Artificial Intelligence: As an innovative technique in healthcare sector and as a potent technique to fight against COVID-19

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Abstract:
Artificial Intelligence (AI) is refers to an innovative technique which generally deals with the machines. AI re use do decrease or minimize the errors and defects in any field. It is a widely separated technique which is used in many fields and especially in pharama sector it is growing day by day to set the new goals and achieved the new and difficult tasks. AI is also used in the detection, diagnosis, prevention and treatment of covid-19. In the crises of covid-19 or pandemic of covid the AI technology is used as a very potent and powerful weapon. The AI technology needs some work & time to make and innovative and bright future in health care sector. This article provides a brief overview about the technique of AI it's applications, use of AI technique as a potent weapon in covid pandemic problems associated with AI and last but not the least feature of AI in healthcare.

Keywords: Artificial Intelligence, History, Applications of AI, Advantages & Disadvantages, AI in COVID Pandemic, Litrature review, problems associated with AI.

Introduction

Artificial intelligence, or AI, is a broad trem that refers to the use of a computer to simulate intelligent behaviour with little or no human involvement.**[1]** It is widely acknowledged that the development of AI began with the creation of robots.**[2]** Artificial intelligence (AI), also known as machine intelligence, refers to computers' ability to learn from pre-existing data.**[3]** AI has become an useful force in a wide range of industries, along with the drug discovery field.**[4]**

Software applications that perform tasks that require intelligence were known as artificial intelligence (AI) technology (e.g., problem-solving or learning). Machine learning is a subfield of AI and is described as "the science of getting computers to independently learn from—and able to adapt to—data without being explicitly programmed." [5] Recent years have seen the creation of artificial intelligence (AI) as a promising technique in a wide range of scientific areas, especially in the pharmaceutical sector. [6] A major evolving application of AI is generative modeling.[7]

The concept of using computers to simulate intelligent behavior and critical thinking was first described by Alan Turing in 1950.1 In the book Computers and Intelligence, Turing described a simple test, which later became known as the "Turing test," to determine whether computers were capable of human intelligence.2 Six years later, John McCarthy described the term artificial intelligence (AI) as "the science and engineering of making intelligent machines."[8,9] AI rapidly dominates the health service system. It removes the manual health system into automatic, in which humans conduct the routine works/tasks in medical practice to the management of patients and medical resources.[10]

AI offers the potential for a huge improvement in patient care and a reduction in health care costs. The increasing population is expected to be able to encourage the demand for health services. The health service sector needs innovative solutions to find out how to be more effective and efficient without excessive expenditure.[11]

Artificial Intelligence (AI) IN MEDICINE

AI may improve diagnostic accuracy, improve efficiency in provider workflow and clinical operations, facilitate better disease and therapeutic monitoring, and improve procedure accuracy and overall patient outcomes. The progressive growth and development of the AI platform in medicine is chronicled below and organized by specific time periods of seminal transformation. AIM has evolved dramatically over the past 5 decades. Since the advent of ML and DL, applications of AIM have expanded, creating opportunities for personalized medicine rather than algorithm-only–based medicine.[12]

Brief History of AI

The 1950s to 1970s:

Early AI was focused on the development of machines that had the ability to make inferences or decisions that previously only a human could make.[13] A few years later (1964), Eliza was introduced by Joseph Weizenbaum. Using natural language processing, Eliza was able to communicate using pattern matching and substitution methodology to mimic human conversation (superficial communication), serving as the framework for future chatterbots.[14] The development of the Medical Literature Analysis and Retrieval System and the webbased search engine PubMed by the National Library of Medicine in the 1960s became an important digital resource for the later acceleration of biomedicine.[15]

The 1970s to 2000s:

Most of this time period is referred to as the "AI winter," signifying a period of reduced funding and interest and subsequently fewer significant developments.[16] Many acknowledge 2 major winters: the first in the late 1970s, driven by the perceived limitations of AI, and the second in the late 1980s extending to the early 1990s, driven by the excessive cost in developing and maintaining expert digital information databases. Despite the lack of general interest during this time period, collaboration among pioneers in the field of AI continued.[15]

A "backward chaining" AI system, MYCIN, was developed in the early 1970s.[17] MYCIN became the framework for the later rulebased system, EMYCIN. INTERNIST-1 was later developed using the same framework as EMYCIN and a larger medical knowledge base to assist the primary care physician in diagnosis.[15]

