

## Statistical models for social networks

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The paper presents a flexible framework for specifying exponential random graph models (ERGMs) for social networks data. We develop a two-dimensional hierarchy of potential proximity-based dependence structures for network tie variables, and hence the ERGM form implied by each dependence structure. We show how the hierarchy leads to models that reflect processes of cohesion, closure, brokerage and/or connectivity over short or longer network distances. The adoption of existing approaches to the efficient parameterisation of related network effects (Snijders et al, 2006; Hunter & Handcock, 2006) results in a set of interesting new model forms. We demonstrate the variety of network structures to which these model forms give rise and illustrate their application to the analysis of empirical networks. We conclude by arguing that the model hierarchy provides a broad and valuable framework for the statistical analysis of network data.

**Key Words:** social networks, statistical models, exponential random graph models, dependence structures, model specification