Social Network Inference From Grouped Observations Using Star Models

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In social sciences, the observed raw data is generally the result of social behavior, such as the formation of groups, rather than explicit network structure. The social network perspective suggests that there is a link between a latent network structure and the observable social behavior. Decades of research have established several measures to construct network structure from social data, including the co-occurrence matrix and the half weight index. However, these measures do not describe the generating mechanism that links the latent network structure to the observed groups. To resolve this issue, we propose a model-based approach called the Star Model which assumes that every observed group has a leader and that the leader has brought together the other members of the group. The performance of Star Models is demonstrated by simulation studies. We apply this model to infer the relationships among characters of a famous 18\textsuperscript{th} century Chinese novel, Dream of the Red Chamber, and perform an analysis on a population of dolphins. Supplemental materials including the detailed algorithm for Star Models as well as a toy example are available on-line.