

Complexity in congestive heart failure: a time-frequency approach

ABSTRACT

Reconstruction of phase space is an effective method to quantify the dynamics of a signal or a time series. Various phase space reconstruction techniques have been investigated. However, there are some issues on the optimal reconstructions and the best possible choice of the reconstruction parameters. This research introduces the idea of gradient cross recurrence (GCR) and mean gradient cross recurrence density which shows that reconstructions in time frequency domain preserve more information about the dynamics than the optimal reconstructions in time domain. This analysis is further extended to ECG signals of normal and congestive heart failure patients. By using another newly introduced measure $\hat{\rho}$ gradient cross recurrence period density entropy, two classes of aforesaid ECG signals can be classified with a proper threshold. This analysis can be applied to quantifying and distinguishing biomedical and other nonlinear signals.

Keyword: Phase space; Time frequency; ECG signals