

Popularity-Adjusted Block Models for Networks with Community Structure

Yuguo Chen

*University of Illinois at Urbana-Champaign
E-mail: yuguo@illinois.edu*

Abstract: The community structure observed in empirical networks has been of particular interest in the statistics literature, with a strong emphasis on the study of block models. We study an important network feature called node popularity, which is closely associated with community structure. Neither the classical stochastic block model nor its degree-corrected extension can satisfactorily capture the dynamics of node popularity as observed in empirical networks. We propose a popularity-adjusted block model for flexible and realistic modeling of node popularity. We establish consistency of likelihood modularity for community detection as well as estimation of node popularities and model parameters, and demonstrate the advantages of the new modularity over the degree-corrected block model modularity in simulations. By analyzing the political blogs network, the British MP network, and the DBLP bibliographical network, we illustrate that improved empirical insights can be gained through this methodology.