

Impact of Artificial Intelligence in Healthcare

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Abstract: Artificial Intelligence (AI) is the trending technology that is affecting almost every aspect of our lives. It is also contributed gradually to the changing field of medical sciences. Due to the enormous increase and upgradation in the digital data acquisition, machine learning, deep learning, artificial intelligence applications are too expanding in the areas which were previously only be handled by human experts only. In this review paper we would like to specify the trending technologies using artificial intelligence with their benefits in various biomedical applications. We further tried to identify the challenges of these AI systems in medical field. Because of rapid changes in technology, healthcare sector will see drastic changes in how we prevent, diagnose and cure disease.

Keywords:

I. INTRODUCTION

AI is playing an important role in transforming our daily lives. AI is helping humans to help children learn, drive safely and enhance people's lives. AI applications in homes, schools and hospitals are being implemented in a big way. Universities and companies the world over are standing heavily to develop AI applications which can enhance the lives of humans. AI is making a major impact in the fields of healthcare, education, entertainment, security, schools etc. In health care great improvement has been made to collect data from various devices used for monitoring, applications used on mobiles, from electronic health records, which can be analyzed and better treatment can be given to the patients on the basis of analytical report. Application which are based on artificial intelligence could vastly enhanced health related outcomes and life quality for millions of people in the recent years but only if they have the trust on doctors, nurses and patients and if policy regularity commercial obstacles are removed.

II. BACKGROUND

Major applications based on artificial intelligence in healthcare are in patient monitoring system, automatic devices which help in surgery and management of healthcare systems[1]. As in other fields in healthcare domain data is the key. Patient data can be gathered from personal monitoring machine, healthcare apps, from electronic health records and from robots which are design to help in operations and other medical procedures. But using this data in more accurate diagnosis and treatments has proved to be difficult because of regulations which act as impediment in research.

Poor human computer interaction methods and risks of implementing technologies in such a large and complex system have slowed realization of AI's in healthcare. The removal of these obstacles and going in for innovation have the ability to improve health and hence quality of life for millions of people in coming years. In future we can develop experts systems also known as knowledge based system. An expert system should be competent enough to solve specific problems.

Expert systems has two main block :

1. Knowledge Base
2. Reasoning Engine

Reasoning engine has a series of complex rules(if than, while statements). The information stored in knowledge is mostly incomplete and uncertain. Here we can use the principles of fuzzy logic to arrive at some conclusion. Fuzzy logic is set of mathematical principles used for knowledge representation based on probability and uncertainty. Using fuzzy logic in the realm of experts systems can help humans to solve complex problems with high degree of uncertainty. This can be used in improving diagnosis of disease in chronic conditions.

III. AI IN HEALTHCARE

Machine learning is a sub field of artificial intelligence. Machine learning uses algorithms to automate data analysis by finding patterns in data store and learning from them [4]. Machine learning application can be broadly classified under two categories

1. Supervised learning
2. Unsupervised learning

Supervised learning uses patterns already identified in training data. In unsupervised learning applications are designed to find and learn from patterns which exists in the data.

Data mining is linked to unsupervised machine learning and is used to indentify patterns in large data sets.

Electronic health records (EHR) are effective tools for documenting and sharing health care information. Integrating machine learning based models designed for EHR can help in the detection of potential complications. It can also improve improves health care resource utilization. In some of the hospitals images of X-Rays, MRI etc have been digitized; hence automated image interpretation has started and is slowly gaining momentum.

Artificial Intelligence can do data mining and form results from millions of patients' records. When combined with EHR system, machine learning techniques could be applied to medical image data giving better output. For example, many hospitals have data of millions of patients' scans and each has an associated radiological report and an associated patient records.

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Deep Neural Networks can be trained to produce basic radiological findings with high reliability by training from this data.

It is evident that in future main aim of health care will be sustaining wellness of the population. Portable medical instrument will be used for the diagnosis of illness outside the hospitals and health sensors will monitor our body parameters round the clock. Hence technology will find different community members (that is doctors and patients) in a single group. Health care devices will be using IoT devices to collect and store huge amount of data. This collected data can be used by machine learning and deep learning tools to prescribe tailor made medicines in health care. With the help of artificial intelligence new innovations in the field of healthcare can be done more swiftly and on a regular basis, example AI played a major role in finding Ebola cure. Without the assistance of AI this would have not been possible.

