

Choosing Electrograms Features for Predicting Catheter Ablation Outcomes for Persistent Atrial Fibrillation

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Introduction: The success rate outcomes of catheter ablation treating persistent atrial fibrillation (persAF) using individual features including dominant frequency, complex fractionated atrial fibrillation, and rotors have been disappointing. We aim to identify most important signal features for positive ablations using a Random Forest (RF) classifier.

Methods: A total of 3206 EGMs (nodes) were collected using non-contact mapping catheter of 10 patients for five minutes duration using (Ensite array, St Jude Medical) system. The EGMs were sampled at 512Hz. 1490 EGMs were labelled

by clinicians as positive responses to ablation and 1716 EGMs were labelled as negative by AF cycle length (AFCL). Features were extracted from the three EGM signal domains (spectral, temporal and statistical domain) using time series feature extraction library (TSFEL) in python. Person's correlation was used to remove high correlated and low variance features. Moreover, feature scaling was applied to the features. The most important features were selected for this classification. These features were used as inputs to RF classifier. Five-fold cross validation (CV) was used for training and testing the classifier, where 80% of data were used as training, and 20% as testing.

Results: A CV accuracy of 98.32% and F1 score of 98.19% were achieved for identifying and classifying the responses of EGMs to catheter ablation, with a sensitivity of 98.39% and specificity of 98.25%.

Conclusions: RF classifier showed the potential model for predicting the responses of EGMs to catheter ablation and finding the most important features of EGMs. The most important features are the FFT mean coefficient in the spectral domain, the mean for the statistical domain, while mean differences is the most significant feature for the temporal domain (see Figure 1). This will further inform the further development of key features for guiding catheter ablation in persAF.

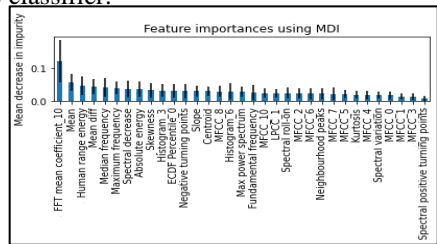


Figure 1: Feature's importance using mean decrease in impurity (MDI)