

Title: Approximate Entropy Normalized Measures for Analyzing Social Neurobiological Systems

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Source: Journal of Motor Behavior

Volume: 44 **Issue:** 3 **Pages:** 179-183 **DOI:** 10.1080/00222895.2012.668233 **Published:** 2012

Document Type: Article

Language: English

Abstract: When considering time series data of variables describing agent interactions in social neurobiological systems, measures of regularity can provide a global understanding of such system behaviors. Approximate entropy (ApEn) was introduced as a nonlinear measure to assess the complexity of a system behavior by quantifying the regularity of the generated time series. However, ApEn is not reliable when assessing and comparing the regularity of data series with short or inconsistent lengths, which often occur in studies of social neurobiological systems, particularly in dyadic human movement systems. Here, the authors present two normalized, nonmodified measures of regularity derived from the original ApEn, which are less dependent on time series length. The validity of the suggested measures was tested in well-established series (random and sine) prior to their empirical application, describing the dyadic behavior of athletes in team games. The authors consider one of the ApEn normalized measures to generate the 95th percentile envelopes that can be used to test whether a particular social neurobiological system is highly complex (i.e., generates highly unpredictable time series). Results demonstrated that suggested measures may be considered as valid instruments for measuring and comparing complexity in systems that produce time series with inconsistent lengths.

Author Keywords: Analysis of Regularity; Entropy Measures; Social Neurobiological Systems; Time Series

KeyWords Plus: Time-Series Analysis; Sample Entropy; Complexity; Behavior; Dynamics

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Publisher: Routledge Journals

Publisher Address: Taylor & Francis LTD, 4 Park Square, Milton Park, Abingdon OX14 4RN, Oxfordshire, England

ISSN: 0022-2895

Citation: Fonseca S, Milho J, Passos P, Araújo D, Davids K. Approximate Entropy Normalized Measures for Analyzing Social Neurobiological Systems. *Journal of Motor Behavior*. 2012; 3 (44): 179-183.