

Review

Big Data, Extracting Insights, Comprehension and Analytics in Cardiology: An Overview

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ABSTRACT

Healthcare system facilitates the treatment of patients with the support of wearable, smart, and handheld devices, as well as many other devices. These devices are producing a huge bulk of data that need to be moulded for extracting meaningful insights from them for the useful use of researchers and practitioners. Various approaches, methods, and tools are in use for doing so and to extract meaningful information in the field of healthcare. This information is being used as evidence to further analyze the data for the early care of patient and to devise treatment. Early care and treatment can facilitate healthcare and the treatment of the patient and can have immense potentiality of dropping the care cost and quality refining of care and can decrease waste and chances of error. To facilitate healthcare in general and cardiology in specific, the proposed study presents an overview of the available literature associated with big data, its insights, and analytics. The presented report will help practitioners and researchers to devise new solutions for early care in healthcare and in cardiology.

Keywords

Healthcare; Handheld devices; Cardiology.

INTRODUCTION

The increase in use of smart devices such as sensor, actuator, and wearable devices, as well as other devices, has produced massive amount of data that need to be shaped in a structure way to mine the information and useful insights for the useful use of research and practice. This increase of information can yield research issues and challenges as extracting useful information becomes a challenging task for research. The useful insights once drawn in a successful way can ultimately care the patient and provide effective treatment in the early stage. Diverse approaches, methods, and mechanisms are in practice to tackle the issues of big data and its analytics in the field of healthcare in general and cardiology in specific.

The role of data processing and information in healthcare has always been vital in healthcare for decision-making and its provision. Medical big data is produced from the communication and digitiza-

tion in healthcare. Healthcare providers and hospital industry provide a huge amount of data from other segments, such as medical equipment, medical insurance medical research, and life science. Huge amount of data exists, which grasps the potential of support of healthcare and medical tasks. The integration of machine learning, artificial intelligence, and advanced analytics offers numerous opportunities for transmuting such data into actionable and expressive insights for supporting decision-making. This can ultimately make availability of patient care at high quality and real-time situation response and can protect lives on the clinical side and develop the services and processes, improve the use of resources, and minimize the costs on the maintenance and financial front [1, 2].

With the rise of advanced approaches such as analytical techniques and approaches, the stakeholders of healthcare can not only connect the data power for historical analysis of data but also predict future outcomes with predictive analytics for defining best accomplishment for present situation [3, 4]. Conventionally, the practitioners

of clinic rely on reserved information accessible to them and their past involvement for treatment of patients. Data availability from diverse sources deals with the chance to have a complete thought of patient well-being. The use of cutting-edge technologies against such data aids access to the appropriate information at precise place and accurate time for delivering precise care [5].

The proposed study presents an overview of the available literature associated with big data, its insights, and analytics. The process of search for the proposed study was done in the popular libraries with the aim of obtaining associated materials. The presented report will help practitioners and researchers to devise new solutions for early care in healthcare and in cardiology.

The remainder of the paper is organized as follows: Section 2 presents the interrelated research to current study. Section 3 presents library-based search process for the proposed study. Section 4 concludes the paper.

2. Related Work

Several approaches have been in practice to tackle diverse issues of big data and its analytics in healthcare. Pevnick et al. [6] offered a review that discusses the current and upcoming devices intended for measuring the actions of heart rhythm, heart rate, and thoracic fluid. Various frameworks were presented, which classify and understand the wearable devices. Mehta et al. [7] presented a systematic mapping study for analyzing and identifying the research studies on analytics of big data and use of artificial intelligence in healthcare. The study identified 2421 papers for the year's ranges from 2013 to February 2019. These papers were evaluated, and the results show that the study will support the necessity in the use of technologies in healthcare. Atallah et al. [8] surveyed the literature associated with the DL and IoT applications for smart cities' developments. Initially, the basics of IoT were defined followed by the characteristics of IoT-produced big data. After that, the various structures used for analytics of IoT big data were presented. The common DL models were surveyed and reviewed the current research employing the IoT and DL for developing services and smart applications for smart cities. The existing issues and challenges encountered throughout the smart city's development were outlined. Kazmierska [9] presented a study on the needs of community in translating multisource data into clinical decision aids.

