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A Case Study on Artificial Intelligence Application in Medical Diagnostics

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Abstract
The main focus of Artificial Intelligence is to improvise the human cognitive capabilities. It brings about tremendous change in health-care, and the date that is being incessantly generated and the progress in the techniques to analyse them are the factors controlling the backbones of development in AI. Today, AI is playing an essential part in the advancement of the field of medicinal diagnostics. The review of AI applications in healthcare and medical diagnostics along with its future applications and effects The techniques are being applied to structure as well as unstructured medical data. Popular and effective AI systems incorporate machine techniques for structured data like neural network, classical support vector machine and deep learning, and NLP for unstructured data. Major AI techniques involve medical diagnostics including cancer, neurology and cardiology.

Keywords: Medical Diagnostics, Support Vector Machine, Deep Learning, NLP

Introduction

Medical Artificial Intelligence

There is a strong likelihood that AI will help doctors make more reliable and error-free clinical decisions and in some cases give it more importance than human judgement in some important areas of medical care (eg. oncology). The four most important perspective of medical investigators':

a) The need of AI application in healthcare
b) Data types to be analysed by AI systems
c) Generating meaningful results using Artificial Intelligence through procedural mechanism
d) Disease groups that can be dealt by AI systems

Need of Ai

AI employs procedural algorithms to process large set of datasets in healthcare, and it further uses the results to come up to a final judgement to assist medical diagnostics. Learning and self-correcting capability can be added feature to improve its accuracy. Moreover, AI systems can provide updated medical information from journals, clinical practices with relatively less error.

Dataset

In the diagnosis stage of clinical dataset, a substantial proportion of data for the literature analysis of Artificial Intelligence is obtained from electro-diagnosis, diagnosis imaging and genetic testing. An example is, Topol and Jha encouraged radiologists into adopting Artificial Intelligence technology while analysing the huge data that is retrieved from diagnostic images. In order to diagnose gastric cancer Li et al tried to analyse the long non-coding RNAs and the abnormal genetic expression that is obtained from them.An electrodiagnosis support sustem had been developed by Shin et al which is used for localising injury to the brain.

There are two other major data sources which comprise of notes made from physical examination along with results obtained from running lab tests. It can be recognized through

images, electrophysiological and genetic dataset since they carry a huge amount of clinical notes that can't be directly analysed. Hence the main focus of AI system is to convert these unstructured texts to system-understandable electronic medical data.

Ai Systems

The AI system is divided into two major categories on the basis of dataset. The first category employs machine learning techniques to analyse structured data directly. On the other hand second category works on unstructured data using natural language processing methods to enhance the structured data. For instance in the medical application of AI, ML techniques works on patients' traits to cluster them or deduce the probability of any particular disease, whereas NLP strives at converting unstructured data to structured data that is further studied using Machine Learning techniques.

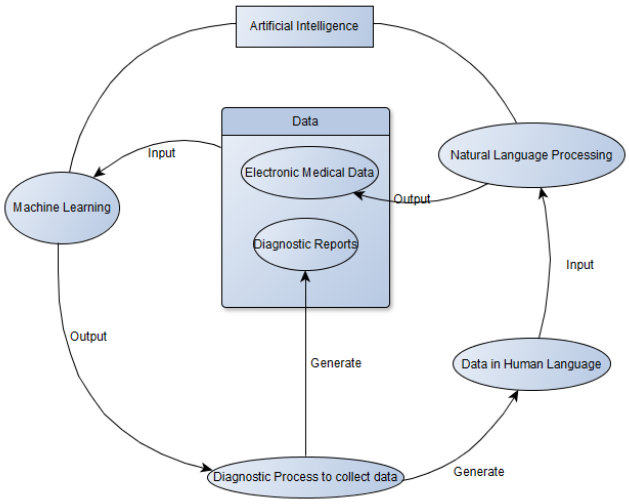

Fig 1: The work process of AI system

Disease Focus

Although there is increase in the literature on AI in healthcare, the main concentration of research is restricted to a few important disease types like cancer, cardiovascular diseases and neural diseases.

