UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Network Analysis

2526-1-F8205B023

Learning objectives

By the end of this course, students will be able to apply methods for the analysis of network data to describe and explain phenomena that can be represented as networks. In particular, they will be able to:

- define network statistical methods (*knowledge and understanding*)
- explain and compare network statistical methods (*knowledge and understanding; making judgements*)
- identify the adequate method to analyse a given network and address specific research questions; motivate the chosen method (*applying knowledge and understanding; making judgements; communication skills*)
- perform statistical analysis using the software R: descriptive analysis, model estimation, interpretation and critical assessment of the results (*applying knowledge and understanding*)
- present the analysis results to an audience thtat might be unfamiliar with the introduced methods (*communication skills*)
- learn model extensions independently (*learning skills*)

Contents

Network definition and representation; network descriptives; network models for cross-sectional network data; models for longitudinal network data; models for the analysis of selection and influence processes; models for the diffusion of innovations and the spread of diseases. The application of these models is illustrated through examples and practical sessions analyzing network data from different disciplines using the software R.

Detailed program

1. Network definition and representation

- Network data
- Adjacency matrix and graphs
- Examples

2. Descriptives

- Density and degree distributions
- Centrality indices
- Network clustering

3. Models for cross-sectional network data

- Unsuitability of standard regression models for network modeling
- Small-world and preferential attachment models
- Quadratic assignment procedure (QAP regression)
- Exponential random graph models (ERGMs)

4. Models for longitudinal network data

- Models for network panel data: Stochastic actor-oriented models (SAOMs)
- Models for relational event data: Relational event models (REMs)

5. Models for selection, influence and diffusion processes

- Definition of influence, selection and diffusion processes
- Stochastic actor-oriented models (SAOMs) for the co-evolution of networks and behaviors
- Models for the diffusion of innovations and the spread of diseases
  The application of these models is illustrated through examples and practical sessions analyzing network data from different disciplines using the software R.

Prerequisites

None

Teaching methods

Face-to-face lectures and practicals.

- 1 three-hour in-person session delivered in a lecture-based format
- 9 three-hour in-person session delivered in a lecture-based format in the first part, and using interactive learning sequences in the second part
- 6 two-hour in-person practicals

Assessment methods

An oral exam consisting of theoretical questions related to the lecture topics and the discussion of a report. The

oral exam assesses the knowledge and understanding of the network concepts and methods taught in the course. The report is an analysis of network data chosen by the students. It assesses the ability to identify adequate methods to answer specific research questions, justify the method choice, and implement the analysis using the software R

Textbooks and Reading Materials

Slides and material on the e-learning page

Reference books:

- Kolaczyk, E. D. (2009). Statistical analysis of network data: model and methods. New York: Springer.
- Kolaczyk, E. D., & Csárdi, G. (2014). Statistical analysis of network data with R (Vol. 65). New York: Springer.
- Robins, G., Pattison, P., Kalish, Y., & Lusher, D. (2007). An introduction to exponential random graph (p*) models for social networks. Social networks, 29(2), 173-191.
- Snijders, T. A., Van de Bunt, G. G., & Steglich, C. E. (2010). Introduction to stochastic actor-based models for network dynamics. Social networks, 32(1), 44-60.
- Butts, C. T. (2008). A relational event framework for social action. Sociological methodology, 38(1), 155-200.
- Valente, T. W. (2005). Network models and methods for studying the diffusion of innovations. Models and methods in social network analysis, 98-116.

Other references:

- Hennig, M. (2012). Studying social networks: A guide to empirical research. Campus Verlag.
- Lusher, D., Koskinen, J., & Robins, G. (Eds.). (2013). Exponential random graph models for social networks: Theory, methods, and applications. Cambridge University Press.

Semester

Second semester, second cycle (approximately from May to mid June)

Teaching language

English unless an explicit request from the students to hold the course in Italian

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION