



**Doctoral Seminar in MIS II: Social Networks**  
**Fall 2021, Module 2**

Tentative Aug 31

### **Instructor Contact Information**

- **Name of the instructor:** Yuan Yuan
- **Office Location:** KRAN 709
- **Contact:** [yuan yuan@purdue.edu](mailto:yuan yuan@purdue.edu) (preferred) or 617-230-3495 (emergency)
- **Office hours:** By appointment

### **Course Description**

This course aims for familiarizing doctoral students (especially MIS PhD students) with social network research. The course is designed to help students to understand the fundamentals of social networks, to master computational techniques for social network analysis, and to be able to critique most recent social network papers both inside and outside of the area of MIS. Topics include social network theories, analytical models for social networks, machine learning and networks, causal inference for social networks, misinformation, polarization, collective intelligence, and network externalities. Students are expected to complete weekly reading assignments, lead or actively participate in paper discussion, and submit a research proposal by the end of the semester.

### **Assignments**

Your learning will be assessed through a combination of presenting research papers, participation in discussion, reading reflections, and a final research proposal spread throughout the academic period.

<b>Assignments</b>	<b>Due</b>	<b>Points</b>
Presentation & Discussion	Throughout the semester	40
Reading reflections	Before class starts	30
Final research proposal	11:59 pm, Dec 18th	30
		Total: 100

- **Presentation & Discussion** (40 points). Students are expected to present research papers, lead and actively participate in discussion. I will accommodate Zoom meetings for students who cannot attend in person. Any absence should be approved by the instructor at least one week in advance unless it is an emergency.
- **Reading reflections** (30 points). There are 6 reading reflection assignments, with each worth 5 points. All students should complete a 1-2 pages reflection about the weekly reading (see Reading list section). Students should treat the reflection as a paper review, including a summary, the strengths and weaknesses of the paper, and potential follow-up directions. Students are encouraged to write down their questions or related research ideas and discuss them in class. Reflections should be submitted before the class starts. If you anticipate a late submission, please discuss it with the instructor before the class starts.

- **Final research proposal** (30 points, Dec. 18). Students will submit a research proposal related to social networks by the end of the semester. The proposal may contain motivations, theory or literature review, research design, and data collection/analysis plans or preliminary results (if applicable). The proposal should be double spacing, approximately 10-15 pages excluding references, and written in *Management Science* format (<https://pubsonline.informs.org/page/mnsc/submission-guidelines>). Students are encouraged to schedule office hours with the instructor to receive early feedback on their research proposal. If you anticipate a late submission, please discuss it with the instructor as early as possible.

In this class grades reflect the sum of your achievement throughout the semester. You will accumulate points as described in the assignments portion above.

As a guideline, a student who completes all their presentation duties, actively engages in class discussion, submits their reading reflections and research proposal on time with satisfactory quality should expect to receive an A or A-.

## Tentative Course Schedule

Week	Topic
Week 1	<i>Introduction to networks</i>
Week 2	<i>Network science models</i>
Week 3	<i>Machine learning and networks</i>
Week 4	<i>Causal inference for social networks</i>
Week 5	<i>Advanced topics I</i>
Week 6	<i>Advanced topics II</i>
Week 7	<i>Advanced topics III</i>

## Reading list

The color indicates the requirement for each paper. Students are encouraged to mention some of the other relevant papers during their presentations.

- To be presented by a student and discussed in reading reflections
- Required be read in advance, but not necessarily discussed in reading reflections
- Recommended to read in advance (will be mentioned in class)
- Optional

### 1) Introduction to networks

"Chapter 2: Graphs" Easley, David, and Jon Kleinberg. *Networks, crowds, and markets: Reasoning about a highly connected world* (2012)

McPherson, Miller, Lynn Smith-Lovin, and James M. Cook. "Birds of a feather: Homophily in social networks." *Annual review of sociology* 27.1 (2001): 415-444.

Granovetter, Mark S. "The strength of weak ties." *American journal of sociology* 78.6 (1973): 1360-1380.

Burt, Ronald S. "Structural holes and good ideas." *American journal of sociology* 110.2 (2004): 349-399.

Aral, Sinan, and Marshall Van Alstyne. "The diversity-bandwidth trade-off." *American journal of sociology* 117.1 (2011): 90-171.

Goel, Sharad, et al. "The structural virality of online diffusion." *Management Science* 62.1 (2016): 180-196.

Travers, Jeffrey, and Stanley Milgram. "An experimental study of the small world problem." *Social networks*. 1977. 179-197.

## 2) Network Science models

Barabási, Albert-László, and Réka Albert. "Emergence of scaling in random networks." *science* 286.5439 (1999): 509-512.

Watts, Duncan J., and Steven H. Strogatz. "Collective dynamics of 'small-world' networks." *nature* 393.6684 (1998): 440-442.

Snijders, Tom AB, et al. "New specifications for exponential random graph models." *Sociological methodology* 36.1 (2006): 99-153.

Airoldi, Edoardo Maria, et al. "Mixed membership stochastic blockmodels." *Journal of machine learning research* (2008).

Kivelä, Mikko, et al. "Multilayer networks." *Journal of complex networks* 2.3 (2014): 203-271.

Jackson, Matthew O., and Asher Wolinsky. "A strategic model of social and economic networks." *Journal of economic theory* 71.1 (1996): 44-74.

