

Social Network Analysis

Dr. Tyler Horan

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Tuesday, Thursday 1:00PM - 2:15PM EST

University of Massachusetts Amherst

Course Links

LMS:

Zoom:

Office Hours

Monday 10-12 and by appointment. Virtual office hours will be held via zoom at this link:

Course Description

This course will primarily focus on the theoretical underpinnings and methodological foundations of social network analysis. The theoretical foundation of social network analysis in the realm of social sciences lies in the interdependencies among actors. The aim of this course is to comprehend the nature of these interdependencies and investigate the regularities within social systems. It will encompass the introduction of both the substantive and theoretical framework for social network analysis, along with certain methodological tools essential for conducting network research.

Objectives

By the conclusion of this course, students should possess the following abilities: (1) a comprehensive understanding of the key theoretical concepts upon which network research is based, (2) proficiency in collecting and organizing social network data, and (3) competence in analyzing and interpreting social network data. Due to the dual objectives of the course, our instructional time will be divided between substantive and theoretical explanations, as well as methodological tools. Each week, we will engage with readings pertaining to a specific domain of social network analysis, exploring the methodological and statistical applications associated with the substantive readings.

Topics

Distributions, Probability, Sampling, Regression, Analysis of Variance.

Prerequisites

Introductory course to Sociology, Political Science, Economics or Anthropology.

Course Materials

The primary texts for the course will be:

Textbook: Kolaczyk and Csardi. 2020. *Statistical Analysis of Network Data with R*. New York: Springer Press

Supplemental Readings and PDFs on Google Classroom.

R for Windows or Mac, with the igraph package installed. We will demonstrate how to install R and packages in class.

Requirements & Expectations

The instructional format of this course is interactive and collaborative in nature. Given that science itself is a social endeavor, significant emphasis will be placed on active engagement with peers, including the instructor, through collaborative work, soliciting feedback, and providing constructive critiques. As such, it is expected that students come prepared for class by completing the assigned readings and actively participating in discussions, posing inquiries, and responding to queries from both their peers and the instructor.

The principal requirement for this course is the completion of a research paper that employs the methods or concepts of social network analysis. This paper may involve either the application of social network analysis to pre-existing data or the collection of data specifically for this course. Alternatively, it may take the form of a research design for a project intended for future completion. Towards the end of the course, dedicated time will be allocated for each student to present their research ideas to the class, facilitating constructive feedback. In addition to the research paper, students are expected to fulfill a series of homework assignments aimed at fostering familiarity with the software and analysis techniques introduced throughout the course.

Leading a class discussion for one week (25%):

Each student will be assigned the responsibility of leading a class discussion, typically working in teams. The designated seminar leaders will disseminate approximately five discussion questions via email or through the course management system, by 2pm the day before the scheduled class. Moreover, the seminar leaders will commence the class by providing a concise overview of the week's topic, encompassing approximately 15 minutes (refer to the attached guidelines). I am available to discuss the discussion questions with you, so kindly arrange an appointment and/or share a draft of the questions prior to our meeting.

Homework assignments (25%):

Between weeks 2 and 7, homework assignments will be assigned and expected to be completed. These assignments are designed to foster familiarity with social network methodologies and tools. They will comprise both traditional problem-solving exercises as well as practical exercises involving social network software.

In-class presentation of research (25%): Each student will deliver a research or proposal presentation lasting between 10 to 12 minutes. The purpose of these presentations is to

provide a concise overview of the theoretical foundations of the proposed research, the methods employed for data collection, and the analysis techniques to be employed. Students are expected to offer constructive feedback on each other's presentations.

Final Paper (25%): The final paper should take the form of a research proposal for a project that applies social network theory and analysis. The paper should consist of a minimum of 15 double-spaced pages. It should provide a brief introduction to the chosen topic (1-2 pages), expound upon the theoretical framework underpinning the research (4-5 pages), and outline the proposed data collection methods, analytical approaches, and hypotheses to be tested. It is important to note that there is no

Academic Honesty

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst.

Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. The procedures outlined below are intended to provide an efficient and orderly process by which action may be taken if it appears that academic dishonesty has occurred and by which students may appeal such actions. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent. For more information about what constitutes academic dishonesty, please see the Dean of Students' website:

http://umass.edu/dean_students/codeofconduct/acadhonesty/

Statement on Disabilities

The University of Massachusetts Amherst is committed to making reasonable, effective and appropriate accommodations to meet the needs of students with disabilities and help create a barrier free campus. If you are in need of accommodation for a documented disability, register with Disability Services to have an accommodation letter sent to your faculty. It is your responsibility to initiate these services and to communicate with faculty ahead of time to manage accommodations in a timely manner. For more information, consult the Disability Services website.

Course Schedule

Week 1 - Course Introduction

Tuesday, September 5

- Course introduction, syllabus, meet and greet each other

Thursday, September 7

- Dalggaard, Introductory Statistics with R, Chapters 1 & 2

Week 2 - Networks in the Social Sciences and Computing in R

Tuesday, September 12

- Kolaczyk & Csárdi (2020) Chapter 1 – “Introduction”
- Kolaczyk & Csárdi (2020) Chapter 2 – “Manipulating Network Data”

Thursday, September 14

- Borgatti et al. (2009) “Network Analysis in the Social Sciences,” Science
- Lazer et al. (2009) “Computational Social Science,” Science
- Butts (2009) “Revisiting the Foundations of Network Analysis,” Science
- Granovetter (1973) “The Strength of Weak Ties,” American Journal of Sociology

Week 3 - Visualization

Tuesday, September 19

- Tufte (2001) “The Visual Display of Quantitative Information” (selected pages, posted on Google Classroom)
- Freeman (2000) “Visualizing Social Networks,” Journal of Social Structure

Thursday, September 21

- Kolaczyk & Csárdi (2020) Chapter 3 – “Visualizing Network Data”

Week 4 - Network Measurement and Description

Tuesday, September 26

- Kolaczyk & Csárdi (2020) Chapter 4 – “Descriptive Analysis of Network Characteristics”

Thursday, September 28

- Song & Eveland (2015) “The Structure of Communication Networks Matters: How Network Diversity, Centrality, and Context Influence Political Ambivalence, Participation, and Knowledge,” Political Communication
- González-Bailon & De Domenico (2021) “Bots are less central than verified accounts during contentious political events,” Proceedings of the National Academy of Sciences
- Melamed & Simpson (2016) “Strong ties promote the evolution of cooperation in dynamic networks,” Social Networks

Week 5 - Mathematical Models

Tuesday, October 3

- Kolaczyk & Csárdi (2020) Chapter 5 – “Mathematical Models for Network Graphs”

Thursday, October 5

- Pomeroy et al. (2020) “Dynamics of social network emergence explain network evolution,” Scientific Reports
- Fowler, Dawes & Christakis (2009) “Model of genetic variation in human social networks,” Proceedings of the National Academy of Sciences
- Song, Nyhuis & Boomgaarden (2019) “A network model of negative campaigning: The structure and determinants of negative campaigning in multiparty systems,” Communication Research

Week 6 - Statistical Models

Tuesday, October 10

- Kolaczyk & Csárdi (2020) Chapter 6 – “Statistical Models for Network Graphs”

Thursday, October 12

- Srivastava and Banaji (2011) “Culture, Cognition, and Collaborative Networks in Organizations,” *American Sociological Review*
- Lee and Monge (2011) “The Coevolution of Multiplex Communication Networks in Organizational Communities,” *Journal of Communication*
- Twyman et al. (2022) “Teammate invitation networks: The roles of recommender systems and prior collaboration in team assembly,” *Social Networks*

Week 7 - Group Structure

Tuesday, October 17

- Kolaczyk & Csárdi (2020) Chapter 7 – “Network Topology Inference”

