

Social Network Analysis: An Introduction
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Social network analysis focuses on relationships between and among social entities. It is used widely in the social and behavioral sciences, as well as in political science, economics, organizational science, animal behavior, and industrial engineering. The social network perspective, which will be taught in this workshop, has been developed over the last sixty years by researchers in psychology, sociology, statistics, and anthropology. The social network paradigm is the theoretical and formal basis for the relational study of social structures in the social and behavioral sciences. The theoretical and methodological basis for this paradigm has been clearly defined, and it has been convincingly applied to a variety of substantive problems. However, a network approach requires a set of concepts and analytic tools, beyond those provided by standard quantitative (particularly, statistical) methods. These concepts and tools are the topics of this workshop.

This one-week workshop presents an introduction to various concepts, methods, and applications of social network analysis drawn from the social and behavioral sciences. The primary focus of these methods is the analysis of relational data measured on groups of social actors. Topics to be discussed include an introduction to matrices and graph theory and their use in studying structural properties of actor interrelations; structural and locational properties of actors, such as centrality and centralization; subgroups and cliques; equivalence of actors, including structural equivalence and blockmodels; local analyses, including dyadic and triadic analysis; hypothesis testing using conditional uniform random graphs and matrix permutations; and an introduction to statistical global analyses, using models such as p_1 , p^* , ERGMs and their relatives. Prerequisites for this course are familiarity with matrix algebra. A background in linear models and categorical data analysis will be helpful, but is not required.

The course will meet for about seven hours each day, according to the following schedule:

Time	Activity
Morning	Lecture
Early afternoon	Computing and Data Analysis
Late afternoon	Questions and Discussion

Course Texts

Wasserman, S., and Faust, K. (1994). *Social Network Analysis: Methods and Applications*. Cambridge, ENG and New York: Cambridge University Press.

Recommended:

Carrington, P., Scott, J, and Wasserman, S. (2004). *Models and Methods for Social Network Analysis*. New York: Cambridge University Press.

Topics Topics to be taught and the relevant chapters from Wasserman and Faust are:

Chapter 1: Introduction

Chapter 2: Social Network Data: Collection and Applications

Chapter 3: Notation for Social Network Data

Chapter 4: Graphs and Matrices

Chapter 5: Centrality, Prestige, Prominence, and Related Concepts

Chapter 7: Cohesive Subgroups

Chapter 9: Structural Equivalence

Chapter 10: Blockmodels

Chapter 13: Dyads

Chapter 14: Triads

Chapter 15: Statistical Analysis of Single Relational Networks

Computer Programs

We will be using a number of different social network analysis computer programs

UCINET from Analytic Technologies. A 60 day trial version is available for free.

<http://www.analytictech.com/archive/ucinet.htm>

NETDRAW from Analytic Technologies comes with UCINET, or free at

<http://www.analytictech.com/Netdraw/netdraw.htm>

Pajek is free at:

<http://pajek.imfm.si/doku.php>

R routines sna, network, and statnet in R from

<http://cran.r-project.org/>

also see <http://www.statnet.org/>

Other Resources

These are some especially useful resources on social networks. I encourage you to explore them and to take advantage of what they have to offer.

The International Network for Social Network Analysis (INSNA) is the international and interdisciplinary professional association for people interested in social network research. Its website (<http://www.insna.org>) is a wonderful source of information and resources on social networks, including links to many informative sites and to social network computer programs and data.

The listserv, SOCNET, is the main on-line forum for discussion of current topics on social networks. Information on how to join is available through the INSNA site (see above) or at: <http://www.insna.org/pubs/socnet.html>

Journals

Social Networks – the flagship journal of the discipline.

Connections is INSNA's newsletter/ informal journal. It is available through the INSNA website or directly at: <http://www.insna.org/pubs/connections/index.html>

Journal of Social Structure is an online journal with many articles of interest to social network researchers. <http://www.cmu.edu/joss/>

Handouts, tutorials, etc.

Steve Borgatti's web page is a nice source of introductory material and handouts on various topics on social networks. <http://www.analytictech.com/networks/>

Bob Hanneman at UCR has a useful online textbook on social network analysis that includes information about how to use UCINET
<http://www.faculty.ucr.edu/~hanneman/nettext/>

Network Data

Data examples from Wasserman and Faust are available at:
<http://vlado.fmf.uni-lj.si/pub/networks/data/WaFa/default.htm>

Miscellaneous social network data and information about Pajek from the Pajek sites
<http://pajek.imfm.si/doku.php>
<http://vlado.fmf.uni-lj.si/pub/networks/book/>
<http://vlado.fmf.uni-lj.si/pub/networks/data/esna/default.htm>
<http://vlado.fmf.uni-lj.si/pub/networks/data/>

Lin Freeman's data archive: <http://moreno.ss.uci.edu/data.html>

Mark Newman's data archive with additional links to other sites:
<http://www-personal.umich.edu/~mejn/netdata/>

Software Documentation

UCINET and NetDraw
<http://www.faculty.ucr.edu/~hanneman/nettext/>

SNA
<http://erzuli.ss.uci.edu/R.stuff/sna/sna-manual.2.2.pdf>
Carter Butts's R routines for social network analysis
<http://erzuli.ss.uci.edu/R.stuff/>

Pajek
<http://pajek.imfm.si/doku.php>

Readings * (and Suggested Further Readings)

1: Introduction to Social Networks and Network Applications

*Wasserman and Faust, Chapters 1 and 2

*Butts, Carter T. 2008 "Social network analysis: A methodological introduction" *Asian Journal of Social Psychology* 11(1) : 13-41.

