Estimation of Cardiac and Non-cardiac Discharge Diagnosis from Electrocardiogram Features

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Introduction: Ensuring timely and accurate diagnosis of medical conditions is paramount for effective patient care. Electrocardiogram (ECG) signals are fundamental for evaluating a patient's cardiac health and are readily available. Despite this, little attention has been given to the remarkable potential of ECG data in detecting non-cardiac conditions.

Methods: In our study, we used publicly available datasets (MIMIC-IV-ECG-ICD and ECG-VIEW II) to investigate the feasibility of inferring general diagnostic conditions from ECG features. To this end, we trained a tree-based model (XGBoost) based on ECG features and basic demographic features to estimate a wide range of diagnoses, encompassing both cardiac and non-cardiac conditions.

Results: Out of 1076 considered ICD codes, 54 exceeded an AUROC score of 0.8 in a statistically significant manner. In an external validation with 16 statements from the previous 54 present in both datasets, 12 of these demonstrated statistical significance above 0.80 AUROC stressing the robustness of our results. Our findings underscore the predictive potential of ECG data in identifying well-known cardiac conditions. However, even more striking, this research represents a pioneering effort in systematically expanding the scope of ECG-based diagnosis to conditions not traditionally associated with the cardiac system. These results hold a lot of promise for the integration in multimodal decision support systems for screening purposes.

Selected results from ECG-based Diagnostic Method

Statement	Int.	Ext.
Cardiac conditions		
AVB	0.8617	0.8936
LBBB	0.8589	0.9337
AF	0.8281	0.8158
Non-cardiac conditions		
Cirrhosis	0.8697	0.8748
Alzheimer's	0.8465	0.8857
Dementia	0.8262	0.8782
Prostate neop.	0.8689	0.9057
Prostate hyperp.	0.8922	0.9164

Tab. 1: AUROC score for the detection of cardiac and non-cardiac conditions on an internal test set (MIMIC-IV-ECG-ICD) and validated on an external test set (ECG View II) demonstrating the feasibility of accurately inferring cardiac as well as non-cardiac conditions from ECG features and demographics alone.