

Artificial Intelligence is Poised to be a Premier Player in the Future of Health Care

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ABSTRACT

The goal of artificial intelligence (AI) is to imitate cognitive processes in humans. Due to expanding availability of health care data and the quick advancement of analytics techniques, it is bringing about a paradigm shift in health care. Recent advancements in the digitized data-collecting process have allowed AI applications to expand into previously believed to be the sole domain of human experts. In this article, we discuss current developments in AI technology across a range of health care applications, as well as the challenges that must yet to be overcome to implement a precise medical AI system.

Keywords: Artificial intelligence, Chatbot, EMR, Health care, Precision medicine, Wearable sensors.

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INTRODUCTION

The need for health care manpower is growing globally, and more so in India. Our nation like other countries is struggling with a scarcity of health care professionals, particularly medical doctors. Health care teams are working hard to keep up with all the latest technological advances that have already set high standards for different types of results. The health care ecosystem is beginning to recognize those aspects of Artificial intelligence (AI) that need to be incorporated into the latest medical technologies. Artificial intelligence is the branch of computer science whose aim is to train computers in such a way so that they can imitate the human mind and take suitable decisions under appropriate circumstances. According to the report of the US Government, in 2026 health care costs in the US will be reduced by 150 billion by utilizing such AI-based methodologies that will be cost-effective leading to fewer hospitalizations, fewer medical consultations, and reduced treatment costs.

At present, it is believed that AI tools will improve and complement human activities in health care but can't of course replace clinicians and other health care staff. Artificial intelligence based methodologies are applicable in a wide range of health care services ranging from patient monitoring to administrative workflow. In this article, we will discuss some applications of AI in health care.

Artificial Intelligence-enabled Symptom Checker

It is an example of patient-oriented AI system which can directly improve a patient care. According to the report of the UK Government, if AI-enabled symptom checker is coupled with telemedicine technology, then the number of hospital visits of patients can be reduced.¹ Different machine learning (ML) and deep learning-based (DL) methodologies can be applied for training the aforementioned AI-enabled symptom checker system where several symptoms of common diseases are considered for the training data set.

Chatbot System

Chatbot is a computer program that automatically gives replies to users via text, pictures, website links, or videos.² In this technology,

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a sufficient number of questions and answers are considered as a knowledge-base which can be used for further training by incorporating AI-based algorithms and automatically generating appropriate answers for any particular disease-related questions. This can help to increase public awareness about many common diseases in the community.

Wearable Sensor Device

A wearable sensor device is a tool that is noninvasively attached to the human body and fetches different signals as inputs for monitoring and detecting health parameters.³ Depending upon the characteristics of the sensors, they collect information. Researchers for the University of Calcutta and the State University of New York at Oswego campus fabricated a Radiofrequency plethysmography sensor to capture the modulations of the human pulse. These newly fabricated sensors successfully since the data of pulse modulations that can help to detect and predict cardiovascular events and diseases.

Diagnostic Tools Using Medical Image Analysis

Another noteworthy application of AI in health care is the implementation of diagnostic tools considering different types of

medical images. In routine clinical practice, radiological images play important roles in the detection of different diseases. As the precision of the scanner has increased over the years, the number of image slices that have increased poses an extensive workload for the technicians and radiologists. So, there is a probability of human error that may overlook some abnormalities while reporting. In this regard, a Computer-aided Detection (CADx) or diagnostics (CADE) methodology can also assist clinicians. Say for example, in lung images detection of pulmonary nodules is a challenge that can seek the assistance of AI. Depending upon the radiological features of pulmonary nodules, 60% of these are actually benign and low-risk. The high-risk nodules that need intervention like biopsy or FNAC can be stratified by AI-based algorithms. This reduces unnecessary interventions in low-risk nodules and hence becomes a very cost-effective methodology.⁴ The University of Calcutta and Peerless Hospital are jointly developing software incorporating ML and DL algorithms that are capable of detecting as well as stratifying the risks of pulmonary nodules.

