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# Effective Cardiovascular Disease Prediction on Different Parameters

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ABSTRACT

Globally, cardiovascular disease is the leading cause of death, according to WHO (World Health Organization) data, with more people dying from CVDs each year than any other cause. In 2016, an estimated 17.9 million people died as a result of cardiovascular disease (CVD), accounting for 31% of all deaths worldwide. A heart attack or a stroke is to blame for the majority of these deaths, at around 85%. Low- and middle-income countries account for nearly three-quarters of deaths from cardiovascular disease (CVD). A staggering 82% of the 17 million non-communicable disease-related deaths in 2015 occurred in countries with low or middle incomes, with cardiovascular disease accounting for 37% of all deaths under the age of 70. Tobacco use, an unhealthy diet, obesity, inactivity, and harmful use of alcohol can all be addressed through population-wide strategies to prevent most cardiovascular diseases [1].

**Keywords :** World Health Organization, Cardiovascular Disease, Heart Disease

## I. INTRODUCTION

As a part of the human anatomy, the human heart is critical. The functioning of the heart is essential to life. As a result, if our heart isn't functioning properly, other parts of our body, such as our kidneys and brain, will be negatively affected, too. A person's risk of heart disease can be estimated by monitoring their heart's function. Heart disease can be predicted by a number of factors, including:

### Cholesterol and hypertension

A lack of physical activity, smoking, obesity, and family history of heart disease are all risk factors for heart disease.

Predictions should be made to reduce the risk of heart disease, which is the leading cause of death in humans. Doctors typically diagnose heart disease based on the patient's symptoms and physical exam. It is difficult to predict heart disease in the healthcare industry. There is an enormous amount of data in the healthcare industry these days relating to patients, their diagnoses, electronic patient records, and medical devices. As part

of the knowledge extraction process, it is a critical resource that must be processed [20].

## TYPES OF HEART DISEASE

These include congenital and coronary heart disease as well as rheumatic heart disease. The most common of these conditions is coronary heart disease, which claimed the lives of more than 360,000 Americans in 2015. Every 40 seconds, an American has a heart attack, according to the Centers for Disease Control and Prevention (CDC). As a result, the United States spends more than $200 billion a year on heart disease treatment [18]. A recent report from the American Heart Association predicts that the cost of treating heart disease will nearly double by 2030 [19].

The following table lists and describes some of the most common heart diseases [21] [22].

Table 1: Types of heart diseases

| Types of heart diseases | Description |
|---|---|
| Angina | A lack of blood flow to the heart muscle causes chest pain. |
| Acute coronary syndrome | In a matter of seconds, the heart muscle's blood supply is cut off. |
| Arrhythmia | Myocardial infarction |
| Cardiomyopathy | The disease of the heart muscle |
| Congenital heart disease | Congenital abnormalities of the heart |
| Coronary artery disease | When blood supply to the body is impeded by a blockage in the arteries. |
| Rheumatic heart diseases | Rheumatoid arthritis |

There are also different heart disease factors, from that most common are listed in the table below with their symptoms [21] [22].

Table 2: Different Risk factors of heart disease

| Risk factors | Description | General Symptoms |
|---|---|---|
| Age | People over the age of 65 are more likely to suffer from heart disease than younger people. | Chest pain<br>Shortness of breath<br>Irregular heartbeat<br>Fatigue<br>Fainting<br>Swollen feet |
| Sex | Males are at greater risk than females | |
| Family History | People are more likely to develop cardiovascular disease if they have a history of it in their families. | |
| Blood Pressure | Blood pressure can cause arteries to narrow and blood vessels to thicken[1], [2]. | |
| Smoking | Smokers have a higher risk of heart disease than nonsmokers. | |
| Poor Diet | For the development of the heart, diet food is essential. | |
| High Blood Cholesterol Level | Plaque formation is accelerated as a result. | |
| Diabetes | Diabetes mellitus is a disease brought on by an excess of sugar in our blood. | |
| Obesity | Heart disease can be exacerbated by a person's obesity. | |
| Physical Inactivity | Heart health is aided by regular physical activity. | |

| | | |
|---|---|---|
| Stress | Damage the arteries | |
| Poor Hygiene | It raises the risk of cardiovascular disease. | |

