Statistical analysis of inhomogeneous space-time cluster point processes

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In the contribution we investigate a class of parametric models suitable for modeling of clustered space-time point patterns which are encountered e.g. in epidemiology. Namely we will consider the inhomogeneous shot-noise Cox processes. The model produces clustered point patterns and enables the first-order intensity function to be inhomogeneous and dependent on covariates. Since the maximum likelihood estimation is computationally prohibitive in this case alternative moment estimation methods have to be used instead.

A natural option is to use a two-step estimation procedure when first the inhomogeneity parameters are estimated from the first-order intensity function and then in the second step the inhomogeneous K-function is used to estimate the interaction parameters. However the estimate of the full inhomogeneous space-time K-function may be quite variable and this influences the quality of the minimum contrast estimate.

The variability may be reduced by using the so-called profile minimum contrast method for the space-time K-function – i.e. to use in the second step the minimum contrast estimation for the profile functions $K(R, \cdot)$ and $K(\cdot, T)$ with fixed spatial and temporal range, respectively. No assumptions on separability of the first-order intensity function are needed and the minimization is computed separately for two sets of interaction parameters with smaller dimension. The asymptotic convergence rates are the same like for the minimum contrast with the full space-time K-function but the numerical stability of the newly suggested procedure is better. We demonstrate the efficacy of the profile minimum contrast method through a simulation study and an application to a real data set.

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