

Analysis of Large Networks

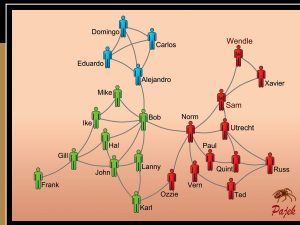
STRUCTURAL ANALYSIS IN THE SOCIAL SCIENCES

46

Exploratory Social Network Analysis with Pajek

REVISED AND EXPANDED EDITION
FOR UPDATED SOFTWARE

THIRD EDITION



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Pajek

Syllabus

Large networks

A.Mrvar

Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

Degree Conditional Bernoulli-Poisson

Small World

Scale Free

What else?

1 Syllabus

2 Introduction

- Definitions
- Connectivity and cohesion
- Centrality and prestige

3 Special types of networks

4 Sources of large networks

5 Acyclic networks

- Citation networks
- Genealogies

6 Large networks

7 Standard network models

- Bernoulli-Poisson and Erdős-Rényi
- Degree Conditional Bernoulli-Poisson
- Small World
- Scale Free

8 What else?



Pajek

Introduction

Definitions

Large networks

A.Mrvar

Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

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Large networks

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What else?

- Network
- Types of networks
- Size and density
- Walk, chain, path, closed walk, cycle, closed chain, loop
- Path length, the shortest path, diameter, average path length
- k-neighbour
- Program Pajek



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Introduction

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Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

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What else?

- Definition of Cluster and Partition
- Cut-outs
- Components
 - weakly connected components
 - strongly connected components
 - biconnected components
- Cores
- Triads and cliques
- Global views
 - reduction
 - hierarchy
- Local views
 - cut-out
 - context



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Introduction

Centrality and prestige

Large networks

A.Mrvar

Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

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What else?

- Centrality and centralization
 - degree
 - closeness
 - betweenness
 - proximity prestige
 - hubs and authorities
- Brokerage roles
 - coordinator
 - itinerant broker
 - representative
 - gatekeeper
 - liaison

Test



Special types of networks

Large networks

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Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

Degree Conditional Bernoulli-Poisson

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What else?

Additional types of networks:

- Multiple relations networks
- Temporal networks
- Two-mode networks, multilevel networks
- Signed networks

For each type:

- Examples
- Presentation in Pajek
- Typical analyses and visualisations



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Large networks

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Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

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What else?

- **Generating networks**
 - Networks obtained from WWW (WoS, Web Crawlers)
 - Networks obtained from texts
 - semantic networks
 - associations
 - dictionary networks
 - words transformation networks
 - Networks obtained from movies (Lindenstrasse)
- **Excel2Pajek, text2Pajek**



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Acyclic networks

Citation networks

Large networks

A.Mrvar

Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

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What else?

- **Acyclic networks**
- **Properties of acyclic networks**
 - source and sink vertices
 - topological sort
 - visualization in layers
- **Computing traversal weights in citations networks**
 - SPC - Search Path Count
 - SPLC - Search Path Link Count
 - SPNP - Search Path Node Pair
- **Searching for main paths**
 - local main paths
 - global main paths
 - key-routes



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Acyclic networks

Genealogies

Large networks

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Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

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What else?

- Collecting genalogical data
- GEDCOM standard for storing genalogical data
- Representing genealogies as networks
 - Ore-graph
 - p-graph
 - bipartite p-graph
- Relinking marriages
 - relinking index
 - blood marriages
 - relinking marriages
- Searching for relinking marriages
- Special genealogies
 - Students and their PhD thesis advisors
 - Noble families
 - American presidents



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Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

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What else?

Additional measures and approaches for analysing large networks:

- Clustering coefficient
- Short cycles
- Islands
- Community detection
- E-I Index
- Comparing partitions
 - Cramer's V
 - Rajski coefficients
 - Adjusted Rand Index



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Syllabus

Introduction

Definitions

Connectivity and cohesion

Centrality and prestige

Special types of networks

Sources of large networks

Acyclic networks

Citation networks

Genealogies

Large networks

Standard network models

Bernoulli-Poisson and Erdős-Rényi

Degree Conditional Bernoulli-Poisson

Small Word

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What else?

- Standard network models
 - Bernoulli-Poisson and Erdős-Rényi model
 - Degree conditional Bernoulli-Poisson model
 - Small Word model
 - Preferential attachment - Scale free model
- Differences among models
 - giant component
 - average degree
 - diameter
 - average distance
 - clustering / transitivity
 - centralization
- Monte Carlo simulations and fitting to real networks



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Syllabus

Introduction

Definitions

Connectivity and cohesion

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Special types of networks

Sources of large networks

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Genealogies

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What else?

- Collaboration networks - Erdős number
- Animations - PajekToSVGAnim
- Communication networks
- Food webs
- Protein-protein interaction networks