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Research Article

THE VALUES AND VISION OF ARTIFICIAL INTELLIGENCE

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A B S T R A C T

Artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and animals. Recently AI techniques have sent vast waves across healthcare, even fueling an active discussion of whether AI doctors will eventually replace human physicians in the future.

We believe that human physicians will not be replaced by machines in the foreseeable future, but AI can definitely assist physicians to make better clinical decisions or even replace human judgement in certain functional areas of healthcare (eg, radiology).

Artificial intelligence (AI) has been developing rapidly in recent years in terms of software algorithms, hardware implementation, and applications in a vast number of areas. Artificial intelligence (AI) is being used or trialed for a variety of healthcare and research purposes, including detection of disease, management of chronic conditions, delivery of health services, and drug discovery. data-heavy nature makes it an ideal candidate for the application of AI across multiple disciplines, from diagnosis and pathology to drug discovery and epidemiology. It is foreseeable that together with reliable data management platforms AI methods will enable effective analysis of massive infectious disease and surveillance data to support risk and resource analysis for government agencies, healthcare service providers, and medical professionals in the future.

INTRODUCTION

Artificial intelligence (AI) is intelligence exhibited by machines. In computer science, the field of AI research defines itself as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of success at some goal (1)Colloquially, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving. (2) definition. (3) The renowned physicist stressed the point that AI could be used to commit deplorable acts in the form of powerful autonomous weapons and other ways in which people in power could use the technology to oppress and control a majority of the population (4) The incidence and mortality of the liver disease grow yearly. The ultrasonography is one of the most common techniques to detect the liver disease. Many researchers have attempted to employ deep learning technology to support the doctor diagnosis by liver ultrasound image (5)

The breast tumor is one of the most common cancers for women. Thousands of women suffer from breast tumor all over the world. The early detection can decrease the death rate

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of the breast cancer significantly. The ultrasonography is a safe and convenient scheme to detect the early breast lesion (6)

The ultrasound imaging is one of the most common schemes to detect diseases in the clinical practice. There are many advantages of ultrasound imaging such as safety, convenience, and low cost. However, reading ultrasound imaging is not easy. In recent years, the success of deep learning in the image classification and segmentation led to more and more scholars realizing the potential of performance improvement brought by utilizing the deep learning in the ultrasound CAD system (7)

Many scholars have attempted to utilize the machine learning technology to detect the fetal ultrasound standard plane automatically (8) The thyroid nodule is a common disease upon a world scale. The ultrasound imaging is a widely employed scheme to detect the thyroid nodule. To support the doctor to diagnose the thyroid nodule, many CAD systems were proposed. Chi *et al*. employed the Goog LeNet to classify the thyroid nodule (9

Detection of thyroid nodules (TNs) has significantly increased over the past two decades with many more nodules now being incidentally detected. Radiologists have identified a few sonographic characteristics of thyroid nodules as suggestive features of malignancy, including hypo-echogenicity, absence of a halo, micro-calcifications, solidity, intra-nodular flow and taller-than-wide shape (10)

For decades, ultrasound image has been extensively applied in the detection of different diseases because of its high safety and high efficiency , such as the breast cancer, the liver cancer, the gastroenteritis disease , the cardiovascular diseases , spine curvature, and the muscle disease (11) However, it requires years of experience and training to read ultrasound image.

The amount of training to be an excellent radiologist is high. In this background, the CAD became a powerful tool to assist radiologists diagnosing. The original CAD system was used to diagnose the breast tumor in the 1960s (12) The application of CAD system improves the accuracy of diagnosis, reduces the time consumption, and decreases the load of doctors (13)

Artificial intelligence (AI) is an important field of computer science that seeks to create complex machines with characteristics of human intelligence. However, what is achievable at this time falls under the concept of “Narrow AI” where technologies exist to perform specific tasks as well as, or better than, humans can (14)

AI is poised to play an increasingly prominent role in medicine and healthcare because of advances in computing power, learning algorithms, and the availability of large datasets (big data) sourced from medical records and wearable health monitors. (15) In a recent publication from western India, using smart phone based AI algorithm to diagnose "Referable retinopathy" had 100% sensitivity and 88%specificity.(16) Recently the US FDA has for the first time approved the use of a smart phone based AIalgorithm for retinopathy diagnosis ((17) This idea of AI in health care is not new IBM's Watson, the well known question answer computing system,is already being utilized to assist in secision making for complex clinical situations. (18)

