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Prediction and Analysis of Heart Disease Using SVM Algorithm

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Abstract: *In this paper the proposed system predicts Heart Disease using SVM algorithm. Heart disease is the most common cause of death globally. Heart disease prediction using data mining is one of the most interesting and challenging tasks. The shortage of specialists and high wrongly diagnosed cases has necessitated the need to develop a fast and efficient detection system. According to past system the integration of clinical decision support with computer based patient record can reduce medical errors, can be made more precise and hence enhance patient safety. The system helps in prediction of heart disease by considering risky factor associated with heart disease . Here system applies support vector machine algorithm on historical information/data of patient and it provides features like Age, Sex, Smoking, Overweight, Alcohol Intake, Bad Cholesterol ,Blood Pressure and Heart Rate to make prediction of coronary heart disease with higher accuracy.*

Keywords: *Heart disease, Data mining, Support Vector Machine, Risky Factor.*

I. INTRODUCTION

Life is completely dependent on efficient working of the heart. The term Heart disease refers to disease of heart blood vessel system within it. The heart is an important organ of human body. If the blood circulation to the body is inadequate, the organs of the body that is brain and heart stop working and death occurs in few minutes. Heart disease is a leading cause of death worldwide from past 15 years. The common risk factors associated are identified as age, family history, Sex, Stress, high cholesterol, Heart rate, smoking, alcohol intake, overweight, physical inactivity, chest pain type and poor diet. Information obtained by examining the history record of the patient, it is possible to isolate the record and give report on HD if it is positive or negative. Heart disease is the most common cause of death globally. Many hospital information systems are designed to support patient billing, inventory management and generation of simple statistics. Some hospitals use decision support systems, but they are largely limited. Mining is a method of exploring massive sets of data to take out patterns which are hidden and previously unknown relationships and knowledge detection to help the better understanding of medical data to prevent heart disease. Classification of coronary Heart Disease can be valuable for the medical practitioners in the event that it is automated with the end goal of quick finding and exact result. Presence of heart disease precisely can spare patients living days. The work incorporates the classes of Heart Disease utilizing Support Vector Machine (SVM). In this a medical choice backing framework for coronary illness characterization in a sane, purpose, precise and fast manner.

II. LITERATURE REVIEW

The survey is carried out on different techniques used in the detection of HD. Different technologies and the rich survey is available for the heart disease prediction model.

Alka S. Barhatte et al.[1] propose ECG signal analysis and classification method using wavelet energy histogram method and support vector machine (SVM). The classification of cardiac heart disease in the ECG signal consists of three stages including ECG signal preprocessing, feature extraction and heartbeats classification. The discrete wavelet transform is used as a preprocessing tool for signal denoising and feature extraction such as R point location, QRS complex detection. Morphological features extracted from the QRS complex are employed as input to the classifier. Binary SVM is used as a classifier to classify the input ECG beat into four classes i.e. Normal, Left bundle branch block, Right bundle branch block and premature ventricular contraction. MIT-BIH[1][12] arrhythmia database is used for performance analysis.

A. Orozco-Duque et al. [2] give premature ventricular contraction detection method based on Discrete Wavelet Transform for preprocessing, segmentation and feature extraction. Discrete Wavelet Transform (DWT) is used to perform baseline wander and power line noise reduction algorithm. Three different feature spaces based on wavelet coefficients are tested. Principal Component

Analysis (PCA) is applied to reduce dimension into a lower feature space. K Nearest Neighbor (KNN) and Support Vector Machine (SVM) [4] are developed and compared in terms of both accuracy and computational cost.

S. S. Mehta et al.[3] gives a frequent feature selection method for Heart Disease Prediction. The QRS detector using SVM is proposed and applied to the CSE ECG database. The information about the QRS complexes obtained by this method is very useful for ECG classification and cardiac diagnosis. Aditya Methaila et al.[5] gives the use of various data mining Classification Techniques, such as Decision Trees, Naïve Bayes, and Neural Network, along with weighted association Apriori algorithm and MAFIA algorithm in Prediction of Heart Disease. Using associated parameters like as age, sex, blood pressure and blood sugar[6] [8] it can predict the likelihood of patients getting heart disease.

V.Krishnaiah et al.[7] observed that Fuzzy Intelligent Techniques increase the accuracy of the heart disease prediction system. The paper, in addition, gives a review of the data mining techniques used for the prediction.

