Social Network Analysis

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Instructor : Dan Ryan
Lectures: Tu-Th 4:00-5:15 pm
Office Hours by Appointment

Unfold

Table of Contents

Part I: What is and Where are...

1. Introduction to the Course (ThW1)

Syllabus. Mechanics. Books & Readings. Requirements. Grading.No reading. Exercise — our baseline network.

Topics and Such

- Books
- Digital Course Library
- E-Assumptions (email, blogs, wikis, etc.)

[+] Other resources

Homework

- Fill out our first day index card
- Take our Media Survey

2. Introduction: Networks everywhere (TuW2)

What is a network? Interest in networks not new. Math + sociology and now physics, computer science, biology, information science, etc. Ubiquity. Network science in physical sciences, life sciences, and social sciences. What are we interested in beyond pretty visualizations (these ARE important)? Want to understand how position of node is important independent variable that can explain things we care about, how to use node metrics to locate important ones, how network structure affects processes that are embedded in/on them (vs. occurring in homogeneous social space), and, in general, understanding the implications of a world that is clumpy.

Reading

- Kadushin, Charles ch 1 "Introduction" (9)
- Hansen et al. Ch 1 "Introduction to Social Media and Social Networks" (7)
- Newman, Barabasi, Watts. 2006. "Introduction," ch 1 of *The Structure and Dynamics of Networks*. (9, PDF)
- TED Nicholas Christakis: The hidden influence of social networks (18:44)
- Wikipedia. Social Network Analysis - Social Network Analysis
- Wikipedia. Social Network Analysis - History of Social Network Analysis

[+] Other resources

Lecture Notes: Networks are Everywhere

Homework

- Problems: 30 (Due in dropbox before class Tuesday 24 January — incentive to get Dropbox set up and figure out how to submit — don't sweat if that's a stumbling block — we'll get ourselves on the same page in class.)

3. Network Basics (ThW2)

Graphs, vertices and edges. In this module we introduce the terminology and concepts of graphs and networks. Also, BEFORE NEXT CLASS you should work through an EXCEL Refresher.

Reading

- Kadushin, ch 2 "Basic Network Concepts, Part I: Individual Members of Networks (14)
- Hansen, et al. Sections 3.1-3.4 of ch 3 "Social Network Analysis: Measuring, Mapping, and Modelling Collections of Connections" (8)
- Lewis, *Network Science : Theory and Applications* (EBOOK) pp. 23-33.

[+] Show other resources

Lecture Notes: Nodes, Vertices, Ties, and Edges

Homework

- Problems 26, 27, 28, 29

Exercises

0026 (Sketch directed network)
0027 (Bibliographic and co-citation networks)
0028 (Density)
0029 (Vertices and Edges)

4. Social Media and Social Networks (TuW3)

We need to be at least passingly familiar with email, newsgroups, listserves, Facebook, Twitter, Youtube, and Wikipedia. This class gives a quick overview and introduction to each.

Reading/Viewing

- Social Networking in Plain English (1:48)
- Ch 2 "Social Media: New Technologies of Collaboration" (19)
- TBOOK Clay Shirky on Social Networking Sites (11:22)
- Jurgenson, Nathan. 2012. "The Facebook Eye" The Atlantic online

[+] Show other resources

Lecture Notes:

Homework

- Problems 31

Exercises

0031 (Social media 101)

Part II: Hands On (ThW3)

5. Getting Started with Software NodeXL

Installing and running NodeXL software; user-interface; data entry; simple visualization

Reading

- Hansen, et al. ch 4 "Getting Started with NodeXL, Layout, Visual Design, and Labeling" (15)
- Marc Smith Introduction to NodeXL - 1 (8:38)
- NodeXL (2:53)

[+] Show other resources

Lecture Notes:

Homework

- Problems 25, 32

Exercises

0025 (Organizational Chart in NodeXL)
0032 (NodeXL 101 review)

6. Data and methods (TuThW4)

Data collection and storageNode data, edge data; one-mode, two mode; field work, surveys, archival; levels of measurement; statistics

