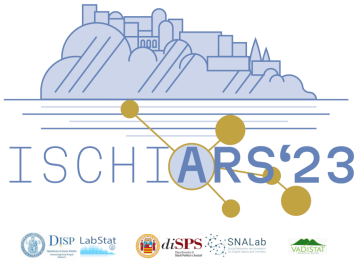

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Coupling Hidden Markov and Dynamic Network Actor Models: time heterogeneity and mixtures processes

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Social networks are systems of actors tied by relationships. These relationships frequently emerge from and are maintained through relational actions, such as instances of communication or exchange. Often, these relational actions can be measured directly, e.g., when people use electronic communication devices. They can be recorded as relational events, i.e., time-stamped sequences of interactions between pairs of actors.

Dynamic Network Actor Models (DyNAMs) can be applied to make inferences about the social mechanisms in which the dynamics of these events unfold. However, the basic DyNAM framework assumes that social mechanisms operate homogeneously over time. This assumption is often not tenable, for instance, in scenarios where the system as a whole is subject to trend shifting. As an example, reciprocity, as the tendency to reply to received messages, may be more relevant in explaining relational actions at an early stage on a newly established messaging channel than after a consolidation period.

Here, we propose an extension of DyNAMs that allows controlling for time heterogeneity by including time-varying parameters. Changes in the parameters are modeled using a Hidden Markov Model, expressing the coefficients' states and switching dynamics for a predefined number of states. We use Hamiltonian Chain Monte Carlo with the No-U-Turn sampler (NUTS) implemented in Stan to make inferences about the model parameters. Using empirical cases, we illustrate the method and discuss how the flexibility of the proposed approach can represent relational event dynamics as a mixture of DyNAMs.

Keywords

Relational event, DyNAM, Bayesian, time-heterogeneity

Topics

- Statistical methods and models for network analysis

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