Automatic Right Ventricular Hypertrophic Detection integrating Electrocardiography-based QRS Biomarkers with Machine Learning

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Context: The electrocardiogram (ECG) is often the initial diagnostic tool employed in patients screening. However, it exhibits limited sensitivity for detecting right ventricular hypertrophy (RVH), primarily due to the overshadowing effects of the left ventricular activation.

Methods: This study addresses this diagnostic challenge by extracting morphological QRS biomarkers from 12-lead recordings to classify RVH patients versus healthy controls. Leveraging a publicly available database comprising 9,001 patients (101 RVH, 8,900 control), we extracted features such as width, amplitudes, slopes between fiducial points, and Hermite transform coefficients. Three algorithms: logistic regression, random forest, and support vector machine were applied after a sequential floating forward selection. The validation was done on an external database (69 RVH, 1,387 controls).

Results: The three classifiers achieved a minimum accuracy of 88% on the independent validation database, with areas under the curve superior to 0.91 (Fig.1). Notably, logistic regression and random forest demonstrated valuable sensitivity, reaching 85% and 87%, respectively. The three or four automatically selected features align with the clinical recommendation guidelines.

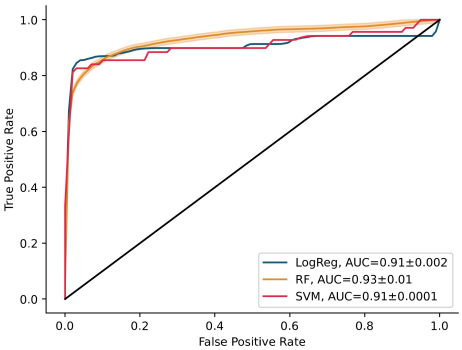

Figure 1: ROC curves of the 3 algorithms: Logistic Regression (LogReg), Random Forest (RF) and Support Vector Machine (SVM), on the validation database.

Conclusions: Sensitive 12 lead ECG classifiers for RVH detection were proposed based on classical extracted biomarker and Hermite function derived features. This finding highlight the benefice of machine learning to gather clinical finding in the ECG automatic detection of RVH.