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Heart Disease Prediction and Detection

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Abstract: ***Heart disease is the most common cause of death globally. According to a recent study by the Indian Council of Medical Research (ICMR) near about 25% of deaths between the ages of 25-69 years cause due to different heart-related problems. The cardiovascular diseases are the highest increased diseases. So we should also have jumped on techniques and methods used for alertness and care to avoid the sudden death of the people because of the heart attack. 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. This paper gives a survey of different techniques applied by the researchers to predict the heart disease from patient's historical data.***
Keyword: Indian Council of Medical Research (ICMR), Heart Disease Prediction,

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. They can answer simple queries like What is the average age of patients who have heart disease?, How many surgeries had resulted in hospital stays longer than 10 days?, Identify the female patients who are single, above 30 years old, and who have been treated for cancer. However, they cannot answer complex queries like Identify the important preoperative predictors that increase the length of hospital stay, Given patient records on cancer, should treatment include chemotherapy alone, radiation alone, or both chemotherapy and radiation?, and Given patient records, predict the probability of patients getting a 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. The cardiovascular diseases can occur due to improper functioning or sudden changes in the major parameters like as blood pressure, temperature, humidity and heartbeat value which is extremely susceptible and variant. Therefore for providing real-time values are important for heart disease prediction. In this system first we analyze the history data of patient and by getting real time ECG signal vales disease is predicted using support vector machine.

II. LITERATURE SURVEY

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. There are many classification techniques involving Nave Bayes (NB), Decision tree (DT), Neural network (NN), the Genetic algorithm (GA), Artificial intelligence (AI) and Clustering algorithms like KNN, and Support vector machine (SVM). Salma Banu et al. gives a prediction model using individual technique and also by combining two or more techniques. This paper provides a quick and easy review and understanding of available prediction models using data mining from 2004 to 2016. Miss. Chaitrali S et al. developed the Heart Disease Prediction system (HDPS) using the Neural network. The HDPS system forecast the likelihood of a patient getting a Heart disease. For prediction, the system uses sex, blood pressure, cholesterol-like 13 medical parameters. Here two more parameters are added i.e. obesity and smoking for betteraccuracy. D. Mendes et al. give a simple and interpretable model based on a real dataset. It consists of a decision tree model structure that uses a reduced set of six

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binary risk factors. The justification is performed using a recent dataset given by the Portuguese Society of Cardiology which originally comprised 77 risk factors.

SunitaSoni, et al. gives a frequent feature selection method for Heart Disease Prediction. Use of the fuzzy measure and the relevant nonlinear integral gives the good performance. The none additively of the fuzzy measure re gets the importance of the feature attributes as well as their interactions. Using features such as age, sex, blood pressure and blood sugar it can predict the likelihood of patients getting a heart disease. And this improves the accuracy and reduces the computational time.

Fizzer Ahmed et al. gives the architecture for heart rate and other data monitoring technique and also how to use a machine learning technique like kNN classification algorithm to forecast the heart attack by with the set of heart rate data and other parameter associated with the heart.

The Wireless Sensor Network (WSN) be capable to acquire the patient's physiological factor and convey it wirelessly by Bees and show the sensor data on Lab VIEW and bring out on the web server to make easy for the family members from far distance to visualize, control and monitor constantly using internet connectivity .

R Ani et al. 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%.

Sugondo Hadiyoso et al. 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 detectedabnormalities.

Heart disease is caused because of an electrical breakdown in the cardiac signal of the heart. In this particular disease person loses consciousness and has no pulse which occurs death within a minute, leads to sudden cardiac arrest. The P, QRS complex and T wave of ECG signal triggered and generates an improper electrical signal that provides clinical information to diagnose. K. Amtul Salam et al. introduced new technologies and algorithms to detect and analyze the ECG signal value. Here recognition of ST segment and QRS complex or R peak detection is done to diagnose an arrhythmia. The paper specifies a method to detect arrhythmia from ECG signal using different concepts as Discrete Wavelet Transform (DWT), Adaptive Least Mean Square (ALMS) and Support Vector Machine (SVM).

