Reviewer's report

Title: Characteristic Wave Detection in ECG Signal Using Morphological Transform

Version: 1 Date: 1 July 2005

Reviewer: Irena Jekova

Reviewer's report:

General

The authors suggest a procedure for detection of the fiducial points in ECG signals. The procedure is based on simple signal processing tools and seems to work. Although, this area has received a lot of attention from researchers and device manufacturers, the issue is relevant. The methods are well described and seemed to be reproducible by other authors. The title and abstract accurately convey what has been found. The writing is acceptable.

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Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

1. The authors should expand section Introduction, by adding some information about previous studies, which concern the detection of fiducial (singular) points in the ECG signals (e.g. Goldberger and Bhargava, 1982, QRS duration measurement using high frequency electrocardiography: applications and limitations of a new technique; Willems et al, 1987, Influence of noise on wave boundary recognition by ECG measurement programs. Recommendations for preprocessing; Laguna et al, 1990, New algorithm for QT interval analysis in 24-hour Holter ECG: performance and application; Laguna et al, 1994 Automatic detection of wave boundaries in multilead ECG signals: validation with the CSE database; Kemmelings et al, 1994, Automatic QRS onset and offset detection for body surface integral mapping of ventricular tachycardia; Daskalov and Christov, 1999, Automatic detection of the electrocardiogram T-wave end; Daskalov and Christov, 1999, Electrocardiogram signal preprocessing for automatic detection of QRS boundaries ect.).

2. The authors should specify, which ECG leads are using, since the claim: At a peak in ECG signal, its left derivative is positive and its right derivative is negative is true only for positive peaks. When the R wave is negative (leads V1, V2) just the opposite is valid. Significant part of the second ECG leads in MIT-BIH database correspond exactly to V1 and V2.

3. How were the 20000 ECG beats from MIT-BIH and 2500 beats from QT database selected randomly or some pre-selection was applied.

4. Did the authors use the same scale (s=20) for the beats from QT database, since the sampling frequency of 250 Hz corresponds to maximal scale s=15.

5. The authors should calculate the positive predictive value PPV = TP/(TP+FP) in order to estimate the influence of the false positive results.

6. Figures 3 (a, b and c) are too small and difficult to read. The authors should improve the figures (probably by expanding their width) in order to make visible the differences between the PR Interval (a), QRS complex (b) and QT Interval (c) marked with the annotations on one hand and with the MMD algorithm on the other hand. Another (maybe even better solution) is to plot the value of the difference.

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Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the
There is no need of such kind of revisions.

Discretionary Revisions (which the author can choose to ignore)

1. The term singular point may be substituted with fiducial point, which is more widely accepted.
2. For more clarity I propose the sentence "Than, the MMD transform can be specified as (page 3, the sentence above equation 7) to become Than, the MMD transform at the central point can be specified as.
3. I propose the signal noise ratio at the 4-th line from the bottom of page 8 to be changed to signal-to-noise ratio.

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: No

Declaration of competing interests:

I declare that I have no competing interests.