Jackson, Matthew O. "The friendship paradox and systematic biases in perceptions and social norms." *Journal of Political Economy* 127.2 (2019): 777-818.

Chen, Xi, Ralf van der Lans, and Michael Trusov. "Efficient Estimation of Network Games of Incomplete Information: Application to Large Online Social Networks." *Management Science* (2021).

## 3) Machine learning and networks

Liben-Nowell, David, and Jon Kleinberg. "The link-prediction problem for social networks." *Journal of the American society for information science and technology* 58.7 (2007): 1019-1031.

Li, Zhepeng, et al. "Utility-based link recommendation for online social networks." *Management Science* 63.6 (2017): 1938-1952.

Dong, Yuxiao, et al. "Inferring user demographics and social strategies in mobile social networks." *Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining*. 2014.

Perozzi, Bryan, Rami Al-Rfou, and Steven Skiena. "Deepwalk: Online learning of social representations." *Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining*. 2014.

Grover, Aditya, and Jure Leskovec. "node2vec: Scalable feature learning for networks." *Proceedings of the 22nd ACM SIGKDD international conference on Knowledge discovery and data mining*. 2016.

Zhou, Fan, et al. "Learning to Correlate Accounts Across Online Social Networks: An Embedding-Based Approach." *INFORMS Journal on Computing* 32.3 (2020): 714-729.

Kipf, Thomas N., and Max Welling. "Semi-supervised classification with graph convolutional networks." *arXiv preprint arXiv:1609.02907* (2016).

Yuan, Yuan, Ahmad Alabdulkareem, and Alex Pentland. "An interpretable approach for social network formation among heterogeneous agents." *Nature communications* 9.1 (2018): 1-9.

#### 4) Causal inference for social works

Aral, Sinan, Lev Muchnik, and Arun Sundararajan. "Distinguishing influence-based contagion from homophily-driven diffusion in dynamic networks." *Proceedings of the National Academy of Sciences* 106.51 (2009): 21544-21549.

"Homophily and Contagion are Generically Confounded in Observational Social Network Studies" CR Shalizi, AC Thomas (2011) *Sociological Methods & Research* 40 (2): 211-239.

Aral, Sinan, and Dylan Walker. "Tie strength, embeddedness, and social influence: A large-scale networked experiment." *Management Science* 60.6 (2014): 1352-1370.

Aral, Sinan, and Christos Nicolaides. "Exercise contagion in a global social network." *Nature communications* 8.1 (2017): 1-8.

Sun, Tianshu, Siva Viswanathan, and Elena Zheleva. "Creating social contagion through firm-mediated message design: Evidence from a randomized field experiment." *Management Science* 67.2 (2021): 808-827.

Huang, Shan, et al. "Social advertising effectiveness across products: A large-scale field experiment." *Marketing Science* 39.6 (2020): 1142-1165.

Yuan, Yuan, et al. "Gift Contagion in Online Groups: Evidence From WeChat Red Packets." *Available at SSRN* (2021).

#### 5-7) Advanced topics

**Students choose 2-3 from the following papers to present. Selected papers should be discussed in reflections.**

Wu, Lynn, Fujie Jin, and Lorin M. Hitt. "Are all spillovers created equal? A network perspective on information technology labor movements." *Management Science* 64.7 (2018): 3168-3186.

Almaatouq, Abdullah, et al. "Adaptive social networks promote the wisdom of crowds." *Proceedings of the National Academy of Sciences* 117.21 (2020): 11379-11386.

Garg, Rajiv, and Rahul Telang. "To be or not to be linked: Online social networks and job search by unemployed workforce." *Management Science* 64.8 (2018): 3926-3941.

Acquisti, Alessandro, and Christina Fong. "An experiment in hiring discrimination via online social networks." *Management Science* 66.3 (2020): 1005-1024.

Klausen, Jytte, Christopher E. Marks, and Tauhid Zaman. "Finding extremists in online social networks." *Operations Research* 66.4 (2018): 957-976.

Rishika, Rishika, and Jui Ramaprasad. "The effects of asymmetric social ties, structural embeddedness, and tie strength on online content contribution behavior." *Management Science* 65.7 (2019): 3398-3422.

Centola, Damon, et al. "Experimental evidence for tipping points in social convention." *Science* 360.6393 (2018): 1116-1119.

Jackson, Matthew O. "The friendship paradox and systematic biases in perceptions and social norms." *Journal of Political Economy* 127.2 (2019): 777-818.

Park, Patrick S., Joshua E. Blumenstock, and Michael W. Macy. "The strength of long-range ties in population-scale social networks." *Science* 362.6421 (2018): 1410-1413.

Sun, Monic, Xiaoquan Zhang, and Feng Zhu. "U-shaped conformity in online social networks." *Marketing Science* 38.3 (2019): 461-480.

Jacobs, Abigail Z., and Duncan J. Watts. "A Large-Scale Comparative Study of Informal Social Networks in Firms." *Management Science* (2021).

Chang, Serina, et al. "Mobility network models of COVID-19 explain inequities and inform reopening." *Nature* 589.7840 (2021): 82-87.

Song, Tingting, Qian Tang, and Jinghua Huang. "Triadic closure, homophily, and reciprocation: an empirical investigation of social ties between content providers." *Information Systems Research* 30.3 (2019): 912-926.