CLASSIFICATION OF ARRHYTHMIA BY USING DEEP LEARNING WITH 2-D ECG SPECTRAL IMAGE REPRESENTATION

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INTRODUCTION

Recently, cardiovascular diseases (CVDs) are the main causes of sudden death and heart failure. ECG is a tool that records the electrical activity of myocardium when state of contraction and relaxation. A normal heartbeat varies with age, body size, activity, and emotions and other aspects.In cases where the heartbeat feels too fast or slow, the condition is known as abnormal. An arrhythmia does not necessarily mean that the heart is beatingtoo fast or slow, it indicates that the heart is following an irregular beating pattern. It could mean that the heart is beating too fast means tachycardia(more than 100 beats per minute (bpm)) or slow means bradycardia (less than 60 bpm), skipping a beat, or in extreme cases, cardiac arrest. An accurate classification of these types could help in diagnosing and treatment of heart disease patients. Arrhythmia could either mean a slow or fast beating of heart. An automated detection of such patterns is of great significance in clinical practice. Therefore, this project aims to identify CVDs using deep learning techniques, which could effectively reduce the mortality rate by providing a timely treatment.

LITERATURE SURVEY

Title: ECG beats classification using waveform similarity and RR interval

Author's Name: Ahmad Khoureich Ka

Year:2011

Description: The proposed method of ECG beat classification is based on waveform similarity and RR interval. The proposed classifier is a patient-specific classifier. A beat database of the patients' ECG is created for the classifier. In the proposed method the wavelet transform based techniques were used to denoise the ECG signal. And a Java implementation to reduce noise due to the baseline wander cancellation and high oscillation noise is used. RR intervals are extracted and used as features. Classification is done using neural networks or fuzzy logic. Experimental results achieved high accuracy for the classification of beats.

Title: An arrhythmia classification system based on the RR interval signal

Author's Name: Tsipouras MG, Fotiadis DI, Sideris D

Year: 2005

Description: Tsipouras et al presents an efficient method based on knowledge-based systems for arrhythmia beat classification and arrhythmic episode detection and classification. The proposed method was based on the RR interval extracted from the ECG signal. A set of rules and a deterministic automaton based on RR interval behavior during arrhythmic episodes are formed, which are used to classify beats and arrhythmic episodes. The proposed method was evaluated using the MIT-BIH arrhythmia database. Experimental results showed that the proposed method achieved high accuracy in both beat and episode classification.

Title: Arrhythmia Classification of ECG Signals Using Hybrid Features

Author's Name: Anwar S.M, Gul M, Majid M, Alnowami M

Year: 2018

Description: Anwar S.M et al proposed a new technique for automatic heartbeat classification of all types of arrhythmias was presented. An improved hybrid feature representation of heartbeat segments was used based on a mixture of a set of derived morphological and dynamic features. The classification was done using twelve ICA projection coefficients computed from the DWT features, plus four RR interval features, and Teager energy value. Two types of evaluation schemes, class- and subject-oriented, were implemented for analyzing the system. On the standard benchmark of MIT-BIH arrhythmia database and MIT-BIH supraventricular arrhythmia database, an average accuracy of with a peak accuracy in a single fold of in the class-oriented evaluation was achieved. An accuracy of in the subject-oriented evaluation was achieved. In future, an automatic patient customization scheme will be considered, allowing the heartbeat classification method to be able to adjust to individual physiological features using wearable sensors.

Title: Multiclass classification of cardiac arrhythmia using improved feature selection and SVM invariants

Author's Name: Mustaqeem, A.; Anwar, S.M.; Majid, M

Year: 2018

Description: Mustaqeem et al proposes a method for multiclass classification of arrhythmia using ECG records with three different SVM based approaches. A wrapper-based feature

selection method is proposed for selecting the most significant features to reduce the dimensions of data. The data is also normalized to avoid conflicts occurring due to the presence of binary values. SVM based methods including one-against-all, one-against-one, and error correcting codes are then applied on the normalized data to detect the presence or absence of disease and classify the records into one of the sixteen given classes. The feature selection, preprocessing, and classification techniques have produced a combination which provides promising results for disease classification. The classification results indicate that one-against-one method is best suited for classification on the ECG dataset taken from UCI repository. Some other classifiers are also implemented using the proposed WFS and normalization approaches and the results show that the proposed method outperforms other state-of-the-art methods employed for classification of arrhythmia using similar dataset. The potential of the one-against-one method suggests that it can be improvised to be used on other disease datasets as well.

Title: Cardiologist-level arrhythmia detection with convolutional neural networks

Author's Name: Rajpurkar P, Hannun, A.Y,Haghpanahi, M, Bourn, C,Ng, A.Y

Year:2017

Description: Rajpurkar.P et al proposed a model which exceeds the cardiologist performance in detecting a wide range of heart arrhythmias from single-lead ECG records. Key to the performance of the model is a large, annotated dataset and a very deep convolutional network which can map a sequence of ECG samples on the clinical side, future work should investigate extending the set of arrhythmias and other forms of heart disease which can be automatically detected with high accuracy from single or multiple lead ECG records. For example, we do not detect Ventricular Flutter or Fibrillation. We also do not detect Left or Right Ventricular Hypertrophy, Myocardial Infarction or several other heart diseases which do not necessarily exhibit as arrhythmias. Some of these may be difficult or even impossible to detect on a single-lead ECG but can often be seen on a multiple-lead ECG.

OUR PROBLEM STATEMENT

 In this project, first we build an effective electrocardiogram (ECG) arrhythmia classification method using a convolutional neural network (CNN), in which we classify ECG into seven categories, one being normal and the other six being different types of arrhythmias using deep two-dimensional CNN with grayscale ECG images. Then, we are creating a web application where the user selects the image which is to be classified. The image is fed into the model that is trained and the cited class will be displayed on the webpage.

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