Visone - Analysis and Visualization of Social Networks

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Advanced Political Network Modeling
Overview

What is visone?
The beginning
A new start
The future

Features
Work flow
Basic Features
Analysis
Visualization

Centralities
Shortest-path centralities
Feedback centralities
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Visone

From Wikipedia, the free encyclopedia

Visone is a comune (municipality) in the Province of Alessandria in the Italian region Piedmont, located about 80 km southeast of Turin and about 30 km southwest of Alessandria. As of 31 December 2004, it had a population of 1,178 and an area of 12.6 km².Visone borders the following municipalities: Acqui Terme, Grugnardo, Morbelli, Moscarsco, Prasco, and Striet.

Demographic evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>1,800</td>
</tr>
<tr>
<td>1991</td>
<td>1,800</td>
</tr>
<tr>
<td>2001</td>
<td>1,800</td>
</tr>
<tr>
<td>2011</td>
<td>1,800</td>
</tr>
</tbody>
</table>

Data from ISTAT

References

1. All demographics and other statistics: Italian statistical institute Istat.
What is visone? — Wikipedia

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http://i11www.ira.uka.de
What is visone?

visone

visual analysis of social networks
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visual analysis of social networks
What is Visone?

visone

visual analysis of social networks

- Italian for mink
What is visone?

- visual analysis of social networks
  - Italian for mink
  - interactive visual graph editor
  - combine analysis and visualization of social networks
  - provide methodological strict methods – increase the application range
  - ease of handling – lots of possibilities
What is visone? The beginning

The beginning (1999)

- closeness and betweenness, radial visualization
- more centralities, layered visualization
- public availability
- but: one edge value, limited graphics, out-dated code base
A new start (2004)

- same analysis and visualization
- more powerful interface
- easier development process
What is visone?

A new start (2004)

- same analysis and visualization
- more powerful interface
- easier development process
- . . . and then it became difficult

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What is visone? A new start

A new start (2004)

- same analysis and visualization
- more powerful interface
- easier development process
- ... and then it became difficult

here we are (2007)

- user interface and network model finished
- analysis: node centralities, some group-level
- visualization: many basic properties (size etc.), radial, layered (soon)
What is visone?

The future

so far focus was on:

- social and political science
- element level analysis and visualizations
- small to medium size networks (< 100 nodes)
- show every node and edge
- usability
- powerful and general interface
What is visone?

The future

The future (2)

where to go?

- advanced and edge centralities
- larger networks
- group level analysis, clustering,
- bipartite graphs, transform and/or reduce graphs
- dynamics

wishes and suggestions are wanted
Features

Structure

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Features

Work flow

- (edge-weighted) mixed multi-graphs
- analysis: compute an other weight
  e.g. betweenness: decimal values for nodes
  e.g. clustering: discrete cluster identifier (partition)
- visualization: map a weight to a graphical property
  e.g. betweenness (decimal): radial, node size
  e.g. clustering (partition): node color, grouped placement
- transformation: modify structure w.r.t. weight
  e.g. betweenness (decimal): remove lesser-valued nodes
  e.g. clustering (partition): group graph
Example: German Companies [Höpner, Krempel ’03]

The German Company Network of 1996

Capital Shares
- financial – financial
- industrial – industrial
- financial – industrial

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Example: German Companies [Höpner, Krempel '03]
Features Basic Features

Graph Editor

- **mixed multi-graph:**
  - (un)directed,
  - (un)confirmed,
  - (un)weighted edges

- **extensive graphical properties:** colors, shapes, sizes, labels

- **templates**

- **basic edge transformations**

- **import from/export to various formats**
Attributes

- data for nodes and edges
- analysis values: indices, partitions, cliques, ...
- user data: names, weights
- types: text, integer, decimal, boolean, and lists
- input parameter for visualization
- visualize multiple aspects
Selections/Groups

sets of nodes and edges

- by attribute values, graphical properties, or incidence
- combine selections and store as attribute
- used in analysis and visualization
Features  Basic Features

Layout

general purpose layout methods
- circular
- force-directed
- spectral
- mds

- edge routing
- label placement
element level
- degree
- centrality
- clustering coefficient

group level
- connectedness
- cliques, k-cliques, ...
- k-core
- role equivalence
- clustering
Analysis

element level
- degree
- centrality
- clustering coefficient

group level
- connectedness
- cliques, k-cliques, ...
- k-core
- role equivalence
- clustering
Visualization

visualize node/edge attribute

- graphical item properties: size, color, border, label
Visualization

visualize node/edge attribute

- **graphical** item properties: size, color, border, label
- **radial** layout
  higher valued nodes are more central
Visualization

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  higher valued nodes are ranked higher
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  higher valued nodes are ranked higher
- **grouped**
Centralities

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**Centralities**

**Shortest-path centralities**

**Closeness**

**intuition:** a node is central, if it is close (on average) to all other nodes

definition: \( c_C(v) = \frac{1}{\sum_{t \in V} \text{dist}(v, t)} \)
Closeness

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  \[
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  \]
Shortest-path centralities

generalization

- **directed**: undirected edge $\Rightarrow$ pair of directed edges
- **weighted**: sum of edge lengths
- **range**: strongly connected components
Centralities Shortest-path centralities

Shortest-path centralities

generalization
- directed: undirected edge $\Rightarrow$ pair of directed edges
- weighted: sum of edge lengths
- range: strongly connected components

normalization
- computed node-wise on the maximum subgraph it is well-defined for
- normalization w.r.t. network: weight by relative size of range
- normalization across networks: divide by total score
Betweenness

- **intuition**: a node is central, if it is *between* many other nodes

  \[ c_B(v) = \sum_{s,t \in V} \frac{\sigma(s, t|v)}{\sigma(s, t)} \]

- **weighted**: sum of edge *lengths* not strength
- **range**: complete graph
Eigenvector centrality

intuition: a node is central, if it has many central neighbors

definition: $c_E(v) = \lambda \sum_{u \in V} c_E(u)$
Matrix operations

- **adjacency matrix** $A$ of graph $G = (V, E)$
- **transpose** $A^T$: reverse edge direction, mirror at diagonal
- **product** $A \cdot A$: connect pairs of nodes at distance two
Hubs and Authorities

adjacency matrix $A$

hub centrality: $c_H(A) = c_E(A A^T)$

authority centrality: $c_A(A) = c_E(A^T A)$
Centralities

Feedback centralities

Hubs and Authorities

diagram of \( AA^T \)

diagram of adjacency matrix \( A \)

diagram of \( A^T A \)

hub centrality:
\[ c_H(A) = c_E(AA^T) \]

authority centrality:
\[ c_A(A) = c_E(A^T A) \]
Thank you

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- use Webstart version
  - click ’n’ run
  - cached on your hard disk (offline)
  - automatic test for updates (online)

Thank you for your attention!