Exploiting Artificial Intelligence to Enhance Healthcare Sector

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Abstract: The resonance of the Artificial Intelligence (AI) makes it familiar in the lives of current generation. Artificial Intelligence is concerned to build smart machines possessing capability to perform different tasks without any human interaction. So, these machines are considered as a replica of human intelligence. The predictions and processing of large amount of data performed by artificial intelligence can be faster and more accurate compared to human beings whereas humans take a lot of time to analyse the huge volume of data. As the technology is upgrading gradually in the present generation, artificial intelligence created its own significance in the market through its emerging technologies such as machine learning and deep learning. Many small and large sector enterprises have been started utilizing the artificial intelligence. It is existing in many forms such as SIRI, ALEXA etc. and also been implementing in many areas such as healthcare, education, business, finance, manufacturing, banking and more. This paper focuses on and presents the implementation, impact of artificial intelligence in healthcare.

Keywords: Artificial Intelligence, Deep Learning, Healthcare, Machine Learning, Neural Network.

1. Introduction

People astonish by the revolutionary results of artificial intelligence as machines perform the tasks of human beings by substituting the human intelligence. The researchers develop the machines in such a way that they can produce accurate output. These machines should be programmed or trained well to produce exact result as they process a huge volume of data. Once it is programmed well, they analyze the data into very deep and produce accurate result that even the human beings cannot reach to that extent [1].

The following steps are used by the researchers to train the machine:

A Researchers study the requirements for the machine to work on and start designing of it. Development of dataset is the major part of training a machine as it should be perfect with its value while handling a huge volume of data. The entire dataset can be divided into three parts.

a. Training set used to train the AI model.
b. Tuning set used to select the training scenario.
c. Validation set used to evaluate the final model. [4]

AI algorithm is developed based on deep Convolutional Neural Networks (CNN) and is tested to check whether it is capable or not. The potentiality of Artificial Intelligence is echoing beyond multiple enterprises as the development and implementation of AI in all areas change the working style of the people from traditional to innovative with unimaginable speed in many research projects, business, healthcare etc. Its influence on healthcare is truly life-changing with its strength to imitate human cognitive functions. Generally, doctors analyze the reports manually but the implementation of AI in this sector helped them in such a way that they can easily diagnose the patients’ diseases and provide them with fast and accurate result reports generated by these machines. AI helps the patients by reducing their number of visits to the doctor and the administrative staff have benefitted by transforming their voice notes to text transcription.

2. Approach to AI
Artificial Intelligence can be approached in three ways known as machine learning, cognitive computing, and deep learning [8].

2.1 Machine Learning: Machine learning is a technique aiming to mold the system with an ability to learn and upgrade automatically from its experience similar to human beings but without their assistance. The learning process of a machine starts by observing the patterns of data later that can be applied in decision making for the user inputs. Machine learning algorithms are categorized as supervised, unsupervised, semi supervised and reinforcement algorithms to train the systems in such a way to get the knowledge by analysing the data and implement them whenever needed in future [8][12][13].

2.2 Cognitive Computing:
The main focus of cognitive computing is to substitute the humans with these systems in some areas, as cognitive systems think same as human mind in producing the solutions to various problems even in complex situations. These systems integrate the huge amount of structured and unstructured data from various sources, perform operations on it with self-learning technology that is programmed by using data mining, Natural Language Processing (NLP) and pattern recognition [8].

2.3 Deep Learning:
Deep learning is a subset of machine learning. In this method, system learns automatically from its flaws or failures and performs operations by using multiple layers of neural networks in which every layer builds its neural network with the previous layer. The first layer draws the raw input data then sends the information to next layer which is then send to the next layer and so on. Finally, the output is presented by the last layer [8].

3. How does Artificial Intelligence improve healthcare?
The current generation is being treated as robotics world era as artificial intelligence is generating an unimaginable impact on human beings by surrounding us with machines in all areas. The illness of people can be cured by medicines, surgeries and various methods of treatments but in current days, AI is helping and empowering the people to navigate and invent new medicines. So, it improves health protection in many forms where machines guide and assist the doctors by providing new suggestions[5]. AI technology is extremely enhancing the potency of healthcare delivery as well as in all aspects of patients’ concerns. When AI machines are used as doctors then they will recognize, analyse the illness and provide the fast-impressive treatment. Implementation of AI is limitless in various acts like diagnosis, execution of the clinical decision, and personalized drugs. AI astonishes the people by its faster pace interpretation of medical issues compared to surgeons or physicians. This
technology minimizes the cost of health care as it is trained in such a way that it detects the problems before humans, diagnose those obstacles more consistently and actively. AI technology is also deployed in compact ultrasonic gadgets, by which an untrained human can use this device as an energetic appliance to diagnose several diseases in underdeveloped zones [11]. Presently the human beings are facing enormous dilemmas in detecting and diagnosing dangerous diseases like cancer and other infectious illnesses. This early detection of diseases, fast investigations and providing exact and Intime treatment will save many lives. Some universities developed AI machines that predict an individual who suffers from heart stroke and warn the cardiologist, in the same way the cancer patients should also be diagnosed at early stage to save their lives and it can be achieved by evolving AI technology[7]. There are AI machines that obtain the most skilled doctors or competitors for generating drugs that build trust among risky victims. Individuals or doctors can forever make a specific decision with AI’s uncomplicated and perfect outcomes. AI technology is heightened with its robot-assisted operations as the robots strengthen the destiny of surgery.

