SI 608 001/101 FA 2020

SI 608 – Networks

School of Information, University of Michigan, Fall 2020

Class sessions: Tuesdays 1-4pm, Remote instruction

Instructor: Ceren Budak (cbudak@umich.edu)

Office hours:

- Wednesdays 9-11am (timing subject to change based on student survey responses on time-zones)
  - https://umich.zoom.us/j/94738830559 (Links to an external site.) (Password: 624432)

GSI: Yijing Chen (yijingch@umich.edu)

Office hours:

- Mondays 9-10 am & Thursdays 9-10 am (drop-in)
  - https://umich.zoom.us/j/9666237865 (Links to an external site.) (Passcode: 252946)

Instructional Aides: TBD (TBD)

- Office hours: TBD

Note: Some syllabus details are subject to change.

Course Overview

We will cover topics in network analysis in this course, including social networks and information networks (e.g., the web). We will introduce basic concepts in network theory, metrics to characterize networks, models to explain the generation of networks, and methods to further analyze networks. In the lab sessions, the students will experience various analysis tools to analyze real-world network data. In the second half of the course, we will introduce a wide variety of applications of network analysis to real-world problems such as information retrieval. The final course project will provide students the opportunity to apply the concepts and techniques learned in class to networks of their interest. Students will also participate in the class through group discussions of related papers.
Learning Objectives

Upon completion of this course, students should be able to:

- Understand basic concepts and metrics in network analysis
- Understand how to characterize, model, and analyze a network
- Utilize a variety of tools to manage, measure, visualize, and analyze networks
- Apply concepts and techniques of network analysis to real-world problems involving networks
- Start working toward becoming a professional with expertise in network analysis

Course Evaluation

- **Group Paper Discussions (10%)**: We will have a set of papers to discuss each week (except for the first 2 and the last weeks). Students will sign up for one of those papers and during the first half hour of the lecture, you will be assigned to breakout rooms with the other students assigned to the same paper. Each group will create a summary of their paper and present it to the rest of the class.

- **Four homework assignments (30%)**: No late submissions will be accepted under *any* normal circumstances. Extensions will only be granted under extreme circumstances to students with *documented* reasons (e.g. medical) at the instructor's discretion.

- **Midterm Exam (20%)**: The midterm is take-home. Students have roughly a week to work on it.

- **Course Project (40%)**: The projects will be a group effort. Students need to form groups (3-4 people) and define their project in the first few weeks of the class.
  - Proposal: 4%
  - Midterm Evaluation: 8%
  - Final presentation: 8%
  - Final report: 20%

**Late homework policy**: The homework assignments are due when the next class begins. No late submissions will be accepted under *any* normal circumstances. Extensions will only be granted under extreme circumstances to students with *documented* reasons (e.g. medical) at the instructor's discretion.

**Lab submission policy**: Second half of each class for the first 5 weeks will be a lab session. The lab submissions are due the end of the class and will be in person. Labs will not be graded (best effort) but effort will count against class participation.

Class format

Typical format will be as follows:

- Group Discussions about papers (except for week 1, 2, and 14): ~30 mins
- Lecture: ~90 mins
- Lab/Project: ~60mins
Text


(Online) Classroom Policy

This course will be taught online this year due to health risks posed by COVID-19. The lectures will be mostly delivered synchronously but will be recorded and available after the lecture. Some modules might be pre-recorded but the instructional team will be available during lecture time even when the modules are pre-recorded. This structure is subject to change as we progress during the semester, as a function of how well the current structure is working for students. Students are asked to attend class on time and remain (virtually) through the entire class. I don't take attendance in this class, but we do have in-class labs that must be completed for credit. These labs do not need to be completed during lecture time--you will have 1 week to turn in the labs. But the instructional team will be available during class time to help guide you, if you have questions. The lectures will be recorded so you can view them afterwards, in case you need to miss a class due to a health concern.

Communication

The best way to contact any member of the teaching team is by using Slack. We will try to answer questions that are sent via Slack within about 48 hours. Responses on weekends and holidays may be slower. If you have questions about course material, homework, or labs, please attend office hours. These office hours will be held online and will be recorded. Your GSI should be your first choice for technical questions; conceptual questions are best directed to Dr. Budak. Personal matters should be communicated via email to Dr. Budak. Please include “[SI 608]” in your subject line to receive a timely response.

Original Work

Unless otherwise specified in an assignment all submitted work must be your own, original work. Any excerpts, statements, or phrases from the work of others must be clearly identified as a quotation, and a proper citation provided. Any violation of the School’s policy on Academic and Professional Integrity (stated in the Master’s and Doctoral Student Handbooks) will result in serious penalties, which might range from failing an assignment, to failing a course, to being expelled from the program. Violations of academic and professional integrity will be reported to UMSI Student Affairs. The faculty instructor determines the consequences impacting assignment or course grades; the Assistant Dean for Academic and Student Affairs may impose additional sanctions.

