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Luca Mesin

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Heartbeat monitoring from adaptively down-sampled electrocardiogram

Luca Mesin*

Mathematical Biology and Physiology, Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129, Turin, Italy

*Corresponding author. Luca Mesin, Ph.D. Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino; Corso Duca degli Abruzzi 24, Torino, 10129 ITALY Tel.: 0039-011-0904085; fax: 0039-011 5644099; luca.mesin@polito.it

Abstract

Background and Objective. Heartbeats Holter monitoring is important for the detection of arrhythmias and possible anomalies, which are predictive of cardiovascular risks and infections. Reducing the number of acquired samples is useful to save energy and memory, but a proper down-sampling schedule is needed to record all useful information.

Method. An adaptive algorithm for the non-uniform down-sampling of data is used to reduce the mean sampling frequency of ECG data. The acquired data are processed to extract RR rhythm and to classify the heartbeats among a set of possible types of arrhythmias.

Results. The proposed method is tested in terms of the ability to estimate the heart rate and to classify the heartbeats from the MIT-BIH Arrhythmia data down-sampled below the Nyquist limit. The mean accuracy in identifying the heartbeats was over the 98% and the RMS error in estimating the RR time series was lower than the 1%. Variability, spectral and complexity indexes extracted from RR series were estimated with a mean error that was lower than 10%. Classification accuracy was above the 95%.

Conclusions. An adaptive method to down-sample ECG data is discussed. It can be useful to save energy and to reduce memory occupation, while still preserving important information on the heartbeats.