Thursday, October 19

- McPherson, Smith-Lovin & Cook (2001) “Birds of a Feather: Homophily in Social Networks,” *Annual Review of Sociology*
- Lewis et al. (2008) “Tastes, ties, and time: A new social network dataset using Facebook.com,” *Social Networks*
- Newman (2001) “The structure of scientific collaboration networks,” *Proceedings of the National Academy of Sciences*

Week 8 - Experiments in Networks

Tuesday, October 24

- Kolaczyk & Csárdi (2020) Chapter 10 – “Networked Experiments”

Thursday, October 26

- Nickerson (2008) “Is voting contagious? Evidence from two field experiments,” *American Political Science Review*
- Aral and Walker (2012) “Creating Social Contagion through Viral Product Design: A Randomized Trial of Peer Influence in Networks,” *Management Science*
- Bond et al (2012) “A 61-Million-Person Experiment in Social Influence and Political Mobilization,” *Nature*

Week 9 - Dynamic network processes

Tuesday, October 31

- Kolaczyk & Csárdi (2020) Chapter 11 – “Dynamic Networks”

Thursday, November 2

- Aral, Muchnik & Sundararajan (2009) “Distinguishing Influence-based contagion from homophily-driven diffusion in dynamic networks,” *Proceedings of the National Academy of Sciences*
- Centola (2010) “The Spread of Behavior in an Online Social Network Experiment,” *Science*
- Fowler et al (2011) “Causality in Political Networks,” *American Politics Research*

Week 10 - Online social networks

Tuesday, November 7

- Lazer et al. (2021) “Meaningful measures of human society in the twenty-first century”

- Zhang et al. (2021) “Assembling the Networks and Audiences of Disinformation: How Successful Russian IRA Twitter Accounts Built Their Followings, 2015?2017,” Journal of Communication
 - Kramer, Guillory and Hancock (2014) “Experimental evidence of massive-scale emotional contagion through social networks,” Proceedings of the National Academy of Sciences
 - Mosleh et al. (2021) “Shared partisanship dramatically increases social tie formation in a Twitter field experiment,” Proceedings of the National Academy of Sciences
- Thursday, November 9*
- Bail et al. (2018) “Exposure to opposing views on social media can increase political polarization”
 - Cinelli et al (2020) “The COVID-19 social media infodemic,” Scientific Reports
 - Green et al (2020) “Elusive consensus: Polarization in elite communication on the COVID-19 pandemic,” Science Advances

Week 11 - More on experiments, lab and field

Tuesday, November 14

- Fowler and Christakis (2010) “Cooperative Behavior Cascades in Human Social Networks,” Proceedings of the National Academy of Sciences
- Rand, Arbesman and Christakis (2011) “Dynamic social networks promote cooperation in experiments with humans,” Proceedings of the National Academy of Sciences
- Melamed, Harrell & Simpson (2018) “Cooperation, clustering, and assortative mixing in dynamic networks,” Proceedings of the National Academy of Sciences

Thursday, November 16

- Centola et al. (2021) “The reduction of race and gender bias in clinical treatment recommendations using clinician peer networks in an experimental setting,” Nature Communications
- Traeger et al. (2020) “Vulnerable robots positively shape human conversational dynamics in a human-robot team,” Proceedings of the National Academy of Sciences
- Stewart et al. (2019) “Information gerrymandering and undemocratic decisions,” Nature

Week 12 - Affiliation networks & Information Flow

Tuesday, November 21

- Song, Eberl & Eisele (2020) “Less fragmented than we thought? Toward clarification of a sub disciplinary linkage in communication science, 2010-2019,” Journal of Communication
- Fowler & Jeon (2008) “The Authority of Supreme Court Precedent,” Social Networks
- Bond & Sweitzer (2018) “Political Homophily in a Large-Scale Online Communication Network,” Communication Research

Weeks 13 and 14 - Student Presentations

Tuesday, November 28

- Student presentations

Thursday, November 30

- Student presentations

Tuesday, December 5

- Student presentations