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Parametric inference for discretely observed non-ergodic diffusions

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We consider a multidimensional diffusion process X whose drift and diffusion coefficients depend respectively on a parameter λ and θ. This process is observed at $n+1$ equally spaced times $0, \Delta_n, 2\Delta_n, \ldots, n\Delta_n$, and $T_n = n\Delta_n$ denotes the length of the 'observation window'. We are interested in estimating λ and/or θ. Under suitable smoothness and identifiability conditions, we exhibit estimators $\widehat{\lambda}_n$ and $\widehat{\theta}_n$, such that the variables $\sqrt{n}\,(\widehat{\theta}_n - \theta)$ and $\sqrt{T_n}\,(\widehat{\lambda}_n - \lambda)$ are tight for $\Delta_n \to 0$ and $T_n \to \infty$. When λ is known, we can even drop the assumption that $T_n \to \infty$. These results hold without any kind of ergodicity or even recurrence assumption on the diffusion process.

Keywords: non-ergodic diffusion processes; parametric inference for diffusions