io-port 05049861

Ortner, Mathias; Descombes, Xavier; Zerubia, Josiane

A reversible jump MCMC sampler for object detection in image processing.

Niederreiter, Harald (ed.) et al., Monte Carlo and quasi-Monte Carlo methods 2004. Refereed proceedings of the sixth international conference on Monte Carlo and quasi-Monte Carlo methods in scientific computation, Juan-les-Pins, France, June 7–10, 2004. Berlin: Springer (ISBN 3-540-25541-9/pbk). 389-401 (2006).

Summary: To detect an unknown number of objects from high resolution images, we use spatial point processes models. The method is adapted to our image processing applications since it describes images as realizations of a point process whose points represent geometrical objects. We consider models made of two parts: a data term which quantifies the relevance of a set of objects with respect to the image and a prior term, containing strong geometrical interactions between objects. We use the Maximum A Posteriori estimator, which is obtained by combining a reversible Markov chain Monte Carlo (RJMCMC) point process sampler with a simulated annealing procedure. The quality of the results and the speed of the algorithm strongly depend on the used sampler. We present here an adaptation of Geyer-Møller sampler for point processes and show that the resulting Markov chain keeps the required convergence properties. In particular, we design an updating scheme which allows the generation of points in the neighborhood of some others, and check the relevance of such moves on a toy example. We present experimental results on the difficult problem of the detection of buildings in a digital elevation model of a dense urban area.

Keywords: RJMCMC; non homogeneous Poisson point process; image processing building detection; spatial point processes