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Review Article

Appositeness of artificial intelligence in modern medicine

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ABSTRACT

Artificial intelligence (AI) can be demonstrated as intelligence demonstrated by machines.AI research has gone through different phases like simulating the brain, modeling human problem solving, formal logic, large databases of knowledge and imitating animal behavior. In the beginning of 21st century, highly mathematical statistical machine learning has dominated the field, was found useful and considered in helping to solve many challenging problems throughout industry and academia. The domain was discovered and work was done on the assumption that human intelligence can be simulated by machines. These initiate some discussions in raising queries about the mind and the ethics of creating artificial beings with human-like intelligence. Myth, fiction, and philosophy are involved in the creation of this field. The debates and discussion also point to concerns of misuse regarding this technology.

Keywords: Artificial intelligence, Application, Data, Healthcare

INTRODUCTION

Artificial intelligence (AI) is the simulation of intelligent behavior and critical thinking with the application of modern technology.

It is the development of intelligent devices that has the ability to learn, rather than merely accumulate information. It assists human intelligence by finding solutions to complex problems using critical thinking abilities.

The application of AI in healthcare is revolutionizing the practice of medicine. The knowledge of the advancements in this field is vital for the medical practitioners for their journey towards the greater canvas. John McCarthy coined the term 'Artificial intelligence' in 1956 to define the science and engineering of making intelligent machines.

'Turing test' was developed by Alan Turing to test the ability of a computer to achieve near human performance in cognitive tasks.[1] Computers have transformed every aspect of human life, perhaps the most magnificent of its application would be betterment of human health and well-being.

TYPES OF AI APPLICATIONS

A rather large portion of AI research is being put into possibilities in healthcare applications as compared to other areas. AI techniques such as fuzzy expert systems, artificial neural networks, hybrid intelligent systems and

Bayesian networks are being used in various aspects of healthcare.[2]

In healthcare applications, AI can be of two types, i.e.; virtual and physical. While the physical part deals with creation of intelligent prosthesis, care of the elderly and robotic surgery, the virtual part deals with Electronic health records, diagnostic tools, etc.

AI uses flow charts and database to arrive at the most probable diagnosis or detection of a variation in the anatomy in imaging. The amount of data required is alarming and the computers lack the ability to observe and gather clues that an experienced physician can while being with the patient. Further researches in this field aims at alleviation of this major drawback.

MAJOR APPLICATIONS OF AI

The established applications of AI in healthcare are software applications, Electronic health record software (EHR) which records patient socio demographic profile, medication details and investigation reports. EHRs was initiated as to improve healthcare quality and to capture billing data.[3-5] Apart from that, there are medical database software's for disease categorization, cross reference for similar symptom complex, case reviews and treatment plans.

There are medical research and education software's along with diagnosis available now. AI is used to logarithmically analyze symptom complexes to reach a probable diagnosis. These applications are also used for home diagnosis and decision-making regard to need for a hospital visit. All these applications were helpful in reducing healthcare overburden during the COVID pandemic. It also helps in medical imaging software, 3D modeling of human anatomy, 3D printing of medical equipments and human body parts for grafting. It helps to track, renew and cancel prescriptions for the patients. For example, MediTab, Script Sure Telemedicine Software, online appointments, video consultation and e-prescriptions.

Another useful application of AI during the pandemic like Doxy.me, Zingtree, Practo, Lybrate, Tata health. Appointment scheduling software were opted by many clients. Some of the online doctor booking applications are Simply Book, Me, QKDoc. In addition, there are medical billing software for hospital accounting like hospital management software automated accounting which are used for billing, claims, OP management, etc.

Application incorporates medical equipment management software, automated stocktaking, and equipment maintenance alert and scheduling. Health tracking apps, fitness trackers, diet trackers, meditation and stress reducing apps are also had been more popular during this pandemic period due to movement restrictions. Personal health record software and medical diaries of an individual is also part of these innovations.