Gaurav Kumar Malik et al. develop an automated physiological signal diagnostic tool that can help to detect arrhythmia 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 BIHarrhythmia database. This method uses 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. J. P. Kelwade et al. uses an artificial neural network (ANN) classifier to predict cardiac arrhythmias using the same dataset MIT BIH.

III. SYSTEMARCHITECTURE

Cardiovascular disease is the leading global cause of death. System will help to predict heart disease depending on the patients ECG values and medical Dataset of the patients and SVM classifier

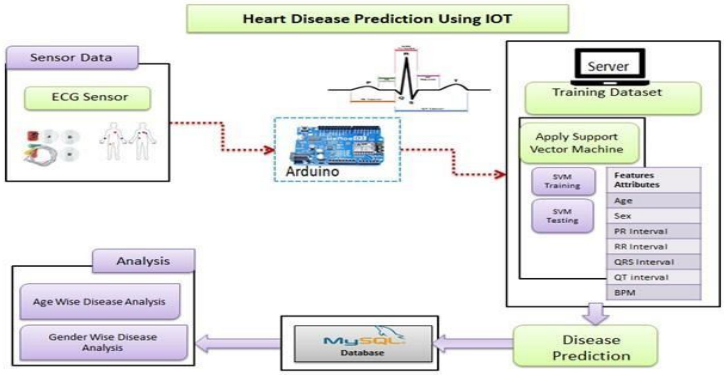


Fig: System Architecture Of Heart Disease Prediction

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1) *Load Patients Dataset:* Get historical information/data of patient. a. Preprocessing The ECG signal getting from the sensor containing noise so preprocessing can be done to remove noise and get the final ECG value.
2) *Get Real time Patient Data*: By attaching the sensor to the body the detail of the body parameter value are calculated such as ECG signal value and temperature value.
3) *ECG Module (AD8232):* The AD8232 module breaks out nine connections from the IC that you can solder pins, wires, or other connectors to. SDN, LO+, LO-, OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino or other development board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to attach and use your own custom sensors. Additionally, there is an LED indicator light that will pulsate to the rhythm of a heartbeat.
4) *ECG Signal Perimeter:* It represents the period of one phase of the wave which provides the information about the propagation time of the impulse to both atria. Following Table shows the normal ECG Parameters. Phase Duration Amplitude : – P Wave 0.06-0.11 ¡0.25 PR – Interval 0.12-0.20 – PR Segment 0.08 - – QRS Complex ¡0.12 0.8-1.2 – ST Segment 0.12 – QT Interval 0.36-0.44 - – T Wave 0.16 ¡0.5
5) *Heart Disease Prediction Using Machine Learning:* The system deals with existing arrhythmia data and performs analysis on that data. We are using Kaggle dataset for prediction of heart disease. https://www.kaggle.com/shayanfazeli/heartbeat/data This dataset is composed of two collections of heartbeat signals derived from two famous datasets in heartbeat classification, the MIT-BIH Arrhythmia Dataset and The PTB Diagnostic ECG Database. The number of samples in both collections is large enough for training a deep neural network. This dataset has been used in exploring heartbeat classification using deep neural network architectures, and observing some of the capabilities of transfer learning on it. The signals correspond to electrocardiogram (ECG) shapes of heartbeats for the normal case and the cases affected by different arrhythmias and myocardial infarction. These signals are preprocessed and segmented, with each segment corresponding to a heartbeat. Arrhythmia Dataset Number of Samples: 109446 Number of Categories: 5 Sampling Frequency: 125 Hz Data Source: Physionet's MIT-BIH Arrhythmia Dataset Classes: ['N': 0, 'S': 1, 'V': 2, 'F': 3, 'Q': 4] Analyze Live Patient Data Patient is connected with 3 ECG connectors. Data is taken from sensors and ADC values are then supplied to trained network. Network then predicts the type of arrhythmia for the patients.

a) Interfaces used in System

b) Hardware: The minimum configuration required on computer.

