Winter Course 2019 – Social Network Analysis

Prof. Pietro Battiston
Prof. José Maria Jd. Da Silveira
Profa. Ivette Luna
Prof. Marcelo Pereira

Period – From July 11th to July 19th

Credits – 4

Course aim

This course is aimed at postgraduate researchers in Economics and related fields. The course follows a hands-on approach that will give participants experience of analyzing real social network data. No prior knowledge of social network analysis (SNA) is required, but the knowledge of standard statistical methods is preferable. The Python language and libraries will be used for visualization and statistical analysis of real data networks. Therefore, those unfamiliar with SNA will get an overview of the methods and the theoretical foundations of the relational approach and those with some familiarity should get the opportunity to structure their knowledge.

Syllabus and day-to-day schedule

Day 1 - 11/07 (Prof. Silveira)

- **Morning**: introduction to the history and theory of social network analysis, fundamentals, goals and possible applications of the method.
- **Afternoon**: detection and description of structural properties - centrality, cohesion, positional analysis techniques.

Day 2 - 12/07 (Prof. Silveira)

- **Morning**: network processes - subgroups (homophily, assortativity, structural holes, small worlds).
- **Afternoon**: blockmodeling.

Day 3 - 15/07 (Prof. Battiston)

- **Morning**: free.
- **Afternoon**: introduction to the Python syntax and to the Python docs, overview of fundamental data structures, basics of object oriented programming.

Day 4 - 16/07 (Prof. Battiston)

- **Morning**: control flow, how to import/create a module, presentation of Python libraries for network analysis (examples with toy data).
- **Afternoon**: loading a dataset exhibiting community structure, analysis of its topological features.

Day 5 - 17/07 (Prof. Battiston)

- **Morning**: elements of graph drawing, comparison of most popular algorithms.
- **Afternoon**: (game-)theoretical foundations of community structure/clustering, discussion of mathematical methods for communities identification.

Day 6 - 18/07 (Prof. Battiston)

- **Morning**: mathematical methods for communities identification: focus on complexity and weighted vs. unweighted networks.
- **Afternoon**: experimenting with communities detection.

Day 7 - 19/07 (Prof. Battiston)

- **Morning**: introduction to issues and examples of multilayer and multiplex networks. Endogenous formation paradigms for multilayer networks. The problem of reconstructing multiplex networks from data.
- **Afternoon**: application: examining the network of diffusion of a disease or of human mobility through the networks of transportation systems.

Assessment - Frequency and a final assessment exercise/project.

Requirements to attend the course

Participants will need to each have a computer available with Python 3, jupyter notebooks and the required libraries installed. Install instructions (all required softwares are open source and easy to obtain) will be shared with the participants.

The program assumes no prior knowledge of Python. If participants already know a bit of Python, the introductory part in the afternoon of the third day can be squeezed.

References

Jackson, Matthew O. *Social and economic networks*. Princeton university press, 2010.

Doreian, Patrick, Vladimir Batagelj, and Anuška Ferligoj. (2005). Generalized Blockmodeling. New York: Cambridge University Press.

Girvan, M., & Newman, M. E. (2002). Community structure in social and biological networks. *Proceedings of the national academy of sciences*, *99*(12), 7821-7826.

Stefano Battiston, Guido Caldarelli and Antonios Garas, editors (2018). Multiplex and Multilevel Networks. Oxford University Press.

Contact

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Short bio – Pietro Battiston

Pietro Battiston is a researcher in Economics with a background in Mathematics and a passion for programming (and for music). He obtained his PhD in 2014 from University of Milan Bicocca, where he returned in 2017. He has spent visiting periods at the CEU in Budapest and Barnard College at Columbia, New York. His main research interests are Network Theory (in particular, applications to economic and financial networks), Law & Economics, Experimental Economics, and Bibliometrics. On such topics, he has published on the Scandinavian Journal of Economics, on the Journal of Economic Behavior & Organization, and others. He is a core developer of the **pandas** Python library for data manipulation, and an occasional contributor of other open source projects. His first book *"Network responsibility"* is planned for fall 2019, from Columbia University Press.