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

INTRODUCTION:

As cardiovascular diseases (CVDs) are a serious concern to modern medical science to diagnose at an early stage, it is vital to build a classification model that can effectively reduce mortality rates by treating millions of people in a timely manner. An electrocardiogram (ECG) is a specialized instrument that measures the heart's physiological responses. To accurately diagnose a patient's acute and chronic heart problems, an in-depth examination of these ECG signals is essential. The proposed model consists of a convolutional neural network having three convolutional, two pooling, and two dense layers. The proposed model is trained and evaluated on the MIT-BIH arrhythmia and PTB diagnostic datasets. The classification accuracy is 99.16%, which is higher than state-of-the-art studies on similar arrhythmias. Recall, precision, and F1 score of the proposed model are 96.53%, 95.15%, and 99.17%, respectively. The proposed model can aid doctors explicitly for the detection and classification of arrhythmias.

LITERATURE REVIEW:

[1]. Arrhythmias are defined as irregularities in the heartbeat rhythm, which may infrequently occur in a human's life. These arrhythmias may cause potentially fatal complications, which may lead to an immediate risk of life. Thus, the detection and classification of arrhythmias is a pertinent issue for cardiac diagnosis

Advantages:

The results obtained are better as compared to the other existing techniques and will greatly reduce the amount of intervention required by doctors. For future work, the proposed method can be applied over some live ECG signals and Bi-LSTM can be applied instead of LSTM.The results obtained are better as compared to the other existing techniques and will greatly reduce the amount of intervention required by doctors. For future work, the proposed method can be applied over some live ECG signals and Bi-LSTM can be applied instead of LSTM.

Disadvantages:

The model has under-fitting and over-fitting issues, which appear when the model has learnt less than or more than 20 epochs. The over-fitting issue model has a tendency to remember data and is unable to generalise new data, while the under-fitting model has a difficult time testing but is capable of generalising new data.

[2]. Electrocardiogram (ECG) serves as the gold standard for noninvasive diagnosis of several types of heart disorders. In this Study, a novel hybrid approach of deep neural network combined with linear and nonlinear features extracted from ECG And heart rate variability (HRV) is proposed for ECG multi-class classification.

Advantages:

The implementation of Such recent CNNs is very challenging on low-power Embedded devices or wearable devices for long-term Mobile monitoring due to the huge computational Requirements. The hardware design and implementation of The proposed ECG multi-class classification system can be A goal for future investigation.

Disadvantages:

Despite the high performance of the Proposed approach, there are few limitations that can be Investigated in the future. First, the proposed system Requires an automated approach for eliminating all noise And artifact sources from the ECG signals before extracting The ECG features and HRV measures or passing the ECG Signals to the CNN model

]3]. Arrhythmogenic right ventricular cardiomyopathy (ARVC), is an inherited heart muscle disease Characterized by fibro-fatty replacement of the right ventricular myocardium that predisposes patients to Arrhythmia and right ventricular (RV) dysfunction leading in some cases to sudden cardiac death (SCD)

Advantages:

Propose the utilization of a low –Complexity CNN that accomplishes significantly trustworthy classification performance with an Accuracy of 99.98% and 98.6%, a sensitivity of 99.98% and 98.8% and a specificity of 99.96% and 98.25% For the training and testing processes, respectively.

Disadvantages:

Detection and analysis of a heart disease which has Not been widely investigated till now, namely ARVC, based on an everyday medical examination like ECG.

[4]. Cardiovascular diseases (CVDs) are the leading cause of human death. A normal heartbeat varies with age, body size, activity, and emotions. The electrocardiogram (ECG) recordings are widely used for diagnosing and predicting cardiac arrhythmia for diagnosing heart diseases.

Advantages:

1. An accurate taxonomy of ECG signals is extremelyhelpful in the prevention and diagnosis of CVDs.
2. Deep CNN has proven useful in enhancing the accuracy of diagnosis algorithms in the fusion of medicine.

Disadvantages:

1. The present research uses only a single-lead ECG signal.
2. The effect of multiple lead ECG data to further improve experimental cases will be studied in future work.

[5].
It is due human activities such as work, relationship or finance, stress in daily life, and prolonged stress can negatively impact a person's immune system, which can lead to several health problems and aggravate cardiac diseases such as myocardial infarction, hypertension and diabetes.

