

Assignment 3: Literature review

Medical Diagnosis using Deep Learning techniques in healthcare: A Literature Review

Subtitle: How can deep learning methods are applied for improving diagnostic process in the medical field?

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Autumn term 2021

Swedish title: XXX – not mandatory

Abstract

In this literature review the application of deep learning for medical diagnosis in healthcare is addressed. A thorough analysis of more than five peer reviewed articles are referred in the domain of deep neural networks application in the medical field has been conducted. In search of articles some of authors in common highlighted an ethical issues and explained some real time scenario about diagnostic errors which leads to unnecessary treatments increase the medical bills and deteriorate the health of a patient. Such diagnostic errors that harm the patient in various ways could be minimized using machine learning algorithm or advanced deep learning algorithm,also such models of algorithms predict the disease in medical diagnosis with accurate information and more effective outcomes for specific illness. Then the selected articles are analyzed to show the impact of Deep learning (DL) methods in improving the disease diagnosis. Furthermore, this report explains about the research question, inputs and outputs, problem and research gaps, commonalities, findings and summary.

Keywords: Medical Diagnosis, Artificial Intelligence (AI) deep learning, Machine learning, deep learning neural networks, healthcare.

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1 Literature review

The objective of this research lies in identifying in which areas of the diagnostic process AI has already been applied and how the approaches are to be evaluated. This paper covers articles in healthcare-related to diagnosis, prediction, and treatment. Also, a critical review are frequently performed in an unsystematic manner [1], but benefit from informative explanation of the literature was retried [2]. After retrieving the literature, I carefully read the title, abstract, and keywords of each publication to determine its relevance to my research question. In addition to AI ethics issues, some of the literature search within the Information system (IS) discipline, arguing that IS as interdisciplinary community addressing social technical challenges for medical specialists. Moreover, I focused on papers that specifically considered and applied AI in the context of diagnostics (For example, identified publications from healthcare and biomedical engineering). Thus the literature search considered more than five peer reviewed articles which mainly concentrated on substantial and high quality articles.

1.1 Area of relevance

In recent years, artificial intelligent has shown great promises in medical field. AI has the potential to provide data driven clinical decision support to physicians and hospital staff which pave the way for an increased revenue potential. To enhance healthcare services, the mail goal of this review is to address the applications of deep learning in medical diagnosis in a concise and simple manner. Why this is important? It was noticed that from DL, it minimize in diagnostic errors and provide patients with proper treatments, Deep learning methods are applied to improve diagnostic process. Deep learning (DL), a subset of AI designed to identify patterns, uses algorithms and data to give automated insights to healthcare providers. Moreover, AI technology can help minimize the inefficient, ensuring substantially more stream lined and cost effective ecosystems. Thus this paper associate the view of few peer reviewed articles which focus on various medical diagnosis in healthcare and how different algorithms in deep learning models be improving with accurate result.

1.2 Research question

The research question is “How can DL be used for improving medical diagnosis in healthcare?” .It was accepted that the outcome of a treatment could be affected due to mistakes made by clinicians in the diagnosis of a patient [3].Due to this factors, inappropriate treatment could be given where patient deprived in crucial care. Also, the environment, and the devices (radiology) utilized for diagnosis, can also prompt diagnosis mistakes. Hence these factors could add to a critical impact on the patient’s health, increase the general medical expenses, and cause mental distress. Therefore Deep learning is the engine that is assisting with driving advances in the improvement of medical care quality with less cost. In addition the author[4] conducted an empirical study stated that by utilizing deep learning classification algorithms, for a particular illness, we can improve the precision, speed, reliability, accurate decision and performance of the diagnosis on the current system.

1.3 Review

In medical diagnosis different deep learning algorithms are used to identify patterns and in order to provide a better and accurate result. Among various algorithms, a few most common DL models algorithms are addressed and other relevant algorithms are listed in tabular (Table 1). At first, Convolution neural network (CNN) is a DL model, it is specially designed to work with image recognition and deal with noisy images. In medical diagnosis, Pneumonia is one of the leading causes of death among children. Nahid et al. [5] proposed a model that uses image processing methods and CNN on X-rays to detect pneumonia. This model achieved 97.92% accuracy. In another study, Stephen et al. [6] proposed the diagnosis of pneumonia by designing CNN model. They used data augmentation methods instead of transfer learning to obtain a large amount of training data. They claimed that the resulting method achieved noteworthy accuracy. Similary other disease COVID-19 has been declared as an epidemic disease of the year 2020. As of when this paper is being written, no vaccine has been found to cure it. Therefore, early identification of COVID-19 becomes necessary. In this regard, Elaziz et al. [7] proposed a CNN based method to detect COVID-19 using chest x-ray images. The proposed method could help in its early diagnosis with comparatively less cost. Secondly,Artificial Neural Network (ANN), ANN is motivated by the human mind structure that uses neurons for data processing. It can be used to solve the complex mathematical task, a large signal processing, or even parallel computations. Due to complexity in recognizing symptoms of Urinary

