DEVELOPING A SMART INTEGRATED MODEL BY LEVERAGING MACHINE LEARNINGTOOLS AND TECHNIQUES FOR THE EARLY DIAGNOSIS OF CARDIOVASCULAR DISEASES

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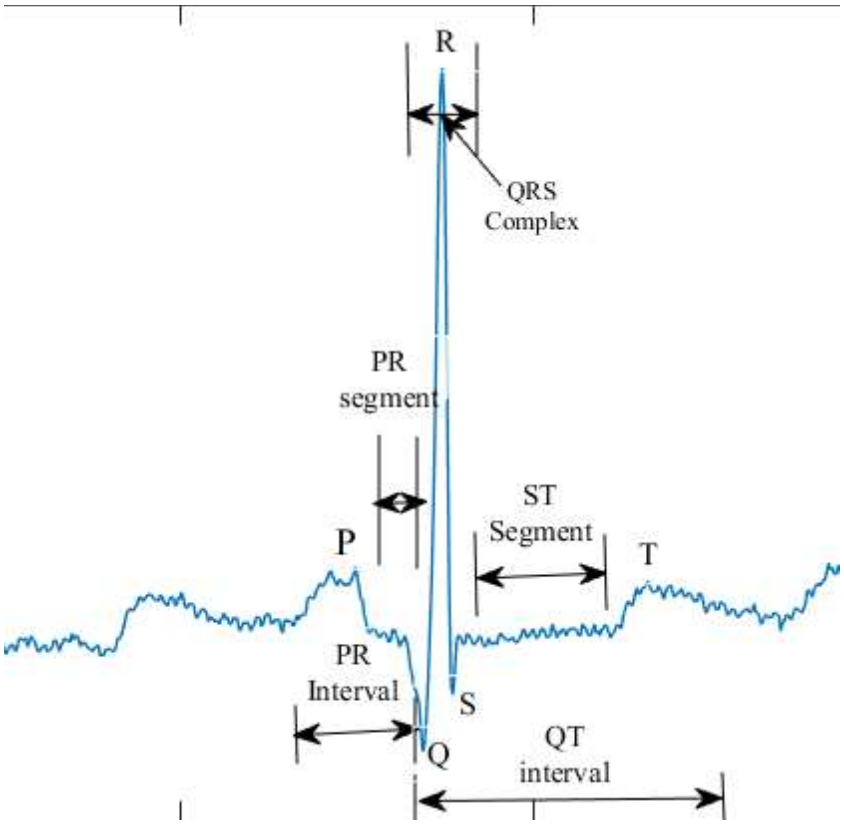
ABSTRACT

The human body's most important organ is the heart. An electrocardiogram (ECG) is a type ofheart scan in which the electrical activity of the heart produces a periodic time-varying signal.The heart's electrical signals are recorded by an electrocardiogram. It is a common procedure that does not cause any pain and is used to quickly monitor the health of the heart. It is an established method for diagnosing cardiac conditions. Sensors are positioned on the chest andlimbs to monitor the ECG signal. An electrical signal is generated by a portion of the heart during each heartbeat.

One of the most pressing issues facing the healthcare industry today is the classification of heart diseases. As a result, the goal of this work is to use machine learning methods like lineardiscriminant analysis, support vector machine (SVM), multilayer perceptron, random forest, and k-nearest neighbor to classify various heart diseases. The signal needs to be classified in two main ways: the first is to extract the features or pre-process them, and the second is to usemachine learning algorithms. The famous MIT-BIH Arrhythmia information base and quantitative measurements like precision, responsiveness, furthermore, accuracy can evaluatethe presentation of these techniques.

INTRODUCTION

Heart disease is a serious health problem that affects a large number of people worldwide. Common signs of heart disease include shortness of breath, weakness, and swollen feet. The current methods of diagnosing heart disease are ineffective for early identification for a numberof reasons, including accuracy and execution time, so researchers are looking for an effective method. When modern technology and medical professionals are unavailable, it is extremely difficult to diagnose and treat heart disease. Numerous people can avoid death by receiving theright diagnosis and treatment.



Consequently, to address these issues, a non-invasive diagnosis system utilizing ML classifiersis being developed. Heart disease is accurately diagnosed by an expert decision system employing artificial fuzzy logic and machine learning classifiers. As a result, the death rate goes down. HD was identified by a number of researchers using the Cleveland Heart Disease Data Set. For training and testing, machine learning predictive models require precise data. Anelectrocardiogram, or ECG, is a diagnostic test that measures the electrical activity of the heart.It is a common non-invasive method for assessing the heart's health and function.

OBJECTIVE

1) To study the heart signal database (Arrhythmia).

2) To study and perform denoising and feature extraction using discrete wavelet transform.

3) To classify heart disease signal using machine learning technique

4) To calculate the accuracy, sensitivity, precision for the ECG signal.