Hawe, Penelope, Cynthia Webster and Alan Shiell 2004 "A glossary of terms for navigating the field of social network analysis" *J Epidemiol Community Health* 58: 971-975

Marsden, Peter. 2004. "Network Analysis." Pp. 819-825 in Kimberly Kempf-Leonard (ed.) *Encyclopedia of Social Measurement*. San Diego, CA: Academic Press,

2: Representing Networks: Graphs, Matrices, and Network Visualization

*Wasserman and Faust, Chapters 3 and 4

Freeman, Linton "Visualizing Social Networks" *Journal of Social Structure*, available at: <http://www.cmu.edu/joss/content/articles/volume1/Freeman.html>

Freeman, Linton 2005. "Graphic techniques for exploring social network data." Chapter 12, pages 248-269 in Carrington, Peter J., John Scott, and Stanley Wasserman (eds.) *Models and Methods in Social Network Analysis*. Cambridge: Cambridge University Press.

McGrath, Cathleen, Jim Blythe, and David Krackhardt “Seeing Groups in Graph Layouts” available at <http://www.andrew.cmu.edu/user/cm3t/groups.html>

Cox, Michael A. A. and Trevor F. Cox 2008. Multidimensional Scaling. *Handbook of Data Visualization* Springer Handbooks Comp.Statistics, , III, 315-347.

Johnson, Stephen, 1967. Hierarchical clustering schemes, *Psychometrika* 32(3):241-254.

3: Graph Theory for Network Analysis

*Wasserman and Faust, Chapter 4

*Borgatti, Stephen ms. *Graph Theory* www.steveborgatti.com/papers/graphtheory.doc

Borgatti, Stephen 1994 “A quorum of graph theoretic concepts.” *Connections* 17:47-49.

4: Centrality and Centralization

*Wasserman and Faust, Chapter 5

*Freeman, Linton 1979. “Centrality in social networks: Conceptual clarification.” *Social Networks* 1:215-239.

*Butts, Carter T. 2008 “Social network analysis: A methodological introduction” *Asian Journal of Social Psychology* 11(1) : 13-41. (pages 22-25)

5: Cohesive Subgroups and Two Mode Networks

*Wasserman and Faust, Chapters 7 and 8

Freeman, Linton 1992 “The sociological concept of group: An empirical test of two models.” *American Journal of Sociology*. 98(1):152-166.

Moody, James and Douglas R. White. 2003. “Structural Cohesion and Embeddedness: A hierarchical conception of Social Groups.” *American Sociological Review* 68:103-127.

Breiger, Ronald. 1974. “The duality of persons and groups.” *Social Forces*. 53:191-190.

6: Equivalences and Blockmodels, Network Roles and Algebraic Models

*Wasserman and Faust, Chapter 9, 10, and 11

White, Harrison, Scott Boorman and Ronald Breiger. 1976. "Social structure from multiple networks: I. Blockmodels of roles and positions." *American Journal of Sociology* 81(4):730-780.

Borgatti, Steve and Martin Everett 1992. "Notions of position in network analysis." *Sociological Methodology* 22:1-36.

Doreian, Patrick, Vladimir Batagelj, and Anuska Ferligoj 2005. "Positional analyses of sociometric data." Chapter 5 pages 77-97 in Carrington, Peter J., John Scott, and Stanley Wasserman (eds.) *Models and Methods in Social Network Analysis*. Cambridge: Cambridge University Press.

Miller McPherson, Lynn Smith-Lovin, James M. Cook. 2001 Birds of a Feather: Homophily in Social Networks, *Annual Review of Sociology*, Vol. 27 (2001), pp. 415-444.

7: Local Structure, Subgraphs: Dyads, and Triads

*Wasserman and Faust, Chapters 6, 13 and 14

*Butts, Carter T. 2008 "Social network analysis: A methodological introduction" *Asian Journal of Social Psychology* 11(1) : 13-41. (pages 25-26)

Holland, Paul, and Samuel Leinhardt 1971. "Transitivity in structural models of small groups." *Comparative Group Studies* 2:107-124.

Faust, K. (2007). Very Local Structure in Social Networks." *Sociological Methodology*, 37:209-256.

8: Matrix Permutation Tests for Comparing Relations

*Baker, Frank B. and Lawrence J. Hubert 1981 The Analysis of Social Interaction Data : A Nonparametric Technique, *Sociological Methods and Research* 9: 339-361

Hubert, L. 1978. "Evaluating the conformity of sociometric measurements." *Psychometrika* 43:31-41.

9: Introduction to Statistical Models, ERGMs

Robins, Garry, Pip Pattison, Yuval Kalish, Dean Lusher 2007 "An introduction to exponential random graph (p) models for social networks" *Social Networks* 29: 173–191

Wasserman and Faust, Chapter 15