Artificial Intelligence in Health Care: Scope and Challenges

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Abstract: *Artificial intelligence is the latest emerging field of engineering. It aims at revolutionizing the technological world. In this article, I will discuss the scope of artificial intelligence in health care. There are numerous types of artificial intelligence technologies. I will briefly talk about the technologies that are most relevant to health care in hospital settings. Then I will discuss the implication of this technology on various levels in the department i.e administration, intervention, clinical decision making, and patients monitoring. Furthermore, I will mention some of the future plans for improving and implementing this technology. Finally, I will write about some of the challenges that come in the way of implementing the technology.*

Introduction

The Merriam-Webster Dictionary defines Artificial Intelligence as, "the capability of a machine to imitate intelligent behavior." It is the newest and the most extensively researched field in engineering. Scientists also predict that it will be the main contributor to the fourth industrial revolution. John McCarthy is the founding member of AI. He states artificial intelligence as the science and engineering of making intelligent machines. These machines mimic human cognitive functions. The artificially intelligent machines or robots are incorporated with various features that make them distinguishable from the normal machines. These features provide them the intelligence level of a human being. The machines can/will reason and make decisions like human beings (or far better decisions than a human). They can store and represent an immense amount of knowledge than an average human being. They have excellent task processing and communication skills.

Types Of AI (Artificial Intelligence) Relevant To Healthcare

Artificial intelligence is a collection of technologies, not a single one. Machine learning, natural language processing, physical robots, robotic process automation, and rule-based expert systems are the most relevant and beneficial AI technologies in healthcare.

Machine Learning

Fitting models to data using statistical techniques is an application of artificial intelligence. After

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that, the models are trained using real-world data. It's a type of computer algorithm that gets better over time by learning from its previous mistakes. Observation, data entry, personal experiences, or instructions all serve as the starting points for the process of learning new information. Finally, the system looks for patterns within the data in order to make better decisions for the next time Health care machine learning applications include neural networks, deep learning, and precision medicine. Predicting which treatment protocols will be most effective based on a patient's individual characteristics and the treatment environment is the goal of precision medicine. In categorization applications, a neural network is a sophisticated form of machine learning. Predicting whether a patient will get a certain disease is made easier by these applications. A type of machine learning known as deep learning is the most complex. Image recognition in radiology is an example of how deep learning can be applied to healthcare. Radiomics is another area where it is used. There are many clinically relevant features that can be found in imaging data that are not visible to the naked eye. Oncology-focused image analysis frequently employs these kinds of analyses. They hope to achieve results that are far more precise than those produced by CAD automated tools. Speech recognition is increasingly relying on deep learning as well.

Natural Language Processing

Speech recognition, text analysis, and translations are all included. Statistical and semantic natural language processing are the two most common approaches. Clinical documentation and public research are created, understood, and classified using NLP in the health care industry. These systems are capable of analysing unstructured patient records. Besides that, they are able to write reports and transcribing patient exchanges. The conversational form of AI is also initiated by natural language processing.

Physical Robots

Physical robots are already in use in industrial units. After embedding the AI capabilities in their operating systems, they have become more intelligent and human-like. Surgical robots are a good example of physical robots. Surgeons gain superpowers as a result. Surgery is given a boost thanks to these implants. These surgical robots are used commonly in prostate surgeries, gynecologic surgeries, and head and neck surgeries.

Robotic Process Automation

It does not involve physical robots. These are the computer programs on servers that are incorporated with artificially intelligent technology. It is used to perform administrative tasks. The repetitive tasks like prior authorizations, updating patient records, and billings are performed by these robotic process automation technologies.

Rule-Based Expert Systems

It relies on a set of if-then rules to function. They were used in clinical decision support. The expert persons and engineers construct the series of rules in the particular desired domains. If the set of rules

become a huge number, they have to be broken down and omitted. This is why this technology is slowly being replaced by more artificially intelligent machines.
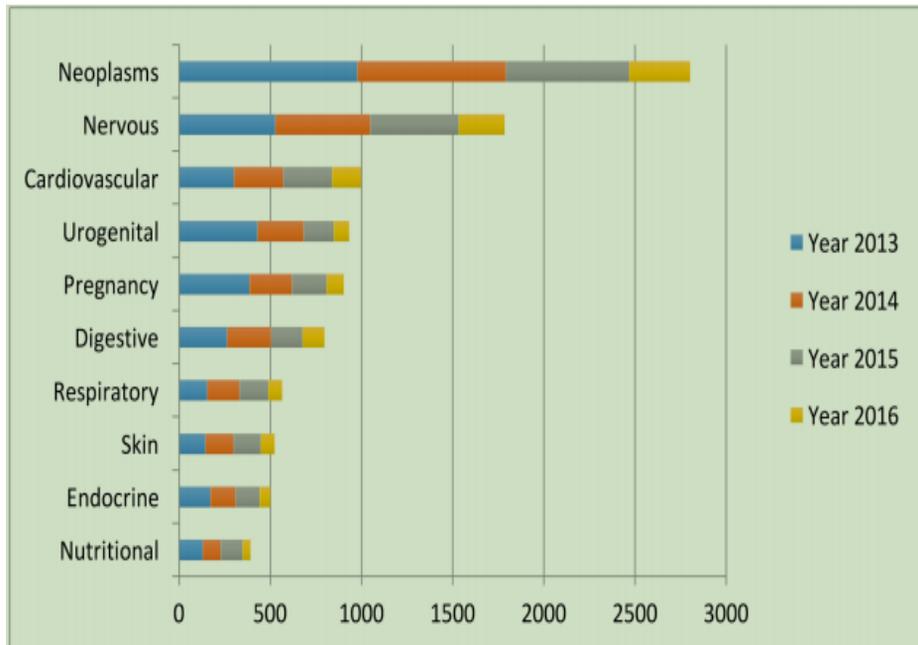
The following are the ten most prevalent disease types as described in the AI literature. The disease names' first vocabularies are shown. The comparison is made by searching the AI literature on PubMed for disease types..

AI in Healthcare Intervention

Artificial intelligence can be very beneficial in health intervention programs. Electronic health records integrated with machine learning technologies can analyze the biometric and medical histories of individual patients. These details can help in treatment recommendations based on the current hospital guidelines. The waiting stress in the emergency departments can also be reduced by these programs that are linked with hospital servers. The servers maintain a record of the patients and also analyze their queries. The artificially intelligent programs that are infused with Fuzzy logic can be used in medication administration. For post-operative patients, this technology has been used to administer vasodilators. Robotics and computer vision have been used to analyse 3D medical images automatically. This technology's most recent advancements offer the promise of even faster and more precise results. Facial analysis can be used to determine a patient's current health status. The robotic assistants could also be very helpful for older citizens who receive little care from family members. These robots could assist them in their daily activities and manage their health.

AI in Healthcare Administration

Greater health care infrastructures require greater administration. The artificially intelligent technology is very beneficial for administration purposes. It serves in daily tasks such as keeping patients record, data entry, automatic review of laboratory and imaging results. This saves a lot of

doctors time which can be invested in one to one interaction with patients. The electronic health records that are linked with machine learning technology can prove very beneficial for clinicians and administrators. They would help in retrieving accurate and context-relevant information of patients. This leads to greater search accuracy and retrieval speed. These machine learning algorithms can also be used in scheduling patient appointments. The appointments could also be easily made on a prioritization basis depending on which patients need immediate help. This thus reduces the time spent on maintaining the records manually or in electronic systems without machine learning technology. The technology also helps in predicting the length of stay of patients in hospitals at the pre-admission stages. This helps in the effective utilization of hospital resources. The natural language processing discussed above can also help the administrators to record their documentations. This can also help the clinicians to record their documentation instead of note-taking leaving behind more time to be spent with the patients.

## AI Assisting in Making Better Decisions

Machine learning, deep learning, and natural language processing help the clinicians in making much better decisions. There are clinician decision support programs. These programs come up with clinical data and knowledge to support the clinician's decision. This helps in reducing medical errors and increases the efficiency and efficacy of the results. It has been around since the 1970s and is now being used to predict the development of septic shock and assist in diagnosis. Patients with chronic obstructive pulmonary disease benefit from its use.These systems also make better and personalized decisions based on the patient's medical history. The sequential decision making incorporated in the AI systems also helps in recommending alternate treatments. The neural network technology, in the future, would also assist in making much better decisions than the clinicians. These artificial neural networks will have the superior ability to predict many diseases like cancer, diabetes, cardiovascular diseases, etc. These networks will also be used in histopathological and radiological diagnosis. Incorporating the deep learning technology into this neural network processing would also help in finding the gaps in treatment protocols. This would thus reduce potential medical errors.

