Chapter 3
A Comprehensive Study on Algorithms and Applications of Artificial Intelligence in Diagnosis and Prognosis:
AI for Healthcare

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ABSTRACT

Machine learning and deep learning are branches of artificial intelligence consisting of statistical, probabilistic, and optimisation techniques that allow machines to learn from previous observations recorded by humans. These machine learning algorithms, when combined with other technologies, can be used to perform very intuitive yet awkward human-like tasks. Using these algorithms, humans can enable computers to learn about certain things like recognising an object in an image. Prognosis is an important clinical skill, particularly for cancer patients' clinicians, neurooncologists. One of the biggest challenge for AI in prognosis is to verify and validate its models. Unlike diagnosis, the prognosis models are centered on predictive data that usually addresses the patient and not the disease. Prognosis models

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were developed to aid in the decision-making of patients' treatment.AI can have bigger impact in the health care domain with more healthcare providers using AI to make the first diagnosis and prognosis more accurate and interpretable with the available patient data for better therapy.

INTRODUCTION

machine learning (and deep learning) are branches of artificial intelligence consisting of statistical, probabilistic, and optimisation techniques (often inspired by nature and its phenomenon) that allow machines (computers) to learn from previous observations recorded by humans. These machine learning algorithms, when combined with other technologies like especially Computer Vision, can be used to perform very intuitive yet awkward human-like tasks. Using these algorithms, humans can enable computers to learn about certain things like recognising an object in an image, classify text into different categories based on its feature(s), etc. Since machine learning can do these problematic tasks efficiently and without the requirement of human resources, the range of fields in which machine learning can be used, is extensive whether it be logistics, agriculture, information technology, healthcare, and many more. In the healthcare domain, machine learning isn't only providing ease of operations in many applications, but also creating new possibilities like the prediction of certain diseases without the need for professional medical personnel. The same can be extended to the fields of diagnosis and prognosis, as many machine learning models are coming up which are as useful as 96% or even more in diagnose of diseases like Alzheimer's, and perform some initial analysis even to suggest some primary treatment for the same. While the applications of machine learning in diagnosis and prognosis are still in an early phase and open to research, beneficial machine learning models are there for the diseases which can be diagnosed by some visual scans. These include Fractures (by analysing X-rays), Alzheimer (by analysing neuroimaging data), Cancer (by analysing CT Scans), COVID19 (a preliminary diagnosis can be made with the help of Chest X-Ray scans), and others. A variety of machine learning techniques, like Artificial Neural Networks (ANNs), Bayesian Networks (BNs), Support Vector Machines (SVMs) and Decision Trees (DTs). These have been generally applied in clinical exploration for the advancement of prediction models, bringing about viable and exact dynamic, for both diagnosis and prognosis. But the advantages of machine learning in diagnosis and prognosis isn't only limited to severe diseases requiring visual scans. The activity trackers which can monitor the heart rate, blood oxygen level, blood pressure, etc., health data is collected. This data can then be fed to a pre-trained machine learning model to analyse if the received information represents a healthy person, or are there few abnormal values. So, the activity tracker itself can notify the person about its health. And, many instances of such incidents have already been recorded where smartwatches or activity trackers sent distress signal when the patient's health data became very abnormal, and thus was able to save the patient. Not just diseases, but a healthy routine of an individual, a constant monitoring of a patient (also known as Remote Patient Monitoring), timely suggestions for calorie intake or to drink water, these are all done using machine learning models. AI in healthcare is creating new possibilities and making it available for an even more significant number of people at ease. In this chapter, detailed research is performed on the various applications of machine learning in healthcare (especially in diagnosis and prognosis), what are the current trends in it, and what future developments are possible.