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

RAHUL. C-**(Team leader)**

Vignesh. P-**(Member)**

SURAVARAPU SAI CHARAN REDDY-**(Member)**

Mythiresh G-**(Member)**

LITERATURE SURVEY

S.NO	TITTLE	AUTHOR	ABSTRACT
1.	CLASSIFICATION ARRHYTHMIA BY USING DEEP LEARNING WITH 2-D ECG SPECTRAL IMAGE REPRESENTATION (2020)	AMIN ULLAH[1] SYED MUHAMMAD ANWAR[2] MUHAMMAD BILAL[3] RAJA MAJID MEHMOOD[4]	The electrocardiogram (ECG) is one of the most extensively employed signals used in the diagnosis and prediction of cardiovascular diseases (CVDs). The ECG signals can capture the heart's rhythmic irregularities, commonly known as arrhythmias. A careful study of ECG signals is crucial for precise diagnoses of patients' acute and chronic heart conditions. In this study, we propose a two-dimensional (2-D) convolutional neural network (CNN) model for the classification of ECG signals into eight classes; namely, normal beat, premature ventricular contraction beat, paced beat, right bundle branch block beat, left bundle branch block beatpremature , atrial contraction beat, ventricular flutter wave beat, and ventricular escape beat. The one-dimensional ECG time series signals are transformed into 2-D spectrograms through a short-time Fourier transform. The 2-D CNN model consisting of four convolutional layers and four pooling layers is designed for extracting robust features from the input spectrograms. Our proposed methodology is evaluated on

			a publicly available MIT-BIH arrhythmia dataset. We achieved a state-of-the-art average classification accuracy of 99.11%, which is better than those of recently reported results in classifying similar types of arrhythmias. The performance is significant in other indices as well, including sensitivity and specificity, which indicates the success of the proposed method.
2.	FRACTAL ANALYSIS OF THE ELECTROCARDIOGRAM SIGNAL (2014)	IBTICEME SED JEL MACI[1] F.BEREKSI-REGUIG[2]	In this paper, the analysis of the electrocardiogram (ECG) signal is carried out according to a non-linear approach. This concerns the eventual fractal behavior of such a signal and the correlation of such behavior with normal and pathological ECG signals. The analysis is carried out on different ECG signals taken from the MIT-BIH arrhythmia database. In fact these signals are those of six subjects with different ages and presenting both normal and abnormal arrhythmias situations. The abnormal situations are atrial premature beat (APB), premature ventricular contraction (PVC), right bundle branch block (RBBB) and left bundle branch block (LBBB). The fractal behavior of these signals is analyzed according to the determination of the multifractal spectrum and the fractal dimension variations and looking for eventually a fractal signature of each heart disease and age of the subject. The obtained results show a fractal signature according to the age and the pathologies for the studied cases. However further investigations are required on larger databases to confirm such results.
3.	ECG BEATS CLASSIFICATION	MANAB KUMAR DAS[1]	Classification of electrocardiogram (ECG) signals plays an important role

	USING MIXTURE OF FUTURES(2014)	SAMIT ARI[2]	in clinical diagnosis of heart disease. This paper proposes the design of an efficient system for classification of the normal beat (N), ventricular ectopic beat (V), supraventricular ectopic beat (S), fusion beat (F), and unknown beat (Q) using a mixture of features. In this paper, two different feature extraction methods are proposed for classification of ECG beats: (i) S-transform based features along with temporal features and (ii) mixture of ST and WT based features along with temporal features. The extracted feature set is independently classified using a multilayer perceptron neural network (MLPNN). The performances are evaluated on several normal and abnormal ECG signals from 44 recordings of the MIT-BIH arrhythmia database. In this work, the performances of three feature extraction techniques with MLP-NN classifiers are compared using five classes of ECG beats recommended by AAMI (Association for the Advancement of Medical Instrumentation) standards. The average sensitivity performances of the proposed feature extraction technique for N, S, F, V, and Q are 95.70%, 78.05%, 49.60%, 89.68%, and 33.89%, respectively. The experimental results demonstrate that the proposed feature extraction techniques show better performances compared to other existing features extraction techniques
4.	CLASSIFICATION OF CARDIAC ARRHYTHMIAS USING DEEP LEARNING(2018)	JEONG HWAN KIM[1] JEONG WHAN LEE[2] KYEONG SEOP	The main objective of this research is to design Deep Learning (DL) architecture to classify an electrocardiogram (ECG) signal into normal sinus rhythm (NSR), premature ventricular contraction (PVC), atrial premature contraction (APC) or

		KIM[3]	right/left bundle branch block (RBBB/LBBB) arrhythmia by empirically optimizing the numbers of hidden layers, the number of neurons in each hidden layer and the number of neurons in input layer in DL model.Methods/Statistical analysis: For our experimental simulations, PhysioBank-MIT/BIH annotated ECG database was considered to classify heart beats into abnormal rhythms (PVC, APC, RBBB, LBBB) or normal sinus. The performance of classifying ECG beats by the proposed DL architecture was evaluated by computing the overall accuracy of classifying NSR or four different arrhythmias.Findings: Base on testing MIT/BIH arrhythmia database, the proposed DL model can classify the heart rhythm into one of NSR, PVC, APC, RBBB or LBBB beat with the mean accuracy of 95.5% by implementing DL architecture with 200 neurons in input layer, 100 neurons in the first and second hidden layer, respectively and 80 neurons in the 3rd hidden layer. Our experimental results show that the proposed DL model might not be quite accurate for detecting APC beats due to its morphological resemblance of NSR. Therefore, we might need to design more sophisticated DL architecture by including more temporal characteristics of APC to increase the classification accuracy of APC arrhythmia in the future research efforts.
5.	INTELLIGENT DEEP MODELS BASED ON SCALOGRAMS OF ELECTROCARDIOGRA M SIGNALS FOR	YEONG-HYEON BYEON[1] SUNG-BUM PAN[2] KEUN-CHANG[3]	This paper conducts a comparative analysis of deep models in biometrics using scalogram of electrocardiogram (ECG). A scalogram is the absolute value of the continuous wavelet transform coefficients of a signal. Since

