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Medicine

Artificial Intelligence & Medical Diagnosis

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Abstract: Living in the era of the fourth industrial revolution, technology is a blessing which none can avoid. This article will be focusing on recent advents in the technology of Artificial Intelligence. The article purports to make the case that artificial intelligence is being used and continuously researched upon to make it ready for use in all domains of life and more importantly in the field of medicine where precision can mean life or death of a patient. The article closes with the economic and practical benefits of the use of Artificial Intelligence in the medical diagnostic procedures and the author relies on the works of renowned publicists to establish this case.
Keywords: ai, neural network, machine learning, aimed, healthcare, medicine, advancement, google, future, robot, artificial intelligence, research, technology, diagnosis.

INTRODUCTION

Artificial Intelligence has taken over our daily lives. There are numerous projects being undertaken to study the "Future of Work" in the fourth Industrial Revolution. Technologies like artificial intelligence, big data, block-chain, internet of things all are now part of our daily lives. Be it our smartphones, T.V.s or watches. Any emerging technology is first utilized for security and medical research.

In 1895, Wilhelm Rontgen received the Nobel Prize for taking a photograph of a human hand. Today X-ray examination is a sine-qua-non for every road injury affecting the bones and consequently has a significant role in Medical Diagnosis. But at that point in time it was an inventive step. A step which has led to every nook and corner of the world having an X-Ray machine of their own.

Thus, even artificial intelligence is at the final stages of its research and very soon it will be hitting the road and those who are adept at handling technology will be preferred.

Similarly, the term Artificial Intelligence, which was coined during a workshop held at Dartmouth College in 1956 [1] is just a subject of research but tomorrow it will be a tool because that is what humans have been doing, by developing cognitive offloading tools. Cognitive offloading is the tendency to rely on things like internet, calculators, appointment reminders, to do list etc. which only increases with time. Which is to say - the more we use the network to find information and encounter data, the fewer probabilities we will have to use our memory.

RESEARCH METHODOLOGY

The research article is secondary in nature. The author has relied on empirical works of celebrated professionals and respected organizations to reach the conclusion set out.

One must have heard of Predicting Cardiovascular Risk Factors using Retinal Fundus Photographs? Or Diabetic Retinopathy? Or Pre-diagnosing Osteoarthritis using Cartilage MRI? Or Stroke? [2] These are lesser used modern scientific diagnostic techniques which like X-Rays will become an everyday chore for medical professionals.

Following are the major fields in which Artificial Intelligence can aid modern Health Care & recent Projects which are being implemented.

Medical Imaging & Biomedical Diagnostics

Doctors aided by Google recently developed an Algorithm for detecting the cardiovascular risks of an individual by recognizing hidden patterns in Retinal images. Over 280,000 Retinal images of patients, were used to train and understand the hidden pattern [3]. It was validated on two Individual datasets of 12,026 & 999 patients respectively. Another machine was easily able to make out the peculiarities of a blood vessel and inform various variables like age (+/- 3.3 yrs.), smoking status, systolic blood pressure, and HbA1c just by analyzing images. Similarly, detection of Diabetic Retinopathy & Macular edema was automated just by Analyzing Retinal fundus photographs.

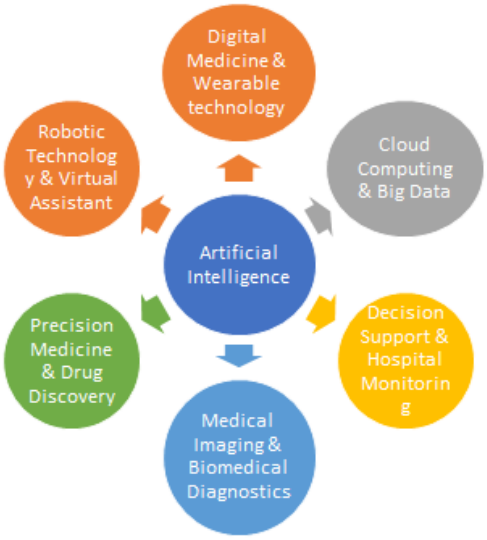

Fig-1: Project management

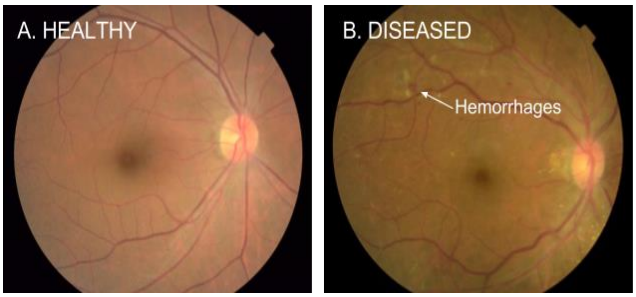

Fig-2: Images of Retinal fundus [4]; a)Healthy retina b) Referable diabetic retinopathy due to presence of hemorrhages

Cloud Computing & Big Data

Identifying Clinical Variations using Machine intelligence in Colorectal Surgery

Artificial intelligence can help in decreasing the cost and time of traditional methods by creating a valid clinical pathway. A Study conducted by Piyush Mathur & Kamal Maheshwari under the aegis of Ayasdi Clinical Variation Management (CVM) application, a data of 1,786 patients were analyzed [5]. The patients were undergoing Colorectal Surgery in 2015-2016. The algorithm was programmed to analyze multidimensional data sets under supervision.

