Measuring Predictablity Using Multi-Scale Embedding

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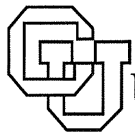

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Measuring predictability using multi-scale embedding

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One of the key issues in time series analysis is the question of what is the "best" time scale for the predictions. In the past, this question often played only a secondary role since the data tended to be available on one time scale only. In many domains this has dramatically changed: consider the financial domain. Until recently most instruments were modeled with daily data, but now, data on a minute-by-minute basis are commonly available.
This research frames the problem of the best prediction horizon in the time-frequency domain by combining wavelets with nonlinear predictors. When interested in prediction, it is crucial to avoid any leakage of the future into the input: we use edge wavelets to cleanly fulfil this requirement. This yields a multi-scale embedding as input to our "predictability meter." We then model the dynamics of the wavelet coefficients on each octave separately through a neural network.
This divide-and-conquer strategy can yield insights into the problem of where the dynamics resides. We show our method on three examples: (1) on a filtered logistic map (in the time domain), (2) on a series obtained through the evolution of wavelet coefficients, and (3), on the real-world problem of exchange rate prediction, using nine years of 30-minute data by Olsen and Associates.

Citation

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