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Prediction of Heart Diseases Using SVM

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Abstract: *The advancement in technology has encouraged the researchers to develop software for assisting doctors in making decision without consulting the specialists directly. The software development exploits the potential of human intelligence like reasoning, making decision, learning (by experiencing) and lots of others. Various automated systems and tools like Arterial Spin Labelling (ASL) imaging, Support Vector Machine (SVM) ASL-MRI, biomarkers, Natural language processing (NLP), Brain-computer interfaces (BCIs), and various algorithms helps to decrease errors and control disease progression. The computer assisted diagnosis, decision support systems, expert systems and implementation of software may assist physicians to attenuate the intra and inter-observer variability.The Support Vector Machine Model may be a supervised machine learning technique which is predicated on the statistical theory. Support Vector Machines have been successfully applied to variety of classification and regression tasks. SVM basically works because the linear separator between two data points to spot two different classes within the multidimensional environment. SVM uses a really big set of non-linear features that's task-independent. They have an ingenious thanks to prevent over-fitting. They have a really clever thanks to use an enormous number of features without requiring nearly the maximum amount computation as seems to be necessary. The prime objective of this approach is to maximise the margin between the classes and to attenuate the space between the hyper plane points.Heart disease is that the normal term utilized in the health industry.The meaning of the heart malady is that the heart isn't working legitimately or regularly. In the medical terminology the heart attack may be a condition where the availability of the blood to the organs of the body is blocked then it'll result into the blood clot. Now-a-days there are numerous heart diseases like arterial coronary Disease, Congestive coronary failure and Bad Heart Rhythms etc. There are numerous numbers of individuals who are affected by the heart diseases. The heart diseases may or might not have the symptoms before it attacks the people. So, we'd like to predict the heart diseases for the people it effects or not. Now-a-days such a lot number of individuals is died suddenly thanks to the heart attack because the life sort of the people is modified rapidly. The support vector machine is a supervised learning method. Support Vector Machine can predict the heart disease supported the given factors like sex, age, pulse etc. The Support Vector Machine technique is more accurate and sensitive than compared to other algorithms.This study aims to spot predictors of medication adherence in HF patients.*

Keywords: Support Vector Machine, Heart diseases, Symptoms, Machine learning, Prediction, etc.

I. INTRODUCTION

Heart disease is that the normal term utilized in the health industry. The meaning of the heart disease is that the heart isn't working properly or normally. In the medical terminology the heart attack may be a condition where the availability of the blood to the organs of the body is blocked then it'll result into the blood clot. Now-a-days there are numerous heart diseases like arteria coronaria Disease, Congestive coronary failure and Bad Heart Rhythms etc. There are numerous numbers of individuals who areaffected by the heart diseases.

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Now-a-days death of the people is raised due to the heart diseases. Heart Attack is that the main reason for the death of the people. There are numerous reasons and factors which involve within the occurring of the heart diseases. The death of the male is quite the feminine thanks to the heart diseases due to the smoking and drinking habit of the male. Because the heart supplies blood to all of the body's organs, human existence is mostly dependent on its proper functioning. Heart diseases consists the High blood pressure, Heart attack, Heart value disease and Heart failure etc. In case of the heart diseases, it's important to predict the diseases within the early stages and take the treatment in early.

In this paper we use the one of the Machine learning algorithms to predict the heart diseases in early stages based on the factors like age, sex and blood pressure etc. The Support vector machine algorithms provide the better accuracy and results when compare to the other algorithms.

II. HEART-DISEASES

There are two sorts of heart condition factors for risk. They are;

- The **Controllablecomponents**are smoking, drinking, weight, blood weight and cholesterol these can be controlled by the people to diminish the heart infections.
- The **Uncontrollable components**are sex, age, history of the family. These can't be controlled by the people to scale back the heart illnesses.

There are numerous sorts of the heart diseases are present within the world. Some of the heart diseases are given below.

Figure 1: Types of Heart Diseases

A. Congenital Heart Disease

The Congenital heart condition is sort of heart condition that has been occurring within the heart since birth of individuals. Some of the samples of congenital heart condition are:

- **Septal Defects**: The septal surrenders have the gap between the two chambers of the heart of individuals.
- **Obstruction Defects**: In the obstruction defects there is fractional or total block of the flow of blood among the chambers of the heart.
- **Cyanotic Heart Disease**: The cyanotic heart infection has the deficiency or less sum of the oxygen around the human body.