From 2000 to 2020: seminal advancements in AI

In 2007, IBM created an open-domain question– answering system, named Watson, that competed with human participants and won first place on the television game show Jeopardy! In 2011.[18] Given this momentum, along with improved computer hardware and software programs, digitalized medicine became more readily available, and AIM started to grow rapidly.[19,20] DL marked an important advancement in AIM. In contrast to ML, which uses a set number of traits and requires human input, DL can be trained to classify data on its own.[21]

Types of AI of relevance to healthcare

Artificial intelligence is not one technology, but rather a collection of them. Most of these technologies have immediate relevance to the healthcare field, but the specific processes and tasks they support vary widely. Some particular AI technologies of high importance to healthcare are defined and described below:[22]

- Machine learning – neural networks and deep learning
- Natural language processing
- Rule-based expert systems
- Physical robots
- Robotic process automation

Machine learning – neural networks and deep learning

Machine learning is a statistical technique for fitting models to data and to 'learn' by training models with data.[22] It is a broad technique at the core of many approaches to AI and there are many versions of it.[23]

A more complex form of machine learning is the neural network – a technology that has been available since the 1960s has been well established in healthcare research for several decades [24] and has been used for categorization applications like determining whether a patient will acquire a particular disease.

The most complex forms of machine learning involve deep learning, or neural network models with many levels of features or variables that predict outcomes. There may be thousands of hidden features in such models, which are uncovered by the faster processing of today's graphics processing units and cloud architectures. A common application of deep learning in healthcare is recognition of potentially cancerous lesions in radiology images.[25]

Deep learning is increasingly being applied to radiomics, or the detection of clinically relevant features in imaging data beyond what can be perceived by the human eye.[26]

Natural language processing

Making sense of human language has been a goal of AI researchers since the 1950s. This field, NLP, includes applications such as speech recognition, text analysis, translation and other goals related to language. There are two basic approaches to it: statistical and semantic NLP. Statistical NLP is based on machine learning (deep learning neural networks in particular) and has contributed to a recent increase in accuracy of recognition. It requires a large 'corpus' or body of language from which to learn. In healthcare, the dominant applications of NLP involve the creation, understanding and classification of clinical documentation and published research. NLP systems can analyse unstructured clinical notes on patients, prepare reports (eg on radiology examinations), transcribe patient interactions and conduct conversational AI.[26]

Rule-based expert systems

Expert systems based on collections of 'if-then' rules were the dominant technology for AI in the 1980s and were widely used commercially in that and later periods. Their systems today. Expert systems require human experts and knowledge engineers to construct a series of rules in a particular knowledge domain. They work well up to a point and are easy to understand.[27]

Robotic process automation

This technology performs structured digital tasks for administrative purposes, ie those involving information systems, as if they were a human user following a script or rules. Compared to other forms of AI they are inexpensive, easy to program and transparent in their actions. Robotic process automation (RPA) doesn't really involve robots – only computer programs on servers. It relies on a combination of workflow, business rules and 'presentation layer' integration with information systems to act like a semi-intelligent user of the systems.[28]

APPLICATIONS IN MEDICAL IMAGING

Plain Film Radiography

The chest radiograph is the most common imaging examination worldwide, with 2 billion performed per year.[29] Furthermore, the availability of labeled images, the currency of AI research, is greatest with chest radiographs. For these reasons, chest radiography has garnered the greatest interest amongst AI researchers and continues to be an active research area. It is fitting to begin the discussion with the data that underpins AI. Among the largest medical AI datasets to date is known as ChestX-ray14.[30] The latest innovation to ChestX-ray14 and CheXNet is the release of Chester in 2019: a web-delivered disease prediction system.[31] The goal of Chester is to deliver the AI model CheX-Net, which was trained on ChestX-ray14, to a global userbase.[32]

Advanced Imaging

AI also has several applications in advanced imaging. For instance, magnetic resonance imaging (MRI) may be virtually enhanced using AI models. Gong et al.[33] trained a deep learning algorithm on brain MR images on 10 pre- and postcontrast brain MR images, allowing it to learn how the image changes after the administration of gadolinium. The use of the algorithm provided significant improvements in peak-signal-to-noise ratios of more than 5 decibels, allowing greater interpretability of the images.[34]

Non-interpretive Tasks

Perhaps AI's greatest utility will be outside of image interpretation entirely. A radiology fellow spends only 53.8% of their working time on image interpretation. The remainder of the time is spent on nonimage-interpretative tasks, such as protocoling studies, consulting with technologists, and consulting with clinicians regarding critical findings. AI could assist in improving workflow by aiding radiologists in these tasks.[35]

