

# Comparison of ANN and Fuzzy logic based Bradycardia and Tachycardia Arrhythmia detection using ECG signal

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**Abstract** - Heart diseases are common these days due to unhealthy food habits. One of the biggest causes of deaths today is heart diseases. These need to be monitored and diagnosed early to shun deaths because of coronary heart diseases. ECG signal i.e. Electrocardiogram signal is used to detect the heart disease, an individual is suffering from. The ECG signal formed will let the doctor know about the heart condition of patient. Heart disease detection using ECG signal is a wide area of research as accurate diagnosis is important for correct treatment of the patient. Arrhythmias can be predicted from the ECG signal. The waveforms of ECG signal and their correct analysis is important for the prediction of infection or patient's condition of heart. In this paper, fuzzy logic system is used for the detection & prediction of heart diseases. A comparison between the traditional and the proposed method is done .

**Index terms** - Heart diseases; Fuzzy logics; Cardiac arrhythmias; ECG signal; Disease Detection.

## I. INTRODUCTION

Health issues are growing day by day due to wrong eating habits and increasing pollution. Most popular are heart diseases that are a big reason for human deaths. Heart diseases are not only common in India but are growing globally. Large numbers of deaths are being recorded worldwide due to heart attacks or heart failures. Heart failures occur because of the blockage of blood vessels that transports blood to heart. Heart diseases are commonly called as coronary artery diseases that are cause of heart attacks and can lead to death. Also, large numbers of people undergo heart transplants and bypass surgeries to treat and overcome their heart diseases. For detecting and predicting heart diseases of a patient, ECG signal of a person needs to be recorded and then analyzed properly. The process of registering the movement of heart of an individual by laying electrodes on his/her body is called Electrocardiography. These electrodes notice even little electrical change in the cell during each heartbeat. The graph that is formed of the signal is referred to as Electrocardiogram. This graph of voltage versus time is of the ECG signal that is formed after non-obtrusive therapeutical procedure. A regular advancement in the ECG signal will represent a healthy heart, whereas variations in the signals occur when a person is suffering from any heart disease. Accurate and efficient diagnosis and detection of disease is important for providing correct treatment to the patient and for saving his life. The system that is used for diagnosing the heart diseases is being automated nowadays. Automating this system will ease the process of diagnosing and will also improve the accuracy of the system. Chances of human error are also negligible when the results will be computed automatically.

## II. TRADITIONAL APPROACHES

ECG signal is used for the detection of the various heart related diseases. Various methods for the detection of the QRS waves and R waves have been introduced earlier. Some of the Techniques of detection of the peaks signal are discussed below:-

**Hilbert transform:-** This is considered to be an efficient approach for the detection of the peaks from the ECG signal as this adaptively determines the threshold for peak. It performs extremely well in the noise. This method minimizes the effects of the large peaks. This method is used for detection of dominant peak points in signal.

**Adaptive thresholding:-** This method is considered to be one of the significant techniques for the detection of the R peaks from the ECG signal. In previous thresholding methods choosing the high threshold results in lack of proper detection and choosing low threshold value results in incorrect detection of the peaks. By using adaptive thresholding method the detection is done by using pair of the threshold limits i.e. up limited threshold and down limited threshold. In this algorithm the number of the peaks that are detected by the using up and down limits are not equal, the error is then obtained by subtracting the limits.

**Wavelet transform:-** Wavelet transform is used for the detection of the ECG signal for the extraction of the desired coefficients and its details. This method is considered to be an efficient method as this provides good time resolution at high frequency, in addition to this it provides efficient localization in both time and frequency domain.

**Artificial neural networks (ANN) :** For the extraction of the feature from the ECG signal artificial neural network is an effective approach. By applying the ANN method the compression ratio increases and the number of the ECG cycles also increase. The features that are matched with the feature of the original signal are extracted by the amplitude, slope etc of the received signal .this method is efficient for many real time application.

**Genetic and evolutionary methods:** This method is considered to be efficient method that uses a transformative approach to reduce the features set. The clustering approach is used for the determining the features and then by using iterative methods the most separable features are obtained. This method is used along with various classifiers like SVM to minimize the errors.

