A REPORT

ON

‘ ECG CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK ’

BY

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UNDER

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Abstract-Electrocardiogram (ECG) can be reliably used as a measure to monitor the functionality of the cardiovascular system. Recently, there has been a great attention towards accurate categorization of heartbeats.While there are many commonalities between different ECG conditions, the focus of most studies has been classifying a set of conditions on a dataset annotated for that task rather than learning and employing a transferable knowledge between different tasks. In this paper, we propose a method based on deep convolutional neural networks for the classification of heartbeats which is able to accurately classify five different arrhythmias in accordance with the AAMI EC57 standard.The CNN architecture is described in detail below.

INTRODUCTION-

Medical technology is quickly being reformed by deep learning since it is able to provide large amounts of data. The main issue is that the accuracy should be high since the life of a patient might depend on it.

ECG is widely used by cardiologists and medical practitioners for monitoring the cardiac health. The main problem with manual analysis of ECG signals, similar to many other time-series data, lies in difficulty of detecting and categorizing different waveforms and morphologies in the signal. For a human, this task is both extensively time-consuming and prone to errors.That is where the machine learning algorithms come into play.

DATASET USED-

The dataset used for the project is from PhysioNet MIT-BIH Arrhythmia .Since a large amount of labelled data is available,it becomes easier to train the neural network.

ARCHITECTURE-

The CNN architecture consists of 3 cnn layers in loop of size 5. Here, all convolution layers are applying 1-D convolution through time and each have 32 kernels of size 5. We also use max pooling of size 5 and stride 2 in all pooling layers. The predictor network consists of five residual blocks followed by two fully-connected layers with 32 neurons each and a softmax layer to predict output class probabilities.The diagram is shown below.
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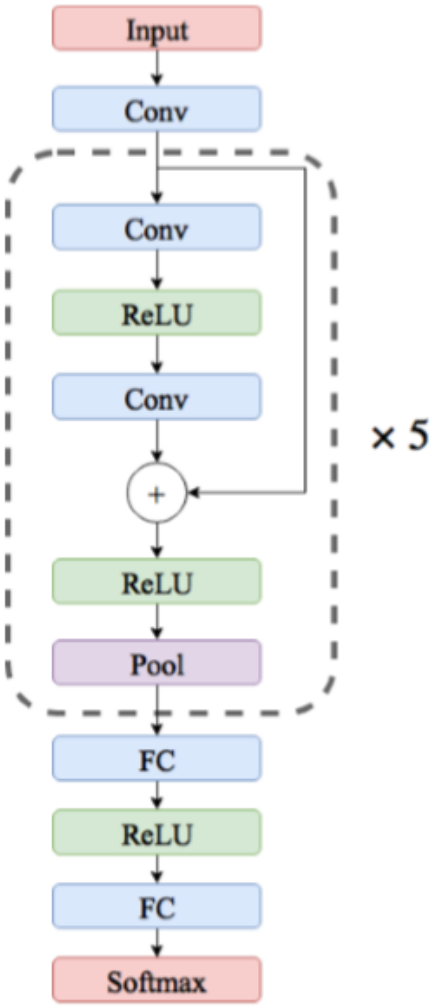


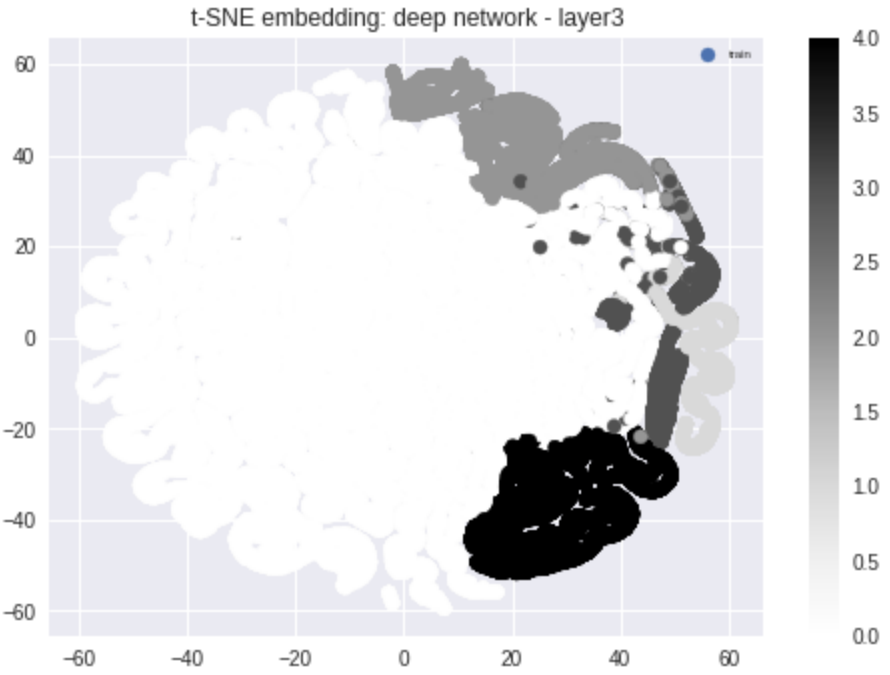
Fig. 2: Architecture of the proposed network.

ACCURACY-

The accuracy obtained from the architecture is 91.35% which is close to the state of the art accuracy(95.2%).

VISUALISATION-

To better understand how the network works we have used tsne to visualise the output of the neural network.The representation is shown below.



Implementation on the Raspberry Pi

Initial stage of the project was done on the google colab(cloud gpu) but in a practical scenario the code will have to run on a small embedded system which can remain pemanently attached to the ECG machine.

Signal Data

The pins of the raspberry pi are not secure enough.That is why we decided to take the data from the pins of an arduino uno instead.The data received from the arduino is stored on the memory card of the raspberry pi

Code

All the codes for this project are uploaded on my github and the link is shared below.

Links and References

- ECG HEARTBEAT CLASSIFICATION:A DEEP TRANSFERABLE REPRESENTATION ,Mohammed Kachuee,University of California,Los Angelos(UCLA)
- Github link for the codes used in the project- https://github.com/mayankmssharma/Signal-Analysis-using-deep-learning