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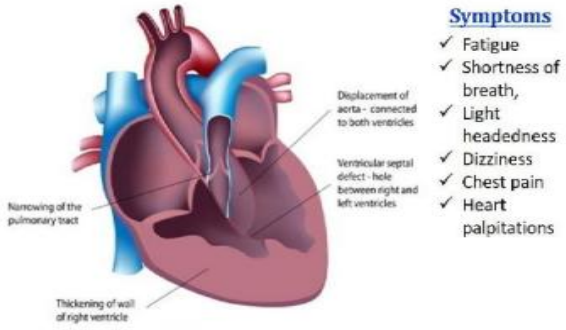

Figure 2: Congenital Heart-Disease

B. Coronary Artery Disease

The main function of the coronary arteries is to provide of the nutrients to the muscle of the heart and to circulation of the blood through oxygen. The Coronary arteries are often damaged or diseased due to the cholesterol. The cholesterol causes the coronary arteries to provide the less amounts of oxygen and nutrients to the body.

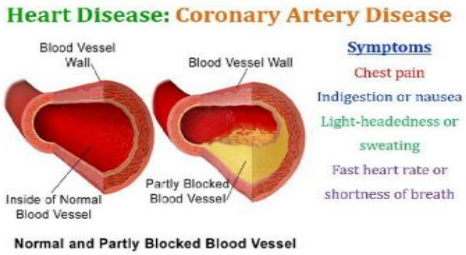

Figure 3: Coronary Artery Disease

C. Cardiovascular Disease

Cardiovascular infection, by and large, alludes to conditions that include limited or blocked veins that can prompt a coronary episode, chest torment (angina) or stroke. Other heart conditions, for instance, people who influence your heart's muscle, valves or cadence, likewise are viewed as sorts of coronary illness.

Cardiovascular malady incorporates conditions that influence the structures or capacity of your heart, for example,

- Coronary supply route infection (narrowing of the courses)
- Heart assault.
- Abnormal heart rhythms, or arrhythmias.
- Heart disappointment.
- Heart valve infection.
- Congenital coronary illness.
- Heart muscle sickness (cardiomyopathy)

Cardiovascular sickness can happen when courses that supply blood and oxygen to your heart muscle and different organs, (for example, the cerebrum and kidneys) become stopped up with greasy material called plaque or atheroma. This procedure is called atherosclerosis. "Cardio" alludes to the heart, and "vascular" alludes to all the veins in the body. In correlation, coronary illness is increasingly explicit and alludes just to maladies of the heart, for example, coronary conduit sickness, cardiovascular breakdown, heart valve variations from the norm, and anomalous heart rhythms.

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III. LITERATURE REVIEW

Many researchers have analyzed different data classification algorithms in various aspects.

S. Krishnan J. Geetha S[11] has made a system that predicts the developing potential results of heart disease. Their aftereffects of this system give the chances of happening heart disease to the extent rate. They have considered datasets used are organized similar to therapeutic parameters. Their structure evaluates those parameters using the information mining plan strategy. Their datasets were set up in python programming using two standard Machine Learning Algorithm to be explicit Decision Tree Algorithm and Naive Bayes Algorithm and have exhibited the best estimation among these two to the extent the precision level of heart illness

Jesmin Nahar etal (2013) [4], have analyzed the performance of classifier with predictive Apriori for classifying heart disease in women and men.

Ms. Ishtake et al (2013) [5] have analyzed the working of Decision tree, Neural network and Naïve Bayes network in predicting heart attack.

According to Rashedur M. Rahman, and Farhana Afroz (2013) [7], have learned the performance of Neural Network, Decision Tree and Fuzzy logic in diagnoising diabetes.

Siddharth Swarup Rautaray and Monali Dey (2014) [6], have studied the working of Naïve Bayes Network and MLP in health care domain.

Rich Caruana and Alexandru Niculescu-Mizil (2006) [8] says that, bagging works well with most decision tree types and requires little tuning, but neural networks and Support Vector Machines require careful parameter selection. Their research on STATLOG data set concludes that learning methods such as random forest, boosting, SVM and baggings achieve excellent performance that would have been difficult to obtain just 15 years ago.

Y. Khourdifi, M.Bahaj [13] has talked about the forecast of coronary illness and abused the Fast Correlation-Based Feature Selection (FCBF) strategy to channel excess highlights so as to improve the nature of coronary illness order. They have done order dependent on various arrangement calculations, for example, Support Vector Machines, Multilayer Perception, Random Forest, Naïve Bayes and a K-Nearest Neighbour, Artificial Neural Network techniques. Their proposed blended methodology is applied to heart illness dataset and accomplished a greatest order precision of 99.65% utilizing the upgraded model proposed by FCBF, PSO, and ACO.

