Gibbs point process approximation based on Stein's method

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Abstract

Gibbs point processes are widely used both in spatial statistics and in statistical mechanics, as they allow a very flexible modelling of interaction between the points. However, a notorious difficulty with Gibbs processes is that in most cases of interest their densities can only be specified up to normalizing constants, which typically renders explicit calculations, e.g. of the total variation distance between two such processes, difficult.
Based on the results of Schuhmacher and Stucki [1] we obtain upper bounds for the total variation distance between the distributions of two Gibbs point processes in a very general setting. Applications are provided to various well-known processes and settings from spatial statistics and statistical physics, including the comparison of two Lennard-Jones processes or hard core approximation of an area interaction process.
The proof of the main results is based on Stein's method. We construct an explicit coupling between two spatial birth-death processes to obtain Stein factors, and employ the Georgii-Nguyen-Zessin equation for the total bound.

Keywords: Conditional intensity, pairwise interaction process, birth-death process, Stein's method, total variation distance.
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Bibliography

[1] Dominic Schuhmacher and Kaspar Stucki. On bounds for Gibbs point process approximation. *Preprint*, 2012. Available at http://arxiv.org/abs/1207.3096.