AI in Monitoring Patients

Artificial intelligence technology plays a huge role in patient monitoring. The fitness monitoring devices and applications have provided access to digital data and made health more personalized. Patients can themselves record their blood pressures, sleep patterns, heartbeat rates, calorie intakes, and calories burned throughout the data. The waveform pattern learning technology has been beneficial in monitoring and analysis of various graph reports of patients. These include electrocardiographs, electroencephalographs, electromyography, and Doppler ultrasounds. This software is also used in analyzing and monitoring cardiovascular and respiratory rhythms in intensive care units. The virtual assistants equipped with natural language processing can also communicate appropriate health and medication information to the patients after their hospital visit. They can also schedule the next visits for the patient.

AI In Future

There is an immense number of future plans in artificial intelligence technology. Here I will mention a few plans. The future of AI is considered robots and virtual assistants. Mobile autonomous, industrial, and educational types of robots are being used in the healthcare sector. Greater investments and research is made to produce more human-like robots. This is to make humans feel comfortable in the presence of robots. At the present time, surgical robots assist humans in performing surgeries but in the future, it is predicted that these humanoid robots can perform surgical operations.

Figure 1. Maturity levels of application of AI in healthcare delivery.
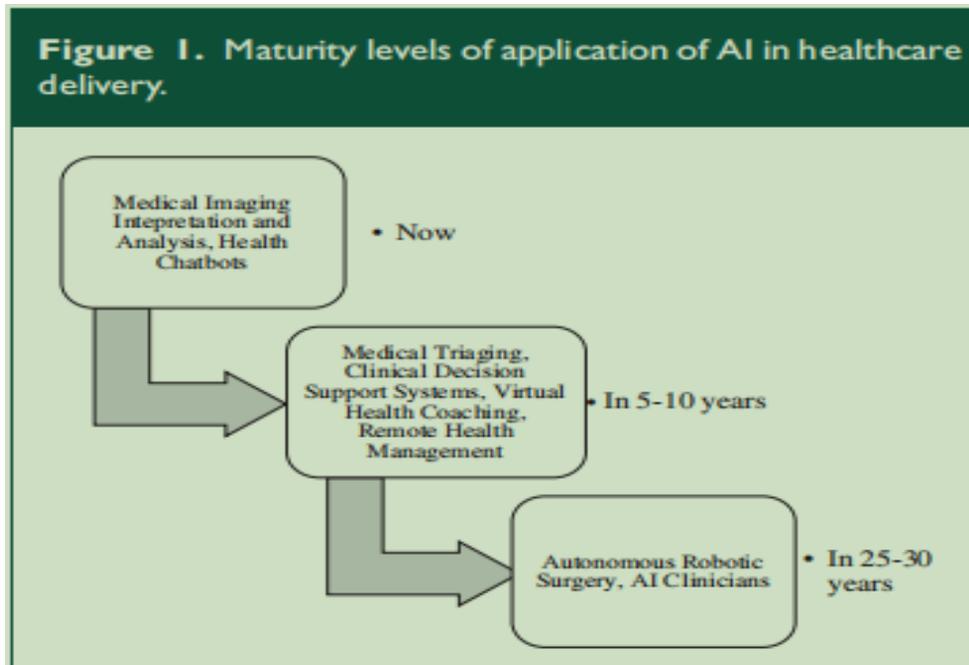
Challenges

Great technologies also come up with some challenges. This rapidly developing technology of artificial intelligence comes with some challenges. I will discuss a few challenges here. One of the biggest challenges is the problem of bias. Internal bias in the data can produce undesired results. These systems are only as good as the data that they are trained on. This data may be good or bad. Bad data usually comes up with racial, communal, gender, or ethical biases. If the bias goes unnoticed or unrecognized in the algorithms that make important decisions, it will lead to an ethical bias. Processing huge volumes of data to build an AI system that is incorporated with machine learning or deep learning technologies requires a massive amount of computer power. It will also be a challenge for hospitals and clinics to invest in such immense power computers. Collecting relevant data in mass quantity will also be a challenge for the administrators. They must ensure to collect huge amounts of relevant, less biased data and then ensure to keep the data and systems updated. There is also a common narrative about artificial intelligence technology that in the future it will replace the humans' race. It is true only to some extent. This technology will replace all the labor work with automated

machines. But in order to make more informed and less biased decisions, humans must accompany these robotic technologies.

Conclusion

In light of the above discussion, it is clearly evident that this technology will revolutionize the world of health care. The hospitals will be more updated and automated with virtual assistants and automated robots. Surgical robots will be accompanying doctors during surgeries. The diseases could easily be predicted even before their onset. This will positively affect the health of the citizens on a massive level. Thus greater investments should be made towards this technology and the future workforce must be prepared and efficiently equipped to work in collaboration with these robotic technologies.

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