Making Smartphone Selfies into Powerful Diagnostic Tools

Every year, cell phone cameras are improving, and they can now take snaps that are good enough for algorithms using AI for analysis. The fields of dermatology, dentistry, and ophthalmology have especially benefited from these simple tools.⁵

Researchers in the UK have developed a gadget that analyses pictures of a child's face to detect developmental disorders. This program can identify distinct characteristics in children, checking their jawline, location of eyes and nose, and other characteristics that could point to a particular craniofacial abnormality. Currently, such tools can help in clinical decision-making by matching common pictures of more than 90 illnesses.

Smartphones can be used to take pictures of eyes, skin lesions, oral lesions, wounds, infections, side effects of medications, or other such abnormalities, which could expedite the diagnosis of various diseases especially in underserved remote areas lacking medical expertise.

Chemotherapy Planning

Chemotherapy is a frequent component of treatment regimens in cancer patients, but most patients and their families are deeply concerned about its side effects and toxicities. The dose of chemotherapy depends on the patient's body schema, comorbidities, and the type of cancer.⁶

Researchers from the National University of Singapore (NUS) have implemented an AI-based platform that recommends chemotherapy using a digital profile that is created utilizing clinical data and other requisite parameters.⁷ This enables the oncologists to deliver the precise dosage of chemotherapy keeping minimum adverse effects.

Artificial Intelligence in Precision Medicine

Pharmacogenomics is a very important property in different diseases like cancers, cardiovascular, and endocrinological diseases. Pharmacogenomics helps in selecting the correct drug for the correct patient based on the genomic, proteomic, or metabolomic of the particular patient that the AI can include in its algorithm for precision medicine.⁸ AI can also help to predict those patients who have higher chances of adverse effects of certain drugs.

Decoding Patient's Mind Using Brain-Computer Interfaces

Due to several neurological disorders and trauma, some patients lose their abilities to speak, interact or move around leading to severe social and occupational challenges.⁹ An AI-enabled brain-computer interface can provide a better quality of life to such patients after stroke or locked-in syndrome or those with spinal cord injuries by decoding their neural activities.

Electronic Health Record

Electronic health record (EHR) is a software that is used to document, store, retrieve, share, and analyze information about an individual patient.¹⁰ In India, medical consultations are paper-based work and the digitization processes of these consultations have some probability of generating errors. An AI-based algorithm can analyze the images of prescriptions and digitize all this information thereby reducing such human error and can effectively reduce human workload.

Telemedicine Technology

In the past pandemic, both health care organizations and patients have opted for telemedicine technology to provide quality care.¹¹ Telemedicine technology provides appropriate consultation facilities to patients even if they are far away from the clinicians. Artificial intelligence plays a crucial role in the implementation of a successful telemedicine workflow. Telemedicine has a huge volume of health information, and through several ML-based algorithms can analyze the teleconsultation dates can be reminded the patients. The probability of missed appointment dates is thus reduced and thereby improved patient care.

Cyber Security

Cyber security in health care aims to protect the confidentiality, integrity, and availability of health care information. In the modern era, several health care organizations have used different types of information systems like electronic health records, radiology information systems, and clinical decision support systems for storing a wide range of confidential health information for future use.¹² This huge volume of information is secured in cloud servers but still, there is the probability of hacking these data. Moreover, during the past pandemic hospitals and clinics opted for telemedicine technology for patient care. In such telemedicine consultations, several confidential information has been transferred through cloud-based servers. Artificial intelligence can propose an improved security algorithm which will become difficult to break by the hackers and hence improve patient confidentiality.

CONCLUSION

In this article, we discussed several applications of AI in health care that can improve the efficacy and accuracy of patient care and routine workflow in hospitals. The ML/DL-based algorithms are capable of analyzing different modalities of medical images and provide precise diagnostics models for the early detection of diseases. Further, the chatbot system has enabled the collection and incorporation of huge clinical data for several common diseases in the community. Cyber security has improved patients' confidentiality in Health informatics. Despite having the satisfactory performance of the algorithm, AI can't explain the inner characteristics of several applications. In this regard, several AI researchers are presently trying to incorporate explainability into this model for clinical

applicability. The most noteworthy challenge in the implementation of AI in clinical use is that AI researchers lack clinical knowledge of the diseases. Hence only good collaboration between AI researchers and clinicians can make successful models for future clinical use.

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