Bayesian modeling and uncertainty quantification for descriptive social networks

Sudipto Banerjee

University of California Los Angeles
E-mail: sudipto@ucla.edu

Abstract: This talk presents an easily implementable Bayesian approach to model and quantify uncertainty in small descriptive social networks. While statistical methods for analyzing networks have seen burgeoning activity over the last decade or so, ranging from social sciences to genetics, such methods usually involve sophisticated stochastic models whose estimation requires substantial structure and information in the networks. At the other end of the analytic spectrum, there are purely descriptive methods based upon quantities and axioms in computational graph theory. In social networks, popular descriptive measures include, but are not limited to, the so called Krackhardt's axioms. Another approach, recently gaining attention, is the use of PageRank algorithms. While these descriptive approaches provide insight into networks with limited information, including small networks, there is, as yet, little research detailing a statistical approach for small networks. This talk presents an interface of Bayesian statistical inference and social network analysis by offering practicing social scientists a relatively straightforward Bayesian approach to account for uncertainty while conducting descriptive social network analysis. The emphasis is on computational feasibility and easy implementation using existing R packages that are available from the Comprehensive R Archive Network (https://cran.r-project.org/). We analyze a network comprising 18 websites from the US and UK to discern transnational identities, previously analyzed using descriptive graph theory with no uncertainty quantification, using fully Bayesian model-based inference.