AF Classification from a short single lead ECG Recording

Midterm Report

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1 Introduction

This project encourages the development of algorithms to classify, from a single short ECG lead recording (between 30s and 60s in length), whether the recording shows normal sinus rhythm, atrial fibrillation (AF), an alternative rhythm, or is too noisy to be classified.

2 Features

The experiments have been conducted with a broad aim of validating the feature creation process as well as observing the performance of the selected algorithms on the test dataset. The features were extracted with the help of biosppy library. The features that were selected for the experiments were:

- Mean Amplitude: The mean value of the amplitudes for the sample
- Std Amplitude: The standard deviation of the amplitudes for the sample
- Max Amplitude: The maximum value of the amplitudes for the sample
- Min Amplitude: The minimum value of the amplitudes for the sample
- Median Amplitude: The median value of the amplitudes for the sample
- Mean R-peaks Difference: The mean value of the difference in time between the r-peaks
- Std R-peaks Difference: The standard deviation of the difference in time between the r-peaks
- Median R-peaks Difference: The median of the difference in time between the r-peaks
- Mean R-peaks Difference Difference: The mean value of the difference of difference in time between the r-peaks

- Std R-peaks Difference Difference: The standard deviation of the difference of difference in time between the r-peaks
- Median R-peaks Difference Difference: The median of the difference of difference in time between the r-peaks
- Heartbeat length: The length of the heartbeats extracted from the signal
- Mean Heart Rate: The mean value of the heart rates extracted from the signal
- Std Heart Rate: The standard deviation of the heart rates extracted from the signal
- Median Heart Rate: The median of the heart rates extracted from the signal
- Mean Heartbeat R-peaks Difference: The mean value of the difference in time between the r-peaks of the heartbeats
- Std Heartbeat R-peaks Difference: The standard deviation of the difference in time between the r-peaks of the heartbeats
- Median Heartbeat R-peaks Difference: The median of the difference in time between the r-peaks of the heartbeats

3 Analysis

We performed cross validation to select the optimal value of the hyper-parameters. The data was partitioned as training set and validation set in the ratio 80-20. The model was trained on the 80% of the samples, the hyper-parameters were learned using the validation set which comprised of 20% of the samples and the performance of the model was evaluated using the test set given. The hyper-parameters were selected by comparing the F1 score the model achieved using them.

3.1 XGBoost

We looked at the variation of feature set size by applying feature selection and the effect of applying PCA with 10 principal components on the F1 score during the implementation of the XGBoost classifier. Both these methods reduced the performance of the classifier on the validation data set. Hence, we used all the features listed above in our classification task. The hyper-parameters considered during the classification task and their values selected after cross validation along with the F1 score on validation set were:

PCA	Max Depth	Number of Rounds	Learning Rate	F1 Score
No	64	64	0.8	0.709
Yes	64	64	0.8	0.613

Table 1: Performance of XGBoost classifier on the validation set

4 Evaluation

The following table shows the F1 score of the XGBoost classifier when evaluated over the testing set provided. The value of the hyper-parameters selected are the ones mentioned above.

Classifier	F1 Score
XGBoost	0.722

Table 2: Performance of XGBoost on the test set