Abstract

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Project Title: Multichannel EEG signals – Analysis and Classification using Recurrence Quantification and Network Analysis

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Feature extraction methods have been extensively studied in pattern recognition and pattern classification. However these methods have not been proven to be universally successful on nonstationary data. In this research, the authors introduce a feature extraction method based on recurrence quantification analysis to deal with the complexity and nonstationarity of time series data that affect the performance of a pattern classifier. A feature vector is formed by calculating the statistics of the recurrence plot of a nonstationary time series. The statistics include Recurrence Rate (RR), Determinism (DET), Laminarity (LAM), Mean diagonal line length (L), Trapping Time (TT), Longest diagonal line (L_{max}), Longest vertical line (V_{max}), Entropy (ENTR), Global clustering coefficient (CC), Transitivity (TRAN), and Assortativity (A). Features represent the characteristic behavior of nonstationary time series data. The method is applied to the problem of classifying electroencephalograms of epileptic seizures. The results show that the proposed method is successful with 100% classification accuracy. The accurate results indicate that the proposed method is very effective for classification of nonstationary time series data such as EEG signals.

Keywords: Recurrence Theory; Dynamical System; Electroencephalogram (EEG); Feature Extraction; Artificial Neural Network