The technologies which we have mentioned above already exist but at present they have a very limited capacity. In future there will be further develop and will play a major role in health care with the development of new applications. Example Virtual reality in future will play an important role in medical training and provide comfort to patients by speeding up the recovery period. Robotics is another branch of technology which can help the clinical staff in hospitals. Robots can also monitor the patients health round the clock without tiring and can provide emotional support to the patients. 3D printing technology is being increasingly used now by scientist and by astronauts. In future this technology will be used to manufacture body parts which can be transplanted in human bodies. In future with advancement in nano technology we will be able to built nano sized robots which will be implanted in human body. These nano sized robots will not only monitor various human parameters but will be able to cure the human body. All this will be done in real time. Thus diagnosis and cure will be available cress crossing geographical locations and will be a boon in those areas where medical facilities are not available or number of doctors are less. Thus telemedicine will solve lack of doctors shortage. With the advent of technology in health care the size of hospital will decrease and smaller medical centers will be started in various locations for greater efficiency. Ethical and cultural issues, lack of investment or affordability, regulatory environments are some of the important considerations for future technologies to become realities.

IV. FUTURE OF HEALTHCARE

1. Changes in next five years

- Portable medical devices for professionals: Portable diagnosis and treatment devices for medical professionals.
- Health sensors for consumers: Wearable devices, smart clothes for monitoring health
- IoT in Health Care: IoT devices can be used to monitor health of individuals
- 3D Printing: 3D printed tissues, skin, blood vessels, bones

- Genomic Analysis: Receiving treatment customized to our molecular breakup and genetic background.
- Robotics: Robotic nurse assistants to support the work of Healthcare professionals
- Virtual Reality in Healthcare: usage of VR in medical training .
- Artificial Intelligence in Medical Decision Support [2]: The expanding role of AI in monitoring and diagnosis
- Augmented Reality: Projecting digital Data on to real life imagery, used for diagnosis and health care

2 Future of Health Care in Next Twenty Five Years [3]

- Telemedicine: Lack of doctor, shortages will be solved via tele medicine, via Ubers of health care to bring the attention and expertise of doctors to the masses
- Hospital redesign: revolutionary changes in hospitals. Hospital becoming smaller as diagnosis and treatment will be done at home.
- Precision Medicine: Using big data and AI to identify the medical approaches for patients based on genetic .
- Inserting Devices inside the Body (ieNano Technology): Nanometer sized robots in our body will cure and monitor health.
- Man Made Organs: Organs can be created using 3D Printings .
- Ageing Research: Ageing of humans may be controlled.
- Designer Babies: Customized babies by altering DNA
- Brain Computer Interface (BCI Technology): Our brains will be directly connected to AI

V. NANO TECHNOLOGY IN FUTURE HEALTHCARE

“Fantastic Voyage” a 1966 Science Fiction movie asubmarine& its crew is shrunk to microscopic level & injected into the body of a injured scientist to repair his body damaged cells. Well we may not be able to shrink a human being or a ship to microscopic level & inject into a human body , but medicine on an atomic & molecular scale is becoming a reality. To build a molecular sized machine is a big challenge as many physical parameters of a substance change when you shrink a substance to microscopic level. Hence to build a molecular sized machines which can manipulate the environment like manipulate structures of proteins or DNA would be a huge transformation of healthcare. However small devices which can be worn by humans are becoming common. These devices monitor our bodies vital signs. Effort is on to shrink these devices further to Nano scale & then these devices can be implanted in our bodies. These Nano device will be able to collect detailed data from within our body enabling doctors to personalize treatment. Already some innovations are working on Nano devices & a few prototypes have been developed & are being tested.

Micro machines could help in fighting cancer by destroying cancer & keeping healthy cells untouched. Such macro machines could help in treatment of Parkinson's disease.

With nanorobots it is argued that they could enter the body & redesign the genome. It is visualized that nanorobots will be injected in our body, detecting & reacting to problems as they arise. It appears that in future with advancement in technology science fiction can become a reality.

VI. IOT IN HEALTH CARE

In the last few years lot of work has been done to connect internet to every day devices. We have many device like armbands, watches, heart beat monitors that measure our physical activity. Basically we install sensors into any device & connect the device to internet. This technology offers great benefits especially in the field of healthcare. IoT devices installed in healthcare field offer great advantages both to patients & doctors. Patients will save time as their physical parameters are being monitored remotely especially patients having moving disability will benefit largely. Hospitals will benefit as they will be less crowded, as routine monitoring of patients can be done remotely. Doctors will have continuous patient data, giving them a more detailed picture of their patient. The moment some of the patients health parameters change, doctors can conduct a tele visit or can dispatch clinical staff to patients home/workplace to attend to the emergency immediately. As the data of millions of patients is being monitored & stored on a continuous basis this will transform healthcare in the coming years. With such fine grained data gathered continuously any small changes in patients data can be detected much earlier & corrective measures could be taken by the doctor or clinical staff well in time. Already these huge data sets are being given to researchers to help improve the efficiency of drugs & better understand the development of various diseases like cancer & diabetes. With the help of IoT technology in future we not only can give better treatment but also can reduce the occurrence of a disease.

