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Clustering comparison of point processes, with applications to random geometric models. (English) Zbl 1328.60122

Schmidt, Volker (ed.), Stochastic geometry, spatial statistics and random fields. Models and algorithms. Selected papers based on the presentations at the summer academy on stochastic analysis, modelling and simulation of complex structures, Söllerhaus, Hirschegg, Germany, September 11–24, 2011. Cham: Springer (ISBN 978-3-319-10063-0/pbk; 978-3-319-10064-7/ebook). Lecture Notes in Mathematics 2120, 31-71 (2015).

Summary: In this chapter, we review some examples, methods, and recent results involving comparison of clustering properties of point processes. Our approach is founded on some basic observations allowing us to consider void probabilities and moment measures as two complementary tools for capturing clustering phenomena in point processes. As might be expected, smaller values of these characteristics indicate less clustering. Also, various global and local functionals of random geometric models driven by point processes admit more or less explicit bounds involving void probabilities and moment measures, thus aiding the study of impact of clustering of the underlying point process. When stronger tools are needed, directional convex ordering of point processes happens to be an appropriate choice, as well as the notion of (positive or negative) association, when comparison to the Poisson point process is considered. We explain the relations between these tools and provide examples of point processes admitting them. Furthermore, we sketch some recent results obtained using the aforementioned comparison tools, regarding percolation and coverage properties of the germ-grain model, the SINR model, subgraph counts in random geometric graphs, and more generally, U-statistics of point processes. We also mention some results on Betti numbers for Čech and Vietoris-Rips random complexes generated by stationary point processes. A general observation is that many of the results derived previously for the Poisson point process generalise to some "sub-Poisson" processes, defined as those clustering less than the Poisson process in the sense of void probabilities and moment measures, negative association or dcx-ordering.

For the entire collection see [Zbl 1301.60005].

MSC:

60G55 Point processes (e.g., Poisson, Cox, Hawkes processes)
60D05 Geometric probability and stochastic geometry
60K35 Interacting random processes; statistical mechanics type models; percolation theory

Cited in **7** Documents

Keywords:

point processes; clustering; random geometric models; void probabilities; moment measures; percolation; germ-grain model; SINR model; U-statistics; Betti numbers; Čech random complexes; Vietoris-Rips random complexes

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