the framework.
- Chapter 13 provides knowledge on biomedical big data analysis which plays a huge impact in personalized medicine. Some challenges in big data analysis like data acquisition, data accuracy, data security are discussed. Huge volume of data in healthcare can be managed by integrating biomedical data management. This chapter will provide brief information on different software that are used to manage data in healthcare domain. Impact of big data and IoMT in healthcare will enhance data analytics research.
- Chapter 14 concentrates on blockchain which is a highly secure and decentralized networking platform of multiple computers called nodes. Predictive analysis, soft computing (SC) and optimization and data science is becoming increasingly important. In this chapter, the authors investigate privacy issues around large cloud medical data in the remote cloud. Their proposed framework ensures data privacy,

integrity, and access control over the shared data with better efficiency. It reduces the turnaround time for data sharing, improves the decision-making process, and reduces the overall cost while providing better security of electronic medical records.

- Chapter 15 discusses the evolution of electronic health record starting with the history and evolution of the health record system in the Egyptian era when the first health record was written, all the way to the modern computerized health record system. This chapter also includes various documentation procedures for the health records that were followed from the ancient times and by other civilizations around the world.

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