i) System: 2.4 GHZ, 80 GB HDD (hard disk drive) for installation

ii) RAM: 512 MB memory ECG Sensor Temperature Sensor
Arduino Wemos

c) Software

i) IDE: Eclipse

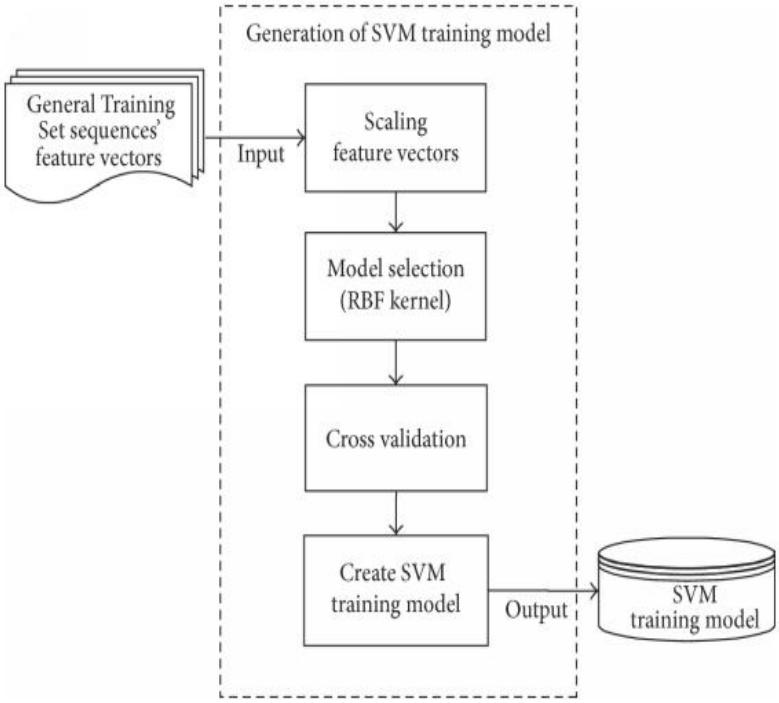
ii) Database : MYSQL Platform :
Microsoft Windows 7 Professional.

IV. ALGORITHMS USD IN SYSTEM

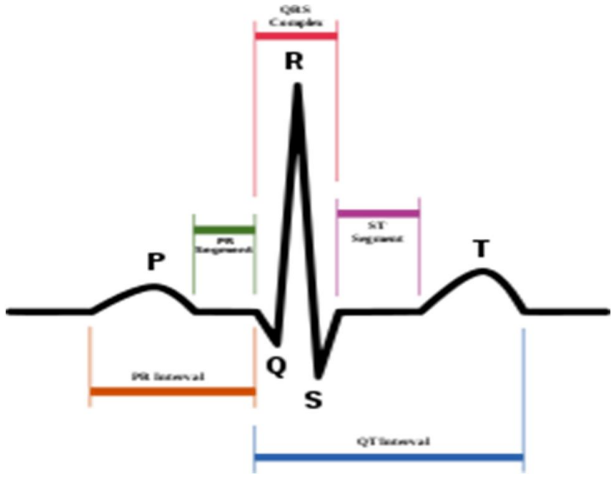
A. SVM (Support Vector Machine)

Support Vector Classification Algorithm Support vector machine (SVM) proposed by vapnik and cortes have been successfully applied for gender classification problems by many researchers. 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. SVM is a strong classifier which can identify two classes. SVM classifies 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.SVM require a huge amount of training data to select an affective decision boundary and computational cost is very high even if we restrict ourselves to single pose (frontal) detection. 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. 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 SVM aims to find the best separating hyper plane given by the equation WTx+b that maximizes the distance between the two classes.