APPLICATIONS IN PATHOLOGY

Unlike the progression of radiology from illuminated X-ray films to digital imaging, pathology has progressed at a slower pace to the digital medium, which the adoption of AI hinges on. Whole-slide imaging (WSI) now enables pathologists to view histopathology slides in their entirety in high resolution with depth manipulation.[36] Rapid advances in technology have enabled fast transfers and ample storage for vast amounts of data. This is particularly enabling in the field of WSI where the amount of data is large and requires real time processing.[37] File size and resolution difference between radiology and pathology studies could be an important differentiating factor in the adoption of AI in the future.[38]

APPLICATIONS IN OPHTHALMOLOGY

Diabetic eye disease is amongst the most common conditions seen in routine ophthalmology practice, and constitutes a significant and growing public health issue. Diabetic retinopathy (DR) is the commonest cause of vision loss in working age adults, with 2.6 million people affected globally in 2015, expected to rise to 3.2 million in 2020.[39] It is that demand that AI diagnostics company IDx (Coral-ville, IA) aims to fulfill, gaining Food and Drug Administration (FDA) approval its IDx-DR cloud-based AI system in April 2018. It is the first medical device to be authorized to provide a screening decision without the oversight of a clinician, stratifying patients into those that have "more than mild" DR who require ophthalmology review, and those that do not, who require 12 monthly screening.[40]

APPLICATIONS IN DERMATOLOGY

The recognition of visual patterns is a fundamental diagnostic skill in dermatology and AI may provide much potential in augmenting image analysis and improving diagnostic accuracy within this field.[41] Recently developed computational neural networks have been used to diagnose skin conditions through visual image recognition and have demonstrated comparable and occasionally greater sensitivity and specificity in classifying images than even clinically experienced dermatologist[42]. AI may also play a future role in the earlier detection and treatment of skins cancers. Furthermore, vast sets of annotated, high-resolution imaging data, encompassing the breadth of diagnostic variety, are required to establish a ground truth for the automated development of algorithms in deep neural networks.[43]

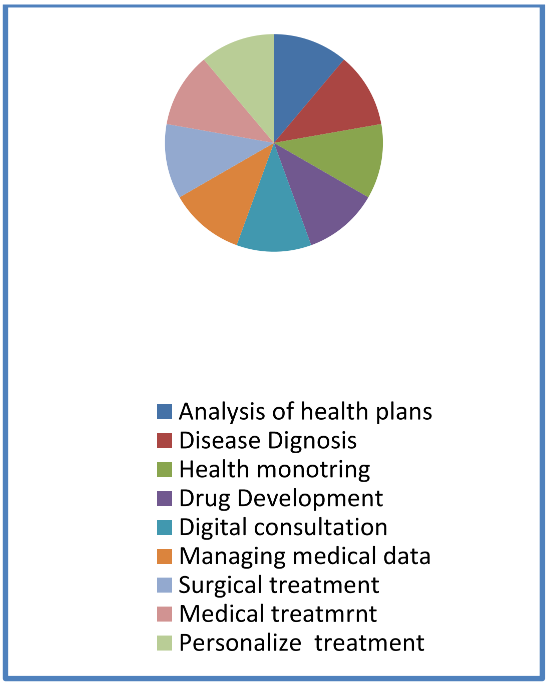

Figure:1 Applications of Artificial intelligence in health care[44,45]

Advantages and Disadvantages of AI

This new era of AI-augmented practice has an equal number of skeptics as proponents [Figure 2]. The increased utilization of technology has reduced the number of job opportunities, which many doctors in the making and practicing doctors are concerned about.[46]

