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Title: Nonparametric Statistical Inference for i.i.d. Sparsely Observed Diffusions: an FDA Perspective

Abstract: Functional Data Analysis (FDA) covers an undeniably central role in studying different statistical inference problems, allowing to consider functional datasets on possibly complex domains, with trajectories observed discretely or continuously. Concerning discrete observations, this approach basically imposes some smoothness conditions on the sample paths and/or their covariance function to apply well-developed approximating methods. However, the usual regularity assumptions seriously limit the appropriateness of FDA in many commonly encountered settings, most notably stochastic differential equations (SDE). In this talk, we introduce a careful modification of existing methods, dubbed the "reflected triangle estimator" and make inferences about the global behavior of the diffusion processes. We show that this allows for the FDA of processes with nowhere differentiable sample paths, even when these are discretely and noisily observed, including under irregular and sparse designs. We then proceed to relate the global behavior of the processes to their local behavior by means of an apparently novel PDE. We establish almost sure uniform asymptotic convergence rates of the proposed estimators as the number of observed curves grows to infinity. Our rates are non-asymptotic in the number of measurements per path, explicitly reflecting how different sampling frequencies might affect the speed of convergence.