

tools for analyzing networks (Gephi)

2011.10.03

tools for analyzing networks

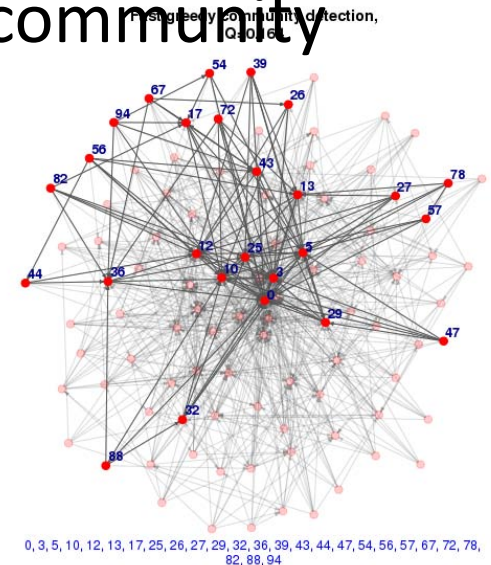
- (static) visualization
 - graphvis
 - LGL (Large Graph Layout)
- domain-specific tools
 - Pajek, UCInet: social network analysis
 - Cytoscape: bioinformatics
- interactive visualization
 - JUNG, Netminer, igraph, SONIVIS, Commetrix, NetworkWorkbench, visone, CFinder,...

<http://oswinds.csd.auth.gr/WWW-tutorial/part3.pdf>
<http://www.insna.org/software/index.html>
<http://www.kdnuggets.com/software/visualization.html>
<http://www.infovis-wiki.net/index.php?title=Category:Software>

igraph <http://cneurocv.s.rmki.kfki.hu/igraph/>

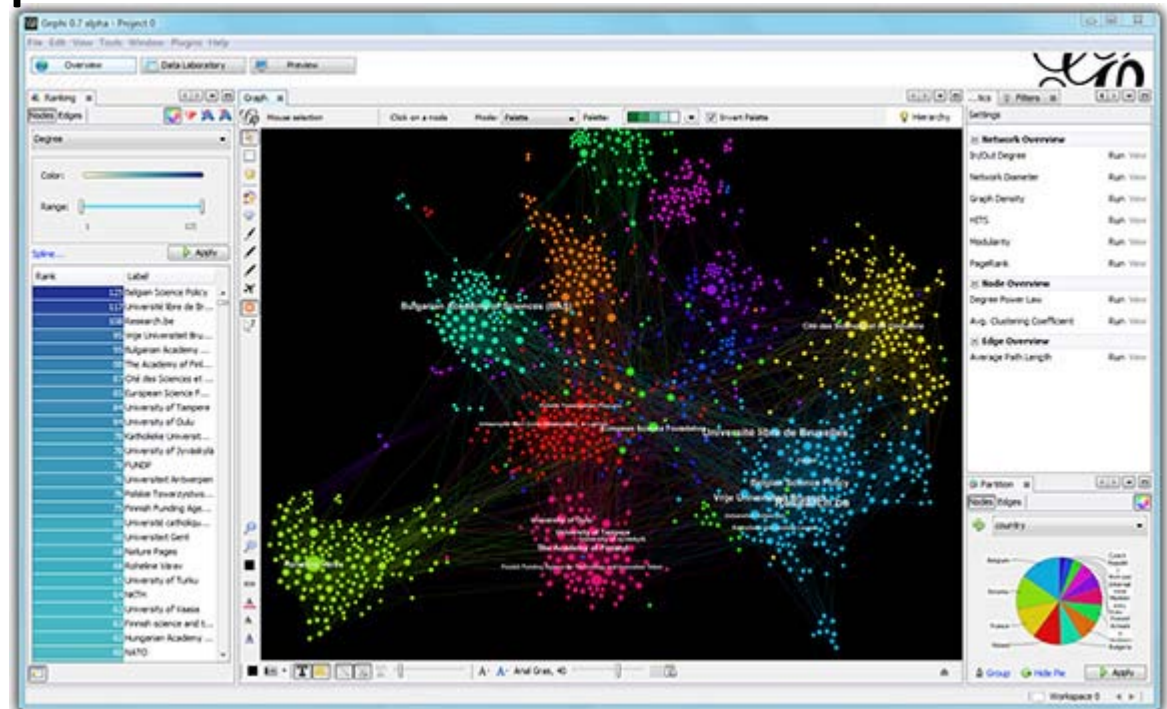
- igraph is a free software package for creating and manipulating undirected and directed graphs. It includes implementations for classic graph theory problems like minimum spanning trees and network flow, and also implements algorithms for some recent network analysis methods, like community structure search.