Reading

Kadushin, ch 2 "Basic Network Concepts, Part I: Individual Members of Networks (14)
Hansen, et al. Sections 3.5-3.12 of ch 3 "Social Network Analysis: Measuring, Mapping, and Modelling Collections of Connections" (13)
Borgatti on data
Marsden, P.V. 1990. Network data and measurement. *Annual Review of Sociology 16:*435-63. ("JSTOR") (READ pp. 435-436.9, 440.8-445)
Hanneman and Riddle 1, 2, 6
Mark Newman data page
Pajek data page

[+] Show other resources

Lecture Notes: Network Data
Homework

- Problems 34, 35, 42, Q47, Q48, Q49

Exercises

0034 (Edgelist and nodelist)
0035 (Name generator field data)
0042 (Data Collection Problems)
0047 (NodeXL Practice)
0048 (Network Data Problem)
0049 (Converting 2 mode data into 1 mode data)
0053
0054

7. Graphs and Matrices (W6)

Graph notation, matrix representations and arithmetic

Reading
FIND SIMPLEST BIT ON MATRICES?

- Wikipedia. Graph Theory
- Hoppe, Bruce. Introduction to Network Mathematics (read sections: Undirected and directed graphs; Adjacent and Incident; Neighborhood and Degree; Density and average degree; Paths and walks; Length, distance, diameter)
- Lewis, *Network Science : Theory and Applications* (EBOOK) pp. 33-38.

[-] Hide other resources

www.mhhe.com Network Graphs

Hanneman and Riddle 3, 4,5.
Easley, David and Jon Kleinberg. 2010. ch 2 "Graphs" in *Networks, Crowds, and Markets: Reasoning about a Highly Connected World*. (22)

Breiger, Ronald L. 1974. "The Duality of Persons and Groups." *Social Forces, Vol. 53,* No. 2, Special Issue. (Dec., 1974), pp. 181-190. (JSTOR)
Newman, Mark. 2010. ch 6 in *Networks: An Introduction*. Oxford University Press.
(RH Notes on Graphs and Matrices)

Lecture Notes: The Mathematics of Networks I

Homework

- Problems 36

Exercises

0036
0055 (Compute degree from Adjacency Matrix)

8. Visualization II: Introduction to GEPHI

Gephi is a powerful and elegant network visualization program. It has a relatively modest initial learning curve and will give us access to a few important functions that NodeXL does not handle well. This will be a short introduction — there will be follow up exercises as the course proceeds.

Reading

Quick Start (tutorial)
Overview
Visualize a Twitter network with Gephi (tutorial)

[+] Show other resources

Lecture Notes:

Homework

- Problems 33

Exercises

0033 (Gephi practice problems)

Part III: Network Metrics

(28 Feb - 6 Mar)

9. Introduction to network metrics: Centrality and Power (Ryan Slides)

Three levels: individual nodes' properties, distribution of node properties, whole network properties; size, density, degree, paths, loops, distance, diameter, flow, cohesion, and influence. Position, power, and influence; Power at the macro level (centralization) and micro level (centrality); Degree, social capital, domination, Closeness, Path distance, Reach, Eigenvector, Betweenness, Flow

Reading

Wikipedia. Centrality
Hanneman and Riddle ch 7 "Connection and distance", Lecture outline RH, 10

[+] Show other resources

Lecture Notes: Node Metrics I

Homework

- Problems 37

Exercises

0037 (Centrality)

8 March

Application: Influence and Diffusion, Networks and Social Movements and Social Change

Social Change and Social Movements, diffusion and contagion; Collective action problems, network structure, thresholds, cascades, critical mass, historical examples

Reading

- Kadushin, ch. 9 (27)
- Hanneman. Social Movements and Innovations
- Wikipedia. "Diffusion of Innovations."

