# LITERATURE SURVEY

**[1]**

**Title: A Novel Deep Arrhythmia-Diagnosis Network for Atrial Fibrillation Classification Using electrocardiogram Signals**

**Year: 2019**

**Authors: HAO DANG, MUYI SUN , GUANHONG ZHANG, XINGQUN QI ,XIAOGUANG ZHOU, AND QING CHANG3**

**Description:**

The study describes a novel deep arrhythmia-diagnosis method, named the deep CNN-BLSTM network model, automatically detect the AF heartbeats using the ECG signals. The model mainly consists of four convolution layers: two BLSTM layers and two fully connected layers. The datasets of RR intervals (called set A) and heartbeat sequences (P-QRS-T waves, called set B) are fed into the above-mentioned model. This algorithm provides a new solution for AF automatic detection.

**[2]**

**Title: An Ensemble of Deep Learning-Based Multi-Model for ECG Heartbeats Arrhythmia Classification**

**Year:2021**

**Authors: EHAB ESSA AND XIANGHUA XIE**

**Description:**

A deep learning-based multi-model system is proposed for the classification of electrocardiogram (ECG) signals. Two different deep learning bagging models are introduced to classify heartbeats into different arrhythmia types. The first model (CNN-LSTM) is based on a combination of a convolutional neural network (CNN) and long short-term memory (LSTM) network to capture local features and temporal dynamics in the ECG data. The second model (RRHOS-LSTM) integrates some classical features, RR intervals and higher-order statistics (HOS), with the LSTM model to effectively highlight abnormality heartbeats classes.

**[3]**

**Title: Arrhythmia Recognition and Classification Using Combined Parametric and Visual Pattern Features of ECG Morphology**

**Authors: HUI YANG (Member, IEEE), AND ZHIQIANG WEI**

**Year:2020**

**Description:**

The work proposes a new method combined with a novel morphological feature for the accurate recognition and classification of arrhythmias. First, the events of the ECG signals are detected. Then, parametric features of ECG morphology, i.e., amplitude, interval, and duration, are extracted from selected ECG regions. Next, a novel feature for analyzing QRS complex morphology changes as visual patterns as well as a new clustering-based feature extraction algorithm is proposed. Finally, the feature vectors are applied to three well-known classifiers (neural network, SVM, and KNN) for automatic diagnosis. The proposed method was assessed with all fifteen types of heartbeats as recommended by the Association for Advancement of Medical Instrumentation from the MIT-BIH arrhythmia database.

[4]

**Title: A Multi-Lead-Branch Fusion Network for Multi-Class Arrhythmia Classification Using 12-Lead ECG**

**Year: 2021**

**Authors: JING ZHANG , DENG LIANG1, AIPING LIU  MIN GAO, XIANG CHEN ,XU ZHANG (Member, IEEE), AND XUN CHEN**

**Description:**

Automatic arrhythmia detection using a 12-lead electrocardiogram (ECG) signal plays a critical role in the early prevention and diagnosis of cardiovascular diseases. In this paper, we propose a novel Multi-Lead-Branch Fusion Network (MLBF-Net) architecture for arrhythmia classification by integrating multi-loss optimization to jointly learn the diversity and integrity of multi-lead ECG. We demonstrate our MLBF-Net on China Physiological Signal Challenge 2018 which is an open 12-lead ECG dataset. The experimental results show that MLBF-Net obtains an average F1 score of 0.855, reaching the highest arrhythmia classification performance. The proposed method provides a promising solution for multi-lead ECG analysis from an information fusion perspective**.**

**[5]**

**Title: New Hybrid Deep Learning Approach Using BiGRU-BiLSTM and Multilayered Dilated CNN to Detect Arrhythmia**

**Year: 2022**

**Authors:** MD SHOFIQUL ISLAM , MD NAHIDUL ISLAM  , NORAMIZA HASHIM   (Member, IEEE), MAMUNUR RASHID   (Member, IEEE), BIFTA SAMA BARI ,(Member, IEEE), AND FAHMID AL FARID (Member, IEEE)

**Description:**

The research provides a dual structured and bidirectional Recurrent Neural Network(RNN) method for arrhythmia classification that addresses the issues with multilayered dilated convolution neural network (CNN) models. Initially, the data is preprocessed by Chebyshev Type II filtering which is faster and does not use statistical characteristics. Noise from the preprocessed filter is also removed by using Daubechies wavelet that can able to solve fractal problems and signal discontinuities. Then Z-normalization is done using the Pan-Tompkins normalization technique for the handling of different normally distributed samples. Finally, a generative adversarial network (GAN)-based synthetic signal is generated for recreation of signal to handle imbalanced signal class.Finally, the signals are classified by fully connected layer and Rectified Linear Unit (ReLU) activation function.