The development of artificial intelligence applications by adopting several digital robotic devices is enhancing the way of lifestyle in various fields for elder and disabled community. Human machine interface (HMI’s) helps the physically challenged or disabled people to monitor their wheelchairs without adopting any joystick and any sensor fixed to their bodies. RUDO is a smart and brilliant gadget that helps the blind people in such a way that they can stand with a well sighted humans and work with them in different sectors[10]. AI technology also helps the pregnant women by guiding them in maintaining their balanced diet and fitness during crucial phases of their gestation. The AI’s expert system connected to smart phones and Personal Digital Assistant (PDA) helps in identifying human illness of ever-lasting consciousness by building up their memory potential so that they can live an independent life [11].

4. AI devices
Artificial intelligence devices are categorized into two types such as machine learning and Natural Language Processing (NLP) whereas the former technique examines the structured data like imaging and genetic data that describes the probability of diseases and later method draws out the details from unstructured data which is then convert into machine-readable structured data [9]. Now-a-days many healthcare industries are developing with the help of AI technologies. The emerging applications of AI devices are categorized into the following types.

4.1 Controlling chronic diseases:
The firms use machine learning technique to test the patient’s health condition using sensors to identify the disease and diagnose it. Machine learning helps in identifying cancers at initial stage, other genetic disorders, predicting all chronical diseases such epidemics and maintaining smart health records.

4.1.1 Medical Imaging:
Use of AI technology in medical scanning devices improves the quality of the image and reduce the exposure of radiation to the patients.

4.1.2 AI and IoT:
The integration and well organization of AI and IoT will provide a better treatment in an efficient way. The smart application which frames, analyses and predicts the disease reduces the workload of the clinical staff. This integration can be used in tracking inventory, managing drugs and chronic diseases [14-16].
5. Major impact of AI in medical areas

5.1 Early detection of cancer:
Many people around the globe are being diagnosed with cancer every year. The term cancer is such a word that causes some sort of fear in the people. The researchers and many doctors have been revising their techniques for several years to fight with the disease and bring out the best results. The cancer can be cured and it is no longer a death causing disease now-a-days as technology has improved day by day but the treatment turns expensive once it is transformed into an advanced stage. When artificial intelligence technology is used in this area, the enormous amount of data should provide to the AI software to help the doctors to reduce the number of patients. AI can help the oncologists to take decisions in a better way by increasing the speed of the treatment process and providing a stress-free experience to the patients. Big data and AI technologies such as machine learning and deep learning play vital roles in developing the algorithms to help in treating the cancer. AI technology provides the best way to diagnose the breast cancer compared to traditional method in which even finding out the tissue in breast was very difficult. In AI technology, the algorithm was developed using convolutional neural network (CNN) to analyze the mammogram images and for the perfect prediction of breast cancer. Let us consider another category of the cancer named colorectal cancer known as world’s third most common cancers that spread to the liver. This cancer can be treated by removing the tumors from their roots. Sometimes the tumors are quite large to be eliminated. So, the patient should be treated by using one the therapies such as chemotherapy to decrease the size of the tumors. After a period of time, tumors are evaluated manually using scans to know whether the tumor has shrunk or any change happens in its appearance. This manual approach has many hurdles such as it takes a lot of time for the radiologists to estimate the tumors and this evaluation varies among the various radiologists as they might mistake while evaluating the tumors which leads to misdiagnose of the disease. AI software helps in treating such cancers by reducing the manual errors and also the doctors in such a way that they can treat more patients at the same time.

5.2 Mining and managing medical data:
Data mining is a fundamental technique used to resolve numerous health issues due to its diminishment of time. Few issues such as loss of clarity, spending a large amount on the equipment, useless care etc. might be caused as the healthcare management stores an immense volume of data regarding patients, hospital assets, operation theatre etc. So, healthcare is progressing into technology to avoid such problems. In data mining, a massive amount of data sets is used as a primary source by which they extract data to predict and investigate various health issues which hold less payment and enhance consistency in decision making. There are many AI based applications which act like a physician, interacts and analyze the patients’ diseases. Similarly, there is a smart health prediction using data mining that predicts the health issues of the sufferers over the internet. Data mining solves few problems of health care sector like prediction of medical diagnosis, effective and accurate treatment and its period, forecasting the budget of hospitalization, patient-related decisions etc. Managing data of health care sector plays a vital role in current generation. AI machines need huge data sets to produce effective, consistent and accurate outputs. The health care management should store the data in the database for more sophisticated use of artificial intelligence technology to improve health care, maintain higher productivity and deploy in various applications.

