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To cite this article: V Ragavi *et al* 2021 *J. Phys.: Conf. Ser.* **1831** 012006

View the article online for updates and enhancements.

Impact of Artificial Intelligence in the field of Health Care

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Abstract. Artificial intelligence (AI) has potentially transformed health care to a very great extent. AI algorithms coupled with machine learning and deep learning algorithm together with high speed processors makes AI powerful. Research has shown that digitization will help health care professionals in making decisions and discoveries much faster than before. This paper discusses about the about how AI algorithm works? It also explore the impacts of artificial intelligence in the field of health care such as virtual medical assistant, automated image diagnosis, personal health companions, oncology, cardiology, radiology, AI powered chatbots.

Keywords: Artificial Intelligence, Machine Learning, Deep Learning, Health Care, Radiology, Oncology, Cardiology, VMA, Chatbot

Introduction

In the evolution of new technologies Artificial Intelligence (AI) is the burning area of research[1]. AI undoubtedly plays an exponential role in healthcare and medicine. It is because of the advances in learning algorithms which are becoming more precise and accurate day by day. Secondly,the rapid increases in computational power and parallel processing technologies have even made AI more powerful. Thirdly, theavailability of huge volume of data supported by endless storage in cloud is a major advantage which helps in development of many AI applications. This data is used to train the learning algorithms to make them more accurate. The algorithms interact with the training data and allow new insight in diagnosis and treatments.Hence it improves patients' outcomes[2].Frost and Sullivan have estimated that AI will improve patient outcome by 30% to 40% with a reduction of 50% in the treatment cost [3]. Studies predicted that growth in the AI health care space is expected to touch $6.6 billion by 2021 with a CAGR of 40% [4]

Background Study

Patel et al discussed about the impact of AI in the field of medicine and their influence in that field. According to the authors AIM (Artificial Intelligence Methods) based systems assist physicians in clinical practice. Increase in the prevalence of EMR (Electronic Medical Records) help in creating discovery – support systems to support doctors.

In [6] Greenspan et al conferred that deep learning algorithms have become an emerging machine learning tool for image processing. CNNs (Convolutional Neural Networks) and deep CNNs are doing extremely well in object recognition and natural image processing.

AI will replace human doctors says Norman [7]. The impact of AI in healthcare is escalating from diagnostic algorithms to surgical robots. The author exclaims that AI is capable of handling huge volume of data that would overwhelm humans. Finally the author concludes that AI will optimize and improve the service of physicians instead of replacing them.

In [8] refers to many applications of AI in healthcare which are very promising. The author explains how robots help surgeons during surgery as well as they help them to integrate data of their patient's pre-op medical records with their real time data to get better outcomes. The author further discusses about the da Vinci Surgical System with robotic limbs which has magnified high-definition 3-D view for surgery. So this enables the surgeons in complex surgery.

Emerging role in the field of AI in hospital setting is discussed by SennarSennaar (2018) [9]. In this article the author pin points about how poor quality of data can ruin the healthcare system. He also throws light on factors which causes resistance in adaptation of AI based applications. Roach has also discussed about applications of AI in Ophthalmology [10].

How AI Algorithm Works?

Looking at the advances in AI, medical practice in the forthcoming years might be like where a patient would have to see the computer for initial diagnosis before visiting a doctor. The accumulating data generation in clinics stored in EMR makes applications of highly data driven. AI algorithms are trained to do the task using these data generated. The data that is generated may be structured or unstructured. AI algorithms can process only structured data. So, the initial task is to convert all unstructured data into structured format. Labeling all data points or annotating data points so that algorithms recognize them is the process of converting unstructured data to structured format. The algorithm is then exposed to large sets of data points and their labels. The algorithm is trained to get the desired output, if the output. This process is repeated until the algorithm satisfies its requirements. Figure 1 shows the process of how AI algorithm works.
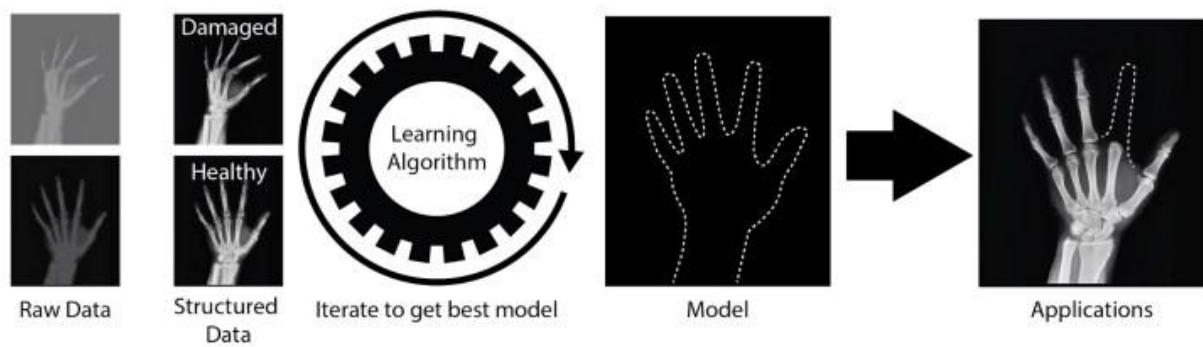
Figure 1: Process of AI Algorithm

Impact of AI in Health Care

As discussed earlier AI has greater impact in medical field though we claim that AI is in its early stage in medicine. Factors such as the amount of data collected in clinics, the super speed computers, easily available EMRs etc., makes AI advancements [11] in areas like Virtual assistants, automated image diagnosis, personal health companions, oncology, cardiology, radiology, AI powered chatbots.