METHODOLOGY

RESULTS

A. Feature Extraction Results for Two Signals

m1	m2	m3	v1	v2	v3	st1	st2	st3	k1	k2	k3	sk1	sk2	sk3
-0.0453	-0.032	-0.0227	3.199	4.2187	4.7352	0.0566	0.065	0.0688	0.0053	0.0058	0.0081	0.0007	-0.0005	-0.002
-0.0442	-0.0313	-0.0223	3.5297	4.5092	5.0186	0.0594	0.0672	0.0708	0.0082	0.0081	0.0102	0.0009	-0.0003	-0.0017
-0.0293	-0.0208	-0.0148	2.0905	2.5229	2.7494	0.0457	0.0502	0.0524	0.0063	0.0065	0.0095	0.0005	-0.0007	-0.002
-0.03337	-0.0239	-0.0171	4.9326	5.5056	5.8117	0.0702	0.0742	0.0762	0.0235	0.0328	0.0263	0.003	0.0027	0.0004
-0.0336	-0.0238	-0.0168	4.1849	4.7489	5.0532	0.0647	0.0689	0.0711	0.0106	0.0178	0.0325	-0.0008	-0.002	-0.0034

Fig.1 Feature Extraction for signal 1

B. Machine Learning Algorithm Classification Results

ML Algorithm	Signals	Precision	Recall	TP Rate	FP Rate	Accuracy
Bayes	AD	0.952	0.87	0.87	0.059	90
	ND	0.842	0.941	0.941	0.13	
Naïve Bayes	AD	1	0.87	0.87	0	92.5
	ND	0.085	1	1	0.13	
LibLINEAR	AD	0.95	0.826	0.826	0.059	87.5
	ND	0.8	0.941	0.941	0.174	
LibSVM	AD	0.64	0.696	0.696	0.529	60
	ND	0.533	0.471	0.471	0.304	
Logistic	AD	1	0.826	0.826	0	90
	ND	0.81	1	1	0.174	
SGD	AD	1	0.913	0.913	0	95
	ND	0.895	1	1	0.087	
SMO	AD	0.846	0.957	0.957	0.235	87.5
	ND	0.929	0.765	0.765	0.043	
LWL	AD	1	0.87	0.87	1	92.5
	ND	0.85	1	1	0.13	
Multi class classifier	AD	1	0.826	0.826	0	90
	ND	0.81	1	1	0.174	
ZeroR	AD	0.575	1	1	1	57.5
	ND	0	0	0	0	
Decision Stump	AD	1	0.87	0.87	0	92.5
	ND	0.85	1	1	0.13	
J48	AD	0.952	0.87	0.87	0.059	90
	ND	0.842	0.941	0.941	0.13	
LMT	AD	1	0.87	0.87	0	92.5

C. Graph of Accuracy of Different Machine Learning Algorithm for Analysis of ECG signal

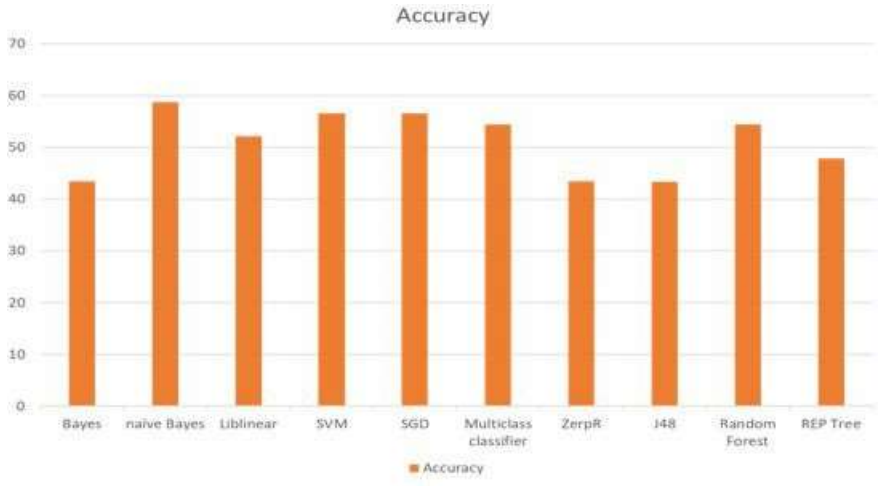


Fig.2 Accuracy of different Machine Learning Algorithm for Analysis of ECG signal

CONCLUSION

In this project, we investigated ways to improve the ECG signal's accuracy and make it suitablefor medical use, allowing doctors to quickly and accurately identify heart conditions. For example, we looked into feature extraction to get the data needed to denoize the signal. Recentstudies have shown promising results when classifying heart disease using machine learning techniques.

Based on a variety of features, such as clinical and demographic data, imaging results, and biomarkers, these methods have demonstrated their ability to accurately predict heart disease.The findings suggest that personalized heart disease treatment plans, risk assessment, and earlydetection can all benefit greatly from the assistance of machine learning models.

Various machine learning algorithms, including decision trees, support vector machines, and random forests, have been used to classify heart diseases with varying degrees of success, as the studies in this analysis have shown. These models have demonstrated high accuracy, sensitivity, and specificity in numerous instances, indicating their clinical potential.

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