VBEM algorithm for the Log Gaussian Cox process

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Abstract. The log Gaussian Cox process [4] is a classical model to represent spatial interactions in count-based maps. For example, it has been used to model weeds counts in crop fields divided into quadrats [2,3]. A MCMC algorithm has been proposed by [2] to estimate jointly the a posteriori mode of the parameters vector and of the hidden Gaussian field which captures the spatial structure of weed repartition.

The drawback of MCMC algorithms is the required computational time. Hence, we propose here a faster algorithm based on a variational principle. The generic VBEM (*Variational Bayesian Expectation Maximization*, [1]) algorithm has been proposed recently. In practice, it is necessary to specify the E and the M steps of the VBEM algorithm for the log gaussian Cox process. We propose a specification based on a mean field hypothesis and on Monte-Carlo simulations in the case of an exponential covariance function. Experiments on simulated data show that the proposed VBEM algorithm is as efficient (except for the estimation of the covariance parameter) and much faster than the MCMC algorithm presented in [2].

Weeds counts are usually only available for a sample of quadrats, since observations are costly to acquire. A future direction of this work will be to consider estimation of the log Gaussian Cox process' parameters from a limited size sample.

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