Northwestern | Kellogg
School of Management

Winning with Networks

MORS 457

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* This syllabus is subject to change

Description

Leaders face new levels of connectivity, complexity, and unpredictability. This course prepares leaders to use the powerful tools of computational thinking and network analysis to better anticipate, understand, and respond to these challenges. The content involves in-depth training within vis-a-vis diverse use cases, including patenting, innovation adoption, influentials, social contagion, crowdsourcing, hot streaks, and prediction markets. Content delivery is lecture-based with in-class experiential exercises and a final group project aided by a "genius bar" where students work hand-in-hand with data scientists. Students leave the course with a practical toolkit for leadership vision enhancement, value creation, and the contagious adoption of your ideas and innovations.

The course counts towards a STEM major and a major in Entrepreneurship and Management and Organizations.

Course Requirements and Assignments

Your final grade is composed of:

1. Course Contribution 5%+10%
2. 8-week long network analysis engagement 25%
3. Course assignments 30%
4. Lab sessions 10%
5. Mid-term Exam 20%

Course Contribution (5%+10%):

Individual Attendance (5%): Regular attendance is expected, which account for 5% of your total grade. If you must miss a class, notify the instructor at least 24 hours in advance via email to make sure the one-time absence will not affect your overall attendance grades. This is also essential for the teaching team to make arrangements for any in-class exercises and so that you can be certain to get the materials that will be distributed during the class. No switching sections.

Note that there are classes where your presence is not only important to yourself but to your fellow classmates. There are sessions that you must attend, which are indicated in the schedule section of this syllabus (such as Midterm, final presentation, and simulation). If you will have to miss any of these classes, you must email the professor by the beginning of the 2nd week. Otherwise I will assume you will be in class.

Individual Participation (10%): Most class sessions involve active discussions, with an emphasis both on theoretical questions and practical implications. You should be prepared to share your ideas and to listen to and interpret the issues presented by others. Most participation will be voluntary; however, in order to ensure that everyone has the opportunity to be involved, individuals will often be called upon "cold." We recommend you turn on your video when you're on Zoom and when it is appropriate to do so.

Quality discussion comments possess one or more of the following attributes:

- Offer a relevant perspective on the issue.
- Provide careful analysis.
- Apply the theory and concepts offered in the readings and lectures.
- Move the discussion forward by building on previous contributions with new insights; do not repeat points already made by others.

Eight-week long network analysis engagement (25%):

The key value of this course lies in its practical nature. This eight-week network analysis engagement offers you an immersive experience of applying everything you have learned in this class, from advanced network analysis tools to principles of social dynamics, to solving a practical problem that fascinates you the most.

A key feature of this engagement project is the concept of "Genius bar" - a unique opportunity for you to work directly with experienced data scientists. You will team up with fellow Kellogg students (4-5 members each team). Teams are assembled by a random algorithm that takes into account the diversity in backgrounds and expertise within the team.

Course Assignments (40%)

A series of individual and group assignments will equip you with practical experience applying the tools from class. The per assignment weighting is indicated in the assignment summary table below.

All assignments are due by 11:59 pm on the day indicated.
Late assignments will be penalized 10% for the first 24 hours, and 20% for the first 48 hours
Assignments more than 48 hours late will not be accepted.
This policy will be strictly enforced. No exceptions will be granted.

Midterm Exam (20%)

A midterm exam will test your cumulative understanding of the course material. The exam is an in-class exam.

Honor Code

As with all Kellogg courses, by enrolling in this course you agree to abide by the Kellogg Honor Code (http://www.kellogg.northwestern.edu/stu_aff/policies/honorcode.htm). In this course you may (and are encouraged to) discuss both the individual assignments and group assignment with your fellow students; however, the finished product that you submit must be entirely your own work. If you have any questions regarding how the honor code applies to this course, please see the instructor.

Readings

All readings are available on Canvas. There is no textbook for the course. Readings are ***optional*** unless noted otherwise – they are intended for you to refer to if you need to revisit a concept. Readings marked as (Advanced) are more difficult and are provided only for those interested in exploring a specific topic in more depth.

