Course Syllabus

CS5840/CS6840 Social Network Analysis (3 credits)

Fall 202X

Time: —

Location: —

Instructor: Hamid Karimi

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Office Hours: —

Delivery Mode: Face-to-face (no broadcast)

Graduate Teaching Assistant (GTA):

- Name: —
- Email: —
- Office hours: —

Course Description

This course introduces the background, techniques, and concepts in social network analysis with an emphasis on graph theory, online social networks, and network analysis techniques.

Preferred Prerequisites

- Programming Language. Students need to be familiar with Python.
- Linear Algebra (MATH 2270). Students need to be familiar with basic concepts in linear algebra such as linear systems, matrix operations, matrix factorization, eigenvectors, and singular value decomposition, etc.
- Data Structure and Algorithms (CS 2420). Students need to be familiar with the evaluation of algorithms and algorithm analysis as well as basic data structures, e.g., array, stack, queue, tree, and graph.
- Data Mining and Machine Learning (CS 5665 and CS 6665). The students need to be familiar with data mining and machine learning concepts and algorithms and should be able to develop predictive models.

Course Objectives

- The course will introduce basic concepts and principal algorithms suitable for investigating (social) networks.

- The course will help students apply and hone their data analysis skills on social media data to find meaningful patterns

- The research-driven nature of the course will improve the critical thinking of students and will help them gain research experiences.

- The course will give students hands-on experiences in using programming languages such as Python and tools such as Networkx to process social networks.

- The course attempts to help students answer the following essential questions

  - How to collect data from a social media platform (e.g., Twitter)?

  - Who are the most important people (actors) in a social network?

  - How does information diffuse throughout a social network?

  - How to identify communities in a social network?

  - How to measure assortativity or social similarity?

  - How to analyze the behavior of individuals online?

Student Outcomes

- SO1 - Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.

- SO2 - Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

- SO6 - Apply computer science theory and software development fundamentals to produce computing-based solutions.

Course Topics

Note: Some adjustments may be made in the progress of the course. Also, some additional materials may be used as well.

Topic 1: Introduction to social network analysis

Topic 2: Linear Algebra Review

Topic 3: Graph Essentials

  - Graph basics

  - Graph Representation

  - Types of Graphs

  - Graph Algorithms

Topic 4: Network Measures

  - Centrality

  - Transitivity and Reciprocity

  - Balance and Status

- Similarity

Topic 5: Network Models

Topic 6: Community Analysis

Topic 7: Information Diffusion

Topic 8: Influence and Homophily

- Measuring Assortativity

- Influence

- Homophily

Topic 9: (Depending on time) Advanced Topics

- Graph Signal Processing

- Deep Learning on Graph

- Evolving Social Networks

- etc

Textbooks (optional)

1. Newman, Mark. *Networks*. Oxford university press, 2018.

2. Zafarani, Reza, Mohammad Ali Abbasi, and Huan Liu. *Social media mining: an introduction*. Cambridge University Press, 2014. (Online PDF). Most of the content is from this book.

3. Albert-László Barabási. Network Science

4. Easley, David, and Jon Kleinberg. *Networks, crowds, and markets*. Vol. 8. Cambridge: Cambridge university press, 2010. Online PFDs

Coursework

In this part, I will explain the coursework. Since the course entails two sections (i.e., CS5840 for undergraduate students and CS6840 for graduate students), the grading slightly differs for these two sections.

Assignments

The purpose of assignments is to help you understand the concepts introduced in the lectures and to gain hands-on experiences to process social networks. Assignments will contain both written questions and programming assignments. Below, there are some policies regarding the assignment:

- You will submit your assignment using the **Canvas System**. The assignment is due by 11:59 p.m. on the due date. No late assignment will be accepted unless you have a legitimate excuse, e.g., an emergency.

- You are required to do your own work. You will be responsible to ensure that your assignment is submitted correctly. If you have multiple files to submit, you need to zip multiple files into one file before submission. If the assignment is submitted incorrectly, you can resubmit it. The system keeps track of the last file submitted for each assignment. If you do not get the confirmation information within a few minutes, you can assume the assignment has not been submitted.

- I highly encourage you to type in the answers to written questions. If you handwrite the answers, make sure they are legible and then properly scan them in a pdf file.

- At the top of the programming assignment, please include comments that include your name, your contact email, and the assignment name or number.

- Both undergraduate and graduate students will have the same number of assignments. Nevertheless, eventually, an assignment with the least score will be dropped for CS5840 (undergraduates), and the average score of the rest of the assignments is considered for CS5840.

Project

One of the main goals of this course is to prepare you to apply state-of-the-art social network analysis tools and algorithms to an application. If you are interested in research, this course will also leave you well-qualified to do social media mining research. You can work in teams of up to 3 people for the Project. I highly encourage you to team up with others to perform the Project.

Item	Description	Due Date	Grade
Proposal	You need to propose a topic for the project. (it means if you don't do it, 10% will be subtracted)	October 10, 202X	-10%
Presentation	You need to record your presentation and upload it (25 minutes).	Dec 16, 202X	35%
Final Report	You need to write a final report in a research paper format about the project.	Dec 16, 202X	50%
Code & Materials	You need to submit your code and other materials.	Dec 16, 202X	15%

Mid-term

There will be an **in-class** mid-term exam on (around end of October), covering the topics that will have been presented by then. The mid-term will have 100 points. **For CS5840 (undergraduates)**, 10 points will be added automatically (e.g., if you get 85, your adjusted grade will be 95).

Research Paper Presentation (bonus)

During Nov and Dec, each student can present a relevant paper during the course. The presentation will be scheduled for 15 minutes. Also, if you decide to present a paper, you need to write a one-page summary of the paper. 70% of the grade is for the presentation and 30% for the one-page summary. You are free to pick up the topic of the paper, but it should be within the scope of the course. You need to send me the paper's title one week before the presentation and I will decide whether the topic/paper is eligible for presentation. The deadline to turn in the one-page summary is your presentation day.

Breakdown of Points

Item	Percentage
Assignments	50%
Project	25%
Mid-term	25%
Attendance and in-class activities	-5%
Research Paper Presentation (Bonus and optional, encouraged for grad students)	up to 5%

Grading Scheme

Grade	Points Range
A	[93%, 100%]
A$^-$	[87%, 93%)
B$^+$	[81%, 87%)
B	[75%, 81%)
B$^-$	[70%, 75%)
C$^+$	[65%, 70%)
C	[60%, 65%)
C$^-$	[58%, 60%)
D$^+$	[55%, 58%)
D	[50%, 55%)
F	[0%, 50%)

Grading Policy and Grades

- Your score for each assignment and exam will be available through the Canvas System. You will be shown each individual score, your percent to date, and any comments. You will be notified via email whenever you receive a score or when a change is made to a score.

- If you want to dispute a score, contact TA within two days of having received the original score. If the disagreement is not resolved after communicating with the GTA, contact me by email (hamid.karimi@usu.edu). I will review your submission, talk to the GTA and then respond to you. I will not consider changes in scores if you do not contact me within one week of when the score is sent to you.