

Exponential Family Random Graph Models - A Survey

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Abstract

Statistical modeling of social networks as complex systems has always been and remains a challenge for social scientists. We review a wide class of exponential family models for social networks, known as Exponential Random Graph Models (ERGMs), or p^* models. They have been developed since the 1980s and are characterized by well-defined sufficient statistics that represent local network characteristics. However, due to the difficulty of dealing with the intractable normalizing constant, pseudo-likelihood estimation methods have been applied in most studies. Recently, simulation based MCMC maximum likelihood estimation techniques have been introduced to improve parameter estimation. An R-package `statnet` has been developed for ERGMs by Goodreau et al. (2008). We illustrate some of the functionality of `statnet` by analysing a friendship network of 1,461 adolescents. It turns out that several well-studied ERGMs do not fit this data set well, although the fit improves dramatically when the models include another recently developed geometrically weighted edgewise shared partner (GWESP) statistic. **KEYWORDS:** Social networks, exponential-family random graph models, goodness-of-fit, pseudolikelihood estimation, Markov chain Monte Carlo, generalized linear models, deviance.

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