Application of AI in Healthcare: A Survey

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Abstract: *Artificial intelligence (AI) has now a days become part of our lives knowingly or unknowingly. AI has developed very swiftly with the development of Software Algorithms, advanced hardware, network capabilities and Internet. In this paper we will discuss the AI applications and the developments in Biomedicine, Biomedical processing and research. This paper aims to track the achievements of new science, to understand discovery of technology, to appreciate the great potential of AI in biomedicine, and to provide young researchers an inspiration in this subject. AI has particular Potenial in planning and distribution of resources in health and medicine. Purpose of this paper is to focus on the ways AI domains can be used to aid treatments such as natural language processing, voice technology and medical robotics. It is also discussed that how AI can be used in medical research, such as medical imaging, eco cardiography, etc.*

Keywords: Artificial intelligence, Machine learning, healthcare applications, Clinical decision, making management, Medical Imaging, Medical Robotics

I. INTRODUCTION

Artificial intelligence (AI) is defined as the intelligence of machines, as opposed to the intelligence of humans or other living species [1,2]. AI can also be defined as the study of ''intelligent agents''—that is, any agent or device that can perceive and under- stand its surroundings and accordingly take appropriate action to maximize its chances of achieving its objectives [3]. AI also refers to situations wherein machines can simulate human minds in learning and analysis, and thus can work in problem solving. This kind of intelligence is also referred to as machine learning (ML) [4] Typically, AI involves a system that consists of both software and hardware. From a software perspective, AI is particularly concerned with algorithms.

An artificial neural network (ANN) is a conceptual framework for executing AI algorithms. It is a mimic of the human brain—an interconnected network of neurons, in which there are weighted communication channels between neurons. One neuron can react to multiple stimuli from neighboring neurons and the whole network can change its state according to different inputs from the environment.

The impact of automation and robotics have been felt by blue-collar jobs for a while. A recent working paper by the National Bureau of Economic Research found that the arrival of one new industrial robot in a local labour market coincides with an employment drop of 5.6 workers.2 Last year alone, there have been news reports of apple-picking robots, Review Medicine and the rise of the robots: a qualitative review of recent advances of artificial intelligence in health Erwin Loh burger-flipping robots4 and a barista robot that makes you coffee. Nature even ran an editorial on sex robots.

There is a false sense of security in assuming that automation will only impact blue-collar type work that requires more manual, repetitive actions and less intellectual input. PwC released a report based on a survey of 2500 US consumers and business leaders, which predicts that AI will continue to make in-roads into white collar industries.7 A large stockbroking firm ran a trial in Europe of its new AI program this year that showed it was much more efficient than traditional methods of buying and selling shares.8 A Japanese insurance firm replaced 34 employees with an AI system, which it believes will increase productivity by 30% and see a return on its investment in less than 2years.9 The Washington Post used an AI reporter to publish 850 article in the past year.10

II. METHODS AND MATERIAL

This paper has been completed on the basis of the information gathered from various sources. Internet, various research papers and articles have been surveyed for the purpose of gathering and understanding information.

III. RESULTS AND DISCUSSION

3.1 What is AI

A. Artificial Intelligence (AI)

John McCarthy is the father of Artificial Intelligence. Artificial C. Intelligence is a way of making computers and computer- controlled machines and software to be intelligent enough to learn, decide, and execute in a manner similar to that of the way a human brain thinks and acts. Artificial Intelligence is a knowledge and machinery based on disciplines such as Computer D. Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. It is defined as "The science and engineering of making intelligent machines, especially intelligent computer programs". Alan M. Turing published "Computing Machinery and Intelligence" in 1950. Alan M. Turing is best known for "The Imitation Game" in which the question "Can machines think" is considered and evaluated. This question has led to the rise of many researchers such as Marvin Minsks, John McCarthy, James McClelland, David Rumel hart, and Lof ti Zadeh, resulting in a substantial amount of work in the area of Artificial Intelligence. Robots are machines that are most often programmed by a computer. They are capable of performing a series of complex actions automatically. Robots can be utilized by using either an external device or through a device that is implanted within the robot itself. The term "robot" was form of written messages so that the interrogator cannot determine whether it is man or woman through the voice. The term "robot" was first used by the Czech writer, Karel Capek. George Devoninvented the first digital and programmable robotic 1945

3.2 What is AI in Healthcare

So, we have established that AI can be helpful in predicting mental health conditions, but can AI also be helpful in the provision of psychological treatments? Researchers found that soldiers are more likely to open up about post-traumatic stress when interviewed by a computer-generated automated virtual interviewer, and such virtual interviewers were found to be superior to human ones in obtaining more psychological symptoms from veterans. [8] What about robot surgeons? Robotic surgical devices already exist, but they still require human control—is AI able to perform autonomous surgery without human input? In a robotic surgery breakthrough in 2016, a smart surgical robot stitched up a pig's small intestines completely on its own and was able to do a better job on the operation than human surgeons who were given the same task. [9] What is even more impressive is that late last year, a robot dentist in China was able to carry out the world's first successful autonomous implant surgery by fitting two new teeth into a woman's mouth without any human intervention.28 AI's current strengths

So, based on the available evidence, what is AI good at today? It is clear that AI's current strength is in its ability to learn from a large dataset and recognise patterns that can be used to diagnose conditions. This puts AI in direct competition with medical specialties that are involved in diagnostic tests that involve pattern recognition, and the two obvious ones are pathology and radiology.

