



A REVIEW PAPER ON HEART DISEASE DETECTION USING ECG FEATURES

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Abstract: Heart disease is crucial health problem in human society. This paper has summarized techniques and available methods for predication of heart disease. Hug amount of patient related data that is ECG signal is stored which can be useful for predicting the occurrence of heart disease. There different types of heart diseases that can be detected through ECG signal and there is need of robust method for detecting such diseases by means of classification process. There is variety of classifiers such artificial neural network, support vector machine, k-nearest neighbor which can be adopted for classification purpose.

Keywords- Heart disease data literature review, Classification, Disease diagnosis

I. INTRODUCTION

The field of signal processing is a very important field of study and one that makes possible various other fields such as communications Speech recognition systems also dictation software need for analyzing and processing data to indentify individual words in a spoken sentence. Health monitoring is now becoming part of everyday life. Today's healthcare industry aims to provide better health services to people in an efficient and patient friendly manner. The Electrocardiogram (ECG/EKG) is a graphical representation of the heart electrical activity which will always consider for diagnosing many heart diseases. The electrocardiogram (ECG or EKG) is a diagnostic tool that is routinely used to evaluate the electrical and muscular functions of the heart. The heart works like a two stage electrical pump and the heart's electrical activity can be measured by electrodes placed on the skin. The electrocardiogram can measure the rate and rhythm of the heartbeat; also provide indirect evidence of blood flow to the heart muscle.

There is a system developed for the electrode placement for routine ECG. Ten electrodes are requires to produce 12 electrical views of heart. An electrode patch is placed on each arm and leg and remaining are placed across the chest wall. The signals are recorded which is received from each electrode. And this recorded signal is printed which is electrocardiogram.

By other way, heart monitor requires only three electrode leads to place one on right arm, left arm and chest. This system only measures the rate and rhythm of the heartbeat. This kind of monitoring does not establish a complete ECG. That ECG signal contains some artificial errors, for example due to electrical equipment which are used to measure the ECG that components creates some noise therefore ECG signal get corrupted and correct information will not be reach to the specialists. We can estimate the ECG signal through the shape, duration, and the coordination of waves. In that case wrong decision will be taken by specialist due to wrong disease diagnose. To avoid the wrong diagnosis the filtering of ECG signal is must be needed and also there is requirement for automatic ECG classification system.

Heart plays the most crucial role in circulatory system. Any abnormal activity with heart will lead to serious health conditions including death.

Types of heart disease:

- Bundle Branch Block

If person have bundle branch block, that means electrocardiogram (ECG) is displaying an abnormal and distinctive pattern, and that indicates electrical impulse of your heart is not being distributed normally through your cardiac ventricles.

- Cardiomyopathy

Common abnormalities in ECG associated with atrial and ventricular hypertrophy, left sided changes are seen but there may be signs of biatrial or biventricular hypertrophy. Interventricular conduction delays (eg. LBBB) occur due to cardiac dilatation.

- Dysrhythmia

An abnormal heart beat indicates Dysrthmia. In dysrthmia rhythm may be irregular in its pacing or the heart rate may be low or high. Some dysrhythmias are life threatening and also other dysrhythmias (such as sinus arrhythmia) and normal.

- Myocardial infarction

Myocardial infarction (MI), also called as a heart attack, MI occurs when blood flow decreases or stops to a part of the heart, causing damage to the heart muscle. The most common symptom is chest pain or discomfort which may travel into the shoulder, arm, back, neck or jaw.

II. LITERATURE SURVEY

Numerous methodologies have been proposed and a dense literature is available for ECG signal conditioning and filtering. But all suffer from different limitations.

Nikhil Gawande, Alka Barhatte[1] There are heart diseases like Ischemic heart disease, arrhythmia etc. And diseases can be classified using Electrocardiography (ECG) signal. ECG is used to the display condition of the patient and for the diagnosis and treatment of various types of heart diseases. There are variations of P-wave, QRS complex and T-wave parameters in ECG are used to identify the type of illness. Some heart diseases are not served though other may prove fatal. Therefore classification of heart disease is necessary. To classify various heart diseases, it is intended to implement CNN algorithm.

Vikas Khandait, A A Shirolkar[2]Employment of digital signal filtering on electrocardiogram (ECG) and classification is according to their features that utilizes support vector machine (SVM) in this paper. Automatic detection and classification of noises can improve the noise containing electrocardiogram (ECG).Designed filters are focused on removing artefacts. Moreover, this paper contains SVM algorithm that consists of an automatic classifier to detect the five pathologies. The classifier was tested on the physioNet ECG Database with an accuracy of 96.60 %.