## II. LITERATURE REVIEW

N. When the heart's blood vessels become obstructed, it is known as heart disease. Several studies have concluded that this disease is now the leading cause of death in the United States. It's concerning that abnormalities can only be discovered at the very end. However, early detection is key to curing the condition. According to this paper, the goal is to develop a data science framework for predicting heart disease by applying various classification algorithms, the influence and distribution of various parameters, and visualisations on Cleveland cardiovascular medical records. In order to reduce the diagnostic error due to the difficulty of visual and subjective interpretations. This project is primarily focused on finding the best classification algorithm for heart disease-related health records and the most important influencing parameters. The classification reports can use this to predict heart disease. A heart disease prediction model was built and tested using various algorithms, including Random Forest, Vector support, Logistic regression, and XG-Boost, to evaluate the system's performance.[1]

O. Satish Chandra Reddy and colleagues [5] Various machine learning algorithms are used to classify and select features for the prediction of Heart disease, which is the focus of this paper. KNN, SVM, Random Forest, Nave Bayes, and Neural Networks are used in the paper. On average, the paper's algorithms achieve an accuracy range of 85.92-89.41% for all of the data combined.

Weka software was used to develop a model for the Marjia et al.[7] to predict heart disease using K Star, J48, SMO, and Bayes Net and Multilayer perceptron. A k-fold crossvalidation study found that SMO and Bayes Net outperform the KStar, Multilayer Perceptron, and J48 techniques in terms of accuracy. It's still not good enough that these algorithms' accuracy performance has been achieved. If accuracy can be improved further, better decisions about diagnosing disease can be made.

As well as the Azam .[8] SVM parameters are optimised to improve prediction accuracy, resulting in a 99.2% accuracy rate using k-fold cross-validation, in this paper's description of automatic CAD patient diagnosis. The paper aids in the early detection and cost-savings of disease. Using this information, it is possible to determine whether or not a person has heart disease.

Using Artificial Neural Network (ANN) and Support Vector Machine (SVM), Cemil et al. [9] propose application of knowledge discovery processes on the prediction of stroke patients, with ANN and SVM giving accuracy of 81.82% and 80.38% respectively for training data set and 85.92% and 84.26% respectively for Artificial Neural Network (ANN) and Support Vector Machine. Support Vector Machine (SVM) is less accurate than ANN in this case. Stroke patients cannot be accurately predicted using the paper's accuracy.

Cardiovascular disease prognosis by Shailendra Narayan Singh et al. [10] Classifier merits and demerits for data classification and knowledge extraction are described using data mining techniques in order to implement algorithms that are most useful in health organisations. The paper explains the merits and drawbacks of the algorithms and how to use them.

Clinical trials conducted by the Sanavar et al. The abstract of a study on heart disease prediction. It explains the various methodologies and the implementation of the proposed methods. This book also provides an overview of heart disease, as well as

the role of data mining in healthcare centres and how to use data mining in a healthcare organisation.

Using data from Vidya K. Sudarshan and colleagues, The focus of this paper is on the use of electrocardiogram signals to characterise coronary artery disease using higher-order spectra. Decision Trees and K-Nearest Neighbors are used in the paper. 98.17 percent and 98.99 percent accuracy are the results of these algorithms' accuracy calculations. The algorithms used in the paper are more accurate at describing coronary artery disease than other methods.

In the Emrana KabirHashi, [13][15] A classification-based clinical decision support system for predicting disease. C4.5 and KNN provide 90.43 percent and 76.96 percent accuracy, respectively, in this paper based on WEKA software and a percentage ratio method for the train and test datasets. A clinical decision support system can benefit from C4.5 Decision Trees, which are more accurate than KNNs.

Megha Shahi and colleagues .[14] Use data mining and WEKA software to develop a heart disease prediction system that can automatically diagnose disease and improve the quality of care in healthcare facilities. SVM, Naive Bayes, Association rule, KNN, ANN, and Decision Tree were used in the paper. Paper explains that SVM has an effective and efficient accuracy of about 85% when compared to other data mining algorithms.