3.3 AI Application

A. AI Application in E-Commerce

Personalized Shopping

Artificial Intelligence technology is used to create recommendation engines through which you can engage better with your customers. These recommendations are made in accordance with their browsing history, preference, and interests. It helps in improving your relationship with your customers and their loyalty towards your brand.

B. Applications of Artificial Intelligence in Education

Although the education sector is the one most influenced by humans, Artificial Intelligence has slowly begun to seep its roots in the education sector as well. Even in the education sector, this slow transition of Artificial Intelligence has helped increase productivity among faculties and helped them concentrate more on students than office or administration work.

C. Applications of Artificial Intelligence in Lifestyle

Artificial Intelligence has a lot of influence on our lifestyle. Let us discuss a few of them. Autonomous Vehicles Automobile manufacturing companies like Toyota, Audi, Volvo, and Tesla use machine learning to train computers to think and evolve like humans when it comes to driving in any environment and object detection to avoid accidents.

D. Applications of Artificial Intelligence in Robotics

Robotics is another field where artificial intelligence applications are commonly used. Robots powered by AI use real-time updates to sense obstacles in its path and pre-plan its journey instantly.

E. AI Biomedicine

AI applications have become common, e.g. Siri, Alexa, and Cortana. In medicine, IBM Watson-Oncology has picked up drugs for treatment of cancer patients with equal or better efficiency than human experts. Microsoft's Hanover Project at Oregan has analyzed medical research to tailor personalized cancer treatment option.[10] United Kingdom's National Health Service (NHS) used Google's DeepMind platform for detecting health risks by analyzing mobile app data and medical images collected from NHS patients.[11] Stanford's radiology algorithm picked up pneumonia better than human radiologists,[10] while in diabetic retinopathy challenge, the computer was as good as expert ophthalmologists in making a referral decision.[11]

In 2018, Krause et al. trained an automated algorithm for diabetic retinopathy (DR) grading while working on quantifying errors in DR grading based on individual graders and the majority decision using adjudication. They retrospectively analyzed Health Insurance Portability and Accountability Act Safe Harbor deidentified images labeled by American board-certified ophthalmologists and retinal specialists in addition to the "developed and tuned" algorithm. The retinal fundus images were contributed by-affiliated clinics, Aravind Eye Hospital, Sankara Nethralaya, Narayana Nethralaya, and Messidor-2 dataset from Brest University Hospital supported Laboratory of Medical Information Processing and the original images from Gulshan et al. Ethics review and institutional review board exemption was granted to the project by Quorum Review Institutional Review Board. These results were rated against the consensus of the retinal specialists as the reference standard. The commonly used International Clinical Diabetic Retinopathy (ICDR) disease severity scale consisting of a five-point grade for DR: no, mild, moderate, severe, and proliferative was used by three ophthalmologists. Three grading types were used in development, including grading by Eye PACS graders, grading by ophthalmologists, and adjudicated consensus grading by retinal specialists.

F. AI in Medical Robotics

Robotics is concerned with the connection of perception to action. AI provides the intelligence by addressing what knowledge is required in the aspect of thinking, representation of the knowledge, and how it is to be used, thus making Robots intelligent. Isaac Asimov, part of the 1945 alumni of Columbia University, coined the term "Robotics". Robots are made out of hardware, which acts as an agent to perform certain defined tasks by manipulation. However; Robots are operated in both supervised and unsupervised manners.

Robots can be in form of manipulators, mobile robots (such as the ones used to automate transport in production processes), and humanoid robots (which have a resemblance close to that of a human being). In medicine, Robots are being used in neurosurgery and in treating cancer patients. Use of Robots for household services, such as cleaning and surveillance, have increased and will continue to do so as time goes on. Major Service providers are now planning to provide home-based robotic services to help the sick and aged who are home alone. In Japan, Robots are being used to guide the blind. In addition, humanoid Robots are being tested and evaluated for deep space travel and exploration by NASA.

G. Future of AI

There is no turning back from the rise of AI in all aspects of our lives. AI already resides in the smartphones that a lot of us own, in the form of smart digital assistants. But AI has progressed beyond helpful chatbots. For example, Google's AI group, Deep- mind, unveiled AlphaGo, an AI that took just 3days to master the ancient Chinese board game of Go with no human input, as reported in Nature.[6] This version of AI was able to win against its previous version (that famously beat the world champion in Go previously) 100 games to 0. More recently, Alpha Zero, another AI from Google, learnt the rules of chess in 4hours by playing against itself 44 million times and went on to beat Stock- fish, a well-established chess program.[7] With dramatic improvements in computer software and hard- ware coming online, and increasing access to large datasets that are increasingly being linked together, it is no wonder that Ray Kurzweil, a Google AI expert and well-known futurist, believes that AI will surpass the brainpower of a human being by 2023 and reach what he terms 'singularity' in 2045, which is when AI will surpass the brainpower equivalent to that of all human beings com

IV. CONCLUSION

In this paper, we reviewed the latest developments in the application of AI in healthcare, including disease diagnostics and prediction, living assistance, biomedical information processing, and biomedical research. AI has interesting applications in many other biomedical areas as well. It can be seen that AI plays an increasingly important role in healthcare, not only because of the continuous progress of AI itself, but also because of the innate complex nature of biomedical problems and the suitability of AI to solve such problems. New AI capabilities provide novel solutions for biomedicine, and the development of biomedicine demands new levels of capability from AI. This match of supply and demand and coupled developments will enable both fields to advance significantly in the foreseeable future, which will ultimately benefit the quality of life of people in need.

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