

# Nonparametric inference of stochastic differential equations based on the relative entropy rate

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## Abstract

The information detection of complex systems from data is currently undergoing a revolution, driven by the emergence of big data and machine learning methodology. Discovering governing equations and quantifying dynamical properties of complex systems are among central challenges. In this work, we devise a nonparametric approach to learn the relative entropy rate from observations of stochastic differential equations with different drift functions. The estimator corresponding to the relative entropy rate then is presented via the Gaussian process kernel theory. Meanwhile, this approach enables to extract the governing equations. We illustrate our approach in several examples. Numerical experiments show the proposed approach performs well for rational drift functions, not only polynomial drift functions.

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