Virtual Assistant for Staff

Smart phones Internet access hasfueled the trend of virtual assistant. According to ResearchAndMarkets [12], virtual medical assistant market is expected to grow up to $1.73 billion at a CAGR of 34.6% from 2019 to 2024. VMA (Virtual Medical Assistant) prevents physicians from becoming data entering clerks. VMAs can be used for transcription. Machine learning - powered VMA namely Robin developed by Robin Healthcare, documents all clinical information from a real-time dialogue between the doctor and the patient. Thus VMAs can be trained for transcription of conversations, which physicians can review later. VMAs can also be used for Medical record keeping. Nuance from Massachusetts has developed a VMA which is EHR (Electronic Health Record) – integrated that automates clinical records by voice recognition.Suki is another customized VMA powered by machine learning. When Suki was implemented in 2018 it was very well received by the physicians as it reduced 60% of their paper work and the records were maintained very accurate.
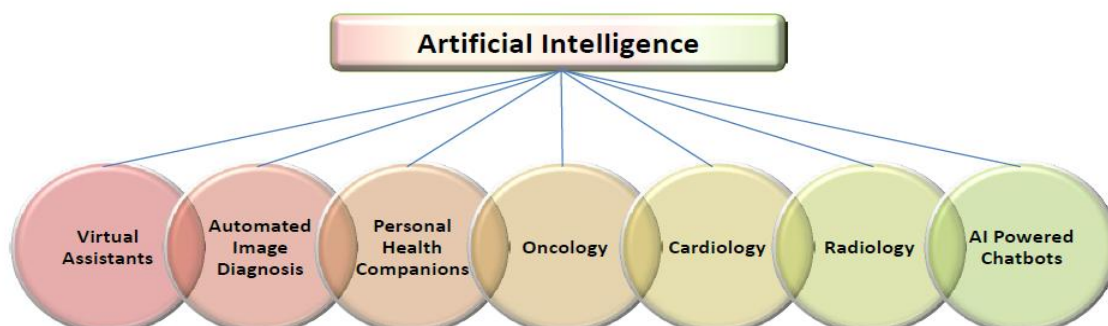

Figure 2: Impact of AI in Health Care

Automated Image Diagnosis

AI does not stop with image analysis, there are many other stages starting from ordering to reporting where AI is blooming. AI finds its place in triaging, worklist assignment, and workflow orchestration. Zebra Medical Vision, GE Health care, vRAD, Aidocare some of the applications of AI used in image diagnosis. AI also aids in decision making, it clearly helps physicians to decide the next clinical pathway. AI has placed its foot in automated immunohistochemical measurement systems [13]. It has been reported specificity levels>85% with this automated diagnosis. AI is also used in digital tissue-based diagnosis.

Personal Health Companion

Health care companions (Robots) are used to care elderly people, help them remain independent, remind them of their daily tasks and tracks their health record and alerts their loved ones when necessity arises. Advancements in AI might go further to include having "conversation" and "socializing" with elderly ones. In hospital, healthcare companions track their patients and update the records. Additionally patients can share their symptoms and the health care companion would suggest a diagnosis to be verified. Ada is one such companion and it used in more than 130 countries across the world.

Assistance in Oncology

Early detection of cancer is the key to save the affected individuals. Deep learning algorithms can classify dermoscopy images and annotate skin lesions more accurately [14][15]. AI has achieved a great level of accuracy in the interpretation of mammograms for breast cancer screening [16]. Deep neural network is able to detect enlarged lymph nodes in tomography images [17].Large collection of data is made available in Cancer Imaging Archive (TCIA) which has enabled radiomics and segmentation within neuro-oncology. This is part of Cancer Genome Atlas(TCGA)(http://cancergenome.nih.gov/). Current methods in neuro-oncology imaging focus on diffuse gliomas. The tumors are graded as II to IV tumors which are classified into lower-grade glimos (grade II & III) and glioblastoma (grade IV) by World Health Organisation(WHO) [18].

Assistance in Cardiology

AI has enhanced cardiologists to treat patients efficiently. Very high quality cardiac ultrasound systems like Philip Epiiq, Siemens SC2000, Point-of –Care ultrasound systems (POCUS), Healthcare Vscan are available in the market.This equipment identifies echo patterns and automatically reads the values to the cardiologist. Certain systems like Philips, EPiq SC2000 use artificial intelligence to automatically identify the segments, label them, anatomy, view optimal echo patterns. This reduces the work of physicians, as all these reading are ready by the time the doctor arrives to see the patients.

Assistance in Radiology

AI is doing tremendously well in the area of radiology. Radiologists are stunned with the data they receive day by day. The data they receive steadily are refined and being reported very accurately. PowerScribe is a virtual medical assistant which converts unstructured data into structured data.

This VMA helps radiologists in different stages of their workflow; it also helps them to integrate and lookup data very efficiently. Deep learning algorithms play a vital role in detection of images, segment the images, and classify them into various types, helps inn prediction of various patterns. There are numerous applications of AI in radiology [19][20]

AI Powered Chatbots

A Chat bot is a machine which can communicate with humans either by text or audio. These chat bots use NLP (Natural Language Processor) and ML (Machine Learning) to get better understanding of humans. There are various levels of understanding with the chat bots. AI powered chatbot basically recreate a human. Like humans these chatbots are trainable and scalable. The most famous chatbots are Bold360, Ada, Watson Assistant, Rulai, LivePerson, Inbenta, Verig etc.,

Conclusion

The application of AI in the field of health care is likely to improve drastically in coming years. It will replace humans for initial diagnosis both in developed and developing countries shortly. AI and ML is making people rely on them for basic work flows, decision making and makes people trust them for safety and accuracy. As we foresee an AI future in the near future it is mandatory that all medical professionals must know the fundamentals of AI technology and their basic solutions which will help them in getting better outcomes to their patients.

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