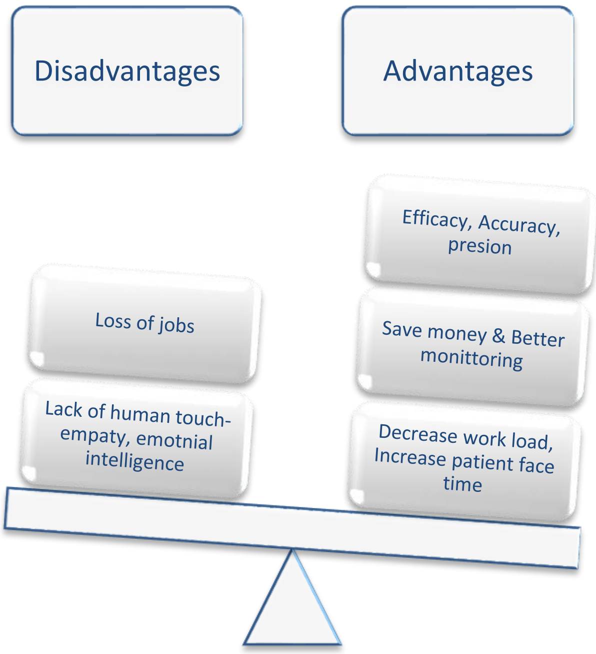

Figure: 2 Advantages & Disadvantages of AI

Table:1 Different types of Artificial Intelligence technologies for medical field

S.NO	Technologies	Description	Reference
1	**Machine Learning (ML)**	Machine learning systems are programs which is, selfimproving and learning with no experience or being trained over some time. They can evaluate the medical results automatically and presents them with a probabilistic degree of accuracy. In the medical field, this technology is used to identify the probability of disease. ML is helpful to save the record of the patient for better treatment.	**[47-52]**
2	**Artificial Neural Networks (ANN)**	Artificial Neural Network works and is inspired by the neural structure of the human brain, working on the concept of backpropagation and layers (Input layers, Hidden Layer, Output layers). ANN function like neurons as each neuron is connected similarly to each ANN neuron has weight and are connected. Helpful to forecast the incidence of disease and in decision making.	**[53-55]**
3	**Natural Language Processing (NLP)**	NLP refers to the speech recognition and evaluation of languages with different techniques. There are many independent NLP algorithms like parsing, POS, tagging using HMM (Hidden Markov Model). In medical, this technology is useful for clinical decision trials, supports and analyses the unstructured data. It is also used for automated coding and maintains clinical documentation of the patient.	**[56-58]**
4	**Support Vector Machines (SVM)**	Support Vector Machines determines the class groups of data for the given input data. It solves the problem of data classification in the primary basis. They are used in E-Mail Spam filters when an SVM classifier is trained; it can use and see new and unseen data-points for future correlations. Used for collection and processing of medical data.	**[59-63]**
5	**Heuristics Analysis (HA)**	This technique uses a trial and error method to detect and discovery in order to solve a problem. The basic algorithm on which heuristic work is to employ such a practical solution which it may not yield the optimal goal but works sufficient to full fill that goal. Heuristic analysis is best to approach for patient safety and efficiently identified different problems.	**[64-67]**

AI provides an excellent capability to perform the required task in the medical field with lesser involvement of human being. AI seems to be the best tool for clinical judgment, analysis and training purpose. It is proved that there is accurate and fast diagnosis by proper implementation of this technology. In our daily life, there are requirements for new innovative technologies which positively affect human lives. In the medical field, AI provides various positive points to create innovation. Table 1 discusses different applications of Artificial Intelligence in the medical field.[68,69]

Limitations of AI

As with any new technology, AI and each of its subfields are susceptible to unrealistic expectations from media hype that can lead to significant disappointment and disillusionment. AI is not a ‘‘magic bullet’’ that can yield answers to all questions. There are instances where traditional analytical methods can outperform ML or where the addition of ML does not improve on its results.[70]

ML provides a powerful tool with which to uncover subtle patterns in data. It excels at detecting patterns and demonstrating correlations that may be missed by traditional methods, and these results can then be used by investigators to uncover new clinical questions or generate novel hypotheses about surgical diseases and management.[71,72] However, there are both costs and risks to utilizing ML incorrectly. The outputs of ML and other AI analyses are limited by the types and accuracy of available data.

An important concern regarding AI algorithms involves their interpretability, for techniques such as neural networks are based on a ‘‘black box’’ design.[73]

AI in fighting against COVID-19

A novel corona virus disease 19, also referred to as COVID-19, is an infectious disease caused by severe respiratory syndrome corona virus type 2 (SARS-CoV-2).[74,75] The most common symptoms experienced by COVID-19 infected patients are dry cough, loss of smell and taste, fever, fatigue, and respiratory illness such as shortness of breath.[76] The cross-sectional view of SARS-CoV-2, which is comprised of spike protein (S), nucleocapsid protein (N), hemagglutinin-esterase dimer (HE), membrane glycoprotein/ matrix (M), an envelope protein (E), and single-strand RNA, non-segmented, enveloped.[77]

