Course Syllabus for SIADS 652: Network Analysis

Course Overview and Prerequisites

This course will introduce students to basic network analysis techniques, emphasizing developing programming skills to manipulate and analyze real network data using Python. The course includes topics such as network evolution, link prediction, network centrality, models of information diffusion on networks, and community structure.

The prerequisites for SIADS 652 are:

- SIADS 542 Supervised Learning
- SIADS 505 Data Manipulation
- SIADS 502 Math Methods for Data Science

Instructors

Daniel M Romero
Associate Professor
School of Information
Complex Systems
Computer Science
Email: drom@umich.edu

Cory Bilyeu
Lecturer
School of Information
Email:
cbilyeu@umich.edu

Erik Lang
Lecturer
School of Information
Email: eriklang@umich.edu

Course Communication Expectations

We will use Slack for most communication related to the class. We will monitor the channel and try to answer your questions as promptly as possible. This should not happen, but if we do not answer your question within 24 hours (not including weekends and holidays, of course), feel free to contact us again. We also encourage you to answer each other's questions and use this platform for discussion related to the class. While we will try our best to monitor and clarify or remove wrong or misleading responses, we cannot guarantee that all statements made by students are correct. Please remember to be civil and treat everyone with kindness and respect. If you prefer not to use Slack, please feel free to email anyone in the instructional team with comments or questions.

How to Get Help

If you have questions concerning the degree program, encounter a technical issue with Coursera, or issues using Slack, please submit a report to the ticketing system at umsimadshelp@umich.edu.

If you have an issue specific to the Coursera environment, you can also begin a live chat session with Coursera Technical Support (24/7) or view Coursera troubleshooting guides. (you may be asked to log in to your Coursera account).

For questions regarding course content, refer to the **Communications Expectations** section above.

Weekly Readings or Textbook Information

Easley, David and Kleinberg, Jon. 2010. *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*. Cambridge University Press, USA.

Newman, Mark. 2018. *Networks*. Oxford University Press, USA.

Liben-Nowell, David, and Kleinberg, Jon. 2007. "The link-prediction problem for social networks." *Journal of the American Society for Information Science and Technology.* 58(7): 1019-1031.

Kossinets, Gueorgi, and Duncan J. Watts. 2006. "Empirical analysis of an evolving social network." *Science*. 311(5757): 88-90.

Romero, Daniel M., Uzzi, Brian, and Kleinberg, Jon. 2016. "Social networks under stress." In *Proceedings of the 25th International Conference on World Wide Web* 9-20.

Kempe, David, Kleinberg, Jon, and Tardos, Éva. 2003. "Maximizing the spread of influence through a social network." In *Proceedings of the ninth ACM SIGKDD international conference on Knowledge discovery and data mining.* 137-146.

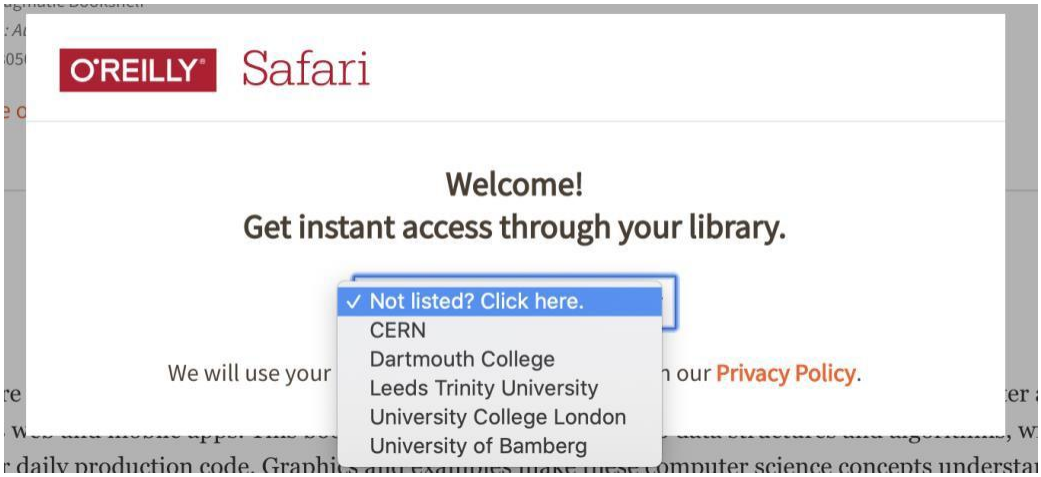
Kim, D. A., Hwong, A. R., Stafford, D., Hughes, D. A., O'Malley, A. J., Fowler, J. H., & Christakis, N. A. 2015. Social network targeting to maximise population behaviour change: a cluster randomised controlled trial. *The Lancet.* 386(9989): 145-153.

