Abstract

“Stochastic processes are commonly used as continuous-time models for discrete statistical observations that exhibit jump or diffusive behaviour. When making statistical inference on the parameters of the process (say the Levy jump measure or the diffusion coefficient), one faces the statistical inverse problem consisting of having incomplete (discretely sampled) observations of the continuous time process. Particularly if one wishes to avoid potentially unrealistic assumptions that the sampling frequency increases asymptotically (corresponding to having approximately continuous observations), the question of optimal estimation is a non-trivial task. We will first show how rather delicate spectral techniques can be used to construct frequentist estimators that attain semi-parametric efficiency bounds for estimating meaningful functionals such as the cumulative distribution function of the jump measure (an inverse problem analogue of `Donsker’s theorem). The Cramer-Rao lower bound explicitly reveals the `ill-posed’ ness of the inverse problem induced by the discrete sampling regime. We will then show that a comparably naive Bayesian approach to solve such inverse problems also works, and is remarkably robust with respect to the sampling scheme. We also prove a nonparametric Bernstein-von Mises theorem that validates efficiency of posterior-based inference for the jump distribution."