[+] Other resources

Lecture Notes: Diffusion

Exercises

0167

Application: Organizations and Networks

From informal organization on the factory floor through teams and leadership to the power elite and board interlocks

Reading

- Kadushin, ch. 7 (18)
- The Power Elite, C. Wright Mills, Oxford University Press, 1956 http://www.marxists.org/subject/humanism/mills-c-wright/power-elite.htm
- The Higher Circles
- The Chief Executives
- Eisenhower on the military industrial complex (2:31)
- DOMHOFF: RULING CLASS COHESIVENESS AND BOHEMIAN GROVE (2:08) (if interterested, see next part)
- Paul Krugman Speaks About Soft Corruption and Oligarchy
- Borgatti, Stephen P. and Pacey C. Foster. 2003. "The Network Paradigm in Organizational Research: A Review and Typology." *Journal of Management 29*(6) 991–1013.

[+] Other resources

Lecture Notes: Title

Exercises

10. Cliques and groups

Groups, clicks, clans, clubs, components, clustersGroups and Sub-structures; Bottom-up approaches: types of dyads, types of triads, the maximal complete sub-graph; Cliques - maximal complete sub-graphs, clique overlap; Top-down approaches: strictly segregated sub-populations, degree of division, key positions and relations; Components - disconnected sub-graphs; Summary: micro position, identity, and life chances; division and macro dynamics

Reading

- Hoppe, Bruce. Introduction to Network Mathematics (read sections: Connected vertices, graphs, and components; Components, cliques, and clusters)

Hanneman and Riddle ch 11.
(RH)
Borgatti Groups
Borgatti Cohesion

[+] Show other resources

Lecture Notes: Groups, Clusters, Cliques, and Clubs

Homework

- Problems 0

Exercises

0039 (Cohesive subgroups)

Application: Small Groups, Leadership, and Social Networks

Reading

- Kadushin, ch. 6 (16)

[+] Other resources

Lecture Notes: Title

Exercises

Application: The Small World, Circles and Communities

Directed search, Milgram's results, Kleinberg's result, Rewiring of lattices, social distance, Blau space, sexual networks, choke points, Watts' "percolation models"

Reading

- Kadushin, ch. 8 (26)
- Dodds, et al. 2003. "An Experimental Study of Search in Global Social Networks." *Science 301,* 827 (2003); DOI: 10.1126/science.1081058
  * Travers, Jeffrey and Stanley Milgram. 1969. "An Experimental Study of the Small World Problem." *Sociometry, Vol. 32,* No. 4. (Dec., 1969), pp. 425-443.JSTOR Stable URL
  * Kleinfeld, Judith S. 2002. The Small World Problem." *SOCIETY JANUARY / FEBRUARY 2002*, 61-66.
- Karinthy, Frigyes. 1929. "Chain-Links" from the book Everything is Changing."
- Kadushin, ch 8 "The Small World, Circles, and Communities" (27)
- Duncan Watts and Dalton Conley discuss Six Degrees of Separation (5:10)

[+] Other resources

Lecture Notes: Title

Exercises

11. Homophily and social segregation

Mating, inter-group relations, identity, conflict, competition

Reading

(RH)
Should this be cohesion and solidarity?
Kadushin, see index.
Zuckerman, Ethan. 2008. Homophily, serendipity, xenophilia
Burkeman, Oliver. 2009. This Column Will Change Your Life The Guardian, Friday 30 January 2009

[+] Show other resources

Lecture Notes: Homophily: Birds of a Feather and the Daily Me

Homework

- Problems 0

Exercises

0038 (Homophily)

Application: Networks as Social Capital

Reading

- Kadushin, ch. 10 (22)

Social Capital + Influence Interview with Valdis Krebs
Social Capital (2:06)

[+] Other resources

Lecture Notes: Title

Exercises

12. Nodes in Context

Positions and Equivalence; Social Roles. Equivalence of positions: The idea of "equivalent" actors; Kinds of "equivalence"; Three main types Structural equivalence, Automorphic equivalence Regular equivalence; Visualizing; Measuring; findings

Reading

- Hoppe, Bruce. Introduction to Network Mathematics (read sections: Structural equivalence)

Hanneman and Riddle ch 12, ch 13
(RH)
Hanneman and Riddle, ch 15
Borgatti Notes

[+] Show other resources

Lecture Notes: Positions, Equivalence and Roles

Homework

- Problems 0

Exercises

0040 (Structural equivalence)

