ENHANCEMENT OF ECG CLASSIFICATION USING GA AND PSO

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Abstract

ECG signal classification utilizes for different predictions of heart diseases. These ECG signals have to be classified using different frequency bands according to different energy levels for better prediction of features. These signals have to be classified in different five bands P, Q, R, S and T. These sub-bands provide peak information available in different sub-bands. For the classification various approaches have to be implemented for filtration of signal. In the purposed work Adaptive filter has been implemented for the noise reduction from these signals. Classification of the ECG signal has been optimized using Genetic Algorithm and Particle Swarm Optimization approach. These approaches of classification provide better results i.e. 100 and 100 for 106^o and 119^o respectively for energy levels of ECG signal.

Keywords:- *ECG, noise reduction, Genetic Algorithm and Particle Swarm Optimization approach*

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1. INTRODUCTION

An electrocardiogram, which is frequently alluded to just as an ECG or an EKG, is a symptomatic apparatus that specialists and medicinal expert's utilization to gauge a tolerant heart movement by giving careful consideration to the electric current streaming in the heart [15]. This is a strategy that is genuinely standard and is performed constantly. It by and large takes five to ten minutes to do and it is both straightforward and protected to perform.

Generally, it is standard for a resting ECG to be managed to patients. A resting ECG happens when the patient is lying on his or her back and the specialist or professional spots metal sensors at the individual's wrists, lower legs and various places in the midsection zone [12]. The sensors have the capacity locate the electric driving forces of the heart, which are then recorded as exceptional tracings on pieces of chart paper. An ECG is not uncomfortable as the current is continually advancing just from the patient and from no place else.

In a general sense a regularly pulsating heart achieves the same example of waves in everybody. In the event that this example changes whatsoever [9], it is conceivably because of a huge number of issues which could incorporate unpredictable heart rhythms, which could be an indication of coronary illness however is not so much so; harm to the muscle of the heart; extension of the assemblies of the heart; a lopsidedness of minerals in the blood lastly, whether a patient is having or has as of now had, a heart assault [5]. The vast majority who hint at coronary illness will discover an ECG helpful in serving to disconnect the issue. It is paramount to note that an electrocardiogram is not idiot proof.

It is conceivable to have an ECG that is ordinary yet at the same time be harrowed by heart issues [16]. The inverse can likewise be genuine - some of the time the diagram from the ECG can demonstrate issues where there are none whatsoever. Atherosclerosis, which is the development of fat in conduit dividers that causes blocked or limited coronary courses, is not generally uncovered with a resting ECG because of the way that when the heart is very still, it is getting enough oxygen [24]. In this example, a specialist may choose that an anxiety ECG that takes a gander at the state of the veins of the heart is in place. An anxiety ECG is carried out while a patient is either riding a stationary bicycle or practicing on a treadmill.

An anxiety test or anxiety ECG can give suggestions that there is a lacking supply of oxygen to particular spots of the heart muscle [14]. The most widely recognized instance of this issue is narrowing of coronary courses, which are stopped up because of the development of plaque. The anxiety test can reveal issues that would be undetected until an individual ends up or she experiencing an agony in their midsection while they are taking part in physical movement.

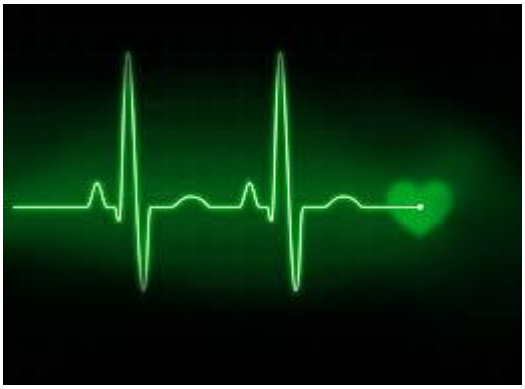

Fig1: ECG Signal

Electrocardiograms are regularly a routine piece of a physical checkup after an individual turns forty years of age. It is exceptionally proposed that an individual have an ECG before they turn forty so later on it can be utilized for examination purposes [21]. The principle objective of any squeezing method is to accomplish greatest information volume decrease while safeguarding the huge peculiarities furthermore recognizing and taking out redundancies in given information set.

