

IPSA-ABU Summer School for Social Science Research Methods

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Introduction to Network Analysis

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Short course description:

The course aims to provide an introduction into the main topics and concepts of social network analysis. It focuses on the analysis and visualisation of complete networks. Participants will get an understanding of basic network analysis concepts like centrality, cohesion, blockmodeling, etc. Special attention will be given to the analysis of large networks. After the course participants should be able to examine data in 'social networks way' – they should be able to identify and formulate their own network analysis problems, solve them using network analysis software and interpret the obtained results. The course is supported by Pajek – a program for analysis and visualisation of large networks.

Detailed course description:

The course will start with an overview of the history of social network analysis, followed by a presentation of some typical and well-known real-life networks. In the main part fundamental concepts and methods of network analysis will be explained. Lab sessions will be performed using the software package Pajek. Then the course will cover the following topics:

1. Basic network concepts: network representations: matrix, graph; types of networks: undirected networks, directed networks, multi-relational networks, 2-mode networks, temporal networks; size and density; small, large and huge networks, sparse and dense networks;
2. Program Pajek and other network analysis software: description of networks in Pajek input file; network layouts: automatic and manual drawing; Unicode; connection with statistical packages (R); utility programs: Text2Pajek, GSView, SVG, King, Inkscape;
3. Paths in networks: walk, chain and path; closed walk, cycle, closed chain, loop; length and value of path; the shortest path, diameter; k-neighbours; acyclic networks;

4. Centrality: degree, closeness, betweenness; hubs and authorities, clustering coefficient; Hummon-Doreian's weights in acyclic networks; small world and scale-free networks;
5. Weights and properties: line and vertex cuts, sub-networks; regression; visualisation in Pajek;
6. Connectivity: weakly, strongly and bi-connected components; global and local views; contraction; extraction; skeletons: minimal spanning trees, Pathfinder;
7. Cohesion: triads, cliques, rings, cores, islands; strong and weak ties; pattern search (motifs);
8. 2-mode networks: examples of 2-mode networks; direct analysis of 2-mode networks; multiplication of networks; transforming 2-mode to 1-mode networks; derived networks; analysis of bibliometric (citation, collaboration, keywords/tags,...) networks;
9. Blockmodelling: direct and indirect approaches; structural, regular equivalence; generalised blockmodelling and blockmodelling of 2-mode networks;
10. Temporal, spatial and multirelational networks: macros and operations on sequences of networks.

After listening to the lectures, participants will work individually in computer labs. Several data sets will be prepared to challenge their knowledge.

Resources:

1. Vladimir Batagelj, Patrick Doreian, Anuška Ferligoj and Nataša Kejžar: Understanding Large Temporal Networks and Spatial Networks: Exploration, Pattern Searching, Visualization and Network Evolution. Wiley Series in Computational and Quantitative Social Science. Wiley, October 2014.
2. Wouter De Nooy, Andrej Mrvar, Vladimir Batagelj: Exploratory Social Network Analysis with Pajek; Revised and Expanded Edition for Updated Software. Structural Analysis in the Social Sciences, CUP, July 2018.
3. Pajek: <http://mrvar.fdv.uni-lj.si/pajek/>

About

Vladimir Batagelj is professor emeritus at the University of Ljubljana. His main research interests are in mathematics and computer science: combinatorics with emphasis on graph theory, algorithms on graphs and networks, combinatorial optimisation, algorithms and data structures, cluster analysis, visualisation, social network analysis and applications of information technology in education. With Andrej Mrvar he is developing from 1996 a program Pajek for analysis and visualisation of large networks. He is a co-author of the books Exploratory Social Network Analysis with Pajek (Cambridge University Press, 2005; Second edition, 2011; Third edition, 2018), Generalized Blockmodeling (Cambridge University Press, 2004) and Understanding Large Temporal Networks and Spatial Networks (Wiley, 2014).

<http://vldowiki.fmf.uni-lj.si/doku.php?id=vlado>