Tutorial: *Pattern Analysis of Complex Signals and Images—Systems Dynamic Approach*

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This mini tutorial will provide working knowledge on methods of nonlinear systems dynamics for analysis and quantification of irregularity, predictability, and dynamical behavior in complex signals and images. The theories and methods to be given in this tutorial include: approximate entropy, sample entropy, multiscale entropy, time-shift multiscale entropy, fuzzy Kolmogorov-Sinai entropy, recurrence plots, recurrence quantification analysis, recurrence networks, cross recurrence plots, joint recurrence plots, fuzzy recurrence plots, fuzzy recurrence networks, fuzzy cross recurrence plots, and fuzzy joint recurrence plots. Applications of the presented methods will focus on pattern analysis and machine-learning classification of physiologic time series of neurodegenerative disorders, image quantification, texture analysis, and immunohistochemistry images of rectal cancer.