GESIS Fall Seminar in Computational Social Science 2023

Syllabus for week 3:
"Social Network Analysis with R"

Lecturers:	Michał Bojanowski
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Date: September 25-29, 2023
Time: 09:30-16:30

About the Lecturers

Michał Bojanowski is an assistant professor at the Chair of Quantitative Methods and Information Technology at Kozminski University and a researcher at the COALESCE Lab at the Autonomous University of Barcelona. He holds a PhD in sociology (2012, ICS / Utrecht University) and his research focuses on modeling social network data, especially collected with non-sociocentric designs as well as on assembling complex social network datasets from non-obvious sources (such as historical archives) often using technically-advanced procedures. Michał is an R developer with over 20 years of experience in writing packages and providing training in academic and business contexts. He is a member of Statnet Development Team, maintaining a suite of R packages for statistical network analysis.

Course Description

The course will provide a hands-on tour through the important concepts and methods of Social Network Analysis (SNA). The main goal is to put the participants on a well-lit road towards conducting a typical social-network-analytic project comfortably on their own using R. The focus is on the practical application of key ideas of SNA rather than discussing (social) theories standing behind them. Nonetheless, pointers to the relevant theoretical and applied literature will be provided.

To this end, the course will discuss importing network data from various formats, managing network data within R, basic SNA descriptives (including density, transitivity, homophily/segregation, and centrality), community detection, and creating effective network visualizations. The course will conclude with coverage of the basics of statistical modeling of networks with Exponential-family Random Graph Models (ERGM) and Stochastic Actor-Oriented Models (SAOM).

Course meetings will consist of two parts. The first part will consist of a presentation, demonstration, and discussions on various SNA concepts and methods. The second part will be focused on hands-on training in applying the presented concepts and tools using real data. While the instructors will provide datasets for these exercises, participants are encouraged to bring their own data.

Keywords

Social network analysis; network data; network visualization; modeling

Course Prerequisites
- Basics of R and RStudio: familiarity with R syntax, working with basic types of R objects such as vectors and data frames
- Basics of quantitative methodology and statistics (e.g. descriptive statistics, linear regression)

For those who would like a primer or refresher in R, we recommend taking the online workshop "Introduction to R" that takes place from 05-07 September 2023.

Target Group
Participants will find the course useful if:
- They intend to extend their arsenal of empirical research skills to network-related problems and network data
- They have experience in conducting SNA research using other tools, but wish to learn doing SNA in R

Course and Learning Objectives
By the end of the course participants will:
- acquire the knowledge and skills necessary to conduct basic SNA project using R on their own
- have an overview of existing SNA-related tools in R
- acquire knowledge and skills to further expand their knowledge and skills in SNA and R

Organizational Structure of the Course
The course will be organized in two 3-hour sessions: lecture/presentation and hands-on lab. Presentations will introduce necessary concepts and demonstrate the discussed tools. Lab sessions will enable the participants to practice, with guidance from the instructors, applying SNA concepts and using tools on real network datasets.

Software and Hardware Requirements
Participants are expected to bring their own laptops with the following software installed:
- R
- RStudio
- R packages: tidygraph, ggraph, graphlayouts, statnet, netrankr, remotes, tidyverse
- Example network data to be installed with R command:
  remotes::install_github('schochastics/networkdata')

Recommended Literature to Look at in Advance
Hanneman, R. A., & Riddle, M. (2005). *Introduction to Social Network Methods*. University of California, Riverside. http://faculty.ucr.edu/~hanneman/
Wickham, H., & Grolemund, G. (2016). *R for data science: Import, tidy, transform, visualize, and model data*. O'Reilly Media, Inc. https://r4ds.had.co.nz/

Day-to-day Schedule
Day 1: Introduction
- R packages for network data and network analysis
- Network data representations

Day 2: Network data
- Managing network data
- Network descriptives

Day 3: Network visualization
- Static network visualizations
- Interactive network visualizations
- Dynamic network visualizations (movies)

Day 4: Groups in networks
- Components, cliques, and community detection
- Homophily and segregation
- Two-mode networks

Day 5: Statistical Social Network Analysis
- Testing hypotheses about network structure
- Exponential-family Random Graph Models (ERGM)
- Stochastic Actor-Oriented Models (SAOM)

Additional Recommended Literature

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2018). *Analyzing Social Networks* (Second edition). SAGE Publications Ltd.

Cranmer, S. J., Desmarais, B. A., & Morgan, J. W. (2021). *Inferential Network Analysis*. Cambridge University Press.

Kadushin, C. (2011). *Understanding Social Networks: Theories, Concepts, and Findings*. Oxford University Press.

Luke, D. (2015). *A User's Guide to Network Analysis in R*. Springer International Publishing.

Lusher, D., Koskinen, J., & Robins, G. (2013). *Exponential Random Graph Models for Social Networks: Theory, Methods, and Applications*. Cambridge University Press.

Scott, J. (2017). *Social Network Analysis* (4th edition). SAGE Publications Ltd.