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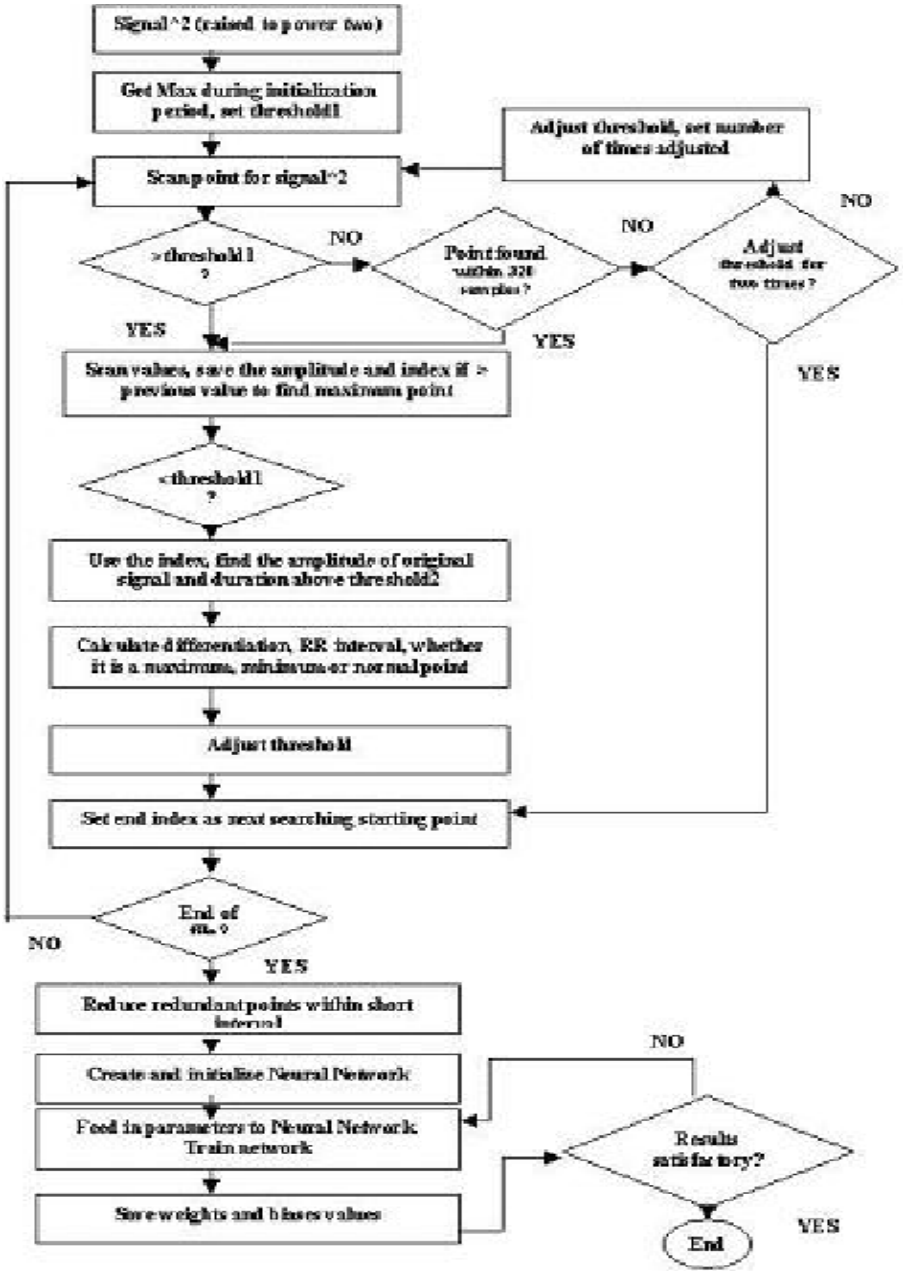
B. (QRS Algorithm)



Electrocardiogram is a graphical record of the magnitude and direction of the electrical activity that is produced by repolarization and depolarization of the ventricles and atria. The fig 1 shows the healthy ECG signal with the standard intervals. It offers information about the rhythm, morphology and heart rate. Any illness in rhythm in the ECG signal is a clue of cardiac arrhythmia. It is identified and analyzed by analysis of the noted ECG signal. ECG signals differs from person to person due to the difference in size, position, age, anatomy of the heart, chest configuration, body weight and other many factors. There are two wavelet functions are used such as daubechies 8 wavelet (db8) and symlets 8 wavelet (sym8) for feature extraction. Fig 1: ECG signal with standard ECG intervals Wavelet Transform helps to decompose the signal it removes the noise and base line wander. Wavelet transform decomposes the signal in four level. SVM (Support Vector Machine) is used to classify the de-noise signals and identify pattern for well classification of ECG signals. Statistical learning theory on this support vector machine depends. Support vector machine it uses the method called supervised learning which is used to identify the patterns and to analyze the data.