Vikas Chaurasia et al.[9] gives three popular data mining algorithms CART (Classification and Regression Tree), ID3 (Iterative Dichotomized 3) and decision table (DT) extracted from a decision tree or rule-based classifier to develop the heart disease prediction models using a large dataset. R Ani et al.[10] propose a patient monitoring system for stroke-affected people to minimize future recurrence of the same by alarming the doctor and caretaker on variation in risk factors of stroke disease. Data analytics and decision-making, based on the real-time health parameters of the patient, helps the doctor in systematic diagnosis followed by tailored restorative treatment of the disease. The proposed model uses classification algorithms for the diagnosis and prediction. The ensemble method of tree-based classification-Random Forest gives an accuracy of 93%. The paper [11] gives an Intelligent Heart Disease Prediction System (IHDPS) using data mining techniques, i.e. Decision Trees, Naïve Bayes, and Neural Network. Each method possesses its own power to gain suitable results. The hidden patterns and relationships among them have been used to construct this system. The IHDPS is user - friendly, web-based, scalable, reliable and expandable. Sugondo Hadiyoso et al.[12] proposed a mini wearable ECG device and real-time arrhythmia detection based on android mobile application. ECG signals can be captured by using the ECG's analog front end and sent to Android mobile through a Bluetooth module device. On Android application, data analysis can be done with the help of Pan Tompkins algorithms to detect complex QRS ECG signal and heartbeats. From the number of heart rate can be detected abnormalities. Gaurav Kumar Malik et al.[13] develop an automated physiological signal diagnostic tool that can help to detect Heart disease at the early stage. The paper gives the use of methods like fourth order wavelet decomposition, wavelet decomposition used for time-frequency representation and feature extraction. For classification, support vector machine is used for detection kinds of ECG signals validated by the data MIT BIH[14][15] arrhythmia database. This method uses fourth-order wavelet decomposition, wavelet decomposition used for time-frequency representation and feature extraction. For classification support vector machine [9][10] is used for detection kinds of ECG signals. J. P. Kelwade et al. uses an artificial neural network (ANN) [12] classifier to predict cardiac arrhythmias using the same dataset MIT BIH.

III. SYSTEM ARCHITECTURE

Heart disease is considered as one of the major causes of death throughout the world. It cannot be easily predicted by the medical practitioners as it is a difficult task which demands expertise and higher knowledge for prediction .System will help to predict heart disease depending on the patient’s historical dataset and SVM classifier. The system also performs analysis of the heart disease based on age, gender and location.

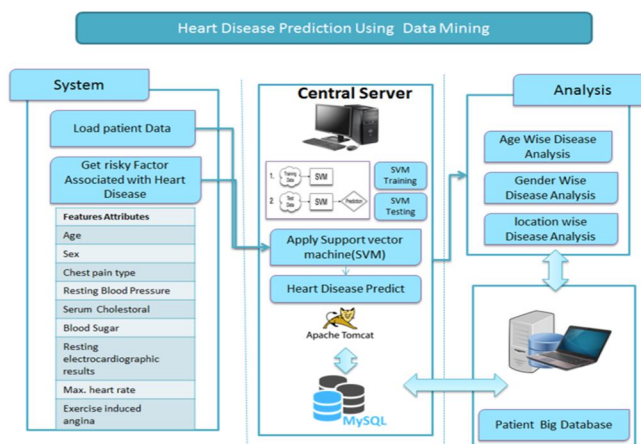


Fig.1 System Architecture

IV. ALGORITHM

- A. Support vector machine (SVM) proposed by Vapnik and Cortes have been successfully applied for gender classification problems by many researchers.
- B. An SVM classifier is a linear classifier where the separating hyper plane is chosen to minimize the expected classification error of the unseen test patterns.
- C. SVM is a strong classifier which can identify two classes. SVM classifier the test image to the class which has the maximum distance to the closest point in the training. SVM training algorithm built a model that predict whether the test image fall into this class or another.
- D. SVM require a huge amount of training data to select an effective decision boundary and computational cost is very high even if we restrict ourselves to single pose (frontal) detection.
- E. The SVM is a learning algorithm for classification. It tries to find the optimal separating hyper plane such that the expected classification error for unseen patterns is minimized. For linearly non-separable data the input is mapped to high-dimensional feature space where they can be separated by a hyper plane.
- F. This projection into high-dimensional feature space is efficiently performed by using kernels. More precisely, given a set of training samples and the corresponding decision values $-1, 1$ the
- G. SVM aims to find the best separating hyper plane given by the equation $Y = Wx + b$ that maximizes the distance between the two classes.

V. PROJECT SCOPE

According to past system the integration of clinical decision support with computer based patient record can reduce medical errors can be made more precise and hence enhance patient safety. The proposed system helps in prediction of heart disease by considering risky factor associated with heart disease. Here the historical information/data of patient is gathered. By applying support vector machine algorithm on features like Age, Sex, Smoking, Overweight, Alcohol Intake, Bad Cholesterol, Blood Pressure and Heart Rate to make prediction of coronary heart disease with higher accuracy is done.

VI. CONCLUSION

The heart is an important organ of the human body. If the blood circulation to the body is inadequate, the organs of the body that are brain and heart stop working and death occurs in few minutes. Heart disease is a leading cause of death worldwide from past 15 years. So it is important to predict Heart disease at an early stage to avoid human death. The importance of data mining in medical domain is realized and steps are taken to apply relevant techniques in the Disease Prediction. The parameter on which heart disease is mostly dependent is extremely susceptible and variant. So after getting historical information about the patient, heart disease can be predicted. Here, the proposed system predicts the heart disease based on the historical clinical data of patient using SVM (Support Vector Machine) algorithm. SVM classifier is used, as the classification accuracy, sensitivity and specificity of the SVM algorithm is found to be high, thus making it a superior alternative for diagnosis. Data Analysis is also done based on age, gender, and location.

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