IDS 564: Social Media and Network Analysis
Spring 2020

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Classroom: Douglas Hall 330
Class Time: Tuesdays 6:30 pm - 9:00 pm

Office Hours: Tuesdays 1:00 – 2:30 pm
(or by appointment)

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Course Overview and Objectives:

Social and economic networks pervade the world around us, and have taken on a new importance with the rise of social media. This course provides an introduction and some hands-on practice in the study of social and economic networks. We will better understand how to analyze social networks, what we can learn from them, and why such learning is useful. Understanding networks has practical benefits for businesses that want to make effective use of social media. More broadly, understanding networks helps us make predictions about the spread of information, the adoption of technologies or social behaviors, or epidemics. The science of social networks is becoming a core tool in business analytics, and also has important applications in computer science, operations research, supply chain management, economics, sociology, political science, physics, biology, and many other disciplines.

In the course, we will study the concepts used to describe and measure networks, learn about various models showing how networks form and evolve, and how networks impact behavior and the spread of information, learning, and social influence. Along with the concepts, we will gain experience with software tools and libraries to visualize social networks, measure and characterize them empirically, fit them to mathematical models, detect communities, predict network links, and detect contagious outbreaks or diffusion.

Requirements and Prerequisites:

Students need to be comfortable with basic concepts in probability theory (especially probability distributions, expected values and Bayes' rule) and statistics; and be willing to work extensively with code in the statistical package R. Beyond that, the course is largely self-contained. Please see the instructor if you are interested in taking the course and do not have the prerequisites enforced now by the course registration system. This course is designed as an elective in the M.S. in Business Analytics; but the material may also be of interest to graduate students in any of the business disciplines, as well as other disciplines such as economics, computer science, political science, sociology, public health, and psychology.

Texts:

1) Main textbook:

Easley, David, and Jon Kleinberg. *Networks, crowds, and markets: Reasoning about a highly connected world*. Cambridge University Press, 2010. (EK)

2) Advanced/Optional recommended texts:

Jackson, Matthew O. *Social and economic networks.* Princeton: Princeton University Press, 2008. (MJ)

Kolaczyk, Eric D., and Gábor Csárdi. *Statistical analysis of network data with R*. Vol. 65. Springer, 2014. (KC)

This is available online at the UIC library:
http://HZ9PJ6FE4T.search.serialssolutions.com/?V=1.0&L=HZ9PJ6FE4T&S=JCs&C=TC0001247657&T=marc&tab=BOOKS

Some software tools to be used:

- R for analysis: Packages such as gephi, statnet, among others.
- Gephi for visualization and analysis
- SNAP libraries (http://snap.stanford.edu/)
- NetLogo for simulations

Office Hours

During my posted office hours, you may feel free to walk in without scheduling ahead of time. If you need to see me outside of office hours, please email me to schedule an office appointment or phone call. I usually check my email at least once per day, and typically respond within 48 hours. During vacation, conference travel, or weekend hours, responses may take longer.

Course Site on Blackboard: *https://uic.blackboard.com*

Course materials will be posted on Blackboard. It is your responsibility to check Blackboard on a regular basis so that you would not miss any important information.

Lab Exercises

Lab Topic	**Software tools**	**Supplementary Reading (see book listings above for abbreviation references)**
1) Network visualization	Gephi, R	Chapters 1 – 2 in EK and MJ
2) Network measures	igraph library in R; Gephi	Chapters 1 – 2 in EK and MJ
3) Community detection	igraph community detection algorithms in R	Sections 4.3 and 4.4 in KC
4) Model fitting: Fitting a hybrid degree distribution to Data	R statistical routines	Section 5.3.4 in MJ; Chapter 6 in KC
5) Link prediction	igraph package in R	Chapter 7 in KC

6) Epidemics and contagion; modeling and prediction for dynamic processes	R (multiple packages)	Section 8.5 in KC

COURSE SCHEDULE IS TENTATIVE AND SUBJECT TO CHANGE DURING THE SEMESTER

Week	Topic	Suggested Reading	Advanced Reading (optional)	Deliverable
1	Introduction: Why Model Networks; Examples; Course introduction	EK: Chapter 1	MJ: Chapter 1	
2	Graphs and network structure	EK: Chapter 2	MJ: Chapter 2	Lab 1
3	Strong and Weak Ties	EK: Chapter 3		
4	Networks in their surrounding contexts	EK: Chapter 4	MJ: Chapter 3	Lab 2
5	Positive and negative relationships	EK: Chapter 5		
6	The Structure of the Web/ Link Analysis and Web Search (part 1)	EK: Chapters 13 & 14		*[Suggested beginning of work on term projects]*
7	The Structure of the Web/ Link Analysis and Web Search (part 2)	EK: Chapters 13 & 14	MJ: Chapter 4, 5.1-5.3	Lab 3
8	Random networks, preferential attachment, and fitting hybrid models (part 1)	EK: Chapter 18	MJ: Chapter 4, 5.1-5.3	Advanced Labs 1, 2 or 3 are due (please choose one).
9	Random networks, preferential attachment, and fitting hybrid models (part 2); Network effects part 1	EK: Chapter 18	MJ: Chapter 4, 5.1-5.3	Lab 4
10	Network Effects part 2	EK: Chapter 17	MJ: Chapter 6	
11	Cascading behavior in Networks	EK: Chapter 19	MJ: Chapter 7	Lab 5
12	The Small-World Phenomenon	EK: Chapter 20	Revisit MJ: Chapter 4; 7.3	Lab 6 (optional)
13	Epidemics; Synthesis and Review of Concepts	EK: Chapter 21	MJ: Chapter 7.2	Advanced Labs 4, 5 or 6 are due

