Chapter 19
An Experimental Healthcare System: Essence and Challenges

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ABSTRACT

Contemporary healthcare systems face growing demand for their services, rising costs, and a workforce. Artificial intelligence has the potential to transform how care is delivered and to help meet the challenges. Recent healthcare systems have been focused on using knowledge management and AI. The proposed solution is to reach explainable and causal AI by combining the benefits of the accuracy of deep-learning algorithms with visibility on the factors that are important to the algorithm's conclusion in a way that is accessible and understandable to physicians. Therefore, the authors propose AI approach in which the encoded clinical guidelines and protocols provide a starting point augmented by models that learn from data. The new structure of electronic health records that connects data from wearables and genomics data and innovative extensible big data architecture appropriate for this AI concept is proposed. Consequently, the proposed technology may drastically decrease the need for expensive software and hopefully eliminates the need to do diagnostics in expensive institutions.

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1. PROBLEM DEFINITION

Recent healthcare systems have been focused on using knowledge management in such a way so as to achieve clinical advice based on multiple items of patient data (Morr, 2010). Most of them consist of three parts: the knowledge base, an inference engine, and a mechanism to communicate. Another approach which does not use a knowledge base uses a form of Artificial intelligence (AI) called machine learning, which allows computers to learn from past experiences and/or find patterns in clinical data.

Artificial intelligence has the potential to transform healthcare organizations and healthcare services. As longevity increases, healthcare systems face growing demand for their services (population ageing, patient expectations, lifestyle choices, and the never ending cycle of innovation), rising the costs and requiring a workforce that is struggling to meet the needs of the patients. AI in healthcare can support significant improvements in Self-care/Prevention/Wellness, Triage and Diagnosis, Diagnostics, Clinical Decision Support, Care Delivery, Chronic Care Management, etc. The number of data sources in healthcare services has grown rapidly as a result of widespread use of mobile, wearable sensors technologies and implants, which has flooded healthcare area with a huge amount of data and changed our understanding of human biology and of how medicines work, enabling personalized and real-time treatment for all. Therefore, the high volume of diversified medical data analysis based on traditional methods becomes non promising solution.

Exploiting AI eliminates the need for writing rules and for expert input. However, since systems based on machine learning cannot explain the reasons for their conclusions, most clinicians do not use them directly for diagnoses, for reliability and accountability reasons. Nevertheless, they can be useful as post-diagnostic systems, for suggesting patterns for clinicians to look into in more depth. Advances in a form of AI called deep learning mean that algorithms can generate layers of abstract features that enable computers to recognize complicated concepts (such as a diagnosis) by building on simpler ones that are accessible in the data. This enables them to learn discriminative features automatically and to create approximate highly complex relationships. Such algorithms have been around for some time now, but the recent expansion of datasets and computational resources have enabled a series of breakthrough improvements that could now be applied to augment healthcare provision.

To reach that goal it is necessary to propose an extensible big data architecture for healthcare applications formed by separate components for storing, processing, and analyzing the high amount of data.

2. EXISTING TECHNOLOGIES FOR HEALTHCARE SYSTEMS

Computers are utilized in healthcare for decades (Korolija, 2013), (Korolija, 2019). Contemporary healthcare systems tend to utilize the technology advancements for reducing costs and producing suggestions with higher accuracies. Many of them are based on AI. There are many AI methods. Most of them are oriented towards producing better results, but using decision trees, a health care professional could follow the decisions that the computer made, enabling him to change the decision by adjusting the path that the computer has taken. However, in general case, decision trees do not produce the same quality output as those methods that do not reveal the decision process. Recent advances in big data processing enable high quality decisions, while at the same time healthcare professionals are not eliminated from the process of making decisions.