CARDIO–VASCULAR DISEASE PREDICTION USING MACHINE LEARNING

Abstract

The heart is an important organ that pumps blood through the arteries and veins called the cardiovascular system. Many people die because of heart disease. In this paper, we are using some machine learning algorithms such as decision trees, K-neighbors classifier & logistic regression to predict cardiovascular disease. To get the best accuracy we are comparing the features of these algorithms.

Keywords: Machine Learning (ML); Cardiovascular; Decision tree; K-neighbors classifier; Logistic regression; Accuracy.

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I. INTRODUCTION

Heart disease is acknowledged as the most complicated and deadly disease affecting people today. This illness causes the heart to operate improperly, resulting in clogged blood arteries, angina, heart attacks, and stroke. These days many people are dying due to heart attacks. So, by using some machine learning techniques we are predicting heart disease with high accuracy. Heart disease is detected using features like - age, sex, constrictive pericarditis, trestbps, cholesterol, fasting blood sugar, resting electrocardiographic results, thalach, exercise-induced angina, old peak, slope, ca, thalassemia, target (heart disease yes=1, no=0). There are now too many advanced tools, such as data mining, machine learning, deep learning, etc., to identify cardiac disease. Therefore, we shall give a basic overview of machine learning approaches in this work. Using machine learning resources, we train the datasets in this work.

II. LITERATURE REVIEW

In the medical center, several types of research have been completed related to disease detection using machine learning techniques.

Limbitote M, Damkondwar K, Mahajan D, Patil P. [1] "*A Survey on Prediction Techniques of Heart Disease using Machine Learning*" in which the objective is to find the most accurate prediction techniques. The main objective is to obtain the most accurate algorithm with less cost.

Alotaibi FS. "*Implementation of Machine Learning Model*" which aims to detect heart failure accuracy using multiple machine learning techniques. In this paper decision trees, logistic regression, random forest, naïve Bayes, and SVM are the techniques used to detect heart failure accuracy.

Zriqat IA, Altamimi AM, Azzeh M. "*A Comparative Study for Predicting Heart Diseases Using Data Mining Classification Methods*", aims to develop an effective intelligent medical decision system using data mining techniques. Here all 5 techniques are compared and the best is selected.

Rajdhani A, Agarwal A, Sai M, Ravi D. "*Heart Disease Prediction using Machine Learning*", predicts the chances of heart disease and classifies the patient's risk level by implementing different data mining techniques. This paper compares all the techniques and one of the best techniques is selected.

Patel J, Upadhyay T, Patel S. "*Heart Disease Prediction Using Machine learning and Data Mining Technique*", to reduce the deaths caused by heart disease, some quick and effective algorithm is used. In this paper, the comparison of the Logistic model tree algorithm and Random Forest algorithm and effectiveness will be selected.

Amudhini VP, Santhini T, Kailash P, Nivetha D, Poonguzhali R. "*Survey on Machine Learning Algorithms for Prediction of Cardiovascular Disease*". Here, the survey of some related works is done by reviewing some projects.

Table 1: Research Analysis

Year	Author Name	Purpose	Techniques	Accuracy
2020	Limbitote M, Damkondwar K, Mahajan D, Patil P.	"*A Survey on Prediction Techniques of Heart Disease using Machine Learning*".	Decision Tree, SVM, ANN, Naive Bayes, Random Forest, KNN.	88%
2019	Alotaibi FS.	"*Implementation of Machine Learning Model*".	Decision Tree Logistic Regression Random Forest Naïve Bayes SVM	82.22% 82.56% 84.17% 84.24% 84.85%
2016	Zriqat IA, Altamimi AM, Azzeh M.	"*A Comparative Study for Predicting Heart Diseases Using Data Mining Classification Methods*".	Naïve Bayes, Decision Tree, Discriminant, Random Forest, and Support Vector Machine	99.0%
2020	Rajdhani R, Agarwal A, Sai M, Ravi D.	"*Heart Disease Prediction using Machine Learning*".	Naive Bayes, Decision Tree, Logistic Regression, Random Forest	85.25% 81.97% 85.25% 90.16%
2015	Patel J, Upadhyay T, Patel S.	"*Heart Disease Prediction Using Machine learning and Data Mining Technique*".	Logistic model tree algorithm, Random Forest algorithm	55.77% 56.76%
2019	Amudhini VP, Santini T, Kailash P, Nivetha D, Poonguzhali R.	"*Survey On Machine Learning Algorithms for Prediction of Cardiovascular Disease*".	SVM, Naïve Bayes, The Neural network, Feed Forward, Backpropagation NN, KNN, Decision Tree	50% -60% 52% 100% 57% 50-60% 80.6%