Ben-Assuli et al. [10] demonstrated power prediction of four popular algorithms and matched their accuracy in congestive heart failure predicting initial patient mortality. The results show that the current models outperform those described in the literature. The results further support the policy-makers in allocation of resources for establishment of comprehensive systems of integrated health IT aiming at simplification of analytics of ML. Dipti Itchhaporia [11] analyzed the existing application and state of machine learning approaches and artificial intelligence in cardiovascular medicine. The effects of emerging technologies on cardiovascular medicine are emphasized for providing understanding to the clinical practice and to find probable patient assistances. Nazir et al. [12] provided a wide-ranging overview of the available big data studies in cardiology. The study followed a protocol of systematic literature review for presenting the published material from 2008 till 2018 associated with big data features, applications, and analytics in cardiology field. The authors identified 190 potential studies and analyzed them.

These studies were published in conferences, books, journals, and many other online materials. The study was presented as an evidence for the researchers and practitioners to devise novel solutions in the area of interest. Nazir et al. [13] presented a comprehensive review of the 10 years from 2008 to 2018 associated with the visualization of big data in the area of cardiology. The study identified 53 prospective papers related to visualization of big data in cardiology. The study was based on protocol with defined research questions, inclusion and exclusion criteria, and quality criteria. These identified studies were analyzed according to the defined research questions. The study highlighted the increase of the number of researches in the area and focused on further research and innovations in the field. These studies were done in order to support the usage of big data in healthcare.

Bizopoulos and Koutsouris [14] surveyed applications of deep learning that uses structured data and signal and imaging modalities from cardiology. The benefits and limitations of applications of deep learning in cardiology and in medicine in general are discussed. Caniere [15] examined the developments of heart rate variability factors during short-term interval all the way through cardiac rehabilitation. Electrocardiography signals, documented with the help of wearable device in 129 patients following cardiac rehabilitation program, were analyzed. The findings of the study present appreciated insights into disease monitoring during cardiac rehabilitation in future application.

3. Library-Based Search Process

This study offers to present an overview of the existing approaches and methods for big data, its analytics, and insights in cardiology. Various popular libraries such as ScienceDirect, IEEE, Springer, and Wiley were searched with the aim of obtaining associated materials interconnected to the current study. The information gathered from these libraries was analyzed and presented from different perspectives in the form of different tables and figures. This information includes the type of article, number of publications, topics covered, subject areas, and publication titles. Initially, the library of ScienceDirect was checked and the following information was obtained. Figure 1 depicts the types of articles with publications. The figure shows that a bigger number of publications were in the form of research article.

Figure 2 presents the articles in total with the given year. More publications are shown in the year 2020, which shows the increase in number of researches.

Figure 3 depicts the subject areas with the number of publications.

The library of IEEE was searched for the purpose of identifying relevant information. Figure 4 represents the information of publication topics with the total number of articles published.

The paper type and total number of publications in the same library are shown in Figure 5.

Figure 6 presents the conference location with the number of publications.

After this, the library of Springer was searched to view the information for the purpose of analysis. Figure 7 depicts the type of articles with the number of publications.

The discipline with the total number of articles is shown in Figure

8. The purpose of this search was to identify the disciplines covered by the area.

The libraries of Wiley and Taylor & Francis were also part of the proposed study. These libraries were searched for relevant information and analysis. Figure 9 depicts the publication types with total number of articles published. In the figure, it is shown that more papers are published with type journal.

Figure 10 presents the number of publications in the given years from 2016 till 2020.

After the statistics were obtained, the papers were reviewed and the details with short descriptions of the papers were given. Table 1 shows the big data and its analytics in cardiology.

Big data are considered to be the main asset of the organization for its successful operations and future endeavour [72–77].

4. Conclusion

Healthcare system facilitates the patients with the support of wearable devices, smart devices, handheld devices, and many other devices. These devices are producing a huge bulk of data that need to be moulded for extracting expressive insights from them for the useful use of researchers and practitioners. Various approaches, methods, and tools are in use for doing so and to extract meaningful information in the field of healthcare. This information is being used as evidence to further analyze the data for the early care of patients and to devise treatment. Early care and treatment can facilitate healthcare and patient and can have immense potentiality of quality refining of care and lessen care cost and can decrease waste and chances of error. To facilitate healthcare in general and cardiology in specific, the proposed study presents an overview of the existing literature associated with big data, its insights, and analytics. The presented report will help practitioners and researchers to devise new solutions for early care in healthcare and in cardiology.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare no conflicts of interest.

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