Summary of Assignments and Lab Sessions (subject to change)

All assignments are due by 11:59pm on the day indicated.

		Title	Distributed	Due	Percentage
1	*Individual*	*Superstars*	1/4	1/11	10%
2	*Individual*	*Visualizing influence*	1/11	1/18	10%
3	*Individual*	*Lab session: Network 1*	1/18	1/25	3%
4	*Individual*	*Lab session: Network 2*	1/25	2/1	3%
5	*Individual*	*Lab session: Network 3*	2/1	2/8	2%
6	*Individual*	*Predicting the present with Google*	2/15	2/22	10%
7	*Individual*	*Lab session: Crowd*	2/22	2/29	2%

Warning: This schedule is subject to change

Week 1 — The Hidden Principles of Success

Too often, accomplishment does not equate to success. We did the work but didn't get the promotion; we played hard but weren't recognized; we had the idea but didn't get the credit. We've always been told that talent and hard work are the key to success, but in today's world these efforts by themselves rarely yield results. In a world of growing complexity and interconnectedness, success and recognition seem to have only a tenuous link to effort, skill or inherent excellence. Instead, they are determined by less obvious factors of human behavior that influence how attention flows through social networks. This week's lecture will introduce several recent groundbreaking research revealing the hidden principles of success, which uses big data to pull back the curtain on the social dynamics that govern success. These science-based principles that drive success offer a new understanding of the very foundation of the how people excel in today's society.

Session 1. Rethink Success.

What is social dynamics? In this lecture we will look at several familiar examples that span across diverse domains, from ace pilots in the WWI to la la land to Usian Bolt. Through these vivid yet apparently disparate examples, we will uncover the first two principles governing social dynamics.

Samuel J. Palmisano, "A Note to Fellow CEOs," *Capitalizing on Complexity: Insights from the Global Chief Executive Officer Study*, IBM, 2010.

Robert M. May, Simon A. Levin, and George Sugihara (2008) "Complex systems: Ecology for bankers," *Nature* 451, 893-895. (advanced)

Install Gephi on your computer. Need it next week. Work with KIS/TA if you encounter any difficulty.

Session 2. Superstars.

Long tail. Success breeds success.

Chris Anderson, "The Long Tail," *Wired*, 2006.

W. B. Arthur, "Competing technologies, increasing returns, and lock-in by historical events," *The Economic Journal* 1989. (Advanced)

Sushil Bikhchandani, David Hirshleifer, and Ivo Welch, "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades," *Journal of Economic Perspectives*, 12(3): 151–170, 1998. (Advanced)

Assignment 1 out

Week 2 — Networks, A first look

Session 1. Introduction to Networks.

Modeling social interactions using networks. What is a network? How do we model networks? How can we visualize networks? Network vocabulary: Nodes, links, homophily, bipartite network, degree, degree distribution.

✻ *In Class Activity. Mapping the Social Network of the Class.*

Barabasi. *Network Science*. Chapter 1
M. E. J. Newman. *Networks: An Introduction*. Chapter 1 and Sections 6.1 and 6.2. (Reference)

Session 2. Mapping Networks – A First Look

What is network data? What data should you collect? How do you collect it?
An introduction to Gephi and mapping networks.

✻ *In Class Activity. Gephi (computers necessary). Install Gephi before class: https://gephi.org/*

Assignment 2 out
Lab session 1 out

Week 3 — Networks, and their Organizing Principles

Networks are pervasive—from the human brain to the Internet to the economy to our group of friends. These linkages, it turns out, aren't random. All networks have an underlying order and follow simple laws. This week we will introduce several foundational concepts of network science, including Small World; Six Degrees of Separation; Scale free network. Late comers; Network Robustness; Navigating a network; Friendship paradox, and more. Understanding the organizing principles of these networks will help us do some amazing things, from designing the optimal organization of a firm to stopping a disease outbreak before it spreads catastrophically.