VII. FUTURE HOSPITALS

Over the past many years there has been a lot of advancement in medical science but hospitals have not changed over the time. Most of the hospitals have remained the same, large buildings having lot of departments housed in the same building like OT, various clinical laboratories, imaging centres, food services, house keeping etc. With new technologies coming up hospitals will have to reinvent & re engineer themselves to accommodate the technological changes coming up in the health care sector. Hospitals of tomorrow will rely on robotics & digital technologies. Many of the tasks (mental & physical) which are performed by the doctors or clinical staff will be automated. Hence lot of free space will be available in hospitals. With the advent of telemedicine's & remote monitoring of health parameters will reduce visits of patients to the hospital. Some studies which were carried out by agencies it has been estimated that 85% consultations do not need to be in person. Again this will put less pressure on the hospitals. Future hospitals may have emergency treatment centers with OTs & a

clinical decision unit, out patient diagnostic centre with beds for short stays. AI smart assistants[5] will attend & take care of patients. They will also take measurements & perform diagnostics. Robot nurses will help & assist the elderly.

Radiology: Effort is on to develop AI solutions to automate image analysis & diagnosis. This can be achieved by highlighting area of interest on a scan. This will increase efficiency & reduce human error.

There is a possibility of fully automated solutions. To automatically read & interpret a scan without human intervention. This can help in instant interpretation. AI is being used to analyze & interpret cardiac MRI images.

AI in rural areas: The advantages of AI in a healthcare settings are clear. It is rather than requiring a specialist doctor to perform eye examination an image can be taken from a device like mobile phone. This image can be uploaded to a cloud database & analyzed by an AI programme. This program is already as accurate as a specialist doctor.

The implications for healthcare in India especially in rural areas: Rural areas are dogged by staffing shortages in the medical sector. AI could ensure that rural areas be service by a few individuals having a mobile device, travelling from village to village. This individual does not need years of specialist training, just the ability to take images. The AI does the rest. This system would allow more time for doctors to handle treatment & patient management, rather than spend a large portion of their time running routine check ups. Integrating AI would allow limited number of specialist to be far more efficient with their time.

Drug development: It is hoped that AI & ML will bring in an era of cheaper, quicker & more effective drugs. Many pharmaceutical companies are collaborating with IT companies in the development of new drugs. Improvement in computational power combined with advances in AI can be used in drug development process.

Patient safety: Digital tools can reduce variations in patient care. Algorithms could standardize tests & procedures in healthcare systems. Algorithms can be updated online from time to time as our anti virus or OS are updated online. Patients will be able to consult any time of the day from anywhere in the world. However we will have to evaluate whether the algorithms are safe or not.

AI may be poorly trained, poorly programmed, have incomplete data or it could have been hacked. Hence poorly designed AI in health care can cause widespread harm.

Traditional VS AI based drug discovery methods

Traditional Method: These are generally Target Driven, they work efficiently for targets as they have well defined structures. They are very limited because of their complex nature of cellular associations and very limited knowledge of intricate cellular pathways.

AI Based: these are generally data driven and has the capability of extracting meaningful information from the huge amount of datasets using various complex algorithms and machine learning techniques.

They identify those compounds that could bind to “in drug gable targets” that is the proteins whose structures are not defined. The usage of Artificial Intelligence has facilitates the development of drug and helps to reduce the time scale and scope of any drug discovery. Already there are some startups which are using AI in drug discovery & development.

VIII. CONCLUSION

AI will play a big role in medical science in future & will completely change the relationship between Health workers & Patients. However still there are some gray areas are there which we will have to resolve before the above scenarios become a reality. At present AI is considered as a decision support tool but in future we will have to go beyond that.

Some issues in using AI in health care will be as follows

- Who is responsible for AI mistakes ie programmer, IT company who has patented that healthcare tool, the regulator or the doctor.
- Does a doctor have a right to go against the machines decisions? Does Vice Versa also holds.
- Human nature will be very hard to digitize & AI machines may find it very difficult to provide a solution between medical advice & patient wishes.

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