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Robust and efficient parameter estimation for discretely observed stochastic processes

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Abstract

In various practical situations, we encounter data from stochastic processes which can be efficiently modeled by an appropriate parametric model for subsequent statistical analyses. Unfortunately, maximum likelihood (ML) estimation, the most common approach, is sensitive to slight model deviations or data contamination due to its well-known lack of robustness. Since the non-parametric alternatives often sacrifice efficiency, in this paper we develop a robust parameter estimation procedure for discretely observed data from a parametric stochastic process model which exploits the nice properties of the popular density power divergence measure. In particular, here we define the minimum density power divergence estimators (MDPDE) for the independent increment and the Markov processes. We establish the asymptotic consistency and distributional results for the proposed MDPDEs in these dependent stochastic process setups and illustrate their benefits over the usual ML estimator for common examples like the Poisson process, drifted Brownian motion and the autoregressive models.

Keywords Stochastic process · Robust estimation · Density power divergence · Poisson process · Brownian motion

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