Session 1. Viral Network - It's a Small World

Which networks are the best for facilitating contagion? What is random network model? aka cocktail party model? Six Degrees of Separation. What does Kevin Bacon have to do with all these?

Recommended "reading": Watch *The social dilemma* on Netflix: https://www.netflix.com/title/81254224
Nicholas A. Christakis and James H. Fowler. "Changing What We Do, or Changing What We Think?" *Connected*, 2011.

Session 2. From Small World to Global Hub.

Identifying the most important people in a network. Power law networks. Scale free network. Late comers; Network Robustness; Navigating a network; Friendship paradox.

Malcolm Gladwell, "Six Degrees of Lois Weisberg," *The New Yorker,* January 11, 1999.
Barabasi, *Network Science*, Chapter 3 (Cambridge University Press)

Barabasi, *Network Science*, Chapter 4 (Cambridge University Press)

Lab session 2 out

Week 4 — Network Influentials

Session 1. Unpredictability and Inequality in a Connected World.

How social influence creates unpredictable successes, catastrophic failures, and radical transformations. How did Susan Boyle have the sixth bestselling album of 2010? The Music Lab experiment. Market inequality and unpredictability. Network effects. Winner-takes-all.

Matthew Salganik, Peter Sheridan Dodds and Duncan Watts, "Experimental Study of Inequality and Unpredictability in an Artificial Cultural Market," Salganik, *Science,* 311(5762), 854–856. (Advanced)

Muchnik, Lev, Sinan Aral, and Sean J. Taylor. "Social influence bias: A randomized experiment." *Science* 341, no. 6146 (2013): 647-651. (Advanced)

Session 2. Guest speaker

Network analytics in action:
Guest speaker: Pioneering the design and use of network analytics to transform organizations; New opportunities in the era of COVID.
By Ben Waber, Co-founder and President, Humanyze

Lab session 3 out

Week 5 — Network Effects

Session 1. Network Effects.

Although software has become easier to build, launching and scaling new products and services remains difficult. Teams launching new products must consider the advantages of "the network effect," where a product or service's value increases as more users engage with it. Apple, Google, Microsoft, and other tech giants utilize network effects, and most tech products incorporate them, whether they're messaging apps, workplace collaboration tools, or marketplaces. Network effects provide a path for fledgling products to break through, attracting new users through viral growth and word of mouth. But, what exactly are network effects? How do teams create and build them into their products? How do products compete in a market where every player has them? This class draws from examples of Slack, LinkedIn, Zoom, Dropbox, Tinder, Uber, Airbnb, and more, to provide practical frameworks and principles that can be applied across products and industries and offer unique insights into what is becoming the number one principle for scaling business and defending against competitors: The Network Effects.

Session 2. THINK Lab
Group exercise on building a business with network insights.

Week 6 — Predictions in a connected world & Midterm

Session 1. Target Market & Echo Chambers.
Community structure is a key architecture of networks. How to detect communities? What are the implications of communities? How to identifying target markets? Echo Chambers and Pitfalls.

✻ *In Class Activity. Mid quarter feedback*

Extra Session. Movie (Optional, All Virtual)

Prize-winning network documentary.
(Tip: Great way to review for midterm)

Session 2. Midterm Exam

An in-class midterm exam that tests your cumulative understanding of course materials.

Week 7 — Predicting the Present

Session 1. Predicting the Present.
The Billion Prices Project. The "Measure and React" strategy at Zara. Predicting box office success, the DJIA, and election outcomes with Twitter. Sentiment analysis with Amazon Mechanical Turk. Twitterbombs, Astroturfing, and Truthy.

Google Flu Trends. Using Google Trends to identify trends and target markets.

Kurt Kleiner, "Bogus Grass-roots Politics on Twitter," *Technology Review,* November 2, 2010.
Hal Varian, "Predicting the Present," *Google Think Quarterly: The People Issue*, 2011.