5.3 Medical imaging analysis:
Artificial Intelligence technology is improving gradually to reveal the obscure view of the images in the radiological department of medical sciences. AI tools are better compared to human beings in identifying the features in images quickly and precisely. The imaging analysis is very useful for the radiologists and pathologists to improve their imaging results. So, the radiological tools such as X-rays, MRI, CT scans etc. analyze the high-resolution images and provide accurate output even though it’s a challenging task for a machine to recognize any flaw from it[2]. The cardiovascular abnormalities are identified by computing the various shapes of the heart to disclose the severity of that disease with
the help of imaging tests such as X-ray that might lead to some diagnostic errors. AI tools can be used in identifying left atrial enlargement from the chest, measuring artery diameter, aortic valve and ventricle walls and eliminating other vascular cardiac problems [3]. The main features of AI tools in imaging are [2]:

i. It examines the images faster than that of human beings.
ii. It helps doctors to operate smartly.
iii. It provides an accurate output.
iv. It predicts whether the person would be attacked by the heart problems or not based on his previous medical history.

5.4 AI robot assisted surgery:
Doctors should be very conscious while performing surgery in operation theatre as it is a tough and challenging task. Health care started using upgrading, active and powerful tool such as robots to assist the doctors in performing surgeries. Now-a-days, the robotic surgery became popular and mandatory due to its efficiency, convenience and provision of magnified result of the surgery [6].

5.4.1 Few applications of Robotic surgery:
Robotic mechanism is treated as a tremendous asset in laparoscopic or open surgery in gynecology as it helps in curing the minute incision smoothly and minimizing the flow of blood so that the patient feel less pain and recover soon. Similarly, in kidney transplantation, manual surgery needs large incisions whereas robotic laparoscopic operation needs small incisions and produces amazing output [6]. Robotic mechanism is widely used in all categories of surgeries such as orthopedics, ophthalmology etc. The robotic instruments are strengthening the future of optical surgery as refined machines have high precision with 10 times wider than that of surgeon and with this technology, doctors can work on difficult operations to furnish millions of souls an opportunity to view the world newly.

5.4.2 Advantages of robotic surgery:
The visualization of surgery outcomes has been improved a lot and doctors can view the 3D images and reports rather than 2D images which provides an immense accurate result. There are many advantages to the patients that they will have less pain, rapid cure and get back to normal life in a short period of time, reduced hospitalization period etc. in addition to loss of less volume of blood, reduction of hazards of infections due to smaller incisions. This leads to overcome anemia (low number of red blood cells) disease after surgery which is the tremendous advantage to lead better and healthier life after surgery when there is no blood transfusion.

5.5 Precision medicine
Accuracy play a vital role in preparing medicines and every milligram is considered as essential in composition of a drug. Artificial Intelligence technology is used to predict accuracy and decision making in composition of medicines. Precision medicine is an approach that allow the doctors to predict the exact treatment suitable for respective disease by observing the genetic history and lifestyle of a patient. The super computers and algorithms are used to predict the accuracy and to estimate the probability of the patients suffer from relative diseases. AI technology educates the medical professionals to estimate the risk of the disease according to its symptoms. Let us consider a psychological condition named “Hypoxemia” in which low oxygen level in blood causes serious harm and rarely leads to death of patients. Anesthesiologists should predict and take some measures to prevent Hypoxemia as their condition is one of the leading causes of anesthesia-related deaths. The “Prescience” machine was developed to predict the risk levels of Hypoxemia and also to know the causes for low or high levels. Precision medicine been saving the lives of the people with the help of AI technologies by overcoming the challenges.
5.6 Bladder Volume Prediction
Artificial intelligence technology is vastly used in healthcare sector to predict several diseases such as cancer, chronic diseases, changes in functioning of the urinary bladder control etc. AI technology is used to monitor the functioning of urinary bladder by connecting the system to digital signal processor through which sensors are able to detect pressure level and fullness of urination by adopting neurological actions from formal neural roots of bladder, so it illustrates the fluctuations of the urination filling. Basically, neuro processing consists of two units such as internal units are embedded in the sufferer whereas an external unit is frequently carried as a wearable gadget [11]. These systems are linked by a wireless root which sends information and facilitates power to the embedded system. Internal units execute number of functions like recording of neural signal, processing of on-chip signals to interact signal data regarding neurostimulation of appropriate nerves using functional electrical stimulation methods and also broadcast with the external unit. Sometimes signal processing requires more complicated algorithms to execute and requires extraordinary computing efficiency, which doesn’t suit for implantation due to size, power consumption, rise in temperature, electromagnetic emission and many more..., the internal unit dispatch the recorded signal to the external unit [11]. External base station has the huge flexibleness which integrates both implant-user and computer interface.

6. Conclusion
Artificial Intelligence is rapidly improving the health care management by implementing advanced AI and machine learning algorithms in the prediction and curing of various deadliest diseases, effectively guides the surgeons and incredibly heightens a lot of applications. It enhanced the performance of the doctors, building the confidence in patients that they might be cured within a short span of time by predicting their diseases at the early stage and providing impressive treatment. The health care sector is being transforming into an AI based technology world by advancing the predictions, innovating new medical equipment and also virtual nurses in assisting sufferers in reserving their consultations, diagnosis, guiding in the process of treatment and notifying them with the outcome of the report.

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