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

by

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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. To allow for negative interaction functions $h$, one considers non linear Hawkes processes

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

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 $\nu$ and the interactions functions together with possibly the parameters $\theta$ of the non linear functional $\phi$ 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 interaction function.