[6]

**Title: ECG Arrhythmia Classification By Using Convolutional Neural Network And Spectrogram**

**Year:2019**

**Authors:** Sena Yağmur ŞEN and Nalan ÖZKURT

**Description:**

The author describes, with a large volume of raw ECG time-series data and ECG signal spectrograms as inputs to a deep convolutional neural networks (CNN). Heartbeats are classified as normal (N), premature ventricular contractions (PVC), right bundle branch block (RBBB) rhythm by using ECG signals obtained from MIT-BIH arrhythmia database. The first approach is to directly use ECG time-series signals as input to CNN, and in the second approach ECG signals are converted into time frequency domain matrices and sent to CNN. The proposed system demonstrated high classification rate for the time series data and spectrograms by using deep learning algorithms without standard feature extraction methods. Performance evaluation is based on the average sensitivity, specificity and accuracy values. It is also worth to note that spectrogram increases the performance of classification since it extracts the useful time-frequency information of the signal.

[7]

**Title: Automatic Cardiac Arrhythmia Classification Using Residual Network Combined With Long Short-Term Memory**

**Authors: Kwan Kim , Minji Lee , Hee Seok Song , and Seong-Whan Lee**

**Year:2022**

**Description:**

The author describes a novel framework for automatic classification that combines a residual network with a squeeze- and-excitation block and a bidirectional long short-term memory. Eight-, four-, and two-class performances were evaluated on the MIT-BIH arrhythmia database (MITDB), the MIT-BIH atrial fibrillation database (AFDB), and the PhysioNet/Computing in the cardiology challenge 2017 database (CinC DB), respectively, and they were superior to the performance achieved by conventional methods. To measure the generalization ability of the proposed framework, AFDB and CinC DB were tested using an MITDB- trained model, and superior performance was achieved compared with ShallowConvNet and DeepConvNet. They performed a cross-subject experiment using AFDB and obtained a statistically higher performance using the proposed method compared with typical machine learning methods. The proposed framework can enable the direct diagnosis of arrhythmia types in clinical trials based on the accurate detection of the minority class.

[8]

**Title: Arrhythmia Classification using Deep Learning and Machine Learningwith Features Extracted from Waveform-based Signal Processing**

**Authors: Po-Ya Hsu and Chung-Kuan Cheng**

**Year:2022**

**Description:**

The study presents a waveform-based signal processing (WBSP) method to produce state-of-the-art performance in arrhythmia classification. When performing WBSP, we first filtered ECG signals, searched local minima, and removed baseline wandering. Subsequently, we fit the processed ECG signals with Gaussians and extracted the parameters. Afterwards, we exploited the products of WBSP to accomplish arrhythmia classification with our proposed machine learning-based and deep learning-based classifiers. We utilized MIT-BIH Arrhythmia Database to validate WBSP. Our best classifier achieved 98.8% accuracy. Moreover, it reached 96.3% sensitivity in class V and 98.6% sensitivity in class Q, which both share one of the best among the related works. In addition, our machine learning-based classifier accomplished identifying four waveform components essential for automated arrhythmia classification: the similarity of QRS complex to a Gaussian curve, the sharpness of the QRS complex, the duration of and the area enclosed by P-wave.

[9]

**Title: Classification of Arrhythmia in Time Series ECG Signals Using Image Encoding And Convolutional Neural Networks**

**Authors: Vandith Sreenivas K, Ganesan M, Lavanya R**

**Year:2021**

**Description:**

Electrocardiograph (ECG) signal analysis has been used extensively to study a patient's heart and detect problems like arrhythmia for decades. Manual analysis of ECG in real time is laborious and therefore not practical for doctors. Deep learning helps make this job much easier due to quicker learning of signal features and event prediction. Deep Learning classifiers can help doctors differentiate between normal and abnormal ECG signals based on the basic and advanced features of ECG signals. it focuses on building a Convolutional Neural Network (CNN) to classify arrhythmia in dual channel ECG signals based on images generated by time series to image encoding techniques. The images were fed as input into the deep learning classifier which further classified the signals into various types. Our model achieved an accuracy of 97% for the GAF images and 85% per cent for the MTF images.

**[10]**

**Title: Meta Structural Learning Algorithm With Interpretable Convolutional Neural Networks for Arrhythmia Detection of Multisession ECG**

**Authors: MAYTHAM N. MEQDAD , FARDIN ABDALI-MOHAMMADI1 , AND SEIFEDINE KADRY (Senior Member, IEEE)**

**Year: 2022**

**Description:**

Detection of arrhythmia of electrocardiogram (ECG) signals recorded within several sessions for each person is a challenging issue, which has not been properly investigated in the past. This arrhythmia detection is challenging since a classification model that is constructed and tested using ECG signals maintains generalization when dealing with unseen samples. He has proposed a new interpretable meta structural learning algorithm for this challenging detection. Therefore, a compound loss function was suggested including the structural feature extraction fault and space label fault with GUMBEL-SOFTMAX distribution in the convolutional neural network (CNN) models. The collaboration between models was carried out to create learning to learn features in models by transferring the knowledge among them when confronted by unseen samples.