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

Literature survey

S. No	Paper Title	Abstract	Disadvantages
1.	An improved cardiac arrhythmia classification using an RR interval-based approach	Accurate and early detection of cardiac arrhythmia present in an electrocardiogram (ECG) can prevent many premature deaths. Cardiac arrhythmia arises due to the improper con- duction of electrical impulses throughout the heart. In this paper, we propose an improved RR interval-based cardiac arrhythmia classification approach. The Discrete Wavelet Trans- form (DWT) and median filters were used to remove high-frequency noise and baseline wander from the raw ECG. Next, the processed ECG was segmented after the determination of the QRS region. We extracted the primary feature RR interval and other statistical fea- tures from the beats to classify the Normal, Premature Ventricular Contraction (PVC), and Premature Atrial Contraction (PAC). The K-Nearest Neighbour (k-NN), Support Vector Machine (SVM), Decision Tree (DT), Naı ̈ve Bayes (NB), and Random Forest (RF) classifier	Only the intra-patient validation was considered for this research thus, the results cannot reflect the generalization performance of the model

		were utilised for classification. Overall performance of SVM with Gaussian kernel achieved Se % = 99.28, Sp % = 99.63, +P % = 99.28, and Acc % = 99.51, which is better than the other classifiers used in this method. The obtained results of the proposed method are signifi-cantly better and more accurate.	
2.	Classification of ECG Arrhythmia using Recurrent Neural Networks	In this paper, Recurrent Neural Networks (RNN) have been applied for classifying the normal and abnormal beats in an ECG. The primary aim of this paper was to enable automatic separation of regular and irregular beats. The MIT-BIH Arrhythmia database is being used to classify the beat classification performance. The methodology used is carried out using huge volume of standard data i.e. ECG time-series data as inputs to Long Short Term Memory Network. We divided the dataset as training and testing sub-data. The effectiveness, accuracy and capabilities of our methodology ECG arrhythmia detection is demonstrated and quantitative comparisons with different RNN models have also been carried out.	Recurrent Neural Networks (RNN) being used for this research is more suitable to handle temporal or sequential data. Convolutional Neural Network (CNN) has multiple convolutional filters working and scanning the complete feature matrix of the image making it a better choice compared to RNN.
3.	ECG-based heartbeat classification for arrhythmia detection: A survey	An electrocardiogram (ECG) measures the	Implementation and inverse of Continuous

		electric activity of the heart and has been widely used for detecting heart diseases due to its simplicity and non-invasive nature. By analyzing the electrical signal of each heartbeat, i.e., the combination of action impulse waveforms produced by different specialized cardiac tissues found in the heart, it is possible to detect some of its abnormalities. In the last decades, several works were developed to produce automatic ECG-based heartbeat classification methods. In this work, we survey the current state-of-the-art methods of ECG-based automated abnormalities heartbeat classification by presenting the ECG signal preprocessing, the heartbeat segmentation techniques, the feature description methods and the learning algorithms used. In addition, we describe some of the databases used for evaluation of methods indicated by a well-known standard developed by the Association for the Advancement of Medical Instrumentation (AAMI) and described in ANSI/AAMI EC57:1998/(R)2008 (ANSI/AAMI, 2008). Finally, we discuss limitations and drawbacks of the methods in the	Wavelet Transform (CWT) used in this paper are not readily available in the widely used tool boxes. A better choice would be to use Discrete Wavelet Transform.

		literature presenting concluding remarks and future challenges, and also we propose an evaluation process workflow to guide authors in future works.	
4.	A deep learning approach for ECG-based heartbeat classification for arrhythmia detection	Classification is one of the most popular topics in healthcare and bioinformatics, especially in relation to arrhythmia detection. Arrhythmias are irregularities in the rate or rhythm of the heartbeat which, in some cases, may occur sporadically in a subject's daily life. To capture these infrequent events, a Holter device is usually employed to record long-term ECG data. Therefore, the automatic recognition of abnormal heartbeats from a large amount of ECG data is an important and essential task. In the last two decades, a huge number of methods have been proposed to address the problem of ECG beat classification. At the same time, deep learning has advanced rapidly since the early 2000s and now demonstrates a state-of-the-art performance in various fields. In this paper, we propose a novel deep learning approach for ECG beat classification. We have conducted the experiments on the well-known MIT–BIH Arrhythmia	Although vectorcardiogram (VCG) based features can provide comprehensive information about the heart condition, the reconstruction of the VCG requires more leads and thus the applicability of these features is rather limited.

		Database, and compared our results with the scientific literature. The final results show that our model is not only more efficient than the state of the art in terms of accuracy, but also competitive in terms of sensitivity and specificity	