Information layering routines can be grouped into two classes: 1) lossless and 2) misfortune coding techniques. Misfortune pressure is helpful where a certain measure of mistake is satisfactory for expanded layering execution [3]. Misfortune less or data saving clamping is utilized as a part of the stockpiling of restorative or lawful records. In lossless information packing, the sign specimens are thought to be acknowledging of an irregular variable or an arbitrary procedure and the entropy of the source sign decides the most minimal clamping degree that can be accomplished.

1.1 Factor Affects ECG

Certain variables or conditions may meddle with or influence the aftereffects of the test. These incorporate, yet are not restricted to, the accompanying:

- Obesity, pregnancy, or as refers to
- Anatomical contemplations, for example, the extent of the midsection and the area of the heart inside the midsection
- Movement amid the technique
- Exercise or smoking before the method
- Certain drugs
- Electrolyte irregularities, for example, a lot of or excessively little potassium, magnesium, and/or calcium.

2. PROPOSED WORK

In the ECG signal classification various approaches has been utilized for ECG signal classification. Various features have been selected for classification of different signal used for ECG signal classification. In classification patterns different bands have to be calculating on the base of P, Q, R, S, T. these signal classification has been done using different Adaptive filters. Adaptive filters removes noise from different input signals. Different optimization approaches have been implemented for classification process to find accuracy at different levels.

In this scenario different energy levels have been implemented on the basis of different ECG signals. Classification accuracy is main parameters that have to be recovered on the basis of signal noise ratio at different peaks of P, Q, R, S and T.

These classification techniques provide different features for classification of different ECG signals. For performance evolution of different ECG signals accuracy have to be measured on the basis of SNR. In this purposed work PSO has to be implementing for the optimization process of ECG signal which is an artificial intelligence for calculation of fitness value.

The results of various wavelets are compared at different Activation Energy Level by using GA and PSO Optimization Technique.

This work flow represents flow of work from loading of signals to classify different ECG signals. In purposed classification approach different optimization approaches have to be implemented to classify different results. These classification approaches provides better results for feature extraction of ECG signals.

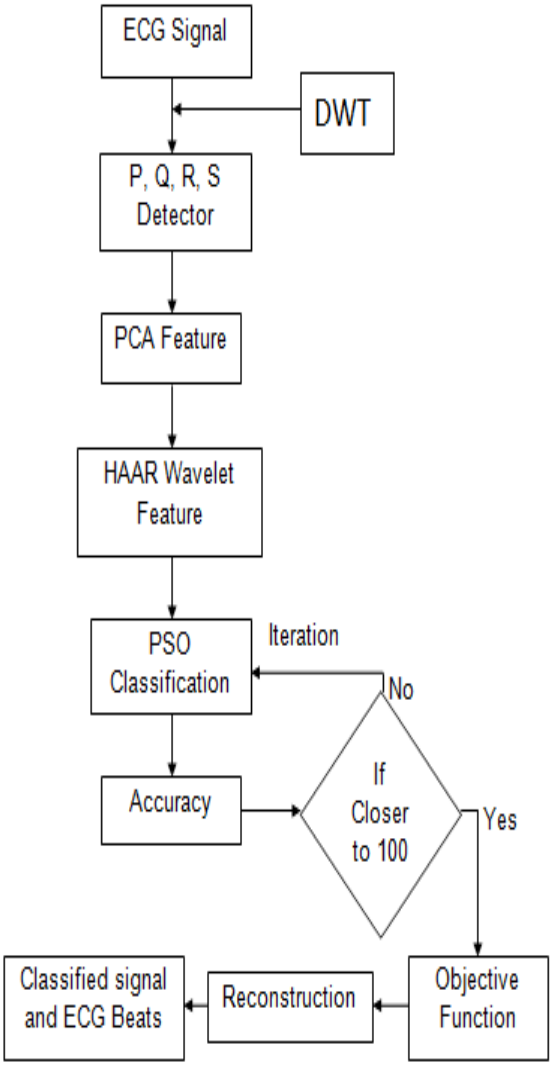

Fig2: Flow chart of Methodology

3. RESULTS

Simulation has been done using ECG signal for classification for detection of different peak values has to be done in this section. ECG signal has been uploaded and then Principal Component Analysis has to be implemented for the extraction of different features from loaded signal.

