Control of ECG Quality in the Hospital

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Digital ECG has become the dominant modality of acquisition, processing, measurement and storage in both clinical trials and in Hospital practice. Storage of digital records allows several post-processing analyses which can include a management system designed toward the quality control of ECG data, based on computational metrics. For example, ECGs with high noise content, particularly when the conditions during ECG acquisition are not rigorously controlled, will need to be promptly detected and indentified. ECG noise can be both low frequency (LF) noise, a disturbance associated with baseline wander or drift in the ECG, possibly associated with poor skin-electrode impedance or breathing artifacts or high frequency (HF) noise, a signal distortion typically associated with artifacts originating from non myocardial sources (e.g. skeletal muscle tremor, power-line artifacts or other mechanical activity).

We present a concept and method to manage the quality of large ECG repositories of digital ECGs and which essentially consists of a scoring module to assess the quality of the ECG according to a set of built-in metrics which include:

- Noise assessment (HF and LF noise),
- Interval annotations (QT, QTcF and QTcB, PR, QRS and HR),
- Amplitude annotations (T and R wave amplitude),
- T-wave complexity,
- QRS Regularity (percentage of normal QRS complexes versus artifacts or abnormal beats).

Using these metrics it is possible to assess the global quality of the ECG, not only based on noise, but on a more heterogenic fashion, weighting abnormal morphology, presence of abnormal beats. It is possible to see rank individual ECGs in the order of increasing score and displays the distribution of individual ECGs on histograms with thresholds marking the cutoff values for questionable vs. acceptable quality. The thresholds for each quality metric can be chosen empirically based on the range of abnormalities observed within a benchmark repository (in our case based on approximately 300.000 digital ECGs from healthcare and clinical trials).

The use of this technique can significantly optimize the quality assessment and the management of digital ECG and secondarily improve the quality of recorded ECG in common clinical ECG practice.