Classification of Paroxysmal Atrial Fibrillation Using Sinus Rhythm Electrocardiograms

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Introduction: Atrial fibrillation (AF) is the most commonly encountered cardiac arrhythmia, increasing the risk of stroke and mortality. Paroxysmal atrial fibrillation (PAF) can be challenging to detect as arrhythmias occur intermittently. A recent study showed that AF was only detected in 34% of patients with PAF when monitoring continuously for 30 days. Rather than trying to detect the arrhythmia, we used machine learning with *sinus rhythm* electrocardiograms (ECGs) from PAF and healthy subjects to detect PAF.

Methods: We extracted a dataset of 362 10-second sinus rhythm ECGs from PTB-XL with half each for healthy and PAF subjects. Various methods have been used in isolation to classify PAF vs. healthy from sinus rhythm ECGs, including complexity, restitution and Symmetric Projection Attractor Reconstruction (SPAR). We extracted features using all three of these methods and combined them into a single feature table. Neighbourhood Component Analysis (NCA) was used to rank the features according to their importance. We then used k-nearest neighbours to perform the classification using the top n features for different values of n.

Results: The classification accuracy taking n as a multiple of 5 is shown in Fig. 1. The best accuracy, of almost 0.68, was obtained using just 5 features which consisted of 4 SPAR features and 1 complexity feature. Using all the features resulted in lower accuracy.

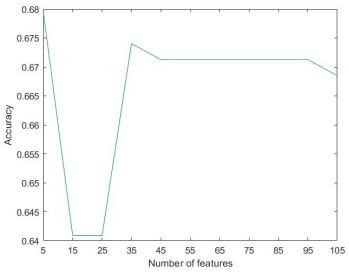

Figure 1: Classification accuracy for the top n features as ranked by NCA.

Conclusions: Using sinus rhythm ECGs to detect PAF is a potentially powerful method of detection, requiring only a 10-second ECG. Combining the features from several methods and using feature selection to obtain the best accuracy is a novel approach. The accuracy using these signals is much higher than with 30 day continuous monitoring when trying to detect an arrhythmia.