70/73-449: Social, Economic, and Information Networks

Course Description:

Interaction is a fundamental part of social science: firms market products to consumers, people share opinions and information with their friends, workers collaborate on projects, agents form alliances and coalitions. In this course, we will use the emerging field of social networks to put structure on this diverse mass of connections. Using a mixture of theoretical, empirical, and computational methods, we will learn about the structure and function of social networks. We will look at how an individual's position in a social network reflects her role in the community. We will learn to identify the most important individuals in a social network. We will consider how our own position in the social network affects our behavior, opinions, and outcomes. And we will explore where social networks come from, and what affects their structure. By the end of the course, you will have the tools and knowledge needed to analyze social network data on your own. The course is capped with a project where you will use your skills to answer your own questions.

Texts (available online):

1) **E&K:** *Networks, Crowds, and Markets* by David Easley and Jon Kleinberg
   Available online here: http://www.cs.cornell.edu/home/kleinber/networks-book/
2) **Newman:** *The Structure and Function of Complex Networks* by M.E.J. Newman
   Available online here: http://epubs.siam.org/doi/pdf/10.1137/S003614450342480

Required software:

Gephi (free), Netlogo (free)

Other useful texts:

Networks: An Introduction by M.E.J. Newman

Six Degrees: The Science of a Connected Age by Duncan J. Watts

Social and Economic Networks by Matthew O. Jackson

Social Network Analysis by John Scott

Understanding Social Networks: Theories, Concepts, and Findings by Charles Kadushin

Course Outline:

Part 1: Introduction to Networks
Part 2: Network Measures
Part 3: Network Statistics
Part 4: Models of Social and Information Networks
Part 5: Network Structure and Function

Grading:

5% Participation
5% Homework Assignments
10% Midterm Data Project
20% Midterm Exam 1
20% Midterm Exam 2
40% Final Data Project

Course Outline

	Topics Covered
Introduction	
	Basics of Networks
	Empirical Networks: Collection Methods, Network Representations, Tools, Visualizations, Famous Networks of History
Network Metrics and Measurement:	
	Network Taxonomy: Weighted Networks, Directed Networks, Bipartite Networks, Hypergraphs
	Basic Network Measures: Degree, Paths, Distance, Degree Distribution, Components, Connectivity
	Centrality: Degree, Closeness, Betweenness, Eigenvector
	Relationships: Reciprocity, Triadic Closure, Clustering, Assortativity
	Bridging Gaps: Closure, Brokerage, Structural Holes, Embeddedness
	Community Structure
Statistical Analysis of Social Networks	
	Challenges: Data Quality, Sampling, Bias
Models of Social Networks	
	Erdös-Renyi Random Graphs, Watts-Strogatz Small World, Preferential Attachment, Collaborative networks
	Simulating Networks
Network Structure and Function	
	Diffusion: Epidemics, Information, Fads, Virality, Information Cascades, Network Effects
	Learning, Social Influence, Opinion Formation, Voting Behavior
	Network Resilience and Failure
	Games on a Network: Bargaining, Collaboration, Trade, Power
	Missing Data and Link Prediction