Timely-Detection of Dynamical Change in Single-Channel Scalp EEG Signals*

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Abstract

We present a robust, model-independent technique for quantifying changes in the dynamics underlying nonlinear time-serial data. After constructing discrete density distributions of phase-space points on the attractor for time-windowed data sets, we measure the dissimilarity between density distributions via L_1–distance and χ^2 statistics. The discriminating power of the new measures is first tested on data generated by the Bondarenko "synthetic brain" model. We then apply the method to scalp EEG data to detect the transition from non-seizure to pre-epileptic activity. The results demonstrate a clear superiority of the new measures in comparison to traditional ones as robust, accurate, and timely discriminators of brain dynamics in different normal and pathologic regimes.

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