Heartbeat signal classification-Lab 1

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1 Dataset

This dataset is composed of two collections of heartbeat signals derived from two famous datasets in heartbeat classification, the MIT-BIH Arrhythmia Dataset and The PTB Diagnostic ECG Database. The number of the abnormal and normal heartbeat in the PTB dataset is

This dataset has been used in exploring heartbeat classification using deep neural network architectures, and observing some of the capabilities of transfer learning on it. The signals correspond to electrocardiogram (ECG) shapes of heartbeats for the normal case and the cases affected by different arrhythmias and myocardial infarction. These signals are preprocessed and segmented, with each segment corresponding to a heartbeat.

2 Results and methodology

2.1 Model

For the model, I used a dense neural network with activation fucntion of Relu and drop out for prevention of overfitting. And I also used batch normalization so that the model can converge faster.

2.2 Results

Our model at first witnessed a case of unbalanced dataset where the data has much more observations of a single Normal class. For that reason, the model couldn't generalize well and was on track to overfit on a certain class.

This showed that the model does not generalize well

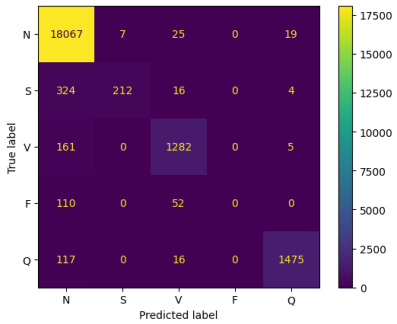

Fig.1 Confusion matrix on training before any data augmentation techniques

enough on the imbalanced data. Furthermore, the model only achieved an accuracy of 0.56 on a test set that is undersampled.

After this I used oversampling to increase the amount of observations for other classes that were less than the normal class and allows it to train on newly augmented data.

This lead to much better classification ability and an accuracy of 96%.

Table1 Comparison of Approaches and Average Accuracy

Work	**Approach**	**Accuracy(%)**
Baseline[2]	Deep residual CNN	93.4
Acharya et al[1]	Augmentation + CNN	93.5
Martis et al[4]	DWT + SVM	93.8
Li et al[3]	DWT + random forest	94.6
My model	**Fully connected**	**96.08**

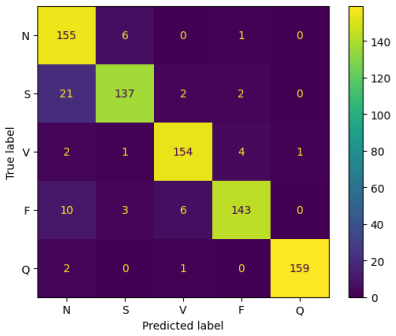

Fig.2 Confusion matrix on the test set after resampling

3 Future work

Possible future work may include trying out certain sequential models like LSTM, Recurrence neural network or using a transformer encoder for better generalization of data.

参考文献

[1] U. Rajendra Acharya, Shu Lih Oh, Yuki Hagiwara, Jen Hong Tan, Muhammad Adam, Arkadiusz Gertych, and Ru San Tan. A deep convolutional neural network model to classify heartbeats. Computers in Biology and Medicine, 89:389–396, 2017.

[2] Mohammad Kachuee, Shayan Fazeli, and Majid Sarrafzadeh. Ecg heartbeat classification: A deep transferable representation. In 2018 IEEE International Conference on Healthcare Informatics (ICHI), page 443–444. IEEE, June 2018.

[3] Taiyong Li and Min Zhou. Ecg classification using wavelet packet entropy and random forests. Entropy, 18(8), 2016.

[4] ROSHAN JOY MARTIS, U. RAJENDRA ACHARYA, CHOO MIN LIM, K. M. MANDANA, A. K. RAY, and CHANDAN CHAKRABORTY. Application of higher order cumulant features for cardiac health diagnosis using ecg signals. International Journal of Neural Systems, 23(04):1350014, 2013. PMID: 23746287.