The main focus of AI in healthcare remains towards few diseases like cancer, neurological diseases and cardiovascular disease. These diseases contribute highly towards global death and it requires immediate diagnosis and treatment. This employs improved analysis procedures.In addition to the three main diseases, AI has also been applied to other diseases. Two examples of very recent applications are the analysis on ocular image data done by Long et al to diagnose congenital cataract disease and another is the dectecting of diabetic retinopathy through photographs of the retina fundus by Gulshan et al.

Current Applications of Ai in Medical Diagnostics

A considerable lot of the present machine learning analytic applications seems to fall under these classifications:

1. Chatbot

Companies are utilizing AI-chatbots with speech-recognition feature that can recognize patterns through symptoms as stated by the patient to frame a potential conclusion, to avoid sickness and additionally suggest a suitable course of action.

2. Oncology

Scientists are trying to identify cancerous tissues using deep learning technique at a comparable level to any trained doctor, which can trigger fast diagnosis of cancer at its initial stages itself.

3. Pathology

Pathology is an important area that if covered by AI systems can be of great help. It is the science or study of origin, nature and course of diseases analysed by lab tests of bodily fluids like sputum, blood and urine, and also through tissue analysis. The traditional methods of diagnosis involve use of microscope which can be time-taking and also at times can have error. The AI techniques like machine learning and machine vision techniques tend to enhance the traditional methods used by pathologists.

Rare disease

There are certain genetic diseases which show phenotypic deviation. This rare disease can also be tackled by AI system which involves a combination of facial recognition software along with deep learning technique that analyses patients' photo and assists in detection of such rare genetic diseases.

Future of Ai in Medical Diagnosis

There is a of diversion of doctor from traditional method to the use of AI chatbots that is AI form of doctor and a UK based digital healthcare organisation is studying this collaboration of patients with AI doctors. Ai is becoming popular in medical services and is in the process of evolving the traditional method to a new way of diagnosing and treating ailments through the fast-growing field of machine learning and big data analytics.

As stated by the CTO of Fujitsu EMEIA, Dr. Joseph Reger "The news that Babylon Health has raised near £50M to build an 'AI doctor' is a promising development for the health industry; trials are currently ongoing in London, where Babylon's tech is being used as an alternative to the non-emergency 111 number,"

China has one of the highest lung disease rates. The AI innovation from Infervision is being used by the Radiologists at Shanghai Changzheng Hospital in China.

This marks an enhancement in therapeutic analysis to recognise suspicious injuries and nodules in lung cancer patients.

The key to better results in treatment of ailment is its early diagnosis. The organisation has combined a computerised tomography (CT) integrate with AI that considers the various attributes of lung cancer and later distinguishes the presumed features of cancer through various CT scan dats.

In a statement, Chen Kuan, founder, and CEO, Infervision said that in no way will this technology ever replace doctors.

"It's intended to eliminate much of the highly repetitive work and empower doctors to help them deliver faster and more accurate reports," said Reger.

Fujitsu's Reger says the process of machine learning is considered to be time-saving but will only be successful if data is implemented as the lifeblood of the system.

"In this instance, data will enable AI machines to learn and understand new medical functions, and then critically provide humans e.g. doctors with the necessary information to diagnose problems," added Reger. "The potential application of AI in healthcare could even grow to possibly predict future illnesses even before they manifest, improving the quality of services for patients. All of this will not be achieved without vast swathes of data, an acceptance that AI will supplement jobs, not replace them, and the overall investment in the technology itself."

Ai Application in Stroke

A very common and often encountered disease is occurrence of a Stroke, which influences over 500 million people around the world.It is the main cause of deaths in middle Asia and one of the main causes in North America. As a result, study to prevent or treat stoke is of much help. Lately, AI has taken stroll and the study shows AI has techniques help in three primary domains of stroke care, i.e.

