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Abstract

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Asymptotic inference of determinantal point processes

Determinantal point processes (DPPs) are stochastic processes involving negative dependencies. Defined on a finite discrete space, they have been used in machine learning and survey sampling design to generate subsets of objects exhibiting diversity. Defined on a continuous space (typically $\mathbb{R}^d$), they provide useful models for the simulation and the description of repulsive spatial point processes. The increasing popularity of DPPs is mainly due to the fact that they are flexible models, through the choice of their kernel, and that both their moments and their density on a compact set are explicitly known. We focus in this talk on the (increasing domain) asymptotic properties of continuous DPPs. As a matter of fact, DPPs turn out to be Brillinger mixing, α-mixing, β-mixing, and negatively associated. These nice mixing properties allow us to get general central limit theorems for functionals of a DPP. As an application, we derive the asymptotic properties of estimating function estimators of a (possibly non-stationary) parametric DPP. This setting includes contrast estimators based on the K-function or the pair correlation, Palm likelihood estimator and composite likelihood estimator. We also discuss likelihood inference, for which the asymptotic properties remain challenging to establish. Nevertheless, we prove under some conditions the consistency of the maximum likelihood estimator of a stationary DPP. We further introduce an approximation of the likelihood, that does not require the spectral decomposition of the kernel and proves to be asymptotically equivalent to the true likelihood. This talk is based on several joint works with Christophe Biscio, Bernard Delyon, Jesper Møller, Arnaud Poinas, Ege Rubak and Rasmus Waagepetersen.