CSC 495: Social Network Analysis

Professor Robin Burke
Spring 2013, Section 901/910, CDM 226
Tu 5:45 — 9:00 pm

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Course web site: http://d2l.depaul.edu/

Description

This course is an introduction to the concepts and methods of social network analysis. Students will learn to extract and manage data about network structure and dynamics, and to analyze, model and visualize such data. Students will use software tools to model and visualize network structure and dynamics. Specific network applications to be discussed include online social networks, collaboration networks, and communication networks. PREREQUISITE(S): CSC 423 or CSC 202 or SOC 412

Textbook: Newman, M.E.J. *Networks: An Introduction*. Oxford University Press. 2010.
Other readings online as assigned.

Assessment

Students will be assessed on the basis of 5 homework assignments, 4 labs, a midterm and a final project.

Homework (5): 30%
Midterm: 25%
Labs (4): 15%
Final project: 30%

Homeworks are due weekly by classtime and cannot be submitted late. This enables us to discuss homework solutions in class.

Attendance at labs is optional, and lab assignments will be due the following week. Lab sessions will be recorded so on-line students can follow along to complete each exercise.

The final project will involve the creation of a network analysis using a data set of the student's choice. Students may work solo or in pairs on this assignment. There are three milestones for this project:

5/7: Project proposal:
5/21: Project data
6/11: Project due

Tentative Schedule

4/2: Introduction to Social Network Analysis

Introduction to the class. Syllabus and expectations. Steps in social network analysis: network definition, manipulation, calculation, visualization. Graph terminology. Social networks. Technological networks. Sampling and data characteristics.
Reading: Newman, Chapters 1, 3 and 4.

4/9: Introduction to R / Lab

The R environment. statnet package for social network analysis. Basic transformation and visualization tools. Lab: Loading, manipulating, visualizing and saving network data in R.
Reading: TBA
Due: Homework 1

4/16: Graph Properties / Visualization

Networks and representations. Adjacency matrix and properties. Weighted, directed, bipartite networks. Trees. Node degree. Paths, components, connectivity and cut sets. Graph laplacian. Random walks. Levels of analysis: node, dyad, triad, subgroup. Best practices for graph visualization. Layout algorithms.
Reading: Newman, Ch. 6 & Chen & Yang, Visualization of Social Networks, Chapter 27 in *Handbook of Social Network Technologies and Applications*, 2010.
Due: Homework 2

4/23: Metrics / Lab

Measures of centrality. PageRank, Hubs and Authorities. Betweenness. Transitivity, Reciprocity. Structural balance. Homophily and assortativity. Lab: Computing and displaying graph metrics in R.
Reading: Newman, Ch. 7
Due: Homework 3

4/30: Midterm / Project Discussion

5/7: Large-scale structure of networks / Algorithms

Shortest-paths and the small-world effect. Degree distributions. Power laws and scale-free networks. Clustering coefficients. Basic graph algorithms: computing properties of nodes and dyads. Maximum flow.
Reading: Newman, Ch. 8, 10

5/14: Clustering / Lab

Graph partitioning. Spectral partitioning. Modularity and modularity maximization. Lab: Calculating and comparing clustering approaches.
Reading: Newman, Ch. 11

5/21: Ego analysis / Bi-partite networks

Analysis of local networks. Structural holes theory. Measures of constraint. Bi-partite and affiliation networks. One-mode projections and analyses.
Reading: TBA

5/28: Exponential random graph modeling

Frameworks for evaluating results in network analysis: autocorrelation, matching techniques, QAP regression, exponential random graphs, and p* models. Computational considerations . Lab: Applying ERGM analysis.
Reading: Newman, Ch. 12, 15.2

6/4: Network evolution / Review

Actor models. Network dynamics vs behavior dynamics. RSiena. Model creation and estimation. Animation with RSonia. Review for the final.
Reading: Snijders, et al. Introduction to stochastic actor-based models for network dynamics. *Social Networks*, 2010.

Policies

Students are expected to attend all classes and participate in in-class exercises. Class will start promptly. I will take attendance. Arrival more than 10 minutes late for class will constitute an absence. Students are individually responsible for material they may have missed due to absence or tardiness.

Assignments (except for designated group assignments) must represent a student's individual effort. While students are permitted to discuss assignments at the conceptual level, under no circumstances should students share code (electronically or otherwise). Use of sources without attribution constitutes plagiarism, a serious violation of academic integrity. Consult the assignment handouts or the instructor if you have questions about how or what to document. The bottom line: do all of your own original work and do not copy from fellow students or past assignments.

School Policies

Disability

Students who feel they may need an accommodation based on the impact of a disability should contact me privately to discuss their specific needs. All discussions will remain confidential.
To ensure that you receive the most appropriate reasonable accommodation based on your needs, contact me as early as possible in the quarter (preferably within the first week of class), and make sure that you have contacted the:PLuS Program (for LD, AD/HD) at 773-325-1677, Student Center #370, and/or The Office for Students with Disabilities (for all other disabilities) at 773-325-1677, Student Center #370

Online Instructor Evaluation

Course and instructor evaluations are critical for maintaining and improving course quality. To make evaluations as meaningful as possible, we need 100% student participation. Therefore, participation in the School's web-based academic administration initiative during the eighth and ninth week of this course is a requirement of this course. Failure to participate in this process will result in a grade of incomplete for the course. This incomplete will be automatically removed within seven weeks after the end of the course and replaced by the grade you would have received if you had fulfilled this requirement.

Email

Email is the primary means of communication between faculty and students enrolled in this course outside of class time. Students should be sure their email listed under "demographic information" at http://campusconnect.depaul.edu/ is correct.

Plagiarism

The university and school policy on plagiarism can be summarized as follows: Students in this course, as well as all other courses in which independent research or writing play a vital part in the course requirements, should be aware of the strong sanctions that can be imposed against someone guilty of plagiarism. If proven, a charge of plagiarism could result in an automatic F in the course and possible expulsion. The strongest of sanctions will be imposed on anyone who submits as his/her own work a report, examination paper, computer file, lab report, or other assignment which has been prepared by someone else. If you have any questions or doubts about what plagiarism entails or how to properly acknowledge source materials be sure to consult the instructor.

Incomplete

An incomplete grade is given only for an exceptional reason such as a death in the family, a serious illness, etc. Any such reason must be documented. Any incomplete request must be made at least two weeks before the final, and approved by the Dean of the College of Computing and Digital Media. Any consequences resulting from a poor grade for the course will not be considered as valid reasons for such a request.

Quarter at a Glance

Week	Date	Reading	Topic	Due
1	4/2	Newman, Ch 1, 3, 4	Introduction	n/a
2	4/9	Butts, `network`, A package for Managing Relational Data in R	Introduction to R / Lab	Homework 1
3	4/16	Newman, Ch. 6 and Chen & Yang, Visualization of Social Networks	Graph Properties / Visualization	Homework 2
4	4/23	Newman, Ch. 7	Metrics / Lab	Homework 3
5	4/30		Midterm / Project Discussion	
6	5/7	Newman, Ch. 8, 10	Large-scale Structure / Algorithms	Project proposal
7	5/14	Newman, Ch. 11	Clustering / Lab	Homework 4
8	5/21	TBA	Ego Analysis / Bi-partite Networks	Project data
9	5/28	Newman, Ch. 12, 15.2	Exponential Random Graph Modeling / Lab	Homework 5
10	6/4	Snijders, et al. Introduction to stochastic actor-based models for network dynamics	Network Evolution / Review	
Finals	6/11			Final Project