- explained later



Gephi <http://gephi.org/>

- Gephi is an interactive visualization and exploration platform for all kinds of networks and complex systems, dynamic and hierarchical graphs.



tutorial of Gephi

- online tutorials
 - <http://gephi.org/users/> (English)
 - <http://oss.infoscience.co.jp/gephi/gephi.org/index.html> (Japanese)



- using wheel mouse is strongly recommended



Input/output

- input
 - CSV
 - Pajek NET
 - Guess GDF
 - GEXF
 - GraphML
 - Graphviz DOT
 - UCInet DL
 - NetdrawVNA
 - Tulip TLP
 - Excel Spreadsheetater
- output
 - CSV
 - Pajek NET
 - Guess GDF
 - GEXF
 - GraphML
 - Excel Spreadsheet
 - SVG
 - PDF
 - PNG

demo for analyzing network

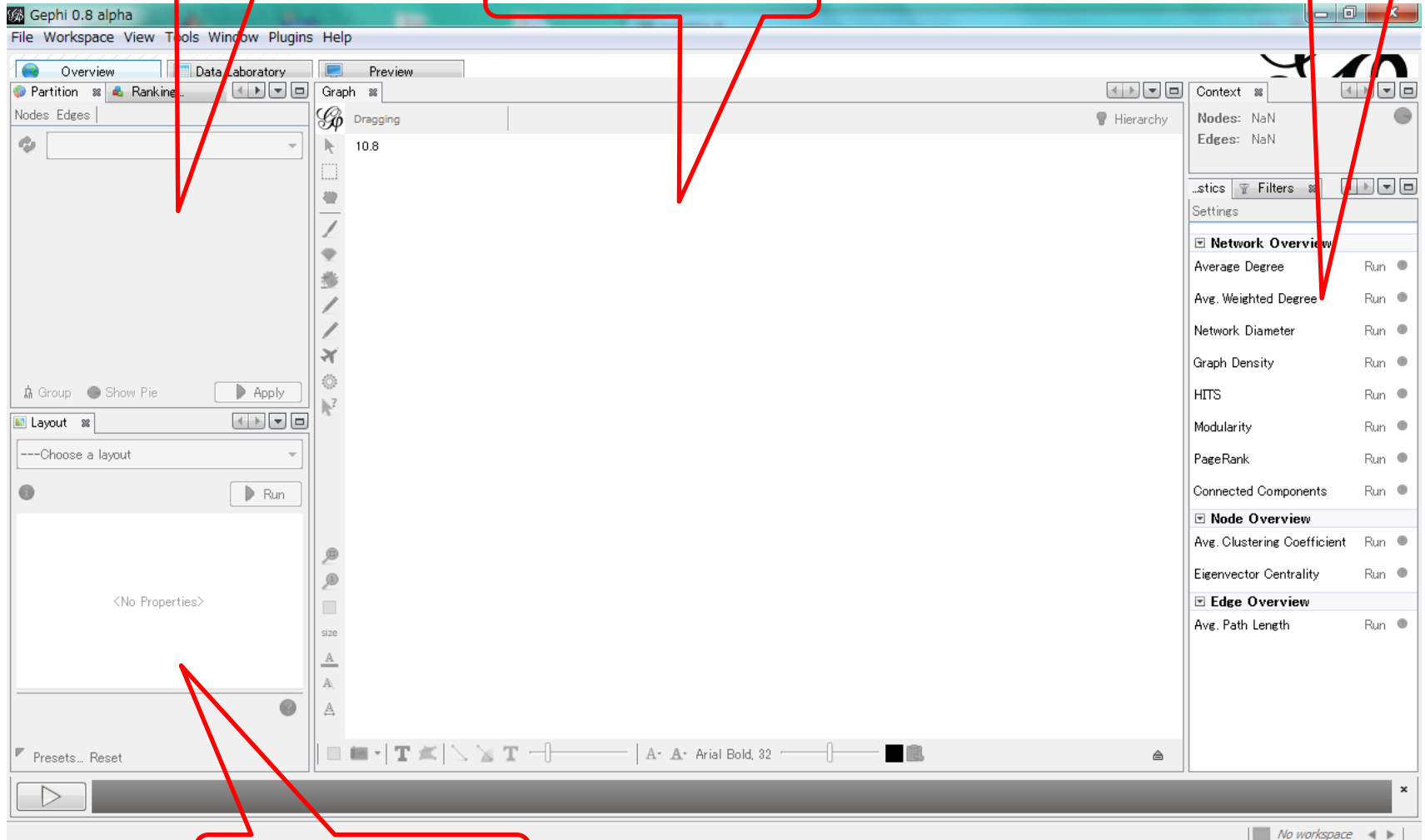
1. import file LesMiserables.gexf
(<http://gephi.org/datasets/LesMiserables.gexf>)
2. layout the network
3. ranking
4. metrics
5. community detection
6. export

