Introduction to social network analysis

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Roadmap

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- Computation
- Organizational research
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Motivation

Why social network analysis?

Social networks matter for many things we care about...

- health and happiness (Bearman and Moody, 2004; Cornwell and Laumann, 2011)
- earnings and promotion (Burt, 1992; Mizruchi et al., 2011)
- employment and job search (Granovetter, 1995; Smith, 2005)

That includes organizations, where networks matter for...

- creativity (Hargadon and Sutton, 1997; Fleming et al., 2007)
- achievement (Sekara et al., 2018; Coleman, 1988)
- careers (Azoulay et al., 2017; Whittington, 2018)

What is social network analysis?

Social network analysis consists of two distinct (but closely related) things. . .

A set of theories. . .

- for explaining why social networks matter for so many different outcomes.
- for explaining the origin of social network structures and how they change.

A set of methods

- for characterizing the properties of social networks along important dimensions.
- for relating those properties to various outcomes of interest.
- for modeling the dynamics of social networks over time.

Today, we'll be focused on the methodology of social network analysis

Background

Where was social network analysis developed?

- Social network analysis (SNA) is a family of techniques for modeling relational data.
- But nothing about these techniques limits them to social networks.
- Consequently, development of SNA has been very interdisciplinary.

Historically, major contributions to SNA have come from...

- sociology (e.g., community, job search)
- anthropology (e.g., kinship)
- mathematics (e.g., graph theory, topology)
- physics (e.g., complexity)

But SNA is widely used in many other fields too...

- literature (e.g., text analysis)
- economics (e.g., education, development)
- health care (e.g., social determinants)
- social psychology (e.g., groups)
- marketing (e.g. influencers)
- computer science (e.g., information networks)

Computation

What's the connection to computational social science?

At a surface level...

- As a network grows in size, many network methods increase exponentially in their computational complexity
- We can see this by considering that the number of possible edges in a network is $\frac{n \times (n-1)}{2}$, where n is the number of nodes.
- Advances in social network analysis are therefore tied closely to advances in computation.

At a deeper level...

- Social network analysis has always been a fairly data-driven field, rather than one being driven by a core set of theoretical principles or models
- Critics of network analysis have often described the field as "a method in search of a theory."
- Similar to other computational techniques, network analysis embraces complex relationships among our "observations" and "variables."
- Interdependence is a feature, not a bug.
- Many techniques from SNA are focused on finding hidden structure, as revealed by patterns in the data (e.g., eigenvector centrality, block models, community detection).

How have advances in computation changed SNA?

Advances in computing have led to major advances in SNA

- Just a few decades ago, analysis of a network of more than a few hundred nodes would have been prohibitive.
- We can now analyze such networks on our laptops.
- Computational advances have also led to new insights connecting micro mechanisms to macro structures, chiefly through simulation.
- As the networks studied have grown (along with computational capabilities) so too have measures for reducing the dimensionality of networks, e.g., community detection.

Organizational research

Social network analysis has been widely used in organizational research

Inter-organizational networks

- strategic alliances (Powell et al., 2005)
- corporate governance (Mizruchi, 1996)
- venture capital (Sorenson and Stuart, 2008)

Intra-organizational networks

- information sharing (Hansen, 1999)
- mobility (Kleinbaum, 2012)

Innovation

- collaboration (Funk, 2014)
- diffusion (Davis and Greve, 1997)

Markets

- trust (Uzzi, 1997; McEvily et al., 2003)
- exchange (Granovetter, 1985)

Frontiers

Where is social network analysis going next?

My $0.02

Field (and lab) experiments

- Growing attention to causal inference.
- Most studies so far have networks as the independent variable.
- But we're starting to see attention to networks as outcomes too.

Network design and interventions

- How do we reshape inefficient networks?
- How do we grow networks that might be optimally effective for certain purposes?

Higher order structure

- What are the appropriate measures of large scale network structure?

Inequality

- How do we make sure the benefits of networks are more evenly distributed?
- How do we promote greater inclusion?

Appendix