Tract Infection (UTI), a model was created utilizing ANN to improve the symptomatic understanding of UTI. On the other hand, Decision Tree (DT) is a predictive procedure that derives in leaves from observation (branches). DT cannot deal with missing features, it come through with the help of vulnerabilities in its tradition structure. It is a well-known fact that the treatment of the thyroid is a long term process. Ionita et al. [8] analyzed the efficiency of ML methods to diagnose and classify the thyroid. DT provided an accuracy of 97.35% on clinical data. The authors compared the results with other ML methods and found DT to be the most efficient method. The chances are that in a little while deep learning models will help radiologists in performing a huge amount of CT scans or X-rays, hence adding to successful treatment and expanding the survival rate of human lives.

DeepLearning Algorithms	Characteristics in Medical Diagnosis
Convolution Neural Network (CNN)	<ul style="list-style-type: none"> -Probability based checking and diagnosis of the illness. -Using the class restrictive probability. -Finds out the disease with higher bias and then gives the aftereffect of the species probably disease.
Artificial Neural Network (ANN)	<ul style="list-style-type: none"> -Reduce complexity -Consumes processing time
Decision Tree (DT)	<ul style="list-style-type: none"> - Complexity increases. -Time-consuming process.
Clustering Algorithms	<ul style="list-style-type: none"> - Simultaneously changes clusters dependent on symptoms. - It doesn't give the precise result for the quantity of illness
Backpropagation	<ul style="list-style-type: none"> - Predefined hidden units. - Time complexity increases.

Table 1: Different deep learning algorithms used in medical Diagnosis

1.3.1 Discussion and Future research:

This study is done to access the influence of ML in medical diagnosis. A comprehensive review of research papers in this study provides an overview of the way DL is being used to diagnose various diseases. The articles considered for review in this study are from the year 2015 to the year 2020. Moreover, we observe certain limitations in building ML models for disease diagnosis. The problems are like finding the best DL model, the use of nonstandard datasets etc. The findings of this study show that the researchers tend to concentrate on combining related diseases in a single system. For example, separate studies were conducted for diagnosis of COVID-19 [7] and pneumonia [5,6]. However, there is a relation between these two diseases, So ML methods could be used to develop a single model that could diagnose both the diseases, i.e., COVID-19 and pneumonia. This could largely benefit patients suffering from both the diseases simultaneously. In additional, one of the important parts of any ML method is the data. Currently, due to non-uniformity in data collection and storage across geography, the developed models could give varying accuracies on data collected from different sources. It is also observed that the most of the researchers point out that their developed model needs further validation on unbiased datasets. This issue could be addressed through data standardization and data normalization processes. However, recent studies have shown that the DL achieved comparable or better results to that of boosting methods.

1.4 Conclusion

Thus I conclude that Deep learning is a fast-developing field that has extraordinary potential in all parts of healthcare, especially in radiology. This precise survey and review evaluated the nature of the existing literature and gave analytic precision to DL methods in the medical diagnosis. DL is used in medical diagnosis for reduction in the overall cost of medical expenditure, and as a 'second' opinion for doctors. The use of mathematical models could be used to make decisions. The primary aim of using DL in medical diagnosis is to improve the accuracy with which a disease is detected. This empirical study stresses the use of DL for effective medical diagnosis. It is observed that over the years the use of DL in medical diagnosis has increased substantially. The limitation of this study is that only articles applying deep learning in medical diagnosis are considered. Articles of artificial intelligence domain that are using techniques other than ML, such as fuzzy logic are not considered. One possible direction for future research on the qualitative moral impacts of DL in medical diagnosis would be to examine whether the moral concerns that are (implicitly) expressed in the literature align with what health care professionals and patients themselves anticipate. Therefore the peer reviewed articles selected for this review described different types of algorithms in DL model with examples are proposed to accomplish the optimal outcomes in patient treatment in medical diagnosis.

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Appendix A – An Appendix