

An Algorithm for Assessment of ECG Quality Acquired Via Mobile Telephone

Philip Langley*, Luigi Di Marco, Susan King, Costanzo Di Maria, Wenfeng Duan, Marjan Bojarnejad, Kun Wang, Dingchang Zheng, John Allen and Alan Murray

Widespread availability of mobile telephony offers the capability to acquire ECG data away from healthcare centres by novice users. To acquire ECGs of diagnostic quality requires skill and is carried out by trained staff in the clinical setting. Adequate skin preparation, correct positioning of electrodes and artefact reduction are fundamental requirements. For the application of acquiring ECGs from mobile telephones by unskilled users it would be beneficial if the mobile device could assess ECG quality and inform the user if the quality was acceptable or not and that was the aim of this study.

Data, provided by the PhysioNet/Computing in Cardiology Challenge 2011, comprised 1500 12-lead ECGs acquired on mobile telephones by users with a range of skills in ECG acquisition. Recorded ECGs were categorised as acceptable or unacceptable by expert annotators. 1000 ECGs and their categories constituted a training set and the remaining ECGs, without categories, constituted a test set. We identified by visual inspection several ECG features that were commonly observed in the unacceptable category for algorithmic development: flat baseline (FB), saturation (SD), baseline drift(BD), low amplitude (LA), high amplitude (HA) and steep slope (excluding pacemaker)(SS). ECGs with any lead exhibiting these features were classed as unacceptable.

For the training set with each feature detection applied separately the following scores were achieved: FL 76.2%, SD 80.9%, BD 61.3%, LA 75.6%, HA 74.1% and SS 77.5%. With all features combined a score of 91.4% was achieved. For test set B the algorithm classified 181 records as unacceptable and 319 records as acceptable and the score was 85.7%.

An algorithm which detected common features of poor quality ECGs was able to classify ECGs with good agreement to expert annotators.