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STERGMs

Separable Temporal ERGMs

More details

STERGMs

- The statistical theory in Krivitsky and Handcock 2014:
 - demonstrates a given combination of formation and dissolution model will converge to a stable equilibrium, i.e.:

$$\text{Prevalence} \approx \text{Incidence} \times \text{Duration}$$

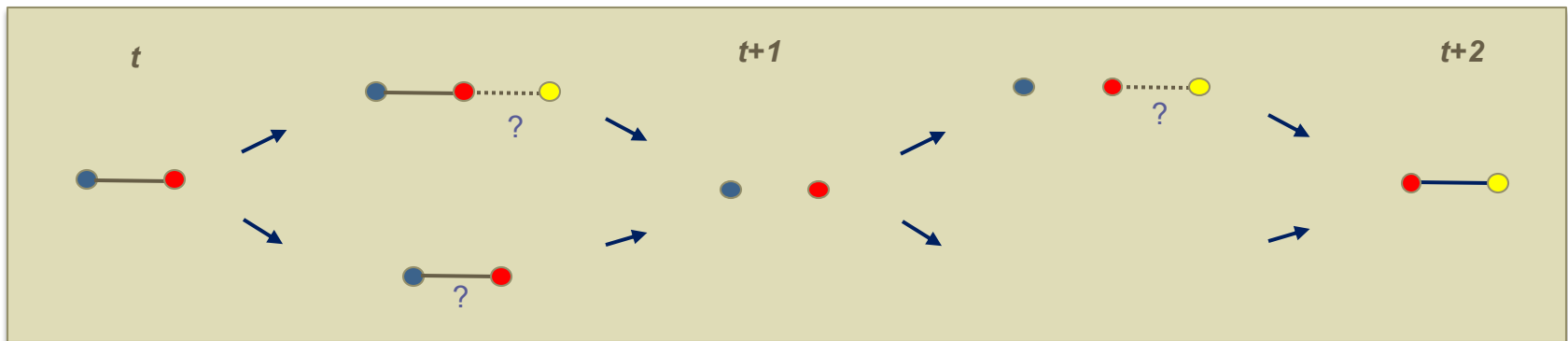
- This and other work provides the statistical theory for estimating models for the formation and dissolution processes, given data on tie prevalence and duration.

STERGMs – dependence across time steps

- The “separable” part of STERGMs means that within a time step, formation and dissolution are independent
- But this does not mean that they are independent across time steps
- Imagine this model:
 - formation = $\sim \text{edges} + \text{degree}(2:10)$
 - dissolution = $\sim \text{edges}$
 - with increasingly negative parameters on the degree terms.
 - i.e. there is some underlying tendency for relational formation to occur, which is considerably reduced with each pre-existing tie that the each actor involved is already in.
- This model implies there is a strong prohibition against being in multiple simultaneous romantic relationships.
- However, note that dissolution is fully independent---all existing relationships have the same underlying dissolution probability at every time step.

STERGMs – dependence across time steps

- Imagine that Chris and Pat are in a relationship at time t .
- During the step between t and $t+1$, whether they acquire a new partner does not depend on whether they break up and vice versa.
- Let us assume that they do break up during this time.
- Now, during the time period between $t+1$ and $t+2$:
 - whether or not they each form new partnership is dependent on whether they are still together at time $t+1$,
 - and that in turn depends on whether they broke up between t and $t+1$.



STERGMs – dependence across time steps

- The simple implication of this is that in this framework, formation and dissolution can be dependent, but that dependence occurs in subsequent time steps, not simultaneously.
- Note that a time step here is arbitrary, and left to the user to define. One reason to select a smaller time interval is that it makes this assumption more justifiable.
- I.e. with a time step of 1 month, then if I start a new relationship today, the earliest I can break up with my first partner as a direct result of that new partnership is in one month.
- If my time step is a day, then it is in 1 day
- The latter is likely much more reasonable.
- The tradeoff is that a shorter time interval means longer computation time for both model estimation and simulation
- At the limit, this can in practice approximate a continuous-time model---the only issue is computational limitations.`

Note on persistence vs. dissolution

- STERGMs can be parameterized for relational persistence
 - log odds that a tie = 1 now, given it = 1 at the last time step
 - consistent with the tie = 1 now in the formation model
- Or relational dissolution
 - log odds that a tie = 0 now, given that it = 1 at the last time step
 - “formation and dissolution” is the more common way to talk about dynamics
- But dissolution is just the inverse of persistence

$$\theta_{\text{persistence}} = -\theta_{\text{dissolution}}$$