A Novel Algorithm for Full-Automatic ECG Interpretation and Diagnostics

Aims: A full-automatic algorithm for ECG diagnostics is considered as a clinical decision support software (CDSS) and is usually designed to provide physicians and other health professionals with clinical decision support. In this work, a new high accurate and full automatic algorithm for interpretation and diagnostics of standard 12-lead ECG signals is presented.

Methods: The advanced algorithm illustrated in this paper is able to provide full-scope atrial diagnostics, ventricular diagnostics including Myocardial Infarction (MI) and hypertrophy, Rhythm diagnostics, diagnostics for repolarization disturbances and bottom-line statements. This interpretation and diagnostics algorithm is based on using scoring methodologies, decision trees and machine learning techniques. A very large number of measurements including fiducial points, segments and intervals were derived from all leads and each ECG cycle and used as input biomarkers for the interpretation algorithm. The development of the proposed algorithm was carried out by means of an internal annotated training databank, whereas the initial performance was validated using an internal annotated test databank. The total number of ECG signals included in the databanks was over seven thousand.

Results: The results obtained from the diagnostics algorithm illustrate a high degree of agreement with the reference annotations. The algorithm was able to detect normal, hypertrophy and MI subjects with the sensitivity greater than 95%, 75% and 92%, respectively. Accordingly, The Positive Predictive Value (PPV) were greater than 83%, 91% and 90%, respectively. The accuracy of diagnostic interpretative statements will be carried out using the well-known European CSE study and databank (Common Standard for qualitative Electrocardiography) with a total size of 1220 biological ECG signals.

Conclusion: The presented algorithm shows very promising results and a superior performance regarding the sensitivity and PPV using internal databank. Further validation procedure on the algorithm will be accomplished using the CSE databank widely accepted as the ‘clinical truth’.