S. Ghumbre, C. Patil, and A. Ghatol (2011) [9],have proved that RBF and SVM have provided high classification accuracy.

K.G. Dinesh, K.A.raj, K.D.Santhosh, V. M.eswari[12] has talked about heart illness expectation and performed information pre-preparing utilizes strategies like the removal of noisy data, removal of missing data, filling default values if applicable and classification of attributes for decision making and prediction at different levels. Their exhibition of the finding model is acquired by utilizing techniques like order, exactness, affectability and particularity examination. This has proposed a forecast model to anticipate whether people have heart illness or not and to give mindfulness or finding on that. They have done examination by comparing the accuracies of applying rules with the individual consequences of Support Vector Machine, Gradient Boosting, Random backwoods, Naive Bayes classifier and calculated relapse on the dataset taken in a district to display an exact model of foreseeing cardiovascular ailment.

IV. SUPPORT VECTOR MACHINE

Machine Learning:Machine learning is the most commonly used technology in now-a-days. The machine learning is an approach to coach the machine to find out from the past experience or previous examples. The main types of machine learning algorithms are given below. They are:

- **Supervised Learning:** In supervised learning the machine is learned from the info which have labels and tag values. By using labelled data, we will easily predict the newly entered data. The supervised learning algorithm is analogous to the scholars which are learning under supervision of teachers.

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- **Unsupervised Learning**: In unsupervised learning the machine is learned from the info which doesn't contain any labels or tag values. In unsupervised learning we classify or group the info by observing the similarity or relationship between the opposite data.
- **Reinforcement Learning:** The reinforcement learning algorithm may be a one sort of algorithm during which the machine is interacting with its environment by performing some actions and analyses the information.

Support Vector Machine: Support vector machine is that the one among the machine learning algorithms. The support vector machine may be a supervised learning algorithm. The support vector machine is employed to classify the given data. The algorithm uses a hyper plane to differentiate the various classes. Support vector machine is additionally used for the multivariate analysis. SVM classify the both non-linear and linear data.The main aim of the SVM classifier is to seek out the hyper plane in an n-dimensional space.

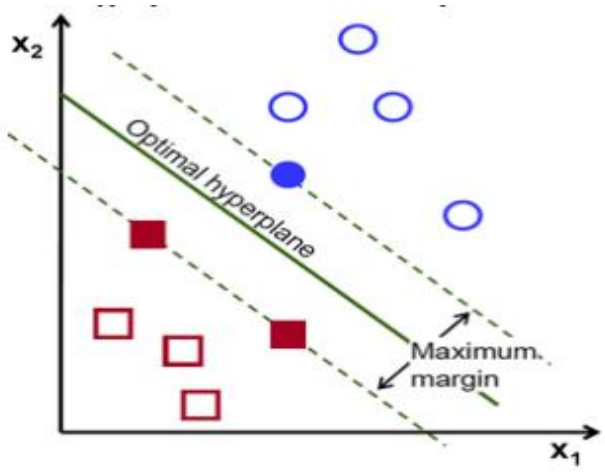

Figure 4: SVM Classifier

In SVM classifier the most aim to work out the plane with the utmost margin between the 2 data classes.

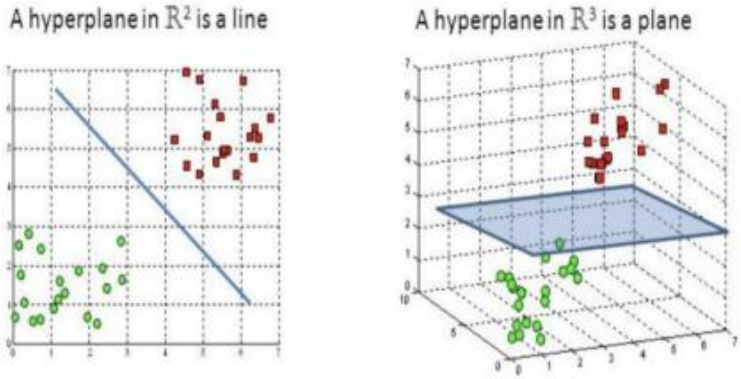

Figure 5: Hyper plane in 2D and 3D

Data Set: For this research process to predict the heart diseases of individuals we take the attributes like sex, age, chest pain, sugar levels of the people.

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Table 1: Data Set for Heart Disease Prediction

Age	Gender	Chest pain	Blood pressure	Sugar levels before eating	Sugar levels after eating	Prediction
63	1	1	145	150	233	0
67	1	4	160	108	286	1
67	1	4	120	129	229	1
3	1	3	130	187	250	0
41	0	2	130	172	204	0
56	1	2	120	178	236	0
62	0	4	140	160	268	0
57	0	4	120	163	354	1
63	1	4	130	147	254	0
53	1	4	140	155	203	1
57	1	4	140	148	192	0
56	0	2	140	153	294	0
56	1	3	130	142	256	1
44	1	2	120	173	263	0
52	1	3	172	162	199	0

In the above dataset in Gender 0 indicates the "female" and 1 indicates the "male". In Chest pain 1 represents "typical angina", 2 indicates "atypical angina", 3 represents "non- angina pain" and 4 indicates "asymptomatic". In prediction value 1 means "yes" and 0 means "No".