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V. MATHEMATICALL MODEL

Let us consider S be a Systems such that

S= {U, Tr,E,Ss,Ds,P}, where P= Prediction of Disease.

U= {U1, U2, U3.Un | U is a Set of all USERS } U is the users of the system. Users of the system may grow as the system is used by more and more people. User is infinite set.

Tr = {Tr |Tr is a Trained Arrhythmia Dataset } System deals with existing arrhythmia data and performs analysis on that data.

E= {E1, E2, E3.En | E is real time value of ECG signal.} E represents the period of one phase of the wave This is also an finite Set.

Ss = {S reg, S login, HeartDisease upload, | Ss is a Set of Storage Service } STORAGE SERVER will provide services like Registration, Login, store heart disease data . As this set also has finite attributes, so this is also Finite Set.

DS = {USER INFO, USER DATA, ECG SignalValue | DS is a Set of data table for permanent storing of data on server} USERINFO = {User ID, Password, FULL NAME, Emia ID, contact | USERINFO is a set for storing User Data }

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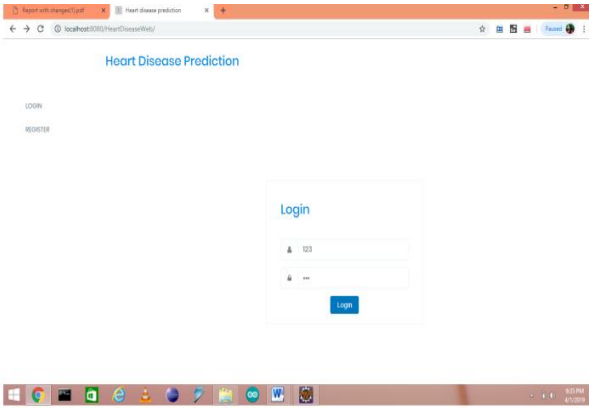
VI. APPENDIX

The framework is divided into three modules which are: doctor account, patient kit, and Server which communicate to each other by using wireless sensors. The application flowchart is given below:

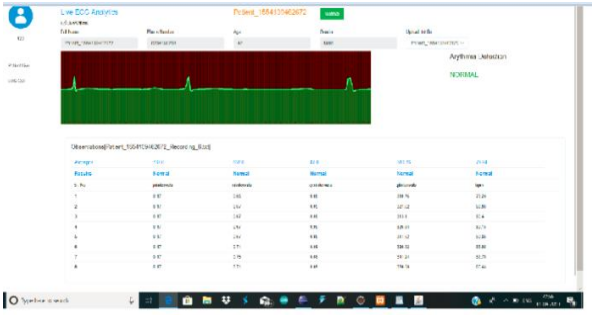
A. Rendering of System

This section demonstrates the rendering of three roles(A doctor,a patient and a server)here we are providing both hardware as well as web application for the ECG detection and prediction system.

Doctors login page:



When the data of the patient comes in doctors portal.the visualisation of the graph as follows:



VII. ADVANTAGES

A. Helps in analyzing patient details and predict.
B. Helps to predict heart disease based on ECG parameters..
C. Explore data mining classification technique to predict precise symptoms and enhance the accuracy in prediction.
D. Provide an application/medium for detecting the heart disease symptoms based on the patients real time values and clinical data.

1) Limitations

a) Requires patient to be in sleeping or relaxed stage.
b) Hardware needs WiFi connectivity.