Artificial intelligence is a broad term defined as the theory and development of virtual systems which are able to perform tasks mainly by utilizing human intelligence such as visual perception, speech recognition, decision making and translation between languages (19). Me chine learning is a subset of AI, that provide systems the ability to automatically learn and improve from experience without being explicitly programmed (20)

Chronological record of significant events

Thought-capable artificial beings appeared as storytelling devices in antiquity, and have been common in fiction, as in Mary Shelley's Frankenstein or Karel Capek's R.U.R. (Rossum's Universal Robots) (21) The study of mechanical or "formal" reasoning began with philosophers and mathematicians in antiquity. This insight, that digital computers can simulate any process of formal reasoning, is known as the Church–Turing thesis (22)

Along with concurrent discoveries in neurobiology, information theory and cybernetics, this led researchers to consider the possibility of building an electronic brain. Turing proposed changing the question from whether a machine was intelligent, to "whether or not it is possible for machinery to show intelligent behaviour" (23)

The first work that is now generally recognized as AI was McCullouch and Pitts' 1943 formal design for Turing-complete "artificial neurons"(24)The field of AI research was born at a workshop at Dartmouth College in 1956, (25)where the term "Artificial Intelligence" was coined by John McCarthy to distinguish the field from cybernetics and escape the influence of the cyberneticist Norbert Wiener. (26)

Attendees Allen Newell (CMU), Herbert Simon (CMU), John McCarthy (MIT), Marvin Minsky (MIT) and Arthur Samuel (IBM) became the founders and leaders of AI research.(27) They and their students produced programs that the press described as "astonishing" Computers were learning checkers strategies (28,29) and by 1959 were reportedly playing better than the average human solving word problems in algebra, proving logical theorems (Logic Theorist, first run c. 1956) and speaking English.(30,31)

By the middle of the 1960s, research in the U.S. was heavily funded by the Department of Defense. and laboratories had been established around the world.(32,33) They failed to recognize the difficulty of some of the remaining tasks. Progress slowed and in 1974, in response to the criticism of Sir James Lighthill.(34)

In the early 1980s, AI research was revived by the commercial success of expert systems,a form of AI program that simulated the knowledge and analytical skills of human experts. By 1985, the market for AI had reached over a billion dollars (35) The success was due to increasing computational power (see Moore's law), greater emphasis on solving specific problems, new ties between AI and other fields (such as statistics, economics and mathematics), and a commitment by researchers to mathematical methods and scientific standards. (36)

Deep Blue became the first computer chess-playing system to beat a reigning world chess champion, Garry Kasparov, on 11 May 1997. (37) In 2011, a Jeopardy! quiz show exhibition match, IBM's question answering system, Watson, defeated the two greatest Jeopardy! champions, Brad Rutter and Ken Jennings, by a significant margin (38) Faster computers, algorithmic improvements, and access to large amounts of

data enabled advances in machine learning and perception; data-hungry deep learning methods started to dominate accuracy benchmarks around 2012 (39)

The Kinect, which provides a 3D body–motion interface for the Xbox 360 and the Xbox One, uses algorithms that emerged from lengthy AI research as do intelligent personal assistants in smartphones (40). In March 2016, AlphaGo won 4 out of 5 games of Go in a match with Go champion Lee Sedol, becoming the first computer Go-playing system to beat a professional Go player without handicaps. (41)

In the 2017 Future of Go Summit, AlphaGo won a three-game match with Ke Jie,who at the time continuously held the world No. 1 ranking for two years. This marked the completion of a significant milestone in the development of Artificial Intelligence as Go is a relatively complex game, more so than Chess.(42)

Clark also presents factual data indicating the improvements of AI since 2012 supported by lower error rates in image processing tasks.He attributes this to an increase in affordable neural networks, due to a rise in cloud computing infrastructure and to an increase in research tools and datasets. Other cited examples include Microsoft's development of a Skype system that can automatically translate from one language to another and Facebook's system that can describe images to blind people. (43)

In a 2017 survey, one in five companies reported they had "incorporated AI in some offerings or processes".[Around 2016, China greatly accelerated its government funding; given its large supply of data and its rapidly increasing research output, some observers believe it may be on track to becoming an "AI superpower". However, it has been acknowledged that reports regarding artificial intelligence have tended to be exaggerated.(44)

