Estimatig the interraction functions and the graph of interactions in multivariate Hawkes processes using Bayesian nonparametric methods

by

Judith Rousseau, Sophie Donnet, Vincent Rivoirard and Deborah Sulem

University of Oxford, Université Paris Dauphine & INRA (INPAG)

Hawkes processes form a class of point processes describing self and inter exciting/inhibiting processes. There is now a renewed interest of such processes in applied domains and in machine learning, but there exists only limited theory about inference in such models.

To be more precise, the intensity function of a univariate Hawkes process has the following form:

$$\lambda(t) = \int_0^{t^-} h(t-s)dN_s + \nu$$

where N is the Hawkes process and $\nu > 0$. Multivariate Hawkes processes have a similar intensity function which involves the interractions functions between the different components of the process. In this work we propose a generic Bayesian non parametric procedure in such models and we study its theoretical properties, both in terms of the estimation of the parameters which are the impulsions ν and the interractions functions, and in terms of the graph of interactions. As a consequence of these results we also obtain theoretical guaranties for Bayesian tests on the existence of an interraction (or self excitation) function.