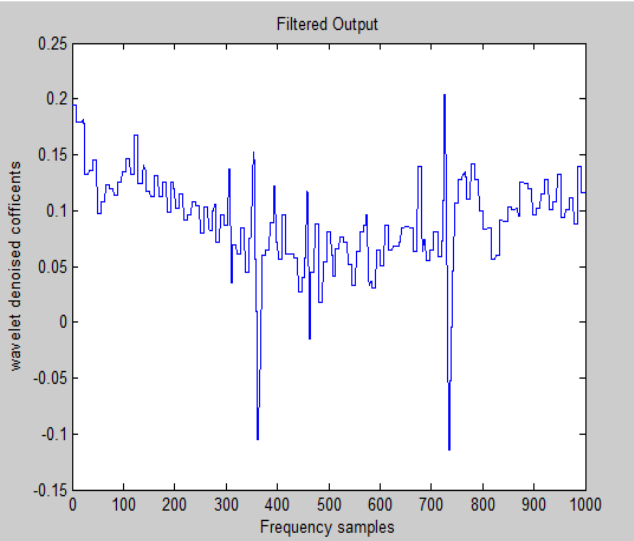

Fig 3: Wavelet Filter Output

This filter output represents removal of noise from ECG signal using different HAAR wavelet filter. This reduction of noise from ECG signal helps for classification that has to be done

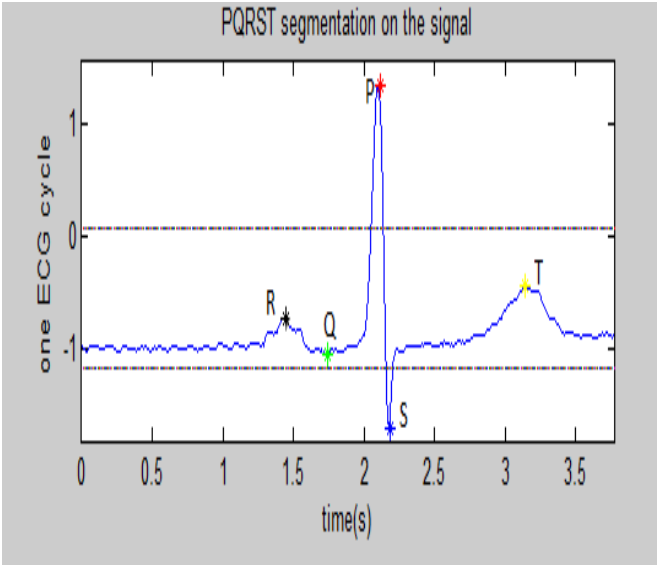

Fig 4: Peak Detection Patterns

The figure 4th defines Peaks detection using P, Q, R, S and T at different energy levels provides for signal processing. This peaks selection provides energy information and distortion in human health for prediction of status of health. This signal processing has been done using various classification approaches.

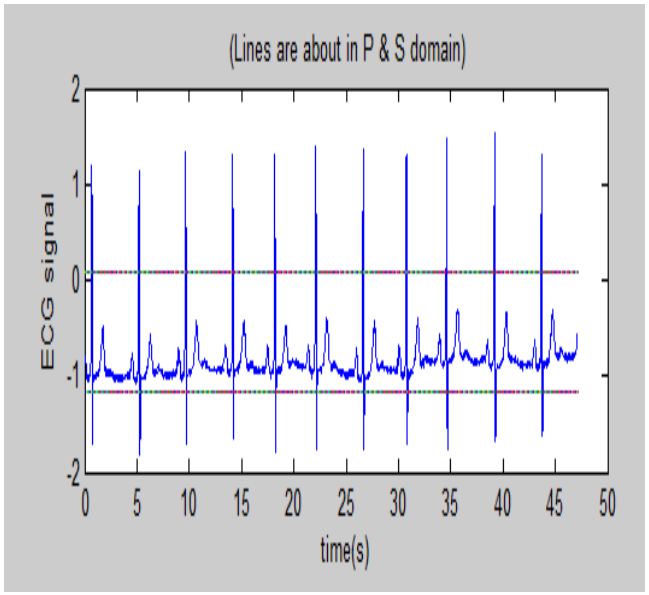

Fig 5: ECG signal in P and S domains

The 5th figure depicts ECG signal against time in P and S domain only. In this figure different band has been used for the spectrogram of ECG signal. These different bands are P, Q, R, S and T. this representation of signals has been done at different P and S domain in signal processing band.

