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Introduction to "Efficient computational strategies for doubly intractable problems with applications to Bayesian social networks" by A. Caimo, A. Mira

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Statistical models which involve intractable likelihood are attracting considerable interest from the statistics community. For example, approximate Bayesian computation (eg., (Marin et al. 2012)) and pseudo-marginal methods Andrieu and Roberts (2009) are two relatively recent approaches which have had a big impact and both of which are the subject of papers in this special issue. The paper by Caimo and Mira is a useful addition to this body of work, in particular to those involving so-called doubly intractable Bayesian models. Here the authors focus on the exponential random graph (ERG) model. This is arguably the most widely used statistical model for the analysis of social network data, despite the fact that the likelihood can almost never be evaluated due to a parameter dependent normalising constant. Bayesian inference for ERG models have been developed by Caimo and Friel (2011) and this paper builds upon and extends the methodology developed there. The main idea here is to develop strategies to improve MCMC sampling efficiency through a synthesis of delayed rejection and adaptive Monte Carlo methods. The starting point is run several chain in parallel, each targeting the posterior distribution combined with the exchange algorithm of Murray et al. (2006). Caimo and Friel (2011) looked at such an approach and designed a proposal distribution based on the current population of all chains. The novelty in this paper is to extend this setup to consider delayed rejection and adaptive Monte Carlo strategies based on (1) the past trajectory of each chain; (2) the current population of chains; (3) the entire past trajectory of all chains. The resulting collection of algorithms typically provide very useful improvements in the statistical efficiency of parameter estimates. This paper very clearly demonstrates that this type of methodology should become an important component in the toolbox for the analysis of social network data. Of course, the strategies presented in this paper could very well find use in more general contexts.

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