World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:8, No:08, 2014

Nonlinear Analysis in Investigating the Complexity of Neurophysiological Data during Reflex Behavior

Authors : Juliana A. Knocikova

Abstract : Methods of nonlinear signal analysis are based on finding that random behavior can arise in deterministic nonlinear systems with a few degrees of freedom. Considering the dynamical systems, entropy is usually understood as a rate of information production. Changes in temporal dynamics of physiological data are indicating evolving of system in time, thus a level of new signal pattern generation. During last decades, many algorithms were introduced to assess some patterns of physiological responses to external stimulus. However, the reflex responses are usually characterized by short periods of time. This characteristic represents a great limitation for usual methods of nonlinear analysis. To solve the problems of short recordings, parameter of approximate entropy has been introduced as a measure of system complexity. Low value of this parameter is reflecting regularity and predictability in analyzed time series. On the other side, increasing of this parameter means unpredictability and a random behavior, hence a higher system complexity. Reduced neurophysiological data complexity has been observed repeatedly when analyzing electroneurogram and electromyogram activities during defence reflex responses. Quantitative phrenic neurogram changes are also obvious during severe hypoxia, as well as during airway reflex episodes. Concluding, the approximate entropy parameter serves as a convenient tool for analysis of reflex behavior characterized by short lasting time series.

Keywords : approximate entropy, neurophysiological data, nonlinear dynamics, reflex
Conference Title : ICNCN 2014 : International Conference on Neuroinformatics and Computational Neuroscience
Conference Location : Paris, France
Conference Dates : August 28-29, 2014