	BIOMETRICS(2019)	KWAK[4]	biometrics using ECG signals are sensitive to noise, studies have been conducted by transforming signals into a frequency domain that is efficient for analyzing noisy signals. By transforming the signal from the time domain to the frequency domain using the wavelet, the 1-D signal becomes a 2-D matrix, and it could be analyzed at multiresolution. However, this process makes signal analysis morphologically complex. This means that existing simple classifiers could perform poorly. We investigate the possibility of using the scalogram of ECG as input to deep convolutional neural networks of deep learning, which exhibit optimal performance for the classification of morphological imagery. When training data is small or hardware is insufficient for training, transfer learning can be used with pre-trained deep models to reduce learning time, and classify it well enough. In this paper, AlexNet, GoogLeNet, and ResNet are considered as deep models of convolutional neural network. The experiments are performed on two databases for performance evaluation. Physikalisch-Technische Bundesanstalt (PTB)-ECG is a well-known database, while Chosun University (CU)-ECG is directly built for this study using the developed ECG sensor. The ResNet was 0.73%—0.27% higher than AlexNet or GoogLeNet on PTB-ECG—and the ResNet was 0.94%—0.12% higher than AlexNet or GoogLeNet on CU-ECG.
6.	STUDY OF CARDIAC ARRHYTHMIA CLASSIFICATION BASED ON CONVOLUTIONAL	YONGHUI DAI[1] BO XU SIYU YAN[2]	Cardiovascular disease is one of the diseases threatening the human health, and its diagnosis has always been a research hotspot in the medical field. In particular, the diagnosis

	NEURAL NETWORK(2020)	JING XU[3]	technology based on ECG (electrocardiogram) signal as an effective method for studying cardiovascular diseases has attracted many scholars? attention. In this paper, Convolutional Neural Network (CNN) is used to study the feature classification of three kinds of ECG signals, which include sinus rhythm (SR), Ventricular Tachycardia (VT) and Ventricular Fibrillation (VF). Specifically, different convolution layer structures and different time intervals are used for ECG signal classification, such as the division of 2-layer and 4-layer convolution layers, the setting of four time periods (1s, 2s, 3s, 10s), etc. by performing the above classification conditions, the best classification results are obtained. The contribution of this paper is mainly in two aspects. On the one hand, the convolution neural network is used to classify the arrhythmia data, and different classification effects are obtained by setting different convolution layers. On the other hand, according to the data characteristics of three kinds of ECG signals, different time periods are designed to optimize the classification performance. The research results provide a reference for the classification of ECG signals and contribute to the research of cardiovascular diseases.
7.	ECG HEARTBEAT CLASSIFICATION BASED ON AN IMPROVED RESNET-18 MODEL(2021)	ENBIAO JING[1] HAIYANG ZHANG[2] ZHIGANGLI[3] YAZHI LIU[4]	Based on a convolutional neural network (CNN) approach, this article proposes an improved ResNet-18 model for heartbeat classification of electrocardiogram (ECG) signals through appropriate model training and parameter adjustment. Due to the unique

		ZHANLIN JI[5]	residual structure of the model, the utilized CNN layered structure can be deepened in order to achieve better classification performance. The results of applying the proposed model to the MIT-BIH arrhythmia database demonstrate that the model achieves higher accuracy (96.50%) compared to other state-of-the-art classification models, while specifically for the ventricular ectopic heartbeat class, its sensitivity is 93.83% and the precision is 97.44%.
8.	AUTOMATIC ECG DIAGNOSIS USING CONVOLUTIONAL NEURAL NETWORK(2020)	ROBERTA VANZATO[1] FRANCESCO BERITELLI[2]	Cardiovascular disease (CVD) is the most common class of chronic and life-threatening diseases and, therefore, considered to be one of the main causes of mortality. The proposed new neural architecture based on the recent popularity of convolutional neural networks (CNN) was a solution for the development of automatic heart disease diagnosis systems using electrocardiogram (ECG) signals. More specifically, ECG signals were passed directly to a properly trained CNN network. The database consisted of more than 4000 ECG signal instances extracted from outpatient ECG examinations obtained from 47 subjects: 25 males and 22 females. The confusion matrix derived from the testing dataset indicated 99% accuracy for the “normal”

			class. For the “atrial premature beat” class, ECG segments were correctly classified 100% of the time. Finally, for the “premature ventricular contraction” class, ECG segments were correctly classified 96% of the time. In total, there was an average classification accuracy of 98.33%. The sensitivity (SNS) and the specificity (SPC) were, respectively, 98.33% and 98.35%. The new approach based on deep learning and, in particular, on a CNN network guaranteed excellent performance in automatic recognition and, therefore, prevention of cardiovascular diseases