Results segregated their data set into 9 distinct groups with Similarity Analysis on basis of Ketorolac dosage, which is a Non-Steroidal Anti-inflammatory drug (NSAID) used mostly in Surgery to treat postoperative pain. They also found a link to low intraoperative fluids and lower length of stay along with lower cost group. Which immensely broaden their clinical pathway for treatment?

Decision Support & Hospital Monitoring

To take an illustration: consider a woman, 60-year-old, visit the Emergency room with a foot sore. Seeing her doctors found no reason for medical concern, nonetheless just to know whether her sore is infected or not they admitted her. On day 3 she developed Pneumonia, seeing this doctors gave her usual treatment of Antibiotics. On day 6 her condition started to worsen, she developed Tachycardia. By day 7 she started having trouble breathing & experienced Septic shocks, she was immediately transferred to ICU. But her condition was not stabilizing and was continuously deteriorating, her kidney started to fail, and then her lungs and by day 22 she dies.

It later came to be known that she died because of Sepsis, which is the 11th leading cause of death [6]. The early diagnosis of patients with sepsis is a challenge for clinicians at the bedside. It was an Infection that turned into Sepsis.

Artificial Intelligence works on analyzing past data and learns the pattern. Therefore, it analyzes all the cases of sepsis and learns about the markers of sepsis. And creating filters which can alert prior to shock & organ dysfunction. So, when a patient visits the hospital it can easily provide pre-diagnosis and assist doctors in moving forward in the right direction of treatment.

Digital Medicine & Wearable technology

Both IBM Watson Cloud & Targeted Realtime Early Warning System (T.R.E.W.S.) are complicated Neural Networks governed and trained by Machine Learning [7]. These sophisticated systems can analyze all your data like age, BMI, heart rate, exercise habits, eating habits, sleep pattern and your psychological behavior through various sensors, for example, your smartwatch, health band, your browsing history, mobile Phone activity etc. Thereafter your data is uploaded on the cloud where this data is categorized and analyzed with the help of Cognitive Networks.

Robotic Technology & Virtual Assistant

Heart Catheterization is done & mainly guided by fluoroscopic imaging. Which exposes operator, staff & patient to harmful radiation? Therefore, a self-directed robot (CATH-BOT) which remotely supervises cardiac catheterization without any harmful ionizing radiation [8].

This robot creates a patient's specific 3D anatomical model by hospital electronic record system which includes MRI, CT, and Ultrasound etc. Temporal syncing is done performed through Respiratory/ECG gating. Location of Catheter is tracked via an electromagnetic tracking system with patient anatomy.

Talking about the initial results – All trial catheterization were successfully completed. No difference in Fluoroscopy EMTs was found. Total procedural time was significantly lower than Fluoroscopy with a difference of 3.9 secs. This project is still under improvisation which will also add catheter feedback positioning.

Precision Medicine & Drug Discovery

Work in Progress: Selection of candidates for Alzheimer Disease treatment [9]. There are several inhibitors of beta-Secretase which can be studied for the treatment of Alzheimer's. A machine learning (ML) algorithm was developed considering structural, physical and chemical characteristics of these inhibitors. Three different functions of ML, Multilayer Perceptron (MLP), Logitboost (LB), & Decision Table (DT) were applied to set of Molecular Descriptors for an active and inactive compound in 5-fold cross-validation. The highest accuracy achieved by this data set was 88.86% by MLP. The model developed is currently being employed for selection of possible drug candidate from the database of these compounds.

CONCLUSION

Based on Data, Statistics, Clinical records & hospital Management it is claimed that in every 3-years Medical Data doubles up & making Health industry, multi-billion Dollar domain. [10] With Average global medical inflation to be 7.2% in 2018 & 6.8% in 2017 [11].

Throwing light on the scenario in India, survey retorted that "low health awareness among the population often delays treatment resulting in the aggravation of insured members' medical conditions. When treatment occurs, private practitioners are prone to use unnecessary surgery and related procedures." –

Therefore it is clear that handling this domain is not an easy task when diverse factors are ruling the graph of this industry. This is where AI comes in, with the help of these automated diagnosis algorithms unnecessary treatment can be avoided thus lowering the inflation.

It has been believed by different doctors that technology has several advantages over traditional practices due to the fact that it can analyze large datasets simultaneously, gives us an unsupervised discovery which discloses hidden patterns and also enhances the speed by suggesting auto-generated clinical pathways.

Artificial Intelligence is a tool which can definitely assist doctors in early diagnosis and help lower the mortality rate & medical inflation.

"The impediment to action advances action. That which is in the way becomes the way" - Marcus Aurelius

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