

Abstract

Premature ventricular contractions (PVCs) occur when the heartbeat is initiated in the ventricles rather than by the sinoatrial node. While isolated PVCs are usually harmless, frequent PVCs can induce ventricular fibrillation or tachycardia and must be treated. When PVCs cannot be suppressed with drugs, catheter ablation is an option. To prepare an ablation procedure, cardiologists need an initial estimate of the PVC origin.

We tested a machine-learning method to localize PVCs using a database of ECGs paced at known locations in 7 virtual patients. For each patient a mesh was created from cardiac imaging data and pacing locations were translated to a reference mesh. We extracted 7 voltage-based and timing-based features from the QRS complexes of the paced beats and used the *Gradient Boosting* method to learn the relation between these features and the origin coordinates. The model was trained repeatedly with upto 6 patients, and tested on the remaining patients.

For all the cases, increasing the number of patients in the training set increased the accuracy on the tested patient, and an optimal number of 25 pacing sites per patient was found, giving us a mean prediction error of about 15 mm.

We conclude that our method gives useful information to efficiently start a catheter ablation procedure. It can be complemented with an intra-procedural method that uses the patient's own paced beats to refine the prediction. Furthermore, the accuracy of the method can be improved by increasing the number of patients in the database.