Table 1: Depicts advantages and disadvantages of AI applications.

AI application
Advantages
Less time for documentation
Eco-friendly paper free data storage
Reducing false negative reporting
Reduced burden on healthcare
Surveillance applications
Latest trends in artificial intelligence
Telemedicine and 3D printing technology
Robotic surgery
Artificial brain project
Disadvantages
Decrement in job opportunities
Automation complacency
Re-enforcement of outmoded practice
Patient privacy violations

ADVANTAGES OF AI APPLICATION

Saves time spend for documentation

With the recent advancements in the field of medicine, there is one major disadvantage in the practice of modern medicine where the physicians spend less time with the patient. More time is being spent on documentation and other paper works. Prefixed with quality indicators, the paperwork's are given vital importance than the total well-being of the patient.

It's an overburden for the doctors who would rather prefer to spend quality time with the patient or own families. Electronic patient records have reduced that burden to a large extent. Many countries have made health records available to the hospitals networked, so that one can present in any hospital hand free. Health history is immediately available to the treating physician with one hand click away. Appointment scheduling, electronic prescriptions and radiological image sharing have all been incorporated into this software so that everything is available at the fingertip. This is one of the most helpful and widespread application of AI in healthcare as of now.[6]

Eco-friendly paper free data storage

Electronic health record and patient record software's has indeed transformed the healthcare facilities by providing a sustained, easily accessible, permanent collection of data regarding patient health history and medications at the touch of a finger. The advantages of this is boundless from accessibility of medical history at one go to the eco-friendliness of a paper free data storage. Once this becomes universally applicable, individuals could travel anywhere around the globe. If at all individual goes sick

during international travel, medical history would be available to the treating doctors for their perusal.[7]

Reducing false negative reporting

Computer aided detection (CAD) is a technology aimed at reducing the false negative reporting due to human oversight and work by pattern recognition software's that can identify and report suspicious features in radiological imaging. It acts as an extra eye to the radiologists who can cross refer before making the final report. CAD has been approved by FDA, CE for breast imaging is been tremendously used for the detection of breast cancers. Chest radiography also had been approved for CAD support.[8]

Reduced burden on healthcare

AI reduced the burden on healthcare systems, reduced expenditure and also helped in reducing stress levels in home-based quarantine. Human Dx and other diagnostic apps have been in use similar way and has revolutionized personal healthcare. CAD refers to the use of computer software to estimate the likelihood of a specific radiological feature suggesting certain disease. Medical Diagnosis software's have been a remarkable blessing during the COVID pandemic with applications such as 'COVID symptom tracker', where a questionnaire is used to assess whether the individual requires a hospital visit or at home treatment. The hospital accounting and billing process, as well as equipment management which used to consume heavy manpower and exhausting hours can be automated with the various hospital management software's.[9]

Surveillance applications

Health tracking apps have become one of the most lucrative applications of AI with the boom in smart phone users and increased health awareness among people. Fitness trackers, diet apps, meditation and stress reducing apps are generating millions of clients overnight. The role of these apps in raising health standards in the society is indeed commendable. Personal health record software's are helping people with chronic illness to keep a medical diary of their symptoms and healing. Home based blood glucose estimation devices can now be linked with smart devices. The information's can be stored and shared with their treating physicians for an accurate and continued surveillance of personal diabetic control. Patients with parkinsonism can keep track of their symptoms, improvements and worsening throughout the day and share their experience with respective clinicians.[6]

Latest trends in artificial intelligence

Telemedicine and 3D printing technology

Telemedicine has been frowned by many, especially during the pandemic as there were limited alternative options for treatment. The Government of India had published guidelines for practice of telemedicine in 2020. Recently there is a dramatic acceptance and growth of telemedicine in our country, as a positive byproduct from the dreaded pandemic. 3D printing technologies has always mesmerized the medical field with custom made equipments and prosthesis, it's no less than a miracle when it come to creation of human body parts for grafting into real human body. The heart was the first organ to be 3D printed. It was a scientific breakthrough as the organ was made from patient's own cells and could not be rejected. The lung, kidney, pancreas etc. have been printed till now. The challenge regard to this is the shortage of organs for transplant. This could revolutionize cancer treatment and organ failure related to morbidities and mortalities in the near future.[10]

