Non-parametric intensity estimation of spatial point processes by random forests

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Abstract

The intensity of a spatial point process is one of the first quantity of interest to estimate in presence of real-data. When no covariate is observed, non-parametric kernel estimation is routinely used, but comes with some drawbacks: it adapts poorly to non-convex domain or manifolds, and the estimation is not consistent in an increasing domain asymptotic regime. When the intensity depends on observed covariates, most estimation methods are parametric. Non-parametric kernel estimation has been extended to this situation, but it appears to be efficient only for a few numbers of covariates, and provides no indication on the importance of each covariate, which is crucial for interpretation. In this talk, we show how to adapt random forest regression to circumvent these drawbacks and estimate non-parametrically the intensity of a spatial point process with or without covariates, while measuring the importance of each variable in the latter case. Our approach allows to handle non-convex domain together with a large number of covariates and also point processes on manifolds. From a theoretical side, we prove that in the case of purely random forests, our method is consistent in both infill and increasing domain asymptotic regime, and may achieve a minimax rate of convergence.

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