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Dynamic stochastic block models for the analysis of weighted network data

We analyze longitudinal weighted network data by proposing an extension of the stochastic block models designed to handle count data characterized by an excess of zeros. Specifically, we explicitly model the distribution of the dyad referred to each pair of nodes, conditional on the blocks they occupied at each time occasion. The time varying block memberships are assumed to evolve over time according to an unobservable Markov chain. For the conditional distribution of the dyad, we consider two alternative versions of the bivariate Poisson distribution: a classical zero-inflated model, and a hurdle model formulation. We further extend the framework to multilayer networks, in which the same set of nodes can interact through different types of connections, organized into distinct layers. For the resulting dynamic models we introduce variational inference as an approximation of likelihood inference. The overall approach is illustrated by two applications: one based on patient transfers within a network of Italian hospitals, and another using data from the SIPRI Arms Transfers Database referred to international arms transfers.

Keywords/Topics

bivariate Poisson, multilayer network inference, Variational Inference

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