Accommodations for Students with Disabilities
If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way we teach may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate accommodations. SSD (734-763-3000; http://www.umich.edu/sswd/) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. I will treat any information you provide as private and confidential.

**Student Mental Health and Wellbeing**

The University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) at (734) 764-8312 and https://caps.umich.edu/ during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. You may also consult University Health Service (UHS) at (734) 764-8320 and https://www.uhs.umich.edu/mentalhealthsvcs, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources.

For a listing of other mental health resources available on and off campus, visit: http://umich.edu/~mhealth/

**COVID19 Syllabus Statement**

While SI6108 will be held online, the statement is important to keep in mind for general campus engagement this semester. Please stay safe and healthy and if you have any concerns, please let me know.

For the safety of all students, faculty, and staff on campus, it is important for each of us to be mindful of safety measures that have been put in place for our protection. By returning to campus, you have acknowledged your responsibility for protecting the collective health of our community. Your participation on campus is conditional upon your adherence to all safety measures mandated by the State of Michigan and the University, including maintaining physical distancing of six feet from others, and properly wearing a face covering in class. Other applicable safety measures may be described in the Wolverine Culture of Care** and the University’s Face Covering Policy for COVID-19. Individuals seeking to request an accommodation related to the face covering requirement under the Americans with Disabilities Act should contact the Office for Institutional Equity. I also encourage you to review the Statement of Students Rights and Responsibilities, which includes a COVID-related addendum.

**U-M Wolverine Culture of Care can be found https (Links to an external site.) (Links to an external site.) (Links to an external site.) campus.blueprint.umich.edu/uploads/wolverine_culture_of_care%20sign_8.5x11_UPDATED_071520.pdf (Links to an external site.)
Schedule (Tentative)

- **Week 1 (September 1): Course Overview; Introduction to Networks**
  - **Reading material:**
    - EK2010 Chapter 1&2
    - N2003 Section 1-3
    - Mislove et al. 2007 “Measurement and analysis of online social networks.”
    - Ahn et al. 2007 “Analysis of topological characteristics of huge online social networking services.”
    - Kwak et al. 2010 What is twitter, a social network or a news media?
  - **Lab:** Introduction to NetworkX

- **Week 2 (September 8): Basic Concepts. Network Metrics I**
  - **Reading material:**
  - EK2010 Chapter 2,3&14 (introductory material from Chapter 14)
  - Friedkin, N. E. "Structural Bases of Interpersonal Influence in Groups: A Longitudinal Case Study." American Sociological Review. 58. 6 (1993): 861. (JSTOR account required for article)
  - Pajek Chapter 6: Center and Periphery
  - Pajek Chapter 9: Prestige
  - **Lab:** Centrality in NetworkX

- **Week 3 (September 15): Centrality. Network Metrics II**
  - **Papers to be discussed**
    - “What is twitter, a social network or a news media?” Kwak et al. 2010
    - “Measurement and analysis of online social networks.” Mislove et al. 2007
    - “Analysis of topological characteristics of huge online social networking services.” Ahn et al. 2007
  - **Reading material:**
    - EK2010 Chapter 1&2
    - N2003 Section 1-3
    - Mislove et al. 2007 “Measurement and analysis of online social networks.”
    - Ahn et al. 2007 “Analysis of topological characteristics of huge online social networking services.”
  - **Lab:** Introduction to NetworkX

- **Week 4 (September 22): Small-world Networks. Network Models I**
  - **Papers to be discussed**
    - “Structural Bases of Interpersonal Influence in Groups: A Longitudinal Case Study.” By Friedkin, N. E.

- **Reading material:**
  - EK2010 Chapter 20: Small World Phenomenon
  - N2003 Section 6

- **Lab:** Small World Networks
- *Project proposals are due*
- HW 1 released

- **Week 5 (September 29): Scale-free Networks. Network Models II**
  - **Papers to be discussed**
    - "Identity and Search in Social Networks" by Duncan J. Watts, Peter Sheridan Dodds, and M. E. J. Newman
    - “Four degrees of separation” by Lars Backstrom et al.
  - **Reading material:**
    - "Power laws, Pareto distributions and Zipf's law" M. E. J. Newman
    - "Topology of Evolving Networks: Local Events and Universality" Réka Albert and Albert-László Barabási
    - "Emergence of Scaling in Random Networks" Albert-Laszlo Barabasi and Reka Albert
    - EK Chapter 18
  - **Lab:** Scale Free Networks
  - HW 1 due

