ICPSR Summer Program: Network Analysis I

Class Time: M-F 1:00 - 3:00 PM

Dates: Monday, June 26 - Friday, July 21, 2017

Instructor: James D. Wilson Assistant Professor of Statistics, University of San Francisco
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Course Website: https://github.com/jdwilson4

Textbooks: Much of this course will be based on the following text book:

- *Networks: An Introduction, 1st ed.* by Mark Newman

We will supplement this book throughout the class with literature, my own network analysis notes, as well as the following text book:

- *Statistical Analysis of Network Data: Methods and Models* by Eric D Kolaczyk

Description: This course will lay the groundwork for social network analysis (SNA) from conceptual, statistical, empirical and computational foundations. We will draw on the rich multidisciplinary history that has shaped the field's development - incorporating perspectives from sociology, physics, mathematics, statistics, and public health.

SNA differs from other analytic perspectives in ways that require unique strategies for data collection, storage, descriptive and statistical analyses. The course will address each of these strategies by surveying a range of the most commonly used analytic techniques. We will demonstrate their empirical applications and computation using the `R` programming language.

We will discuss topics including data collection, network representation, summaries of networks including social balance, distance, density, and centrality, clustering, and an introduction to statistical models for large scale inference.

Learning Outcomes: In this class we will cover topics generally about how to make insights from network data. We will be investigating network data using `R` software. Broadly speaking, we will investigate the following areas:

- Basic graph theory: introduction and definitions
- Summarizing networks with network statistics
  - degree distribution
  - geodesic distance
  - clustering coefficient
  - the small world property
  - counts of subgraphs
- The basics of random graph distributions
  - Erdos Renyi random graph
  - Configuration model
  - Exponential random graph models
  - Latent space models
- Large scale analysis of networks
- Unsupervised learning via community detection
- Dynamic networks: models and analysis
- Multilayer networks: models and analysis

What you should bring to Class:

A computer, lecture notes, a pen or pencil and a sunny disposition :)

Grading: Grading in this class will be based on a combination of in-class participation, reading, as well as quantitative and computational homework assignments given in class. More details of this will be provided in class.