

Abstract

In network analysis, community detection is a fundamental problem. There are many methods to detect the number of communities in network dataset. However, the estimation results of many approaches have an obvious discrepancy with the true number of communities, such as the estimation results of the Bethe Hessian matrix method for Political Blogs dataset. In some network datasets, the communities may have some hierarchy. For example, in a class, students in different interest groups can be considered as different communities, but inside an interest group, there might be small groups. So the interest groups are communities with high hierarchy, and the small groups under them have lower hierarchy. Many approaches of community detection tend to estimate the number of communities with lower hierarchy, but the interest is to estimate the number of communities with the highest hierarchy.

Based on the Bethe Hessian matrix approach, we propose a method to detect the community labels for this kind of hierarchical networks. We perform simulation and numerical analysis. Besides, we also experiment on real data. The future direction of this study is to discover the underlying theory of the hierarchical network structure.