The first case of corona virus infected patient was recorded in December 2019 in Wuhan city, Hubei, China and afterward, the infected cases increased so rapidly throughout the world that the World Health Organization (WHO) has declared it a Public Health Emergency of International Concern (PHEIC) on January 30, 2020.[78]

SARS-CoV-2

The etiological agent was named as SARS-CoV-2 by the International Committee on Virus Taxonomy on 11 February 2020. SARS-CoV-2 is a beta coronavirus of zoonotic origin belonging to the subgenus Sarbecovirus in the Orthocoronavirinae subfamily of the family Coronaviridae transmitted to humans in a spillover event. Bats are thought to be the animal reservoir of SARS-CoV-2 but the other likely intermediate animal host is yet to be identified.

The virus is a spherical particle of 70–90 nm ,[79] having spikes of glycoprotein projecting from its surface that bind to receptor angiotensin-converting enzyme 2 on the surface of the cell. These spikes give the virus a crown-like appearance. At present, 249 protein structures and 255 whole-genome sequences belonging to SARS-CoV-2 are available in the public domain.[80]

AI to Fight Covid-19

Recent research and development in the field of artificial intelligence has greatly improved the COVID-19 screening, diagnostics, and prediction and results in better scale-up, timely response, most reliable, and efficient outcomes, and sometimes outperforms humans in certain healthcare tasks. Machine learning (ML) and deep learning (DL) are the two main branches of AI out of many. Applications of both ML and DL in combating and mitigating the COVID-19 pandemic are reviewed in the subsequent sections. Fig. 2 shows the schematic view of applications of machine learning and deep learning in combating COVID-19. **[81]**

Main applications of AI in COVID-19 pandemic

1. **Early detection and diagnosis of the infection:**
   AI can quickly analyze irregular symptom and other ‘red flags’ and thus alarm the patients and the healthcare authorities. It helps to provide faster decision making, which is cost-effective.**[82]**

   AI is helpful in the diagnosis of the infected cases with the help of medical imaging technologies like Computed tomography (CT), Magnetic resonance imaging (MRI) scan of human body parts.**[83]**

2. **Monitoring the treatment :.**
   AI can build an intelligent platform for automatic monitoring and prediction of the spread of this virus. A neural network can also be developed to extract the visual features of this disease, and this would help in proper monitoring and treatment of the affected individuals. It has the capability of providing day-to-day updates of the patients and also to provide solutions to be followed in COVID-19 pandemic. **[84]**

3. **Contact tracing of the individuals :**
   AI can help analyze the level of infection by this virus identifying the clusters and ‘hot spots’ and can successfully do the contact tracing of the individuals and also to monitor them. It can predict the future course of this disease and likely reappearance.**[85]**

4. **Projection of cases and mortality :**
   This technology can track and forecast the nature of the virus from the available data, social media and media platforms, about the risks of the infection and its likely spread. Further, it can predict the number of positive cases and death in any region. AI can help identify the most vulnerable regions, people and countries and take measures accordingly.**[86]**

5. **Development of drugs and vaccines:**
   AI is used for drug research by analyzing the available data on COVID-19. It is useful for drug delivery design and development. This technology is used in speeding up drug testing in real-time, where standard testing takes plenty of time and hence helps to accelerate this process significantly, which may not be possible by a human. It has become a powerful tool for diagnostic test designs and vaccination development. AI helps in developing vaccines and treatments at much of faster rate than usual and is also helpful for clinical trials during the development of the vaccine. **[87]**

6. **Prevention of the disease :**
   With the help of real-time data analysis, AI can provide updated information which is helpful in the prevention of this disease. It can be used to predict the probable sites of infection, the influx of the virus, need for beds and healthcare professionals during this crisis. AI is helpful for the future virus and diseases prevention, with the help of previous mentored data over data prevalent at different time. It identifies traits, causes and reasons for the spread of infection. In future, this will become an important technology to fight against the other epidemics and pandemics. It can provide a preventive measure and fight against many other

diseases. In future, AI will play a vital role in providing more predictive and preventive healthcare.[88]

7. **Reducing the workload of healthcare workers**
Due to a sudden and massive increase in the numbers of patients during COVID-19 pandemic, healthcare professionals have a very high workload. Here, AI is used to reduce the workload of healthcare workers.[89] It helps in early diagnosis and providing treatment at an early stage using digital approaches and decision science, offers the best training to students and doctors regarding this new disease. AI can impact future patient care and address more potential challenges which reduce the workload of the doctors.[90]