### III. PROBLEM OF THE TRADITIONAL APPROACHES

The process of recording the activity of the heart over time interval by using electrode placed on the body of the patient is called as Electrocardiography. This is used for the detection of the various cardiac diseases. Previously many techniques were used for the detection of the disease. ANN system was used though this method was considered to better but it too had limitation like it cannot take it decision of its own. It works on value given to it. Also the system needs to retrained. So there is need to find a new technique for the detection of the heart disease. So that the R- peaks detection is done easily. As this is an important factor for the detection of the disease as if the disease is not detected, it can cause various deadly problems and can even lead to death.

### IV. FUZZY SYSTEM

Fuzzy control systems are mathematical systems that analyze the input analog values in the term of the logical variables that will take values between 0 and 1. Fuzzy system is an alternative to traditional notions to set membership function.

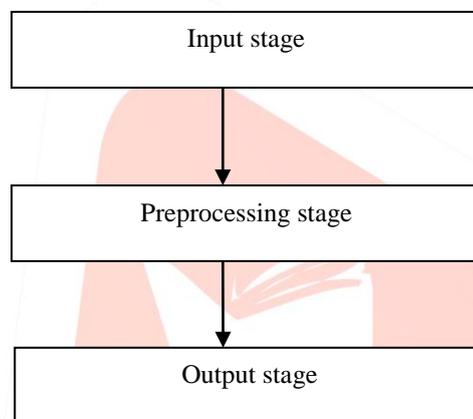


Fig 1. Flow diagram of the Fuzzy system

A fuzzy system consists of the three stages:

- i) Input stage    ii) Processing stage    iii) Output stage
- 1) **Input stage:** Initially stage is the input stage in which the various inputs like switches, etc are taken in accordance with the membership functions and the truth values.
- 2) **Processing stage:** - In this stage the rules are applied and the desired results are obtained and at the end all the obtained results on the basis of rules are combined.
- 3) **Output stage:** - This the final stage in which the combined results are converted back into the specific control output values.

### V. PROPOSED METHODOLOGY

The condition of the heart is defined by the nature of the ECG waveform and heart rate. In the proposed work the disease is detected by using fuzzy logics. Firstly Wavelet transmission is applied for the detection of the peak and after that the Fuzzy system is made that will detect the Arrhythmia diseases.

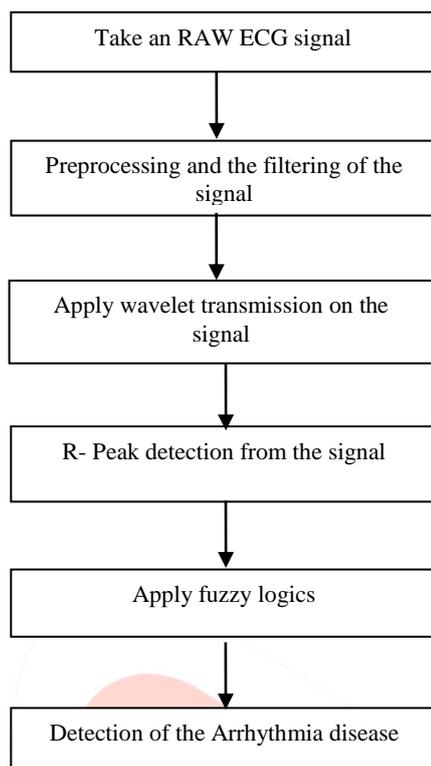


Fig 2. Methodology of proposed work

### Methodology

The methodology of the proposed work is described below. In this proposed methodology two methods are applied firstly the Wavelet transformation is applied for peak detection from the ECG signal and then the fuzzy logics are applied for more accurate detection of the d disease.

- 1) Raw ECG signal is given as the input .
- 2) The preprocessing and the filtration of the signal is done.
- 3) After this the wavelet tranformation is appiled on the filtered signal .
- 4)Now , the R peaks are detected from the signal
- 5)After this apply Fuzzy logics on the detected peaks
- 6)Finally the detection of the arrhythmia diseese are done .

### VI. RESULT AND DISCUSSION

In this section there is discussion about the results of proposed method of detection of the peak in the ECG signal. In this paper an approach is implemented that will various cardiac diseases by detecting the peaks in the ECG signal. In this the wavelet transformation is firstly applied on the signal and the proposed technique is applied .A comparison is made between the traditional method and the proposed method.