- Prediction of a stroke and diagnosing in advance
- If diagnosed, its treatment
- Result prediction and prognosis evaluation

Early Diagnosis

When the blood flow towards the brain is poor it results in cell death ultimately causing a Stroke which is usually caused by formation of thrombus in vessels, hence called cerebral infarction. Due to late detection of stroke symptoms, many patients couldn't receive treatment in time. Device was developed by Villar et al which detects movement and predicts the occurrence of a stroke.

It works on the principle of two important ML algorithms, i.e., PCA and genetic fuzzy finite state machine. The detection process is based on the movement pattern recognition. Whenever there is a deviation from normal in movement patterns, it marks as an alert for stroke and inspected at the earliest possible.

Neuroimaging methods like CT scan and MRI are necessary for disease evaluation like in case of stroke diagnosis. Some researchers have employed ML techniques for analysing neuroimaging data. ML techniques when applied to CT scan helps in detection of free-floating intraluminal thrombus from carotid plaque.

Rehme et al employed a well-known machine learning application called support vector machine commonly called as SVM to keep a track on possibilities of strokes. The accuracy rate of SVM in this case proved to be around 87%. Griffs et al employed Bayes classification in identification process of stroke. The computer aided method provided results very comparable to human experts dealing with it. Kamnitsas et al tried 3D CNN for lesion segmentation in multimodal brain MRI. Rondina et al performed the Gaussian method regression on few sample MRI data to find a convincing result of predicted features.

Treatment

As a serious action of measuring crisis, the visualization and survival rate are associated to the result of intravenous thrombolysis. A research was done for predicting whether symptomatic intracranial haemorrhage was developed by patients with tPA treatment by CT scan. Thw input used for SVM were whole-brain images and the results have outperformed conventional radiology based methods.

Result Prediction and Prognosis Assessment

Stroke prognosis and disease mortality is affected by multiple factors. ML methods have shown improved prediction performance as compared to traditional methods. In order to suppoer the process of clinical decision-making, Using logistic Regression and analysing physiological parameters for a time period of 48 hours after occurrence of stroke a model had been proposed by Zhang et al in order to predict the outcome of the 3-month treatment.A database ws compiled by Asadi et al which consisted of 107 patients who underwent intra-arterial therapy for having acute posterior or anterior circulation stroke.

The authors have studied the obtained data by SVM and simulated neural system, and acquired precision of over 70%. They additionally utilized ML strategies to recognize factors impacting result in brain arteriovenous contortion for which endovascular embolisation can be used for treatment. Standard regression investigation model could just accomplish a 43% precision ratio but their techniques worked outstandingly with a precision of 97.5%.

Conclusion and Discussion

An effective AI framework must have the ML component to handle structured dataset (genetic information, EP information, images) and NLP segment for extracting unstructured datas. Advanced algorithms at that point should be prepared using healthcare data so that it can help doctors with illness analysis and proposing methods for treatment.

In spite of the fact that the AI innovations are drawing in generous considerations in therapeutic research, implementation in real-life is yet confronting barriers. The vwry first problem originates from regulations. The safety needs to be surveyed and the adequacy of AI framworks neds to be maintained which the current regulations lack. US FDA has made the primary endeavour to give regulations to evaluate AI systems in order to overcome the problems.

The second problem is information exchange. To function properly, AI frameworks should be prepared (ceaselessly) by information from clinical examinations. After initial raining when the AI framework is deployed, supply of information continuously turns into a critical concern for advance advancement and change in the framework. Incentives for sharing information related to framework are not given by current healthcare condition. By the by, a healthcare revolution is yet to approach in order to

invigorate information that is being shared in the USA.
While there is much chance, AI in therapeutic diagnostics is still a moderately new approach, with numerous clinicians still left to be persuaded of its unwavering quality, affectability and how it will be basically coordinated into clinical practice without undermining clinical expertise.

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