Cheng Sun, Jingsheng Liao, Gang Wang and Baopu [3] A Portable 12-Lead ECG Acquisition System This paper presents a novel design scheme of a collect ECG data which is sent from the control unit to user's mobile phone by using Bluetooth for next processing, storing, and displaying. The three parts are combined together to achieve a small size, wireless and portable ECG acquisition system.

Aditi Gavhane, Gouthami Kokkula, [4] with the rampant increase in the heart stroke rates at juvenile ages, we need to develop the system which is able to detect the symptoms of a heart stroke at an early stage and prevent it. It is not possible for a common man to frequently undergo costly tests like the ECG and thus there needs to be a system in place which is useful and reliable, in predicting the chances of a heart disease. Develop an application which can predict the difference of a heart disease given basic symptoms like age, sex, pulse rate etc. The machine learning algorithm neural networks which provides the most accurate and reliable algorithm and hence used in the proposed system.

Piotrowskia Z.; Rózanowski[5]We present algorithm for Heart Rate detection based on Short-Term Autocorrelation Center Clipping method. This algorithm is for biological signal detection, electrocardiogram, in noisy environment with lot of artifacts. Using this algorithm is also possible detect the R pointers in the PQRST complex of the ECG signal. In this paper the new system for the heart rate variability estimation is also presented. HRV module is based on parametric and non-parametric methods of the power spectral density computation.

Chen, Jenn-Shyong,[6] Signal Filtering Using the Hilbert-Huang Transform, Journal of Science and Engineering Technology This article presents a new tuning approach for an adaptive internal-model-principle based signal identification algorithm whose computational costs are low enough to allow a real-time implementation. The algorithm allows an instantaneous Fourier decomposition of non-stationary signals that have a strongly predictable component.

Surda, J.; Lovas, S.; Pucik, J.; Jus, M.[7] Jus, M. Spectral Properties of ECG Signal. figures utilization of digital signal filtering on electrocardiogram (ECG). Designed filters are focused on removing supply network 50 Hz frequency and breathing muscle artefacts. The direct methods for heart rate detection are ECG signal spectral analyze Short-Term Autocorrelation method Many algorithms for heart rate detection are based on QRS complex detection and hear rate is computed like distance between QRS complexes. QRS complex can be detected using algorithms from the field of artificial neural networks, genetic algorithms, wavelet transforms or filter banks.

I. I. Christov.[8] Real time electrocardiogram QRS detection using combined adaptive threshold. BioMedical Engineering A real-time detection method is proposed, based on comparison between absolute values of summed differentiated electrocardiograms of one of more ECG leads and adaptive threshold. It combines three parameters: an adaptive slew-rate value, a second value which rises when high-frequency noise occurs, and a third one is intended to avoid missing of low amplitude beats. Next is how to detect QRS complex is to use adaptive threshold.

Kohler, B.-U.; Hennig, C.; Orglmeister, R.[9] The principles of software QRS detection. Engineering in Medicine and Biology Magazine proposed to utilize an adaptive threshold technique on spectrogram computed using Short Time Fourier Transform (STFT) for QRS complex detection in electrocardiogram (ECG) signal. The algorithm consists of pre-processing the raw ECG signal to remove the power-line interference, computing the STFT, applying adaptive thresholding technique and followed by identifying QRS peaks.

Hae-Kyung Jung, Do-Un Jeong,[10] Development of Wearable ECG Measurement System Using EMD for Motion Artifact Removal Motion artifact distorted ECG signal is a commonly known issue in mobile ECG recording. In this paper, we present a better technique to replace existing filtering method for distortion free ECG signal. A belt-type ECG measurement system has been developed to measure ECG signal in daily life.

Nygårds, M.; Sörnmo, L. [11] Delineation of the QRS complex using the envelope of the e.c.g. Medical and Biological Engineering and Computing A new algorithm dedicated to electrocardiograph telemetry devices is proposed which evaluates the quality of electrocardiogram signals acquired in unsupervised environments, raises the assurance of the produced diagnoses, and accelerates protective actions when necessary. The proposed algorithm is implemented in conditions when electrocardiogram signals are highly susceptible to artefacts.

