Chapter 43
Disease Classification Using ECG Signals Based on R–Peak Analysis With ABC and ANN

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ABSTRACT

ECG feature extraction has an important role in identifying a number of cardiac diseases. Lots of work has been done in this field but the most important challenges faced in previous work are the selection of proper R-peaks and R-R intervals due to the lack of appropriate pre-processing steps like decomposition, smoothing, filtering, etc., and the optimization of the features for proper classification. In this article, DWT-based pre-processing and ABC is used for optimization of features which helps to achieve better classification accuracy. It is utilized for initial diagnosis of abnormalities. The signals are taken from MIT-BIH arrhythmia database for the analysis. The aim of the research is to classification of six diseases; Normal, Atrial, Paced, PVC, LBBB, RBBB with an ABC optimization algorithm and an ANN classification algorithm on the basis of the extracted features. Various parameters, like, FAR, FRR, and accuracy are measured for the execution. Comparative analysis is shown of the proposed and the existing work to depict the effectiveness of the work.

INTRODUCTION

Healthcare has always been a challenging frontier for new technological innovations. Artificial Intelligence (AI) is the latest technological advancement. Some healthcare systems are exploring the idea of using artificial intelligence.

Artificial intelligence is not trying to replace the doctors. It is not "man vs. machine". Instead, the future is about working with machines. USP of Artificial Intelligence:

1. Precision
2. Efficiency
3. Speed up process

Applications of AI technology can be panacea for real time diagnosis.
ECG (Electrocardiogram) is a diagnostic tool which is used for assessing:

1. Electrical function of heart;
2. Muscular function of heart (Berkaya et al., 2018).

As it is an easy test to execute, the analysis of ECG tracing needs considerable amount of training. The heart has two stages: electrical pumps with the electrical activity of heart that can be computed with the electrodes within skin.

ECG computes the rhythm and rate of heartbeat and provides indirect confirmation of blood flow towards heart's muscles (Agarwal et al., 2016). A uniform system was implemented for the placement of electrodes for conventional ECG. Ten electrodes are required for generating twelve heart's electrical views. Electrode wires/patches are placed on arms and legs and the remaining six are provided on the chest wall (Omer et al., 2017). Recording of signal received from every electrode is taken after that. Printed view for the records is Electrocardiogram. The monitoring does not comprise of absolute electrocardiogram (Francesca et al., 2018). ECG diagnosis is a challenging domain that require a system that acquire knowledge from examples and real time adaptation.

Big volumes of ECG data are available but the most challenging task is the analysis, interpretation & applications.

So, it is imperative to have system & process which can enhance the knowledge management & learning capabilities of existing systems.

The primary objective of this research work is extracting and analysing the valuable learning from the data to classify Heart disease using Artificial Neural Network on the basis of the knowledge acquisition.

Basic Knowledge About ECG Signal

Knowledge of the fundamental of ECG signal will lay solid groundwork for everything else that is to come.

There are different kind of signals, but ECG signal represents the electrically generated signal during the process of breath inhale and exhale by a human. There are several types of peaks formed such as P, Q, R, S and T.

To determine whether a normal heart rate or diseases is present requires the know-how to calculate the heart rate on the ECG.

Applications of these techniques to both the atrial rate, measured by the rate of the P wave, and the ventricular rate, measured by the rate of the QRS complex.

R-R intervals also play key role to find out the diseases using ECG signal basic knowledge in the medical science. Learning a normal sinus rhythm is based on the R-R intervals of an ECG signal in medical science system.

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