Bayesian inference for Matérn repulsive processes (Supplementary material)

Vinayak Rao∗
Department of Statistics, Purdue University, USA
Ryan P. Adams
School of Engineering and Applied Sciences, Harvard University, USA
David Dunson
Department of Statistical Science, Duke University, USA

1. Supplementary

The plots of figure 1 consider the J-function (van Lieshout and Baddeley, 1996), a measure of spatial interaction with $J(r)$ corresponding to the ratio of the probability there is no event at distance r from another event to the probability there is no event at distance r from an arbitrary point in the space. For a Poisson process, these two probabilities are equal, so that $J(r)$ equals 1. Repulsion correspond to $J(r) > 1$, while $J(r) < 1$ suggests a clustered pattern. The continuous magenta line in figure 1 plots the empirical $J(r)$ as a function of distance r for the pine tree dataset. Again we see that this is a non-Poisson repulsive process. The blue envelope shows posterior predictive estimates for the J-function produced by fitting the Matérn type-III hardcore process (top left), softcore process (top right) and with probabilistic thinning (bottom left). See the main text for a description of these. As with the L-function, the predictive intervals for the hardcore and softcore processes do not fit the data, but contrast the generalized Matérn with probabilistic thinning does a much better job. The bottom right subplot shows predictions from a MLE fit of a Strauss process, which also produces reasonable (but not good) fits.

The top row of figure 2 shows posterior predictive values for a Matérn process with probabilistic thinning for mild (left) and moderate (right) neuropathy. The bottom row shows fits for a Strauss process, again, these are worse.

Figure 3 shows the nonstationary J-function estimated from the Greyhound dataset. This statistic does not capture a significant deviation from Poisson (unlike the L-function), but both the inhomogeneous Matérn model and the inhomogeneous Poisson process fit it well.

∗Corresponding author

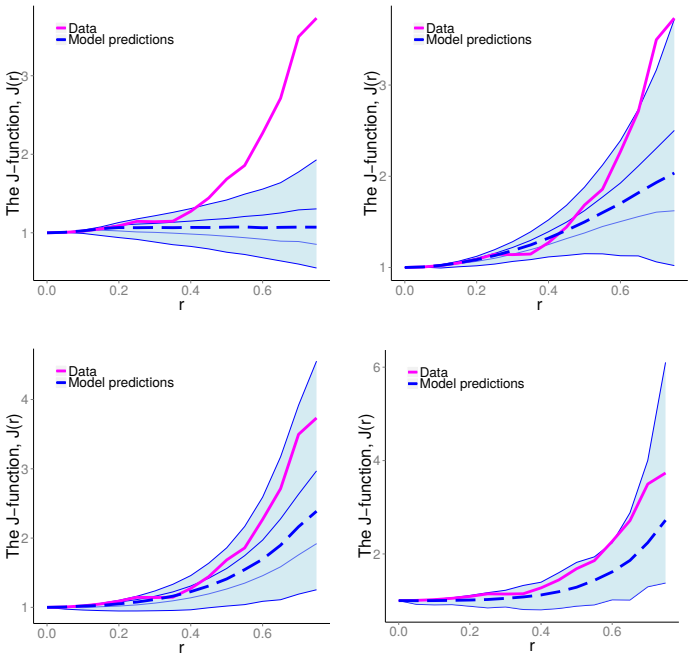

Fig. 1. Posterior predictive values of J-functions for the Swedish pine tree dataset. (Top left) is the Matérn hardcore model, (top right) is the softcore model, and (bottom left) is probabilistic thinning. (Bottom right): predictive values for a Strauss process fit.

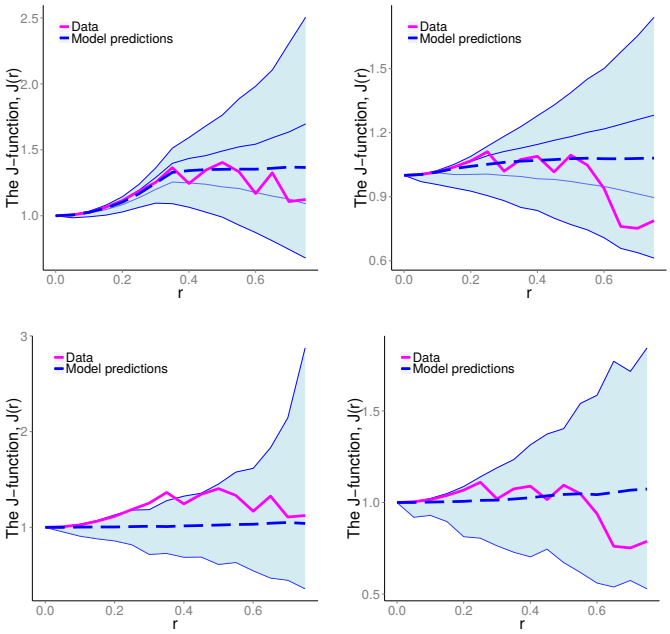

Fig. 2. (Top row): Posterior predictive values of the J-functions for the Matérn model with probabilistic thinning for mild (left) and moderate (right) neuropathy. (Bottom row): Corresponding predictive values for Strauss process fits.

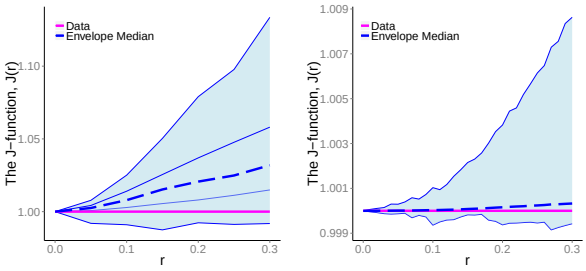

Fig. 3. Inhomogeneous J-function for the Greyhound dataset: (left) posterior predictive values for nonstationary Matérn , and (right) fit of an inhomogeneous Poisson process