Priti Chandra and others .[15] Using WEKA and 10-fold cross-validation, the paper describes a computational intelligence technique for early detection of heart disease. The algorithm used in this study is Nave Bayes, which has an accuracy rate of 86.29 percent. Despite the high degree of precision, automatic heart disease diagnosis remains unsatisfactory.

The Syed Muhammad Saqlain Shah and other .[16] K-Fold cross-validation is used to extract features for the study of Heart Disease Diagnosis. There is a 91.30 percent success rate for the SVM algorithm used in this study. When it comes to heart disease prediction and automatic diagnosis, algorithm accuracy is superior.

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## III. OBERSERVATION AND COMPARATIVE STUDY

There has been a flood of statistical models for estimation that are not capable of producing good performance results in the assessment field. Categorical data, missing values, and large data points are all problems that statistical models struggle to handle. It's for these reasons that MLT is so important. Many applications, such as image detection, data mining, natural language processing, and disease diagnostics, rely on machine learning (ML) for their success. ML has potential applications in all of these areas. diagnosis of diseases such as heart disease, diabetes disease, hepatitis and dengue with the aid of machine learning techniques. SVM has been found to be more accurate in detecting heart disease. These algorithms have both benefits and drawbacks, as this study shows. Improvement graphs for disease prediction using machine learning algorithms. It is clear from the analysis that these algorithms are more accurate in detecting different diseases, allowing for better decision making [2].

**Comparing of Accuracy performance of algorithms from related work**

**TABLE - 3**: COMPARSION OF ALGORITHMS USED IN VARIOUS RELATED WORK

| Year | Author | Purpose | Techniques used | Accuracy |
|---|---|---|---|---|
| 2016 | Marjia et al.[7] | Prediction of heart disease using WEKA and a 10-fold cross-validation | KStar | 75% |
| | | | J48 | 86% |
| | | | SMO, | 89% |
| | | | Bayes Net | 87% |
| | | | Multilayer Perceptron | 86% |
| 2017 | Azam et al. [8] | Automated heart disease detection using the K-Fold cross-validation method | Optimized SVM | 99.2% |
| 2015 | Cemil et al. [9] | Knowledge discovery could be used to predict stroke patients. | ANN | 81.82% for training dataset |
| | | | | 85.9% for test data set |
| | | | SVM | 80.38% for train data set |
| | | | | 84.26% for test data set |
| | | | | |
| 2017 | Megha Shahi et al.[14] | A data mining-based system for predicting heart disease | SVM, Naïve Bayes, Association rule, KNN, ANN and Decision Tree | The paper explains that in some paper SVM effective and efficient accuracy about 85% as compared to other data mining algorithms. |
| 2015 | Priti Chandra et al. [15] | An early diagnosis of heart disease can be made using a computational intelligence technique. | Naïve Bayes | 86.29% |
| 2013 | AbhishekTaneja [23] | Data mining techniques and supervised Machine learning algorithms are used to predict heart disease. | J48 | 95.56 % |
| | | | Multilayer perception | 94.85 % |
| 2016 | Ashok Kumar Dwivedi[24] | tenfold cross-validation can be used to compare the accuracy of various machine learning techniques in the prediction of heart disease. | Naïve Bayes | 83% |
| | | | Classification Tree | 77% |
| | | | KNN | 80% |
| | | | Logistic Regression 85% | SVM 82% |
| | | | ANN 84% | |
| | | | Naïve Bayes | 83% |

## IV. CONCLUSIONS

Heart disease has been found to be one of the leading causes of death in the world, according to research. Cardiovascular disease refers to a group of diseases that affect both the heart and blood vessels (CVD). Heart disease diagnosis is also difficult because it requires the grouping of large clinical and pathological data sets to make a final decision. Prediction models for cardiovascular disease (CVD) need to be developed, and machine learning algorithms can be used for this purpose.

The proposed research must take into account risk factors such as hypertension and family history as a predictor, and use selected attributes for accurate heart disease prediction. Various classification models are used to predict the presence or absence of heart disease. The accuracy, sensitivity, and specificity of the prediction models are evaluated using a variety of metrics.

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