

18D028

3 ECTS

Networks: Concepts and Algorithms

Overview and Objectives

Nowadays, networks are pervasive and influence many of our decisions and outcomes. If the shape and structure of the network matters, and if individual positions in such network lead to different outcomes, we need to quantify and measure network and individual actor properties; therefore, we are going to introduce network-based concepts and measures that show up in theoretical and empirical studies. These concepts relate to the local and global properties of a networks. We are going to apply these measures to the analysis of community structure and to the study of computationally tractable models of dynamic behavior in networks, and we are going to study classical models of random network formation that try to express some of the aggregate characteristics of networks.

The course, together with the second part *Networks: Models and Applications*, provides a multifaceted approach to the study of networks, bringing together concepts, models, algorithms, and tools from graph theory, game theory, sociology, economics, computer science, and statistics, among other areas.

Prerequisite reading

This course has no prerequisite readings.

Course Outline

Individual Measures. Connectivity, Centrality, and Similarity.

Global Measures.

Identifying Communities

Random graphs. Power laws, Six Degrees of Separation, and Giant Components

Dynamic Processes in Networks

Required Activities

Attendance to theory class and problem sets (that may include theory problems as well as practice with software and data sets).

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Evaluation

30% Problem Sets, 35% Project, 35% Final Exam

Material

Books:

D. Easley and J. Kleinberg, Networks, Crowds, and Markets, Cambridge University Press 2010

Matthew Jackson, Social and Economic Networks, Princeton University Press 2010

Mark Newman, Networks: An Introduction, Oxford University Press 2010

S. Wasserman and K. Faust, Social Network

Analysis: Methods and Applications, Cambridge University Press 1994

Osborne, An Introduction to Game Theory, Oxford University Press 2003

Other:

A list of other resources (data sets, papers,...) will be provided as the course progresses.