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Editorial

Nonlinear Time Series: Computations and Applications

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There are thirty six papers collected in this special issue, but they do not cover the rich contents of nonlinear time series. Therefore, we cite a few references in this forward to facilitate for readers to obtain a fine profile of this attractive area. They are Luczka [1], Abel and Schwarz [2], Schreiber [3], West and Deering [4], Beran [5], Mandelbrot [6], Adler et al. [7], Touchette [8], Abry et al. [9], Werner [10], Cattani and Rushchitsky [11], Cattani [12, 13], Kantz and Schreiber [14], Fan and Yao [15], Bec and Khanin [16], Bouchaud and Georges [17], Baillie and King [18], Li and Borgnat [19], Parker and Chua [20], T. Machado et al. [21], Bakhoum and Toma [22], and Li and Zhao [23].

In this special issue, the first paper by Li [24] gives a tutorial of fractal time series from the point of view of systems of fractional order. The second by Liu [25] provides a review of chaotic time series. The third by Cattani [26] reveals the fractal shapes and the symmetries of DNA from a view of fractal time series. The fourth one by Mattioli et al. [27] studies large-amplitude pulses with the FitzHugh-Nagumo model to exhibit the sensitivity to local jumps and some unexpected inertia of neurons as response to the high-amplitude spike. The fifth paper by Bakhoum and Toma [28] investigates the dynamics of macroscopic and quantum transitions. The paper by Toma [29] presents a method to synthesize pulse series based on nonlinear differential equations. Abuzeid et al. [30] contributes a paper for constructing a continuous hereditary creep model for the thermoviscoelastic contact of a rough punch and a smooth surface of a rigid half-space. The paper by Zhao et al. [31] discusses the detrended fluctuation analysis method to detect the long-range correlation and scaling properties of daily precipitation series of Beijing from 1973 to 2004 before and after adding diverse trends to the original series.

Seven papers in the applications of nonlinear time series to computer science are collected in this issue. The paper by He et al. [32] shows an improved scheme of block cipher based on dynamic sequences generated by multiple chaotic systems. Peng et al. contribute their paper [33] in the field of chaotic communications. The paper by Zheng et al. [34] gives a method to build representative-based data aggregation tree in wireless sensor networks for the security purpose and opens a problem of how to evaluate the life time of the proposed method from a view of time series. Two papers, respectively, by Li and Li [35] and Xia et al. [36] are in the field of intrusion detection. The paper by Chen et al. [37] proposes an approach for estimating the space usage of skyband operator over sliding windows of data streams. The paper by Chen et al. [38] presents an improved algorithm of adaptive random early detection.

Prediction is an interesting topic in time series. The paper by M. Li and J.-Y. Li [39] gives a proof of the predictability of long-range-dependent series. Dong [40] reviews the concepts, models, and algorithms with respect to nonlinear time-series data mining in engineering asset health and reliability prediction. She and Yang's paper (see [41]) provides a method in adaptive local linear prediction and its application to hydrological time series. The paper by Shang et al. [42] discusses the method of max-margin classification for prediction. Leon and Zaharia's paper [43] addresses stacked heterogeneous neural networks for time series forecasting.

We collected 7 papers in the area of applications of nonlinear time series to signal and image processing. The paper by Huang and Qiu [44] proposes a blind deconvolution procedure for estimating a regression function with possible jumps preserved by removing both noise and blur when recovering the signals. The paper by Friston et al. [45] generalizes the concept and theory of filtering. Sterian and Toma's paper is presented in [46], which discusses the method of signal processing and sampling for obtaining time series corresponding to higher-order derivatives, which is desired in modeling and controlling dynamic phenomena. Liao et al. in their paper [47] address adaptive image denoising using nonlinear time series analysis. The paper by Li et al. [48] shows an application of nonlinear spectral subtraction method to millimeter wave conducted speech enhancement. The paper by Shan and Li [49] discusses the analysis of nonlinearity of signals from a view of time-frequency distributions. The paper by Sung et al. [50] is an application of time series to the design of very large-scale integrated circuits.

The paper by Chen et al. [51] deals with the outliers and patches in bilinear time series. The paper by Hu [52] studies the quasimaximum likelihood method to estimate unknown parameters in autoregressive processes. Li and Pu's paper [53] gives a scheme of the hypothesis designs of the three-hypothesis test problems. The paper by Nefeslioglu et al. [54] is an application article in geoscience. The paper by Sevimlican [55] is in the field of systems of fractional order. The paper by Farooq et al. [56] investigates a prior knowledge-based Green's kernel for support vector regression. Humi's paper [57] assesses the local turbulence strength from the point of view of time series by establishing the relationship between local turbulence strength and the Lyaponuv exponent in a flow. The paper by Messina et al. [58] may be taken as an initiative work in the aspect of spatial analysis of the nonstationary time-frequency dynamics of oscillatory processes in power systems. The paper by Carlini et al. [59] is in the field of precision agriculture, exploring a greenhouse model towards maximizing the cooling system consumption of energy.

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