Assignment 3 out

Session 2. Hackathon

Group project sprint with the Genius Bar

Week 8 — Persuasion through connections

Why do some things take-off while others don't? The classic mythology of success conveniently ignores the "chicken-egg" problem, skipping the part of the story when the network is sparse and lacks activity. But, in reality, crossing the tipping point is easier said than done, and if leaders don't solve the "chicken-egg" problem, the result is failure. This week we will take a rigorous look at the fundamental forces that shape the word-of-mouth dynamics. What exactly is the tipping point? How do we create contagions and cascades? What is the optimal type of network to start with? How do you design viral features so you can let your network do the work for you?

Session 1. Contagion and persuasion Part 1: Go Viral.

Why do some things take-off while others don't? Tipping point. How do we create contagions? Passive and active viral features.

Jill Lepore, "It's Spreading," *The New Yorker,* June 1, 2009.

M. E. J. Newman. *Networks: An Introduction.* Sections 17.1-17.5. (Advanced)

Sinan Aral and Dylan Walker, "Creating Social Contagion Through Viral Product Design: A Randomized Trial of Peer Influence in Networks," *Management Science*, 2011, 57(9): 1623–1639. (Advanced)

Session 2. Contagion and persuasion through networks.

Case study: A close look at Facebook early strategy that is key for its success.
Big seed viral campaigns for subcritical contagions. Threshold contagion, critical mass, and the cascade window.

Damon Centola and Michael Macy, "Complex contagions and the weakness of long ties," *American Journal of Sociology,* 113(3): 702–34, 2007. (Advanced)

Lab session 4 out

Week 9 — Crowd Intelligence

Eric Schimdt once said, "The Next $100 Billion dollar company will be driven by crowd-based solutions." This week we will explore a deceptively simple idea—the wisdom of crowds—and how it is dramatically impacting the way in which leaders and companies search for tomorrow's biggest ideas. Indeed, studies after studies have shown that large groups of people are smarter than an elite few, no matter how brilliant—better at solving problems, fostering innovation, coming to wise decisions, even predicting the future. We will explore the basic principles behind crowd intelligence, evaluate the relative benefits of accuracy and diversity in forecasting, understand when to use experts or crowds, and how to engage crowds for solving complex problems and discovering innovations. We will visit cases from Netflix, Fold-It, Top Coder to equip you with the toolkit to analyze when and why diverse groups outperform high ability groups.

Session 1. The Wisdom of Crowds.

Evaluating the madness of crowds. The averaging principle and the wisdom of crowds. The relative benefits of accuracy and diversity in forecasting (The Diversity Prediction Theorem).

Prediction markets and how markets reveal and aggregate information. Prediction markets in theory and practice.

✻ *In Class Activity. The Wisdom of the Class.*

Sharad Goel, Daniel M. Reeves, Duncan J. Watts, and David M. Pennock, "Prediction Without Markets," 2010, *Proceedings of the 11th ACM Conference on Electronic Commerce*, 357–366. (Advanced)

Session 2. Crowdsourcing and Open Innovation

How to engage crowds for solving complex problems and discovering innovations? The NetFlix Prize, Fold-It, Top Coder. When and why diverse groups outperform high ability groups.

Eliot Van Buskirk, "How the Netflix Prize Was Won," *Wired*, September 22, 2009.

Scott E. Page, "Making the Difference: Applying a Logic of Diversity," *The Academy of Management Perspectives,* 21(4): 6-20, 2007.

K.R. Lakhani and J.A. Panetta, "The Principles of Distributed Innovation," Innovations: Technology, Governance, Globalization 2, no. 3 (2007): 97-112.

Jeff Howe, "The Rise of Crowdsourcing," *Wired*, June, 2006.

✻ *In Class Activity. The "much anticipated" one-on-one math contest with the prof!*

Week 10 — Season Finale

Session 1. SHOWTIME.

Groups will deliver the final presentation for group project.
Each group will showcase their work. Your slide decks will be ready for you and you may use any additional props that you bring.

Must be present in this class

Session 2. Finale

Debrief, summary & review.