Chapter 17
Potential Integration of Artificial Intelligence and Biomedical Research Applications:
Inevitable Disruptive Technologies for Prospective Healthcare

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ABSTRACT

Hospitals are experiencing an increase in patients due to the prevalence of chronic diseases and the growing elderly population. As a result, every day, a large volume of patient health data is generated, which must be stored and managed effectively. Artificial Intelligence (AI) has played a pivotal role in preventing, diagnosing, treating diseases and rehabilitating patients in the past few decades. Innovations and scientific breakthroughs have improved patient outcomes and population health as the healthcare industry has embraced the digital age. Hence, digital transformation is no longer an option, but rather an industry standard. Though, Biomedical engineering (BE) contributes to improving patient care quality, future healthcare applications will rely on AI enabled BE to solve complex healthcare issues. This book chapter uncovers the potential of AI and BE as a powerful tool for solving some of the most challenging issues of our age and brings comparable changes in scale to the renaissance, the Industrial Revolution in the healthcare sector.

1.0 INTRODUCTION

Business, society, and healthcare are increasingly integrating artificial intelligence (AI) and related technologies. Healthcare solutions have increasingly integrated artificial intelligence, machine learning (ML), biomedical engineering and natural language processing (NLP) into clinical development. From remote patient care to hospital administration, technology plays a crucial role today. The field of

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biomedical engineering applies engineering principles and design concepts to medicine and biology to benefit health care. These technologies are capable of transforming many aspects of patient care as well as administrative processes within providers, payers, and pharmaceutical companies. The requirements of healthcare are vast and complex. The COVID-19 outbreak afforded AI the opportunity to demonstrate its abilities and sophistication with regard to quality of service in the healthcare field. Especially during pandemic period like COVID-19 outbreak, the need for more number of medical practitioners is felt. The safety of the medical practitioners should be ensured first, to foster lifesaving treatments for the massive public. Under such circumstances, clinical decision making becomes difficult/error prone due to the excess number of cases the medical practitioners have to attend, due to the increasing COVID-19 spread and the insufficient number of medical practitioners. Clinical diagnosis, decision making, treatments and remote patient care should be accurate, fast, cost effective, available 24x7 and should be scaled at large to address and enhance patient care with respect to the increase in population (Taylor 2015). Personalized medicine and the need for digital health records are driving artificial intelligence in the healthcare market.

Advances in biomedical engineering improve human health and health care at all levels. Biomedical engineering encompasses many sub disciplines, including active and passive medical devices, orthopaedic implants, medical imaging, tissue and stem cell engineering, clinical engineering and biomedical signal processing (Michigan Tech 2019). The integration of artificial intelligence with biomedical engineering enhances the accuracy of decision making, which is vital to identifying the right treatment at the earliest. Furthermore, biomedical engineering is involved in the development of artificial organs, the development of diagnostic machines, the training of clinicians in the use of machines, and the study of biological systems (Roberson 2017).

Currently, algorithms outperform radiologists in detecting malignant tumors and guiding researchers in how to construct cohorts for costly clinical trials. However, AI will not be able to replace humans for a wide range of medical processes for a variety of reasons. We explore both the potential of AI for automating aspects of healthcare and the barriers to rapid implementation of AI.

2.0 LITERATURE SURVEY

AI seems more feasible than ever due to advancements in computing and processing power, coupled with hardware modernizations. The most significant AI breakthroughs of recent years can be attributed to machine learning. Instead of giving AI a fixed set of directions, AI models for healthcare applications is trained using large data sets to overcome the bias in outcomes. Increasing data generation from healthcare has led to potential improvements in accountability, quality, efficiency, and innovation. A great deal of research and innovation is conducted within the healthcare industry and hospital workflows. This is done with the goal of improving patient safety, reducing physician stress levels, and increasing the overall state of healthcare.

Gene technology, based on bioinformatics, offers enormous benefits for disease prevention and health care. The field of medical informatics today includes the concept of linking information sources through information and communication technology, enabling medical personnel to access information from a distance regardless of whether it comes from a patient's body or from an electronic archive (Snyder et al. 2011).