PAJEK

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1 Introduction

Pajek is a program, for Windows, for analysis and visualization of large networks having some thousands or even millions of vertices. In Slovenian language the word pajek means spider.
The main motivation for development of Pajek was the observation that there exist several sources of large networks that are already in machine-readable form. Pajek should provide tools for analysis and visualization of such networks: collaboration networks, organic molecule in chemistry, protein-receptor interaction networks, genealogies, Internet networks, citation networks, diffusion (AIDS, news, innovations) networks, data-mining (2-mode networks), etc.
The main goals in the design of Pajek are:

- To support abstraction by (recursive) decomposition of a large network into several smaller networks that can be treated further using more sophisticated methods;
- to provide the user with some powerful visualization tools;
- to implement a selection of efficient (subquadratic) algorithms for analysis of large networks.

With Pajek we can: find clusters (components, neighbourhoods of important vertices, cores, etc.) in a network, extract vertices that belong to the same clusters and show them separately, possibly with the parts of the context (detailed local view), shrink vertices in

clusters and show relations among clusters (global view).
Besides ordinary (directed, undirected, mixed) networks Pajek supports also multi-relational networks, 2-mode networks (bipartite (valued) graphs networks between two disjoint sets of vertices), and temporal networks (dynamic graphs networks changing over time).

2 Data Object

In Pajek six types of objects are used:

1. Networks main objects (vertices and lines). Default extension: .net. Network can be presented on input file in different ways:

   - using arcs/edges (e.g. 1 2 line from 1 to 2)
   - using arcslists/edgeslists (e.g. 1 2 3 line from 1 to 2 and from 1 to 3)
   - matrix format

   Additional information for network drawing can be included in input file as well. This is explained in the section Exports to EPS/SVG/VRML.

2. Partitions they tell for each vertex to which class vertex belong. Default extension: .clu.

3. Permutations reordering of vertices. Default extension: .per

4. Clusters subset of vertices (e.g. one class from partition). Default extension: .cls.

5. Hierarchies hierarchically ordered vertices. Default extension: .hie.

6. Vectors they tell for each vertex some numerical property (real number). Default extension: .vec.

3 Main Tools

3.1 File

Input/Output manipulation with the six data objects.

- Network
- Time event Networks
- Partition
- Permutation
- Cluster Hierarchy

3.2 Net

Operations, for which only a network is needed as input.

- Transform
- Random Networks
- Partitions
- Components
- Hierarchial Decomposition
- Numbering
- Citation Weight
- k-neighbours Path Between 2 vertices.
- Vector

4 Draw Window Tools

The most important Tool is drawing tool which can be used to see our networks. There are different type of layouts Circular Energy Eigen Values Graph only.

Again many functions can be operated on this layouts or views and the result can be exported as eps or in other formats.

5 Conclusion

We have just explained few functions or operations that are possible in pajek which will help to analyse our networks.

References

[1] Pajek Program for Analysis and Visualization of Large Networks Reference Manual List of commands with short explanation version 1.13 Vladimir Batagelj and Andrej Mrvar Ljubljana, $March 27, 2006$.

[2] V. Batagelj, A. Mrvar: Pajek Program for Large Network Analysis. Home page: http://vlado.fmf.uni-lj.si/pub/networks/pajek/.

[3] V. Batagelj, A. Mrvar: Pajek Analysis and Visualization of Large Networks. In Junger, M., Mutzel, P. (Eds.): Graph Drawing Software. Springer (series Mathematics and Visualization), Berlin 2003. 77-103. ISBN 3-540- 00881-0. Springer, Amazon, preprint.