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Monte Carlo evaluation of blockmodeling approaches for temporal networks

The social network analysis methodology is essential for studying the relationships among units. For example, suppose the aim is to identify groups of equivalent units (according to their links) and the links among the obtained groups. In such a case, a researcher can apply one of developed approaches to blockmodeling, e.g., generalized blockmodeling, stochastic blockmodeling or k-means based blockmodeling. When several networks are observed regarding the same units at different points in time, a researcher might use available blockmodeling approaches for temporal networks (e.g., Matias and Miele 2016, Bartolucci and Pandolfi 2020, Bar-Hen et al. 2020, Žiberna 2020, Škulj and Žiberna 2021). Since these approaches have been developed recently, they have not been thoroughly compared on empirical network data.

Therefore, a short overview of blockmodeling approaches for temporal networks will be provided, along with a Monte Carlo simulation study results. The aim is to evaluate the differences among these blockmodeling approaches and provide general guidelines on using one approach or another.

Special attention will be given to the algorithm for generating dynamic networks with a specified blockmodel and partition. This algorithm generates links by considering different local network mechanisms like mutuality, popularity, and transitivity. As a result, the generated networks by this algorithm more closely represent real-world networks. Furthermore, the networks are generated so that the blockmodel type and partition can change in time.

Different factors are considered in this study, such as blockmodel type, blocks’ densities, the stability of groups in time, local network mechanisms, and network size. The study results indicate that separate analyses of networks at different time points is sufficient in some cases, e.g., when large networks are observed with high density difference between null and complete blocks or when partitions are very unstable in time. However, using blockmodeling approaches for temporal networks can be beneficial especially when there is some dependency between partitions from consecutive time points. Especially recommended are approaches for blockmodeling temporal networks are those proposed by Bar-Hen et al. (2020) and Matias and Miele (2016).