- **Week 6 (October 6): Networks over Time**
  - **Papers to be discussed**
    - “Scale-free networks are rare” by Broido and Clauset
  - **Reading material:**
    - "Empirical Analysis of an Evolving Social Network" Gueorgi Kossinets and Duncan J. Watts
    - "Team Assembly Mechanisms Determine Collaboration Network Structure and Team Performance” Roger Guimerà, Brian Uzzi, Jarrett Spiro, and Luís A. Nunes Amaral
    - "Group Formation in Large Social Networks: Membership, Growth, and Evolution" Lars Backstrom, Dan Huttenlocher, Jon Kleinberg
    - "Graphs over Time: Densification Laws, Shrinking Diameters and Possible Explanations" Jure Leskovec, Jon Kleinberg, Christos Faloutsos
  - **Lab:** Networks over Time
  - *HW 2 assigned*

- **Week 7 (October 13): Communities**
  - **Papers to be discussed**
- “The Anatomy of the Facebook Social Graph” by Ugander et al.
  - **Reading material:**
    - Heuristics for community detection, K-means clustering, betweenness clustering, and modularity
    - “Friends and Neighbors on the Web” Adamic, Adar
    - “A Social Network Caught in the Web” Adamic et al.
    - “Finding community structure in very large networks” Clauset et al. 2004
    - “Community structure in social and biological networks” Girvan, Newman 2001
    - “Community Detection and Mining in Social Media” by Tang et al. 2010
  - *HW 2 due

- **Week 8 (October 20): Ranking, Web**
  - **Papers to be discussed**
    - “Statistical Properties of Community Structure in Large Social and Information Networks” J. Leskovec, K. Lang, A. Dasgupta, M. Mahoney.
    - “Finding community Structure in Very Large Networks” Clauset et al. 2004
    - “The ground truth about metadata and community detection in networks” Peel et al.
  - **Reading material:**
    - EK2010 Chapter 13&14
    - “LexRank: Graph-based Lexical Centrality as Salience in Text Summarization” Erkan, Radev 2004
  - *Midterm assigned

- **Week 9 (October 27): Classification and Recommendation**
  - **Papers to be discussed**
    - “The authority of Supreme Court precedent” James H. Fowler and Sangick Jeon 2008
    - “Graph Structure in the Web.” Broder et al. 2000
  - **Reading material:**
    - “Iterative Classification in Relational Data” Neville, Jensen 2000
    - “Node classification in social networks” Bhagat et al. 2011
    - “Predicting Positive and Negative Links in Online Social Networks” Leskovec et al. 2010
    - “Query Suggestion Using Hitting Time” Mei et al. 2008
    - “Experimental Study of Inequality and Unpredictability in an Artificial Cultural Market” Salganik et al. 2006
  - *Midterm due
  - *HW 3 assigned

- **Week 11 (November 10): Diffusion and Cascades --- WILL BE ASYNCHRONOUS, HAPPY ELECTION DAY! Exercise your right :)**
  - **Reading material:**
- “Diffusion of Innovations.” Everett Rogers (this is a book, I don’t expect you to read all of it but it is a nice reference book you should be aware of)
- “Everyone’s an influencer: Quantifying Influence on Twitter” Bakshy et al.
- EK2010 Chapters 19, 21

**Week 11 (November 10): Project midterm presentations and feedback**
- "HW 3 due"
- Midterm report due

**Week 12 (November 17): Influence vs. Homophily**
- Papers to be discussed
  - “Experimental Study of Inequality and Unpredictability in an Artificial Cultural Market” Salganik et al. 2006
  - “Query Suggestion Using Hitting Time” Mei et al. 2008
  - “Everyone’s an influencer: Quantifying Influence on Twitter” Bakshy et al.
  - “The structure of Virality of Online Diffusion” by Goel et al.
- **Reading material:**
  - EK2010 Chapter 4: Networks in their surrounding contexts
  - "Maximizing the Spread of Influence Through a Social Network" Kempe et al. 2003
  - "Cost-Effective Outbreak Detection in Networks" Leskovec et al. 2007
  - "Influence and Correlation in Social Networks" Anagnostopoulos et al. 2009
  - “Randomization tests for distinguishing social influence and homophily effects" La Fond et al. 2010
- "HW 4 assigned"

**Week 12 (December 1): Graph Traversal/Search**
- Papers to be discussed
  - “Origins of Homophily in an Evolving Social Network” by Kossinets et al.
  - "Influence and Correlation in Social Networks" Anagnostopoulos et al. 2009
  - “Randomization tests for distinguishing social influence and homophily effects” La Fond et al. 2010
  - “Social Structural Determinants of Similarity among Associates” Feld 1982
- **Reading material:**
  - Breadth-first, depth-first, greedy best-first, and A* search algorithms
  - Sections 3&4 in “Artificial Intelligence: A Modern Approach.” Russell and Norvig (but the material presented in the slides should suffice.)
- "HW 4 due"
- **Week 14 (December 10): Final Project Presentation**
  - *Project reports due*

**Note: Papers listed here will be updated in the next few weeks.**

**Course Summary:**

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