

Characterization results and Markov chain Monte Carlo algorithms including exact simulation for some spatial point processes

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The area-interaction process and the continuum random-cluster model are characterized in terms of certain functional forms of their respective conditional intensities. In certain cases, these two point process models can be derived from a bivariate point process model which in many respects is simpler to analyse and simulate. Using this correspondence we devise a two-component Gibbs sampler, which can be used for fast and exact simulation by extending the recent ideas of Propp and Wilson. We further introduce a Swendsen–Wang type algorithm. The relevance of the results within spatial statistics as well as statistical physics is discussed.

Keywords: area-interaction process; continuum random-cluster model; exact simulation; Gibbs sampling; Markov chain Monte Carlo; nearest-neighbour Markov point processes; Papangelou conditional intensity; penetrable sphere model; phase transition; spatial point processes; Swendsen–Wang algorithm; Widom–Rowlinson mixture model