Robotic surgery

The field of robotic surgery uses Artificial intelligence for analyzing radiological images, detecting cancers, facilitating instrument positioning and can boost the capability of the robotic surgical systems in perceiving complex and varied human anatomy *in-vivo*, help in decision making, increase precision and safety of surgical cuts.[11-17]

Artificial brain project

In 2012, Google launched an artificial brain project where the system was trained to recognize cats. It was done based on 10 million YouTube videos showing cats. The system could predict an image of a cat with 75% accuracy after 3 days of learning. In 2017, Google CEO-Sundar Pichai announced the launch of Google AI, a division of Google dedicated to Artificial Intelligence. Google claims to transform Health care in the future with the help of AI. They have developed a retinal scan device that could diagnose and predict signs of diabetic retinopathy, which has high probability to be even missed by a trained clinician. The Google health division uses AI to research in improvement of breast cancer screening and diagnosing with more precision. Prediction of medical events, chance of re-admission is all promising areas of research for AI application. All these applications can help in faster decision making among the doctors.[4,18]

DISADVANTAGES

There is huge dilemma among the people regarding the security of jobs following advent of AI. But in an indirect way, it paves path for trained personnel in the particular arena.

Decrement in job opportunities

The disadvantages of AI application in healthcare are the replacement of many job opportunities of the past with computers which require less manpower to manage them. A study published by Challen et al in the British Medical

Journal categorizes the issues with AI in healthcare into short, medium- and long-term issues.[5] But in an indirect way, it paves path for trained personnel in the particular arena.[6]

Automation complacency

Distributional shift is a mismatch between training and operational data results in the system generating erroneous predictions in a confident manner. Automation complacency refers to as implicit trust on AI for diagnosis by clinicians may result in failure to cross check and consider alternatives. Negative side effects of AI fail to consider the unintended consequences of a treatment option it suggests.

Insensitivity to impact in discrimination of a benign versus malignant swelling, human errors on the side of caution and over diagnose malignancy while the same is not true for AI systems. While this causes a decrease in diagnostic accuracy of physicians, the outcome is critical for safety.[6]

Re-enforcement of outmoded practice

Lack of adaptation with changes or updates in the medical field, as these systems are trained and stored with historical data. Reward hacking is finding hacks or loopholes without fulfilling the intended goal. Blackbox decision making is a problem in the training data, which can result in inaccurate prediction, which is not open to inspection or interpretation. Self-fulfilling predictions is to detect a certain illness, but there can be bias towards the outcome designed to detect.[6]

Patient privacy violations

As in today's world a lot of health information is transferred, but usually neglected part is the risk of patient privacy violations. But recently there are some constructive steps taken from the policy maker's side. Even there was an incident in a hospital at US; personnel's were given charges for violating rules for procurement of patient data.[19]

CONCLUSION

The future of AI in healthcare is boundless and will transform medicine in a bigger way. As Eric Topol says in his book 'Deep medicine' AI will make healthcare humane again by bringing the healers closer to the patients and bring more empathy in to the picture, when they can dedicate more of their valuable time for the patient rather than the paper works.

We can expect leaps of development in the field of medicine with the integration of AI and a new generation of AI trained physicians, who can perform superhuman deeds with the help of machines for the betterment of humanity. Artificial intelligence is still in its infancy and the applications of AI in medicine are yet to be explored to its full potential. AI promises to ease the burden on healthcare professionals and the knowledge about its recent advances is vital for the updated perspective of the ever-evolving medical field.

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