

WORKSHOP
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Reconstructing stochastic state spaces from discrete time series

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Abstract

State-space reconstruction—inferring a latent dynamical system directly from time series—has become a fundamental tool of experimental nonlinear dynamics. Unfortunately, its mathematical basis, the Takens embedding theorem, only applies, strictly speaking, to smooth, deterministic dynamics, measured without noise. Attempts to apply it to stochastic dynamical systems do not have happy outcomes. In this talk, I will discuss the theoretical basis for hoping that stochastic state space reconstruction is nonetheless possible, and some recent progress on consistent algorithms for discrete-valued, discrete-time data. An equivalent, if more statistical-sounding, way to think about all this is “adaptive nonparametric modeling of categorical time series”. I’ll close with some examples of applications in neuroscience.