1. Most deep learning algorithms utilize enormous number of nodes and hidden layers.
2. This increases model and computational complexity, and increases inference time, while degrading the performance of the algorithms.

Advantages:
1. Make a significant impact.
2. Make it easier to automate algorithm.

Disadvantages:
1. We want to use statistical testing to test for bias.
2. variance associated with the aforementioned methods.

[6]. Mapping multichannel time-series data into a more abstract yet informative bidimensional domain and exploring visual patterns help the processing of signals in a wide range of applications. These mappings have benefits including better noise robustness and more options regarding augmentation. Bi-dimensional transformations applied on time-series data have been used in many studies ranging from pattern recognition in patient pathology to emotion detection.

Advantages:
1. Investigated the possibility of visual pattern recognition in information flows and directionality of the interaction between channels by taking advantage of pretrained classifiers.
2. In this technique, spectral and phase information were encoded as a bi-dimensional representation.

Disadvantages:
1. Bi-dimensional maps generated based on estimating direction in the frequency.
2. Domain perform quite well in classification of multichannel non-linear signals using image-based transfer learning.

[7]. The major contribution of this research is to construct a reliable and adaptable deep learning classification approach by combining pre-trained convolutional neural networks with a mixture of higher-order spectrum estimates of arrhythmias ECG information. When employing third cumulants and GoogleNet, the highest average accuracy was reached at 97.8%. The suggested technique is an efficient automated cardiac arrhythmia classification method. It delivers a dependable identification system based on well-established CNN architectures rather than training a deep CNN from scratch.

ADVANTAGES:

- The development of computerized Electrocardiography (ECG) systems has increased the possibility of collecting more ECG data at the clinic or remotely
- This produces a large amount of patient data that needs to be reviewed by a cardiologist.

DISADVANTAGES:

- The disadvantage of CNN algorithms is that it has higher computational processing cost.
- In the absence of access to powerful computational processing, SVM can be a reliable solution.

[8]. Large datasets are necessary for training deep learning models in order for them to function successfully.

- The ECG readings can detect rhythmic anomalies in the heart, often known as arrhythmias.
- The majority of existing solutions for automated AF categorization are based on hand-crafted characteristics.

ADVANTAGES:

1.In this research work a brief study on ECG signals have been performed.

2.The earlier models are unable to get deep analysis.

DISADVANTAGES:

1.The features like alpha, beta, delta and gamma have been analyses and get signal become strong.

2.The earlier models with PSO, GA, RFO and Machine learning are not that much efficient.

[9]. .It is still a challenge to develop an electrocardiography (ECG) interpreter based on ECG basic characteristics because of the uncertainty of ECG delineation. An ECG interpretation gap exists between ECG devices and cardiologists. This study first adopted a deep learning model to delineate ECG features such as P, QRS, and T waves based on 1160 8–10-s lead I or lead II ECG signals from a clinically-used 12-lead ECG device whose ECG device interpretation is AF as a training dataset.

ADVANTAGES:

1. ECG data digitalization, acquisition, and heterogeneous data formats are still impeded by ECG device manufacture.

2.which requires fewer ECG samples and is independent of specific ECGs.

DISADVANTAGES:

1. In addition, the Proposed model and algorithms can be easily applied to other ECGs' interpretations of rare-seen ECG cases.
2. We believe that this study can facilitate artificial intelligence-based applications on ECG interpretation in clinical practice and bridge the gaps between the research and clinical practice.

[10]. Arrhythmias are defined as irregularities in the heartbeat rhythm, which may infrequently occur in a human's life. First, 1D ECG signals are translated into 2D Scalogram images to automate the noise filtering and feature extraction. For future work, the proposed method can be applied over some live ECG signals and BiLSTM can be applied instead of LSTM.

ADVANTAGES:

1.Arrhythmia classification is the most crucial subject in healthcare.

2. An arrhythmia is a rhythm or heart rate irregularity.

DISADVANTAGES:

1.The heavy computing burden caused by the use of CWT is a drawback. We could never achieve a complete inter-subject state, even though doing so will signif_icantly minimise the amount of intervention required by doctors.

2. It will be an excellent Future avenue for researchers. A robust arrhythmia classification algorithm is needed to Address these issues.

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