Afonso VX, Tompkins WJ, Nguyen TQ, Luo S [12]We have designed a multirate digital signal processing algorithm to detect heartbeats in the electrocardiogram (ECG). The algorithm include a filter bank (FB) which decomposes the ECG into sub bands with uniform frequency bandwidths. Features computed from a set of the sub bands and a heuristic detection strategy is used to accomplish decisions from multiple one-channel beat detection algorithms. The beat detection algorithm has a sensitivity of 99.59% and also positive predictivity of 99.56% against the MIT/BIH database.

Anchana Khemphila, Veera Boonjing[13], introduces a classification using Multi-Layer Perceptron (MLP)with Back- Propagation learning algorithm and a feature selection algorithm along with biomedical test values to diagnose heart disease. But still in some cases wrong diagnosis and treatment are reported. So patients are asked to take number of tests for diagnosis. Our work is to detect and classify heart disease with reduced number of attributes. There are Originally 13 attributes are involved in classify the heart disease. But by using artificial neural network 13 attributes are reduced to 8 attributes.

Yuh-Ren Tsai, Zong-Yi Chang and Chiao-Wei Huang[14]For the applications of automatic disease diagnosis based on electrocardiogram (ECG) signals, precise R-peak detection is complex in ECG signal analysis. In this paper a time-domain multi-level detection algorithm for R-peak detection in ECG signals. The proposed R-peak detection algorithm is an adaptive threshold-based method, which maintains very good accuracy with low computational complexity. In addition, the proposed algorithm does not distort the original ECG signals for facilitating disease diagnosis based on ECG signals.

Alē's Proch'azka and Jarom'ir Kukal Old'rich Vy'sata[15]very common problems in various engineering, economical and biomedical applications is Segmentation, feature extraction and classification of signal components belong to . In this system they use of discrete wavelet transform (DWT) both for signal preprocessing and signal segments feature extraction as an alternative to the commonly used discrete Fourier transform (DFT). Comparison of classification results using different methods of feature extraction most appropriate for EEG signal components detection are given in this work.

Swathi. O. N, Ganesan. M, Lavanya[16] In this work they have developed an algorithm for classifying the ECG signals into normal and arrhythmic signal. Here they have detected the R peaks from noise removed ECG signal with an accuracy of 97.56%. Extracted features from the signal are in time and frequency domain and signal are classified using support vector algorithm. The algorithm is tested by applying on MIT-BIH arrhythmia dataset they obtained overall 80% classifier accuracy.

Pratik D. Sherathia, Prof. V. P. Patel [17] Herat is most common disease and its functioning at older age is complicated. Electrocardiogram (ECG) is the most useful tool in modern tools. This paper provides review and compare various techniques of R peak detection in ECG feature extraction. The various techniques suggested by different researchers are compared using standard MIT-BIH ECG data. The results obtained are compared for Sensitivity and Positive Predictive Accuracy as quality factors.

Shemi P.M., Shareena E.M [18] Noise removing considered as one of the important tasks in signal processing. For detecting heart diseases ECG signal analysis is very important. Due to amplitude and frequency variation of ECG signals due to corruption of noises. Therefore it cause problems to detect the actual abnormality. This paper provides performance comparison of denoising of ECG signals based on different wavelet transform techniques is implemented. Discrete wavelet transform (DWT) and its expansive forms such as double-density discrete wavelet transform (DDDWT), dualtree discrete wavelet transform (DTDWT) and double-density dual-tree discrete wavelet transform (DDTDWT) techniques employing thresholding algorithm are presented for noise removal. ECG signals taken from MIT-BIH arrhythmia database contained noise and used for the analysis. From results of MATLAB simulations we may get that the algorithm based on double-density dual-tree discrete wavelet transform is more effective and gives better performance in terms of both SNR and RMSE.

Rachid HADDADI, Elhassane ABDELMOUNIM, Mustapha EL HANINE [19]In this paper they proposes the application of Discrete Wavelet Transform (DWT) to detect the QRS of an electrocardiogram (ECG) signal. Wavelet Transform provides localization in time and frequency. DWT is used in pre-processing stage remove the baseline wander in the ECG signal. Performance of algorithm QRS detection is evaluated against the standard MIT BIH (Massachusetts Institute of Technology, Beth Israel Hospital) Arrhythmia database.

III. CONCLUSION AND FUTURE WORK

By using different types of data mining and machine learning techniques to predict the occurrence of heart disease have summarized. The variations in heart rate, distance between R peaks and wavelet coefficient are three main characteristics feature considered and extracted from ECG signal. Some methods of deep learning has been discussed which can be implemented for heart disease predication.

IV. ACKNOWLEDGMENT

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