Nonparametric Bayesian intensity estimation for covariate-driven point processes

A seminar by Matteo Giordano

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Thursday 20 Nov 2025 | 14:30-15:30

Room BENVENUTI

Department of Statistical Sciences

A central task in the statistical analysis of spatial point patterns is to infer the relationship between the point distribution and a collection of covariates of interest. This talk will present recent theoretical and methodological advances for covariate-based nonparametric Bayesian intensity estimation, in the two relevant asymptotic regimes for the problem: large domains and replicated observations. For large domains, it is shown how the presence of covariates allows to borrow information from far away locations in the observation window, leading to minimax-optimal posterior contraction rates in both global and point-wise loss functions, under different classes of priors. For the replicated observations regime, we consider the case of “anisotropic” intensity functions, which is common in applications where the covariates have different physical nature. We devise a “multi-bandwidth” Gaussian process method, and prove that it achieves optimal and adaptive posterior contraction rates. We further show how posterior inference can be implemented in practice via a suitable Metropolis-within-Gibbs sampling algorithm. Lastly, we will illustrate the performance of the method via numerical simulations, and present an application to a Canadian wildfire dataset. Joint works with Alisa Kirichenko, Judith Rousseau and Patric Dolmeta.

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