Lecture 3.2 (03:30-03:55)

Fourier analysis of spatial point processes

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In this presentation, we develop frequency domain methods for the estimation and inference of the second-order structure of spatial point processes. The main element here is the discrete Fourier transform (DFT) of the observed point pattern and its tapered counterpart. Under stationarity, we show that both the DFTs and the tapered DFTs, evaluated at different frequencies (which can have the same limit), are asymptotically independent centered Gaussian. Based on this result, we prove the central limit theorem for the statistics that can be written as quadratic forms of the tapered DFT. As an application, we introduce a frequency domain inferential method for stationary point processes. The resulting parameter estimator is computationally tractable and provides meaningful interpretations, even in cases where the model is mis-specified. Lastly, we extend our Fourier methods to a class of non-stationary point processes.