6.3.2 Social Networks Analysis

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Overview and Objectives:
This course is an introduction to Social Network Analysis. The aim is to give students an overview of research on Social Networks, and the descriptive measures, models and analytical methods for empirical Social Network Analysis. This course has a maximum capacity of 30 students. Upon completion of the course, students should be able to:

1. Formulate meaningful research questions in social network analysis;
2. Understand the basics of gathering network data, and the issues and problems in collecting network data;
3. Calculate a range of descriptive measures of social networks, and interpret these measures;
4. Specify empirical analysis of both cross-sectional and longitudinal network data, and interpret the results of such analyses;
5. Formulate agent-based models which generate networks with diverse global structures from local behaviour of agents.

Teaching arrangements and course content:
The course is taught through eight two-hour sessions offered in Trinity Term. Additional hands-on computer lab sessions will also be offered.

The following is an outline of the content of the eight sessions:

- Overview of some network theories motivating the measures treated next: strength of weak ties, cohesion and brokerage, social capital.
- The structure and collection of social network data: egocentric and whole networks; network boundary problem; network surveys and name generators; archival data; experiments.
- Representation of networks: relations, graphs, sociograms, adjacency matrices.
- Visualization of networks.
- Centrality: degree, betweenness, closeness, eigenvector.
- Cohesion: density, fragmentation, cliques, k-plex, k-core, modularity.
- Brokerage: bridges, structural holes.
- Positions and equivalence: structural equivalence, regular equivalence.
- Block modelling.
- Introduction to Exponential Random Graph Models.
- Studies of networks and behaviour: selection and influence.
- Introduction to stochastic actor-oriented models for network dynamics.

Micro-models and macro-properties:
- Network properties at local and global scales.
- Small world networks. Transitivity/clustering, minimum path length, observational and experimental evidence.
- Degree distributions. Scaling properties for cumulative degree distributions, properties of scale free networks.

Generative models: micro-specifications for network growth and evolution.

- Preferential attachment: growth models for scale-free networks, sensitivity to initial conditions and specifications.
- Generation of small world properties: generating small-world networks with local processes.
- Computer simulation, agent-based models: modelling cooperation in networks, modelling the growth of collaboration networks.

Assessment:

This course is assessed by an essay of no more than 5,000 words which is due on Friday of week 10 of Trinity Term. The essay must contain an analysis of observed or simulated network data. The topic should be agreed upon by the student and the course instructors before week 7. In addition, there is a midterm practice assignment. Students have to submit an essay of no more than 2,500 words, describing an analysis of an observed network data set or the exploration of a network simulation model. This assignment is for feedback purpose only.

Key Texts:

- Barabasi, A.-L. and Albert, R. (1999) 'Emergence of scaling in random networks.' *Science* 286:509–512.
- Borgatti, S.P., Mehra, A., Brass, D. and Labianca, G. (2009). 'Network Analysis in the Social Sciences.' *Science*. Vol. 323. no. 5916, 892–895.
- Burt R. (1992). *Structural Holes.* Harvard: Harvard University Press.
- Carrington, P. and Scott, J. (eds, 2011). *The Sage Handbook of Social Network Analysis*. Sage.
- Dodds, P. S., Muhamad, R., and Watts, D.J. (2003) 'An experimental study of search in global social networks.' *Science* 301:827–829.
- Granovetter M. (1993). 'The Strength of Weak Ties'. *American Journal of Sociology,* 1360-1380.
- Lusher, D., Koskinen, J., and Robins, G. (eds., 2013). *Exponential Random Graph Models for Social Networks.* Cambridge University Press.
- Marsden, P.V. (1990) 'Network data and measurement.' *Annual Review of Sociology* 16:435–63.
- Merton, R. (1968) 'The Matthew effect in science.' *Science* 159:56–63.
- Newman, M.E.J. (2010), Networks: An Introduction, Oxford University Press
- Carrington, P.J., Scott, J., and Wasserman, S. (eds. 2005), *Models and methods in social network analysis*, Cambridge University Press.
- Robins, G.L., Woolcock, J., and Pattison, P. (2005) 'Small and other worlds: Global network structures from local processes.' *American Journal of Sociology*, 110:894–936.
- Snijders, T.A.B., Steglich, C.E.G., and van de Bunt, G.G., (2010). 'Introduction to actor-based models for network dynamics.' *Social Networks*, 32, 44–60.
- Travers, J. and Milgram, S. (1969) 'An experimental study of the small world problem.' *Sociometry* 32:425–443.
- Wasserman, S. and Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge University Press.
- Watts, D.J. and Strogatz, S.H. (1998) 'Collective dynamics of "smallworld" networks.' *Nature* 393:440–442.