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Using the Stochastic Block Model for Clustering in Psychological Networks

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Using the Stochastic Block Model for Clustering in Psychological Networks

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Abstract

Psychological network analysis has emerged as a powerful tool for modeling psychological constructs as complex systems of interacting variables. However, existing statistical methods do not explicitly incorporate theoretical assumptions about clustering, despite the central role that clusters play in many psychological network theories. In this work, we propose to fill this gap by using the Stochastic Block Model (SBM) as a prior distribution on the network structure. The SBM assumes that variables belong to latent clusters, with the probability of an edge depending only on the cluster membership of the nodes. By integrating this prior into the well-established Bayesian graphical modeling framework, we enable researchers to formally incorporate theoretical expectations about clustering into the statistical model and to infer the clustering configuration using the data at hand. We demonstrate the advantages of this approach through a simulation study. We further illustrate its practical utility by reanalyzing 30 openly available empirical datasets, where we find evidence of clustering in several cases. This study contributes to bridging the gap between psychological network theory and statistical modeling and provides a new statistical method for estimating the number of clusters and cluster membership of the variables in the network.

Keywords

networks, stochastic block model, Bayesian

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