Table 2 : Literature Review Summary

Finding	Motivation	REFERENCES
Machine learning consists of tools used to identify patterns in data. Using artificial intelligence and machine learning can identify patterns from a large quantity of data, can self-improve when new data becomes available, and becomes quicker at these tasks.	Various types of machine learning are discussed that have historically been used to predict, detect, and manage infectious diseases. It also discusses how these are currently being used to fight Covid-19.	[91]
Advancements in artificial intelligence have made for faster processing and analysis of large and complex data. The recent developments in disease prediction and drug development during the Covid-19 pandemic are discussed.	Machine learning is discussed as a subset of AI as it creates systems capable of learning from the data using statistical methods.	[92]
The novel corona virus has had a wide global impact, making it increasingly important for scientists and researchers to research different methods to help slow down the spread of this virus. While the growing interest in AI has addressed many medical issues, these systems remain insufficient due to the high threat of the virus.	Why is AI not being utilized? What could specific systems in AI be useful?	[93]
Detecting Covid-19 cases has become increasingly difficult for doctors and researchers. While there is public data available on the number of cases and deaths globally and in each country,	A deep-learning model was developed to better the accuracy of covid testing.	[94]

this does not address the missing infections.		
Artificial intelligence can be utilized to mimic human intelligence to solve complex problems. It can be used to achieve strategic differentiation, which will improve business survival when leveraging available organizational resources.	How can AI be used by businesses to improve their business post the pandemic? What type of data is involved? What needs to be done on a business and government level for something like this to occur?	[95]

Problems in the application of artificial intelligence in health service

1. **Data Base**

   Training of the AI model needs a big scale of input regarding health data or others. Such bias may occur when the data used for training does not reflect the target population and when insufficient or incomplete data is used to train AI models, there may be unrepresentative data due, for example, to social discrimination (lack access to services health) and relatively small samples (for example, minority groups).**[96]**

2. **Personal**

   Health service data are the most sensitive information that can be owned by an individual about another. In health care, respecting the privacy of an individual is a vital ethical principle because privacy is bound by patient autonomy or self-government, personal identity and well-being. Thus, it is ethically important to respect patient confidentiality and ensure adequate processes for obtaining correct consent**.** **[97]**

3. **The principle of ethical double effects**

   Considering that science is a backsword, certain findings ultimately cause damage. This is very suitable for special borders in AI. Therefore, the principle of double effect ethics must be carefully considered in applying AI, for example, stem cell research and gene editing.**[98]**

4. **Problem of ethic related to research and biomedical medicine**

   As all new scientific techniques, biomedical ethical principles must be obeyed by AI in healthcare applications. They are autonomy, benefit, non-crime, and justice. They are manifested as consent, privacy, and safety, voluntary participation, autonomous decision making, etc., which should be considered and practiced in any implementation.**[98]**

The future of AI in healthcare

We believe that AI has an important role to play in the healthcare offerings of the future. In the form of machine learning, it is the primary capability behind the development of precision medicine, widely agreed to be a sorely needed advance in care. Given the rapid advances in AI for imaging analysis, it seems likely that most radiology and pathology images will be examined at some point by a machine. Speech and text recognition are already employed for tasks like patient communication and capture of clinical notes, and their usage will increase.
The greatest challenge to AI in these healthcare domains is not whether the technologies will be capable enough to be useful, but rather ensuring their adoption in daily clinical practice. These challenges will ultimately be overcome, but they will take much longer to do so than it

will take for the technologies themselves to mature. As a result, we expect to see limited use of AI in clinical practice within 5 years and more extensive use within 10. It also seems increasingly clear that AI systems will not replace human clinicians on a large scale, but rather will augment their efforts to care for patients.

Conclusion

AI is expanding its footprint in clinical systems ranging from databases to intraoperative video analysis. The unique nature of surgical practice leaves surgeons well-positioned to help usher in the next phase of AI, one focused on generating evidence-based, realtime clinical decision support designed to optimize patient care and surgeon workflow. The application of AI is needed in health services, especially in the management of health services, to make medical decisions, especially predictive analysis, in diagnosing and treating patients.

Artificial Intelligence is an upcoming and useful tool to identify early infections due to coronavirus and also helps in monitoring the condition of the infected patients. . It can significantly improve treatment consistency and decision making by developing useful algorithms. It can track the crisis of COVID-19 at different scales such as medical, molecular and epidemiological applications. It is also helpful to facilitate the research on this virus using analyzing the available data.

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