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Discrete approximation of ECG signals

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Abstract

In medical sciences and especially in diagnostics electrocardiograms (also known as ECG signals) describing the functioning of the human heart are of great importance. Their mathematical modelling, approximation, denoising, segmenting and analysis are growing fields of research. Convenient storage of huge amounts of these data requires efficient and robust compression methods and algorithms.

Besides the standard methods of spectral analysis and wavelet techniques the application of adaptive orthogonal systems such as the Malmquist–Takenaka systems seems very promising. These systems have already been successfully applied to solve various problems e.g. in control theory.

In this research we investigate the non-equidistant discretization generated by the above mentioned systems and its application in the compression of ECG signals. This discretization provides interpolation at chosen points of the signal, gives more detail near important regions and cares less about constant-like parts. Questions arise from finding suitable parameters for the system applied as well as from generating the set of discrete points. We provide possible solutions for these problems and show examples of application on real signals.

Keywords: discrete approximation, non-equidistant discretization, Malmquist–Takenaka system, ECG signals

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