Emerging Current technologies in Artificial intelligence

Artificial intelligence (AI) is the term used to describe the use of computers and technology to simulate intelligent behavior and critical thinking comparable to a human being (45)

AI promises to change the practice of medicine in hitherto unknown ways, but many of its practical applications are still in their infancy and need to be explored and developed better. Medical professionals also need to understand and acclimatize themselves with these advances for better healthcare delivery to the masses (46,47). The application of AI is wide spread in modern day from the diagnosis of disease to cutting edge genome engineering i.e. gene editing. In radiology use of AI is highly appreciated in last decade. In a scheme called radiologist in the loop are bound to associate with interdisciplinary meetings, calls and review reports (48). Study also demonstrates that AI precisely machine learning allow a robust image processing, computer vision and natural language processing enable a technology for future. In the year 2017, Roach *et al* demonstrated application of AI in retinal eye disease.

In a previous study during 2016 involves Google Brain Project report diabetic retinopathy and macular edema. In Google brain project AI was also implemented in studying eye disorders and reported a higher sensitivity in diagnosis in patients having higher risk (49). Relationship between Diagnosis and disease in artificial intelligence Diagnosis of disease using AI is most curial part of innovative technology.

It uses machine learning algorithm to understand onset of disease. In machine learning algorithm Deep Learning algorithms – have recently made huge advances in automatically diagnosing diseases, making diagnostics cheaper and more accessible (50). More precisely, machine Learning algorithms can learn to see patterns similarly to the way doctors see them. So Machine Learning is particularly helpful in areas where the diagnostic information a doctor examines is already digitized (51)

The advantage of machine learning algorithm in diagnosis of various disease includes detecting lung cancer or strokes based on CT scans, assessing the risk of sudden cardiac death or other heart diseases based on electrocardiograms and cardiac MRI images, classifying skin lesions in skin images and finding indicators of diabetic retinopathy in eye images. Diagnosis devices and kits often cost a lot and conventional methods are time consuming as well. Here using AI precisely various machine learning algorithms allow a cheaper and robust diagnosis tools. Further, AI based diagnosis protocols are versatile and applicable to large number of populations (52)

Since there is plenty of good data available in these cases, algorithms are becoming just as good at diagnostics as the experts. The difference is the algorithm can draw conclusions in a fraction of a second, and it can be reproduced inexpensively all over the world. Soon everyone everywhere could have access to the same quality of top expert in radiology diagnostics, and for a low price (53)

Artificial intelligence in drug development process

One of most crucial aspect of healthcare system is to develop novel and effective drug. Drug development process is complex require time and capital investment. The process start from finding ideal target for drug and developing cost effective drug molecule via routine pharmaceutical regulatory cascade. Here use of AI not only reduce time but also cut down cost as well in drug development process.

The use of AI in drug development process provides a platform to compare various databases for efficacy. The AI based drug development process including Identifying targets for intervention, discovering drug candidates, speeding up clinical trials and Finding Biomarkers for diagnosing the disease.

In the very first step of drug development aim is to understand the biological origin of a disease (pathways) as well as its resistance mechanisms. Then you have to identify good targets (typically proteins) for treating the disease (54). In the next step that is finding novel drug molecules AI play vital role. This involves screening a large number – often many thousands or even millions – of potential compounds for their effect on the target (affinity), not to mention their off-target side-effects (toxicity). These compounds could be natural, synthetic, or bio engineered.

Then they blaze through millions of potential molecules and filter them all down to the best options – those that also have minimal side effects. This ends up saving a lot of time in drug design (55)

Third and most important part of drug development process is clinical trial studies and here AI is playing very important role as well. Machine Learning can speed up the design of clinical trials by automatically identifying suitable candidates as well as ensuring the correct distribution for groups of trial participants. Algorithms can help identify patterns that separate good candidates from bad. (56).

Artificial intelligence in genome editing

Genome editing is one of most powerful tool in modern bioengineering and AI application in gene editing is widely accepted. Clustered Regularly Interspaced Short Palindrome Repeats (CRISPR), specifically the CRISPR-Cas9 system for gene editing, is a big leap forward in our ability to edit DNA cost effectively – and precisely, like a surgeon. This technique relies on short guide RNAs (sgRNA) to target and edit a specific location on the DNA. (57).