Yang, Jaewon, and Jure Leskovec. 2015. "Defining and evaluating network communities based on ground-truth." *Knowledge and Information Systems.* 42(10: 181-213.

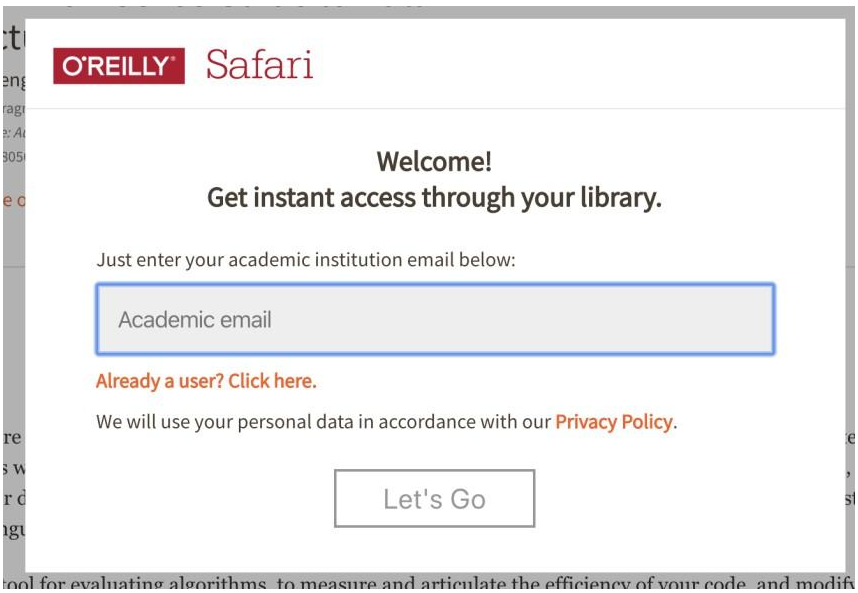
To access the required textbooks, simply click on the links above to direct you to the U-M Library website. Scroll down the page and click on *Available Online* (some texts will have multiple online options, but it is recommended you choose **Safari books online**).

Available online	Get This	N/A	Access to the Safari books online online version restricted; authentication may be required:

After you are directed to the textbook, you will see an O'Reilly pop-up window asking for you to select your institution. U-M is not an available option, so you will need to select the option "Not Listed? Click Here".



You will be prompted to input your U-M email address (no password required).



Learning Outcomes

- Recognize and categorize real world networked data (social, financial, biological, transportation, information, etc.) and represent them using the appropriate network type (directed, weighted, signed, multigraph, bipartite, etc.).
- Define, compute, and interpret basic network metrics such as distance, clustering, degree distribution, and centrality measures.
- Describe several network generative models and understand the properties of the networks they generate.
- Define, compute, and implement several measures that can be used for link prediction using real world data.
- Articulate and implement the dynamics and assumptions of several information diffusion models and be able to implement.
- Articulate the influence maximization problem and basic strategies and heuristics to solve it.
- Articulate the community detection problem and understand its value in several applications.
- Articulate and implement several approaches for community detection.

