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Prediction of Heart Disease Using Machine Learning Techniques

L. Vindhya[1], P. Anvitha Beliray[2*], Chandra Reddygari Sravani[3], D. R. Divya[4]
[1]*Assistant Professor, Department of Information Science and Engineering, S. J. C. Institute of Technology, Chickballapur, India*
[2,3,4]*Student, Dept. of Information Science and Engineering, S. J. C. Institute of Technology, Chickballapur, India*
*Corresponding author: anubeliray3@gmail.com

***Abstract*: Heart disease is one of the significant causes of mortality in the world today. Predicting cardio vascular disease has become the critical challenge in the area of clinical data analysis. Machine learning (ML) is very effective in making decisions and predictions from the large quantity of data produced by the health care industry. Machine Learning techniques are used in recent developments in different areas of the Internet of Things (IoT). Various studies provides only a glimpse in predicting heart disease using Machine Learning techniques which aims to get the features by applying ML techniques that results higher accuracy in the prediction of heart disease. The heart disease prediction model is developed using various combinations of classification and feature techniques, which provides performance accuracy of 88.7% using hybrid random forest with linear model (HRFLM).**

***Keywords*: Cardiovascular disease (CVD), Classification algorithms, Heart disease prediction, Machine Learning, Prediction model.**

1. Introduction

Identifying heart disease is a difficult task because of several contributory risk factors such as diabetes, high blood pressure, high cholesterol, abnormal pulse rate and many other factors. Various techniques of data mining and neural networks have been employed to find out the different variety of heart disease among humans. The severity of the disease is classified based on the methods like Naive Bayes (NB), K-Nearest Neighbor Algorithm (KNN), Genetic algorithm (GA), and Decision Trees (DT). The heart disease must be handled

carefully since its nature is complex. Otherwise it may affect the heart or can cause premature death. Decision trees can be used in predicting the accuracy of events related to heart disease. Several methods are used for knowledge abstraction by using known methods of data mining for the prediction of heart disease. These new techniques are commonly known as hybrid methods. Neural Networks are introduced using heart rate time series. Neural Networks uses several clinical records for prediction such as Atrial fibrillation(AFIB), Left bundle branch block (LBBB), Normal Sinus Rhythm (NSR), Sinus bradycardia (SBR), Right bundle branch block(RBBB), Atrial flutter(AFL), Premature Ventricular Contraction(PVC), and Second degree block (BII) to find the exact condition of the patient related to heart disease. Diagnosis of the heart disease is implemented using GA which results in the new fitness function. For experimental validation, Cleveland dataset is collected from UCI machine learning repository. Generally, Neural networks are regarded as the best tool for predicting the heart disease. The method has 13 attributes for heart disease prediction. The results are generated using Artificial Neural Network ANN, which produces good performance in the prediction of heart disease that achieves high accuracy level.

2. Related Work

Numbers of studies have been done that have focus on diagnosis of heart disease. They have applied different techniques for diagnosis and achieved different probabilities for different methods.

1) A data mining model for predicting the coronary heart disease using random forest classifier

If Coronary Heart Disease (CHD) is one of the common forms of disease affecting the heart and also, an important cause for premature death. According to medical sciences, data mining is involved in discovering the various sorts of metabolic syndromes. Classification techniques in data mining play an important role in the prediction and data exploration. Classification technique like Decision Trees is used in predicting the accuracy and for the events related to CHD. In order to improve the prediction accuracy and to investigate various events related to CHD, Data mining model has been developed using Random Forest classifier. This helps the medical practitioners for predicting CHD with various events and how it is related with the different segments of the population. The events investigated are Angina, Acute Myocardial Infarction (AMI), and Coronary Artery Bypass Graft surgery (CABG). Experimental results shown that classification using Random Forest algorithm can be used in the prediction of events and risk factors that are related to CHD.

2) Using PSO algorithm for producing best rules in diagnosis of heart disease

Now a day, Heart disease is a growing global health issue. In the health care system, limiting the human experience in manual diagnosis leads to inaccurate diagnosis, and the

information regarding illnesses lacks in accuracy as the data's are collected from different medical equipments. Since the accurate prediction of a person's condition is of higher importance, equipping medical science with intelligent tools for treating and diagnosing the illness can reduce doctor's mistakes and also financial losses. Here, one of the most powerful evolutionary algorithms like Particle Swarm Optimization (PSO) algorithm is used to generate the rules for heart disease and the encoded rules are optimized using PSO algorithm based on accuracy.

3) Back propagation neural network for prediction of heart disease

Recently, Effective medical decision support systems are developed using various algorithms and software tools by researchers. Diagnosing the heart disease is one of the important and critical issue and many researchers investigated to develop intelligent medical decision support systems which can be used to improve the ability of the physicians. Neural networks are a widely used tool for the prediction of heart disease diagnosis. In this research paper, System for the prediction of heart disease is developed using neural network. The proposed system uses 13 medical attributes for predicting the heart disease. The experiments conducted in this work shown the better performance of the proposed algorithm compared to the similar approaches of the state of art. Moreover, new algorithms and tools are continued to develop and represent day by day.

4) Analysis of neural networks based heart disease system

Heart disease has become one of the major reasons for the increase in the rate. Healthcare is one of the most important beneficiaries of huge analytics & knowledge. Extracting the medical data progressively has become more and more necessary for the prediction and treatment of high death rate caused by heart attack. Huge amount of data (in Terabytes) are produced every day. Quality services avoid disastrous consequences caused by the poor clinical decisions. Hospitals can make use of decision support systems for minimizing the cost of clinical tests. Now-a-day patient data is maintained in hospital information systems employed by hospitals. Huge amount of data generated by the health care industry is not effectively used. So, some new approach is necessary to predict the heart disease and to decrease the expense in ease.

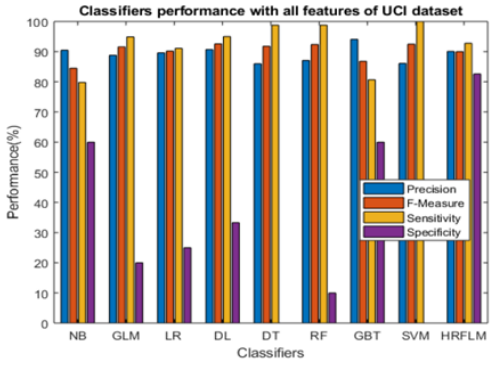

Fig. 1. Performance comparison with various models

3. Conclusion

Machine learning techniques are used in this work in order to process the raw data and provide a new discernment towards heart disease. Prediction of Heart disease is challenging and also important in the field of medical sciences. However, the mortality rate can be drastically controlled if the disease is detected at the early stages and preventative measures are adopted as soon as possible. Further extension of this study is highly desirable to direct the investigations to real-world datasets instead of just theoretical approaches and simulations. The proposed approach combines the characteristics of Linear Method (LM) and Random Forest (RF). HRFLM is proved to be quite accurate in the heart disease prediction. The future course of this research can be performed with diverse mixtures of machine learning techniques to better prediction techniques. New methods can be developed for feature selection to get the broader perception which helps to increase the performance of the heart disease prediction.

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