Application: Network analysis in epidemiology and public health

- DONALD G. McNEIL Jr. "Haiti: Cholera Epidemic's First Victim Identified as River Bather Who Forsook Clean Water" New York Times January 9, 2012
- How Epidemic Spread Relates to Travel (1:31)
- The Spread of Obesity in Social Networks (animation 1:49)
- The Spread of Smoking in Social Networks (animation 1:39)
- Radio Lab: Patient Zero

[+] Other resources

Lecture Notes: Networks and Disease

Exercises

Course Policies

+ Attendance
+ Class Preparation and Assignments

Grading Policy

Your grade for this course will be based on 1) your ability to understand and analyze the various topics and perspectives presented in the readings and during class, and 2) to communicate in writing effectively and with sophistication. Failure to complete all course assignments ON TIME may result in a failing grade. In general, no late papers or make-up work will be permitted. If there is an emergency, an exception to the late policy may be made. In this case, late assignments may be accepted with a grade deduction per day they are late (extreme emergencies excepted).

How will my work be evaluated and graded?

The evaluated work for this course will consist of problem sets, mid-semester exams, and a final exam.

Labs/Problem Sets

There will be problem sets covering material from a section of the course and employing techniques introduced. Grading is based on the degree to which the artifact demonstrates skill competence and professional presentation.

A	Excellent	exceptionally good; extremely meritorious; superior; of the highest quality; very good of its kind ; eminently good
A-	Very Good	
B+	Good	Having the qualities that are desirable in a particular thing; better than average or satisfactory
B	Adequate	Satisfies the requirements of the task, acceptable
B-	Unsatisfactoryish	Falls distinctly short of adequate practice
C	Unsatisfactory	Not acceptable as demonstration of competence
D	Dastardly and Despicable	Strongly suggestive competence has not been acquired yet
F	Failure	Demonstrative of competence nonacquisition

Definitions

Please keep in mind that grades are not measures of effort, stress, time, or other personally variable factors. They represent an assessment of competence demonstrated in the artifact of problem solutions or answers on an exam.

Final course grades will be translations of semester achievement into the conventional scale:

A = Excellent. The work

1. consistently demonstrated competence in skills under consideration,
2. results essentially correct; the final product
3. communicated clearly what was done, how, and why, and is presented in a
4. professional manner.

B = Satisfactory. Fundamentally sound as far as demonstration of competence, but falls short on one or more of above criteria.

B- = Weak Satisfactory. Uneven performance or consistently middling performance with significant gaps.

C,D = Unsatisfactory. Unacceptably low achievement.

Keep in mind that the purpose of these exercises is two-fold. First, you are practicing a skill. Second, you are using the exercise as an opportunity to demonstrate your competence and skill.

With the latter in mind you should shift from thinking of it in terms of "what is required?" and "what does the teacher want?" to "what have I learned how to do and how can I demonstrate it?" Everything you submit should be complete and stand on its own as a document, and, as much as is possible at a given point in time, be something one could show around to say "look what I can do."

NEVER submit "naked" answers that presume that some evaluator knows what the question was. Never omit your reasoning. Never assume that the reader, knows something and doesn't need to read it again.

Accessibility

To request academic accommodations due to a disability, students should contact Services for Students with Disabilities in the Cowell Building. If you have a letter indicating you have a disability which requires academic accommodations, please present the letter to me so that I will be able to provide the accommodations that you need in this class.

Assessment

Skill/Competence	Where Demonstrated
Definitions and terminology	Class, exercises, exams
Matrix representations and matrix math of networks.	Class, exercises, exams
Collecting and entering data.	Class, exercises, exams
Grabbing data from archival and online sources.	Class, exercises, exams
Basic visualization and analysis with NodeXL.	Class, exercises, exams
Basic visualization and analysis with Gephi.	Class, exercises, exams
Capacity to produce/interpret beautiful/meaningful visualization.	Class, exercises, exams
Describe, compute, interpret node, edge, and whole network metrics.	Class, exercises, exams
Apply network analysis to real world issue/problem.	Class, exercises, exams

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