Course Schedule

- **This course begins on August 29 and ends on September 25.**

- Weekly assignments and quizzes will be **due on Wednesdays at 11:59 pm** (Ann Arbor, Michigan time-Eastern Daylight Time - EST, UTC -5). Assignments and quizzes will be due on 9/6, 9/13, 9/20, 9/27. Note that the last deadline is after the official end of the course. If you prefer, you are welcome to submit your work earlier.

Assignment and Quizzes

Assignments consist of a combination of programming and reflection questions. The goal of the assignments is to apply the theory covered in the lecture and readings and the programming covered in the NetworkX tutorials to analyze both real and synthetic networks. Assignments will be partly auto-graded and partly manually graded. Please refer to the document *Assignment Points Distribution* on Coursera for the point distribution of all assignments.

Quizzes consist of multiple-choice and numerical question. You will have 2 attempts to answer each question and you will be told which ones you answered correctly and incorrectly after each attempt. The goal of the quizzes is to assess your understanding of network theory. While you may choose to use NetworkX to answer some of the questions, this should not be necessary for most quiz questions.

Weekly Office Hours via Zoom (Ann Arbor, Michigan time):

Your instructor will hold weekly, synchronous office hours using the video-conferencing tool, Zoom. The schedule of office hours can be found by clicking on the **Live Events** link in the left-hand navigation menu. Additionally, all office hours will be recorded and archived so that you can retrieve them later. Archived office hours can be found by clicking on the **Resources** link in the left-hand navigation menu then clicking the **Archived Sessions** link.

Grading

Course Item	**Percentage of Final Grade**	**Due**
Week 1	Quiz 7% Assignment 18%	Wednesday 9/6 11:59pm
Week 2	Quiz 7% Assignment 18%	Wednesday 9/13 11:59pm
Week 3	Quiz 7% Assignment 18%	Wednesday 9/20 11:59pm
Week 4	Quiz 7% Assignment 18%	Wednesday, 9/27 11:59pm
Total	**100%**	

Note: All assignments are required to earn credit for this course.

Letter Grades, Course Grades, and Late Submission Policy

Quizzes can be submitted late with a 10% daily deduction. The week 4 quiz is an exception: it can be submitted within 24 hours for a 10% penalty, within 24-48 hours for a 20% penalty, and then no credit will be given.

Programming assignments can be submitted late with a 25% daily deduction.

The grading scale for this course is as follows:

A+	98%
A	93%
A-	90%
B+	87%
B	83%
B-	80%
C+	77%
C	73%
C-	70%
D+	67%
D	63%
D-	60%
F	0%

Academic Integrity/Code of Conduct

Refer to the Academic and Professional Integrity section of the UMSI Student Handbook. (access to Student Orientation course required).

Accommodations

Refer to the Accommodations for Students with Disabilities section of the UMSI Student Handbook (access to the Student Orientation course required). Use the Student Intake Form to begin the process of working with the University's Office of Services for Students with Disabilities.

Accessibility

Refer to the Screen reader configuration for Jupyter Notebook Content document to learn accessibility tips for Jupyter Notebooks.

Library Access

Refer to the U-M Library's information sheet on accessing library resources from off-campus. For more information regarding library support services, please refer to the U-M Library Resources section of the UMSI Student Handbook (access to the Student Orientation course required).

Student Mental Health

Refer to the University's Resources for Stress and Mental Health website for a listing of resources for students.

Student Services

Refer to the Introduction to UMSI Student Life section of the UMSI Student Handbook (access to the Student Orientation course required).

Technology Tips

- Recommended Technology
    - This program requires Jupyter Notebook for completion of problem sets and Adobe or other PDF viewer for reading articles.
- Working Offline
    - While the Coursera platform has an integrated Jupyter Notebook system, you can work offline on your own computer by installing Python 3.5+ and the Jupyter software packages. For more details, consult the Jupyter Notebook FAQ.