

ABSTRACT

CERTAIN INVESTIGATIONS ON LEVERAGING INFORMATION TECHNOLOGY FOR ENHANCING THE DIAGNOSIS OF CARDIAC DISEASES

The demand for quality cardiac care has thrown challenges to the field of biomedical engineering to devise reliable and faster techniques to enhance the diagnosis of heart diseases.

In this research work (i) two automatic arrhythmia classification systems have been developed. The classification is based on the features derived from intervals between the characteristic waves and the interval time series of the R wave peaks, which are obtained from the ECG signals using Discrete Wavelet Transform (DWT) (ii) the significance of linear (time and frequency domain), nonlinear and combined measures of Heart Rate Variability (HRV) in the classification of certain cardiac diseases has been explored using HRV data obtained from ECG signals (iii) a heart murmur classification system has been developed. Here, DWT has been used to decompose the heart murmur signals into subbands and the coefficients obtained in each subband are used to calculate a set of time-frequency related parameters. An artificial neural network has been developed feeding these parameters as inputs to classify heart murmurs into eight types (iv) a rule-based ECG analyser has been developed. In a 12-lead ECG, clinically useful information is found in the intervals, amplitudes and time durations of the characteristic waves of each ECG lead. The developed analyser uses the lead measurements extracted from the 12 ECG leads for detecting various cardiac abnormalities (v) rule-based expert systems have been developed in consultation with experts for the following : a) Chest pain diagnosis b) ECG analysis and c) Ischemic Heart Disease diagnosis (vi) a web based telecardiology framework for bringing quality health care to the rural sector has been proposed (vii) a teleconsultation framework has been

proposed to provide tools for establishing meaningful communication between general practitioners in remote areas and specialists typically located in large medical centres. The proposed system is a low-cost framework which supports both image and video based consultation, along with the advantage of voice communication facility. In addition to this, the provision of a direct connectivity to a patient with an image acquisition system through internet protocol (IP) based communication enables online consultation. This research work shows that the effective use of information technology for diagnosing cardiac diseases would assist physicians in providing quality and timely healthcare services to the society.