VIII. CONCLUSION

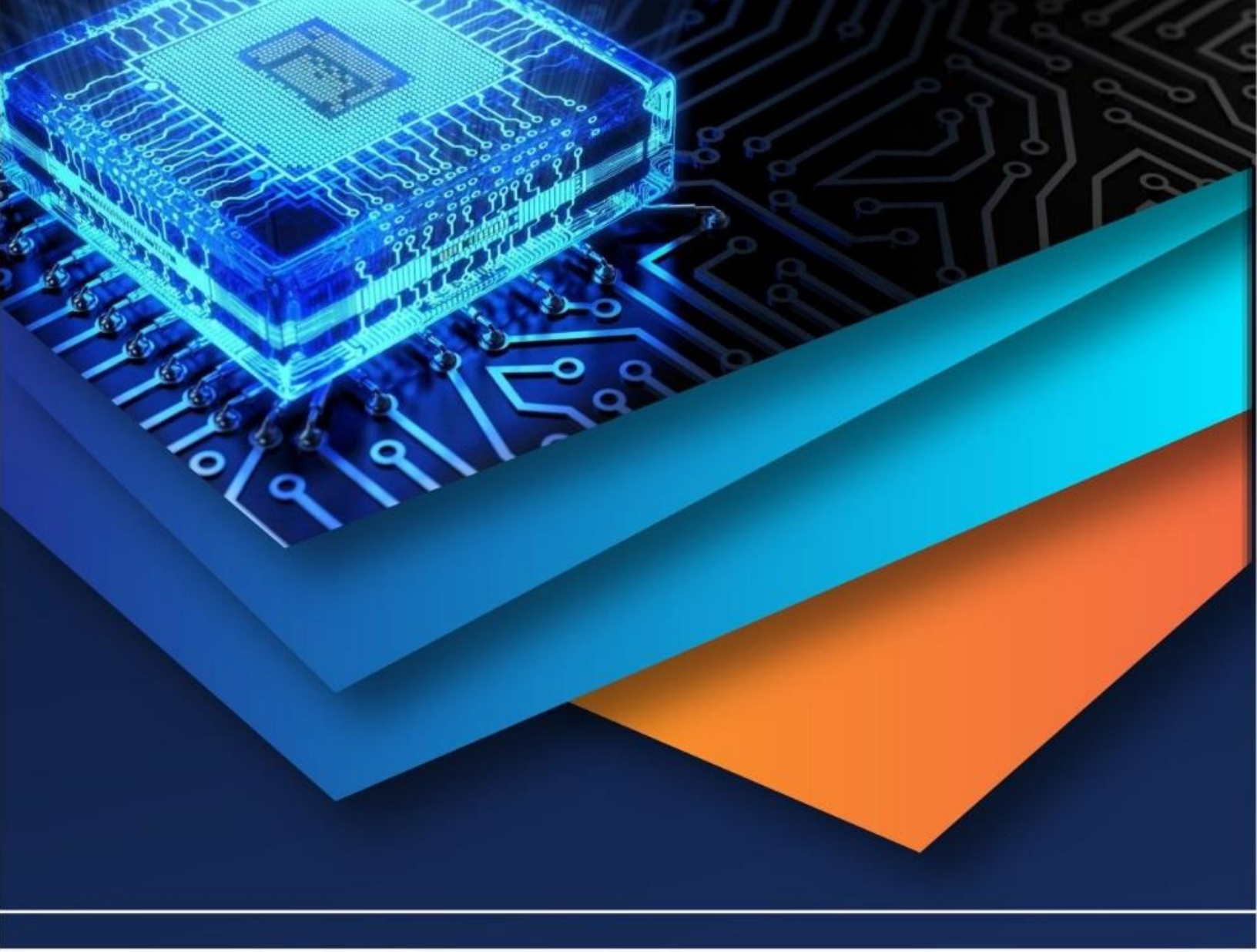
Heart disease prediction is a popular exploration area in computer vision. The parameter on which heart disease is mostly dependent is extremely susceptible and variant. So getting historical information about the patient we can predict the heart disease In this paper, we give a brief review of different methodology in the prediction of Ventricular Arrhythmia disease detection. A large collection of methods are identified for recognition of heart disease. but none of the can give 100% accuracy in the prediction. So there is a need to develop a system which can predict the heart disease with higher accuracy.

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