Classification of Arrhythmia by Using Deep Learning with 2-D ECG Spectral Image Representation

LITERATURE REVIEW

Survey 1:

M. Vijayavanan, V. Rathikarani, and P. Dhanalakshmi (2014)

"Automatic classification of ECG signal for heart disease diagnosis using morphological features,"

An Electrocardiogram (ECG) is a test that records the electrical activity of the heart to locate the abnormalities. Automatic ECG classification is an emerging tool for the cardiologists in medical diagnosis for effective treatments. In this paper, we propose efficient techniques to automatically classify the ECG signals into normal and arrhythmia affected (abnormal) category. For these categories morphological features are extracted to exemplify the ECG signal. Probabilistic neural network (PNN) is the modeling technique engaged to capture the distribution of the feature vectors for classification and the performance is calculated. ECG time series signals in this work are collected from MIT-BIH arrhythmia database. The proposed an accurately classify and discriminate the difference between normal ECG signal and arrhythmia affected signal with 96.5% accuracy.

Survey 2:

P. B. Sakhare and R. Ghongade (2015)

"An approach for ECG beats classification using adaptive neuro fuzzy inference system,"

Electrocardiogram (ECG) is non-stationary signal as it contains the vital information about the heartbeat. Any problem associated with the heart is visible in the ECG as distortion or noise. By only ECG we can detect the arrhythmia. In arrhythmias the ECG signals become complicated and it is not easy to be understood as it contains number of heart beats, for analyzing it requires more time. So the major task is automatic classification of ECG signal while it reduces the cost, complexity and time of the system.

The project focuses on the biomedical signal processing based approach for the automatic classification of ECG signal. We extracted the useful feature of ECG signals, this features are the combination of morphological based and proper statistical features proposed. Once the features extraction is done Adaptive Neuro Fuzzy Inference System (ANFIS) will train to classify the ECG pattern. We are classify the three classes of ECG signals as Normal, left bundle branch block beat (LBBBB) and Premature ventricular contraction (PVC). ANFIS is used for the classification purpose that correctly identifies the three classes. The result indicates a high level of accuracy more than 96%.

Survey 3:

L. S. C. de Oliveira, R. V. Andreao, and M. Sarcinelli Filho (2016)

"Bayesian network with decision threshold for heart beat classification,"

This work proposes a Dynamic Bayesian Network approach (BN) to support medical decision making in the problem of beat classification in electrocardiograms. The BN takes the uncertainty into consideration when making a decision every time new evidence is available. Moreover, the certainty related to the beat classification can be controlled through a threshold adjusted by the specialist. The performance of the BN based classifier is assessed through the MIT-BIH database, considering two beat classes: Premature Ventricular Beat (PVC class) and Other (gathering all other beat classes). The BN with probability threshold of 0.75 achieved scores of Sensitivity and Positive Predictive of 99% for the PVC beats. The results show that the BN framework is a promising tool for classifying cardiac arrhythmias.

Survey 4:

P. Li, Y. Wang, and J. He (2017)

"High-performance personalized heartbeat classification model for long-term ECG signal,"

Long-term electrocardiogram (ECG) has become one of the important diagnostic assist methods in clinical cardiovascular domain. Long-term ECG is primarily used for the detection of various cardiovascular diseases that are caused by various cardiac arrhythmia such as myocardial infarction, cardiomyopathy, and myocarditis. In the past few years, the development of an automatic heartbeat classification method has been a challenge. With the accumulation of medical data, personalized heartbeat classification of a patient has become possible.

For the long-term data accumulation method, such as the holter, it is difficult to obtain the analysis results in a short time using the original method of serial design. The pressure to develop a personalized automatic classification model is high. To solve these challenges, this paper implemented a parallel general regression neural network (GRNN) to classify the heartbeat, and achieved a 95% accuracy according to the Association for the Advancement of Medical Instrumentation. We designed an online learning program to form a personalized classification model for patients. The achieved accuracy of the model is 88% compared to the specific ECG data of the patients. The efficiency of the parallel GRNN with GTX780Ti can improve by 450 times.

Survey 5:
A. H. Khan, M. Hussain, and M. K. Malik, (2021)

"Cardiac disorder classification by electrocardiogram sensing using deep neural network,"

Cardiac disease is the leading cause of death worldwide. Cardiovascular diseases can be prevented if an effective diagnostic is made at the initial stages. The ECG test is referred to as the diagnostic assistant tool for screening of cardiac disorder. The research purposes of a cardiac disorder detection system from 12-lead-based ECG Images. The healthcare institutes used various ECG equipment that present results in nonuniform formats of ECG images. The research study proposes a generalized methodology to process all formats of ECG. Single Shoot Detection (SSD) MobileNet v2-based Deep Neural Network architecture was used to detect cardiovascular disease detection. The study focused on detecting the four major cardiac abnormalities (i.e., myocardial infarction, abnormal heartbeat, previous history of MI, and normal class) with 98% accuracy results were calculated. The work is relatively rare based on their dataset; a collection of 11,148 standard 12-lead-based ECG images used in this study were manually collected from health care institutes and annotated by the domain experts. The study achieved high accuracy results to differentiate and detect four major cardiac abnormalities. Several cardiologists manually verified the proposed system's accuracy result and recommended that the proposed system can be used to screen for a cardiac disorder.

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