				(please choose one).
14	Group project presentations			
15	Final Exam (in classroom)			
16	Term project reports are due			

Performance Evaluation Summary:

Your final grade for this class will be based on the following point distribution:

Activity	**Team/individual**	**Points**
In-class participation quality and attendance	Individual	10%
Five regular lab exercises	Individual	10%
Two advanced lab exercises	Individual	40%
Exam	Individual	20%
Final Presentation and Project Report	Team	20%
TOTAL*	Individual	**100%**

* Bonus points may be awarded towards outstanding in-class participation or submitted work by students.

In Class Participation Quality and Attendance (10%)

In order to make the learning process more effective and interesting, it is important that you come prepared for each class and participate in all class activities. During the semester, we will have several in-class case discussions and exercises. You are highly encouraged to share your experience, and your thoughts on topics being discussed. If you do miss a class, you will be fully responsible to get the notes and assignment from a peer in your class or from the course website. Attendance will be taken in class and will be considered in the final grade.

Use of computers in class: I will encourage use of laptops or tablet computers in regular class sessions as long *as the use is related to what we're covering in that session.* I will require laptops to be closed and put away during specific segments of lecture, guest lectures and some class exercises. If you abuse this policy, I reserve the right to consider this in your final participation grade and also to revoke these privileges. The use of mobile phones or smart phones will not be permitted at all.

Regular Lab Exercises (10%)

Our course plan includes five regular lab exercises; with due dates scheduled approximately every other week. Depending on course progress at the end of the semester, there may be a sixth optional regular lab can replace the lowest grade of the five regular labs. There are two components of your submission: A brief report to be submitted in Word or PDF format in your assignment page, and a short multiple-choice quiz. For your regular lab exercises, your grade will be based primarily on

your quiz submissions and you will not receive a separate grade for your accompanying write-up. By request, I will be happy to provide individual feedback on your lab reports in office hours or individual appointments—or in some cases when a meeting cannot be scheduled—over email. ***Please note that no points can be awarded for late quiz submissions.***

Advanced Lab Exercises (40%)

An advanced lab will accompany each of the regular labs. You must do at least two out of six of the advanced labs over the course of the semester. You may submit any of the first three advanced labs by the mid-semester cutoff date listed on the schedule; and then any of the next three labs by the specified date near the end of the semester. For the advanced labs, you will need to submit a report that is typically more elaborate and detailed than a regular lab, along with any source code or additional completed software files that are requested in the assignment. If you do more than two during the semester, you will ultimately get credit for your two highest scoring advanced labs.

Final Exam (20%)

A proctored in-class exam will be administered to test your grasp of the concepts covered in the course.

Final Presentation and Project Report (team) (20%)

- Teams comprised of 3 students or less will present analysis of a social network in a topic of interest.
- A presentation session is scheduled for the last week(s) of class.
- Your team will submit a final research paper at the end of the semester. Guidelines for this report will be given later in the semester.

Academic Integrity

Academic integrity is a cornerstone of the intellectual life of a university student. Consistent with University policy, violations of academic integrity will be treated as a serious offense. Additionally, you are required to cite your references and identify the sources of all direct quotations used in your projects or written work. Students are expected to respect and act in accordance with the UIC Student Honor Code. Violations of the student code, including but not limited to assignments, exams, or classroom conduct, will be referred to the Office of the Dean of Students. **The range of disciplinary actions for academic dishonesty can include an automatic F in the course and expulsion from the graduate program.** ***Please note:*** *Software tools can automatically detect and alert us to possible instances of plagiarism or copying. Software can detect similarities to text in any Internet sources, published materials, as well as unusually high levels of similarity between student submissions. Once the software raises an alert, we can manually review passages flagged as similar and then take further action if necessary.*

Special Accommodations

If you have any condition, such as a physical or learning disability, which will make it difficult for you to carry out the work as we have outlined it or which will require academic accommodations, please notify Dr. Tafti during the *first two weeks* of the course, or as soon as your condition becomes known to you, and we will strive to accommodate you. For observance of religious holidays that

require you to miss a class, you need to notify the professor by the tenth day of the semester of the date when you will be absent, unless the religious holiday is observed on or before the tenth day of the semester. In such cases, you shall notify the professor at least five days in advance of the date when you will be absent.