Data pre-processing: After collecting the information set, we'd like to pre-process the data. The information pre-processing is employed to scale back the dimensions of the information, remove the noisy data, eliminate the data outliers, determine the relationships among the information, and perform the normalization on data. From the information pre-processingstep, we will extract the information which is required to prediction process.

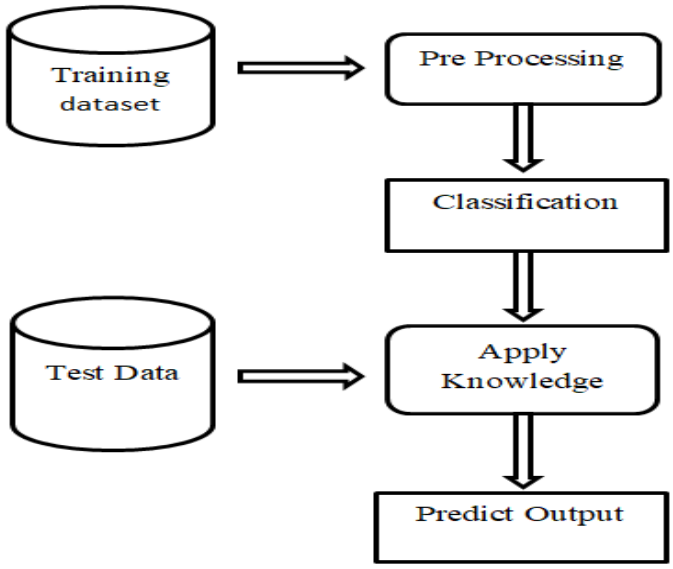

Figure 6: Process of heart disease prediction.

Flowchart representation of prediction process is shown below:

There are numerous machine learning algorithms to see whether has heart disease or not for the people. During this research paper we use the Support Vector Machine algorithm to predict the heart diseases of individuals. We take the Support Vector Machine algorithm for the prediction process because it will give the greater accuracy when compare to the other machine learning algorithms.

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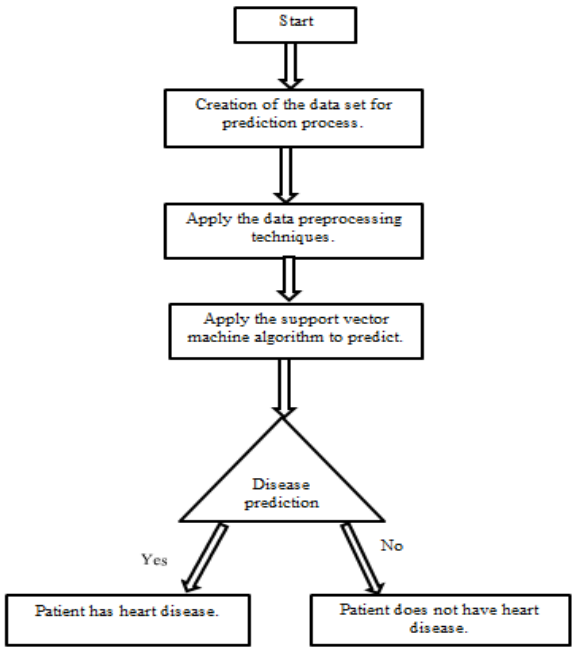

Figure 7: Flow Chart of heart disease prediction

Table 2: Comparison of various algorithms for prediction of heart diseases

Algorithm	Accuracy	Sensitivity	Specificity
ANN	85.30 %	83.75 %	75.73 %
Naive Bayes	81.14 %	61.03 %	70.11 %
RIPPER	81.08 %	86.25 %	75.82 %
Decision Support	79.05 %	83.12 %	74.26 %
SVM	85.97 %	90.10 %	77.20 %
KNN	84.12 %	56.87 %	71.21 %

V. CONCLUSION AND FUTURE SCOPE

There are numerous types of machine learning techniques to detection and prediction of the heart diseases. In this peer review paper, we use the support vector machine to predict and identify the heart diseases of patients. To compare the result of the support vector machine algorithm with the other machine algorithms. The Support Vector Machines algorithm gives the better accuracy, specificity and sensitivity when compare to the other machine learning algorithms.

Future work is to analyse the performance of the classifier after applying feature extraction techniques. The performance of the support vector machine can be improved by using the combination of the other methods, algorithms and pruning of the given data.

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BIOGRAPHY

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