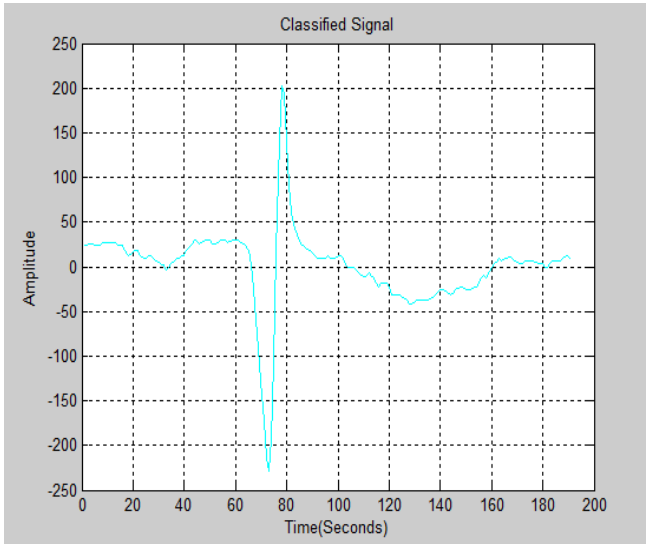

Fig 6: Classified Signals

This graph illustrates the classified signal after processing using Particle Swarm Optimization approach.

Table 1 Classification Accuracy

Wavelet		**Total Accuracy (%)**					
		106°	**114°**	**116°**	**119°**	**217°**	**Average**
HAAR	BASE PAPER	88.63	98.66	99.54	100	92.79	95.924
	PROPOSED WORK	100	100	100	100	99.5	99.9
Meyer	BASE PAPER	90.9	99.13	99.63	100	95.27	96.986
	PROPOSED WORK	100	99.9	98.5	100	99	99.48
Sym3	BASE PAPER	93.33	98.6	99.83	100	96.02	97.556

	PROPOSED WORK	97.5	100	99.9	100	98.2	99.12
Bior3.9	BASE PAPER	90.65	98.38	99.63	100	95.77	96.886
	PROPOSED WORK	100	99.8	99.2	100	99.3	99.66
Db3	BASE PAPER	90.01	98.82	99.54	100	93.53	96.38
	PROPOSED WORK	100	100	100	100	98.2	99.64
Db5	BASE PAPER	91.1	98.7	99.58	100	96.26	97.128
	PROPOSED WORK	99.7	100	99.8	100	99.5	99.8
Db8 (NW1)	BASE PAPER	94.02	99.25	99.58	100	96.02	97.774
	PROPOSED WORK	99.4	99.1	99.7	99	99.2	99.28

Particle optimization approach use different particle values to find out fitness value for each parameter used for the selection of different peaks of ECG signal. PSO utilize different signal processing tool for the calculation of different ECG signals fitness values.

This table comprises of different accuracy values comprised at different energy levels using different classification approaches. This shows classification accuracy using different artificial intelligence approaches that are GA and PSO. This comparison table results provides different accuracies using GA and PSO at various energy levels.

4. CONCLUSION

An ECG is used to measure the heart's electrical conduction system. It picks up electrical impulses generated by the polarization and depolarization of cardiac tissue and translates into a waveform. The ECG is a one of the important physiological signal which depicts the electrical activity of a heart. ECG processing is a topic of great interest in the scientific community because based on the ECG's a diagnosis is done for detecting abnormalities in the heart functioning. Basically, a data coding algorithm seeks to minimize the number of code bits stored by reducing the redundancy present in the original signal.

In this we have many parameters like feature extraction, Q R S detected wave form, filtered output, to classify the GA (Genetic Algorithm) with the help of signals in time domain, GA (Genetic Algorithm) with the help of Fourier transform, GA (Genetic Algorithm) with the help of Spectrogram, GA (Genetic Algorithm) with the help of PSD of signals, GA (Genetic Algorithm) with the help of PSD of signals with Accuracy. In this PSO (Particle Swarm Optimization) has been implemented to find out fitness value of different EEG signal classification approaches. Features extracted for detection of QRS signal

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