III. MACHINE LEARNING

It is one of the fastest-growing fields in computer science. Its application areas are abundant. An engineer writes a set of instructions that guides a computer on how to convert input data into the excepted output in traditional programming. ML, in contrast, side, is a

computer-assisted procedure that allows machines to deal with problems with minimal or no human intervention and perform steps based on previous readings. It uses some statistical mathematical approaches to teach the model.

Each training sample contains an input as well as the desired output. When determining the labels for unseen data, a supervised ML algorithm analyses the sample data and makes an assumption - basically, an educated guess. The most typical and well-liked technique for machine learning is this one. Because these models need to be fed manually tagged sample data to learn from, it is "supervised." Data is labeled so that the machine will know what patterns to search for and connections to make. In unlabeled data, unsupervised learning reveals patterns and relationships. Models are given input data in this situation, but since the positive outcomes are unknown, they must draw conclusions based solely on corroborating evidence without any training or direction. The models must recognize patterns on their own because they weren't taught the "correct answer." For instance, the marketing department of an online retailer could use clustering to enhance customer segmentation. A machine learning model can locate communities of customers who exhibit comparable behaviors given a set of income and consumption data. Training data for semi-supervised learning is divided into two groups. A smaller set of data with labels and a larger set without labels. This method is becoming more and more popular, particularly for tasks requiring large datasets, like image classification. Semi-supervised learning is the best option for businesses that receive a lot of data because it doesn't require a lot of labeled data, is easier to set up, and is less expensive than supervised learning techniques. How a software agent should behave in a situation to maximize the reward is the focus of reinforcement learning. Refined machine learning models, in essence, look for the best course of action to take in a specific circumstance. Trial and error are how they learn to do this. As there is no training data, machines learn from their mistakes and select actions that will produce the best result or the highest reward.

IV. MACHINE LEARNING IN CARDIOLOGY

Machine learning has a wide range of applications including medical applications. Nowadays medical centers are working on the application of machine learning and artificial intelligence to avoid mankind’s errors. Not only in Cardiology every branch of the medical field like Pediatrics, Orthopedics, Dermatology, Pathology, and so on are working based on Machine learning, Artificial intelligence techniques. Here, we are using ML techniques to predict cardiovascular disease. Some of the algorithms are used decision trees, Logistic regression, and K-neighbor classifier.

1. **Decision tree:** Decision Trees are interpreted as supervised learning techniques that can be applied to regression. These models have a tree-like structure, with internal nodes standing in for a dataset's features, branches for previously learned decision rules, and leaf nodes for the results. The main problem faced during the implementation of the decision tree is how to choose an attribute as a root node, the frontier & leaf node. By using attribute selection measures, we can resolve this issue. There are two methods in attribute selection measure namely, 1. Gini-index 2. Information gain.

2. **Logistic regression:** Logistic Regression is the most popular supervised learning. Using a predetermined set of independent variables is used to predict the categorical dependent variable. In a classification rule, the output is predicted by logistic regression.

3. **K neighbor classifier:** It is a simple algorithm in machine learning which follows supervised learning. K neighbor classifier makes the assumption that the new case and the existing cases are similar, and it places the new case in the category that is most like the existing categories.

4. After the analysis, we got the accuracy from the decision tree is 94.34%, logistic regression is 88.68% and the K-neighbor classifier is 64.47%. So, we found the decision tree is the best technique to predict heart disease.

V. CONCLUSION

We have outlined various ML algorithms for heart disease detection. We developed some machine learning algorithms and then examined their features to determine which algorithm was the best. Every algorithm has produced different results in a variety of circumstances. Here we get a decision tree with the best accuracy value and we observed the K neighbor classifier with less accuracy. Further analysis shows that the predictive model for heart disease only achieves marginal accuracy.

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