Artificial intelligence in in healthcare Artificial Intelligence has already arrived in healthcare. Artificial Neural Networks' are a common type of machine learning inspired by the way an animal brain works. They progressively improve their ability at a particular task by considering examples. Early image recognition software was taught to identify images that contain a face by analyzing example images that have been manually labeled as 'face' or 'no face'. Over time, with a large enough data set and powerful enough computer, they will get better and better at this task (58)

The use of AI in healthcare provides study of most complex biological system such as brain and it's functioning in real time. AI also offer a platform where using several neural network allow ease in study in signaling cascade and metabolic events.

By and large AI is used in all the aspect of healthcare starting from drug development, clinical studies, patient's data base analysis, drug interaction and many more. Though there are growing challenges and ethical issues associated with AI but application is vast and growing exponentially. In recent time, Deep Brain Simulations (DBS) are most advance and complex experimentation to study brain and functioning of various part of brain. DBS using conventional approaches does not provide any significant outcome and hence AI was introduced with tremendous success (59)

Since the invention of first computer in 1950 by Alan Turing till date there is vast change in technology and understanding use of technology. Most recent AI is one of most diverse form of computation technology can be applied to human behavior studies. Further, vascular disease such cardiovascular disorders (CVD) are leading cause of death worldwide and understanding of fluid dynamics inside arteries and vessels require machine learning approaches and AI. The role of AI in metabolic modeling and developing molecular signatures of various diseases including infections is grown.

The most crucial aspect of AI in healthcare is developing machine learning platform for next generation sequencing and other computational biology modules (60)

Much has to explore in the context with healthcare precisely study of core biology and bio-engineering however, patients related applications of AI are underway and gain tremendous success indeed. The AI application is appreciated in oncology and study of infectious disease as well.

The clinical trial data analysis is most crucial part of drug development process and regulatory approval. The key area where AI not only involved but also improved healthcare system are Drug Development, Health Monitoring, Medical data analysis, Digital Consultation, Disease diagnosis, Personalized treatment, Surgical treatment, Analysis of health plan and Medical Treatments Future Research perspectives in Artificial intelligence Considering current aspect of AI in medicine in future AI will extract information from patients and develop several databases for reference.

It is evident in future AI based diagnosis system will not only provide more robust diagnosis methods but also tools for all kind of diseases as well. AI will be more useful in studying and understanding etiology for complex diseases such as diseases of brain and neurological disorders. Furthermore, AI based diagnosis system will provide more accurate diagnosis for life threatening diseases such as cancer, metabolic disorders and cardiovascular diseases in advance for effective management (61).

AI may soon become more effective than physicians, who cannot handle millions of images in any reasonable time frame. Artificial intelligence in the Background of Many Diseases. There are many diseases and there also many ways that AI has been used to efficiently and accurately diagnose them.

An article by Jiang, *et al* (2017) demonstrated that there are several types of AI techniques that have been used for a variety of different diseases. Some of these techniques discussed by Jiang, *et al* include: Support vector machines, neural networks, Decision trees, and many more. Each of these techniques is described as having a "training goal" so "classifications agree with the outcomes as much as possible (62). Another conclusion Alic, *et al* (2017) was able to draw was that between the two ANN and BN that ANN was better and could more accurately classify diabetes/CVD with a mean accuracy in "both cases (87.29 for diabetes and 89.38 for CVD). (63)

Research program of the next generation world

Correctly diagnosing diseases takes years of medical training. Even then, diagnostics is often an arduous, time-consuming process. In many fields, the demand for experts far exceeds the available supply. This puts doctors under strain and often delays life-saving patient diagnostics. Detecting lung cancer or strokes based on CT scans Assessing the risk of sudden cardiac death or other heart diseases based on electrocardiograms and cardiac MRI images. Classifying skin lesions in skin images. Finding indicators of diabetic retinopathy. (CT, MRI, genomics and proteomics, patient data, and even handwritten files) in assessing a disease or its progression. An opinion arrived at through a process of reasoning Artificial intelligence is helping us more efficiently diagnose diseases, develop drugs, personalize treatments, and even edit genes. But this is just the beginning.AI is useful in tele health, drug interactions, creation of new drugs, imaging, radiology and other health care conditions. The amount of data collected and managed in (bio) medicine is ever-increasing. Of the more than 7000 RDs described worldwide, only 5% have a treatment (64)

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