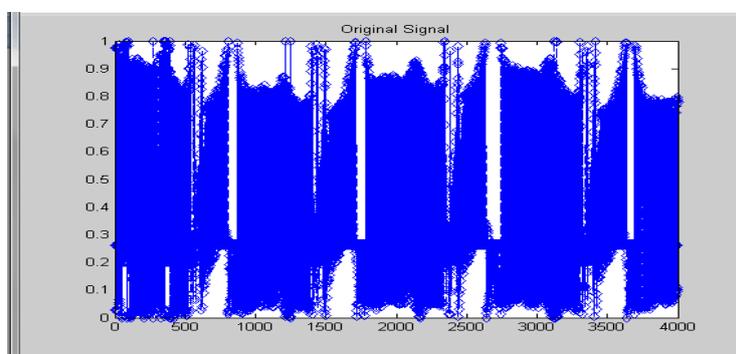


Fig 3. This graph represent the original signal .

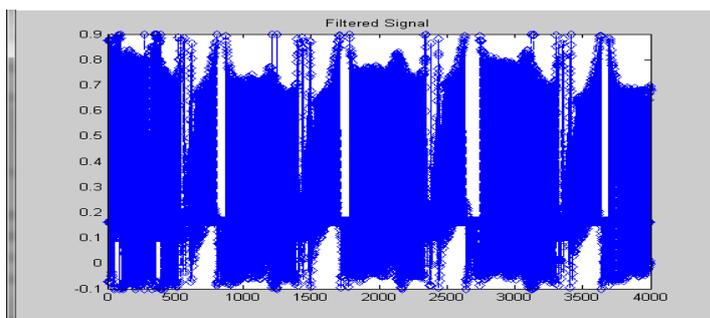


Fig 4. This graph represents the filtered signal

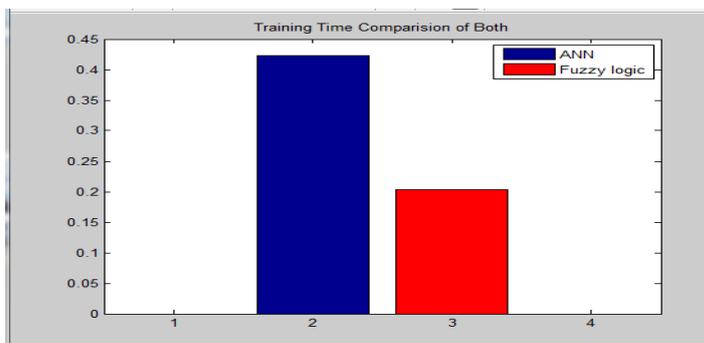


Fig 5. This is a comparison graph between the traditional and the proposed algorithm on the basis of the training time consumption

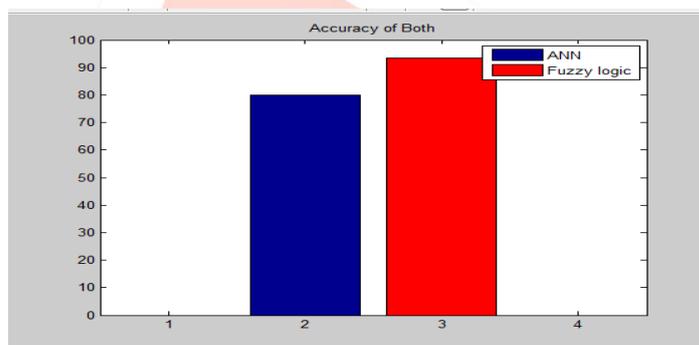


Fig 6. This is a comparison graph between the traditional and the proposed algorithm on the basis of the accuracy of the results obtained.

## VII. CONCLUSION AND FUTURE SCOPE

This paper present an approach for the detection of the R peak in the ECG signal .wavelet transformation and the fuzzy logic are used for the detection of the Arrhythmia diseases. The performance of the proposed algorithm is compared with the traditional method of peak detection in the ECG signal. For the result obtained it is concluded that the proposed algorithm is better than the previously used methods of disease detection. The time taken for the training the system is less than the traditional approach, in addition to this the accuracy of the proposed method is more than traditional method.

It is analysed that the future work can be done on hybrid approaches. By combing the approaches the efficiency of the system can be increases.

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