Pratibodh
A Journal for Engineering
A free and Open Access Journal
Homepage: https://pratibodh.org

Machine Learning in Healthcare

Radhika Baheti[1], Ms. Neelkamal Chaudhary[2]
Department of Artificial Intelligence & Data Science
Jaipur Engineering College & Research Centre
1radhikabaheti.ai@jecrc.ac.in 2neelkamal.ai@jecrc.ac.in

Abstract

The Internet of Things is providing an increasing amount of health data, which machine learning techniques in healthcare use to improve patient outcomes. These methods offer significant challenges along with promising applications. Genetic data, medical document natural language processing, and medical imaging are the three primary domains where machine learning is used. Numerous of these fields concentrate on prediction, detection, and diagnosis. There is currently a sizable medical device infrastructure that generates data, but frequently there is not a supporting infrastructure in place to make effective use of such data. Medical information can be found in a wide variety of formats, which can lead to noise and formatting issues.

Keywords: *machine learning ,healthcare, medicine, big data, genetics, disease*

Article Status

Available online :

1. Introduction

There are ongoing challenges in terms of application and practicality with the introduction of digital technologies in the healthcare sector. Most regions of the world have not yet adopted a fully integrated healthcare system, and the unification of disparate health systems has been sluggish. The importance of the human factor in disease diagnosis and treatment has been repeatedly demonstrated by the intrinsic complexity and nature of human biology, as well as the differences amongst individual patients. But there's no denying that as digital technology advances, medical professionals will need these tools more than ever to give their patients the best care possible.

The widespread use of machine learning in many industries, including healthcare, has been made possible by advancements in data technologies, such as storage capacity, processing power, and data transfer speeds. Recent medical trends have highlighted the need for a personalized medicine, or "precision medicine," approach to healthcare due to the complex nature of providing high-quality care to an individual. Utilizing vast amounts of medical data to identify, forecast, and assess diagnostic options is the aim of personalized medicine. Doctors can then apply these findings to each unique patient.

2. Artificial intelligence and machine learning

AI, or artificial intelligence, has a close relationship with the development of contemporary computing devices. The history of machine learning is deeply ingrained in its origins. A large portion of contemporary computer science was founded on Alan Turing's work in deciphering the German Enigma computer during World War II. He is also honored by the Turing Test, which attempts to determine whether artificial intelligence has merged with human intelligence.

The term "machine learning" was first used in the late 1950s by Arthur Samuel, an IBM employee, who published a paper on teaching computers to play checkers [5]. Machine learning is a subset of artificial intelligence. The best way to define artificial intelligence (AI) is as providing machines with intelligence akin to that of humans in a way that closely resembles the conscience's decision-making and processing. Machine learning (ML) is the branch of artificial intelligence that focuses on enabling machines to learn without human assistance.

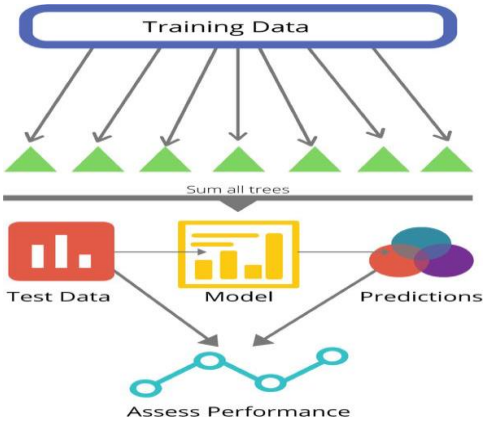
The availability of incredibly large datasets and the advancement of computational techniques, which lessen overfitting and enhance the generalization of trained models, are primarily responsible for the widespread adoption of machine learning. These two elements have propelled machine learning's quick spread and use in practically every industry today. This, together with the growing number of connected devices, or the Internet of Things (IoT), has produced a rich infrastructure that can be used to develop automated and predictive systems.

3.Machine learning algorithms

Supervised and unsupervised learning are the two main categories of machine learning. Both types of algorithms use mathematical models to execute their operations. The goal of every algorithm is to enable computers to acquire new skills.

3.1 Supervised learning

Labeled data, also referred to as training data, are commonly used in supervised learning. Training data consists of one or more inputs and an output that is "labeled." To improve their ability to predict new data (a set of test data), models use these labeled results to evaluate themselves during training [11]. Supervised learning models usually concentrate on regression and classification algorithms [12]. In medicine, classification issues are extremely prevalent. When a patient is diagnosed in a clinical setting, the doctor typically categorizes their condition based on a specific set of symptoms. Given a specific set of data, such as vital signs, medical history, and weight, regression problems typically look at predicting numerical results, such as the estimated length of stay in a hospital.



Figure

An illustration of a random forest model's training and evaluation process. A separately trained tree using the training set is represented by each green triangle. The model is the result of adding up each tree's prediction. The model is then fed test data, or all the trees, and a prediction is generated as a result. The performance of the model is then evaluated by comparing the prediction with the initial test data.

3.2 Unsupervised learning

Unsupervised machine learning looks for patterns in the data by analyzing unlabeled data. Deep learning employs both classification methods and neural nets to make predictions, even on unlabeled data. Perceptrons, as they are commonly called, are modeled after human neurons and are arranged into numerous networked layers, which contribute to the network's "deep" nature.

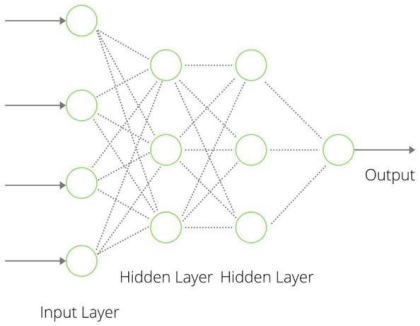


Figure2

A basic neural network example consisting of two hidden layers, each containing three perceptrons. It is possible to alter the number of inputs, hidden layers, and perceptrons in each layer. Furthermore, it is possible to modify the connections that exist between layers and perceptrons.

Conclusion:

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A new and exciting era is beginning for the application of digital technologies like machine learning in the healthcare industry. Our understanding of the genetic and environmental factors that contribute to the onset of complex diseases will rapidly advance due to the convergence of informatics, biology, engineering, chemistry, and computer science. It is exciting to consider the possibility of using copy number variations in cancer diagnosis prediction. It may be possible to enhance patient care on an individual basis by applying machine learning to develop an interpretable way of comprehending how the genomic landscape connects across genes to contribute to inherited cancer risk.

References and notes

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