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Approximate Monte Carlo algorithms for social network models. Preliminary report.

Recent advances in statistical computation has demonstrated the advantages and effectiveness of Bayesian approaches to social network data. Exponential random graph models (ERGMs) represent one of the most important families of statistical models. The ERGM likelihood $f(y|\theta)$ states that the probability of observing a given network graph y is equal to the exponent of the observed network statistics $s(y)$ multiplied by a parameter vector θ divided by a normalising constant term $z(\theta)$ which is computationally intractable for all but trivially small networks. Following the Bayesian paradigm, prior distribution is assigned to the parameter θ. Direct evaluation of the posterior distribution $p(\theta|y)$ requires the calculation of both the likelihood $p(y|\theta)$ and the model evidence $p(y)$ which are both intractable. We present some approximate Monte Carlo strategies based on the exchange algorithm for doubly intractable distributions which improve the efficiency of Bayesian methods for exponential random graph models and increase their scalability to large social networks. (Received August 05, 2015)