0. starting Gephi

ranking/partition

main

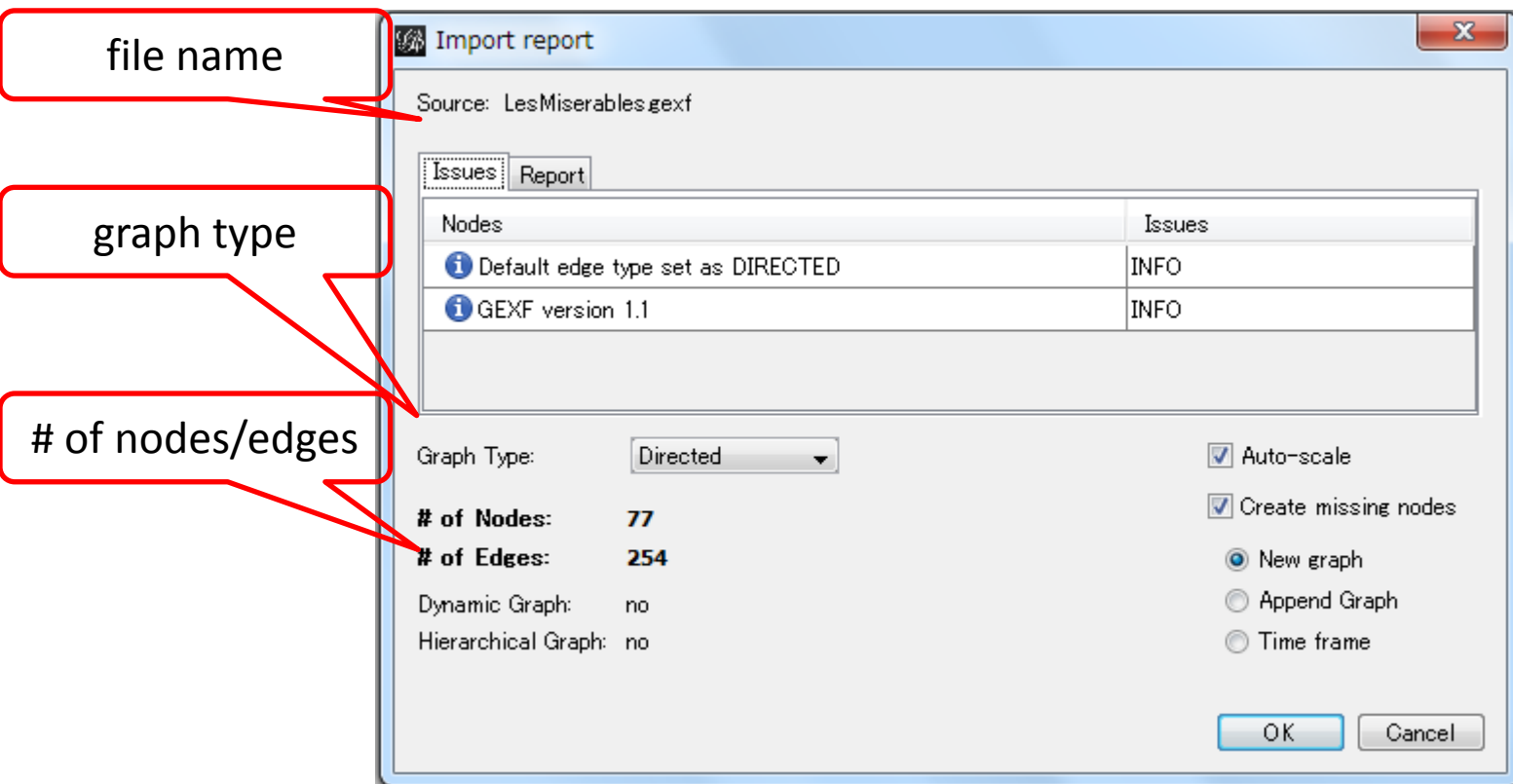
metrics



layout

1. import

- In the menubar, go to File Menu and Open
- import report (summary) appears



2. layout (1)

layout algorithms

network

The screenshot displays the Gephi 0.8 alpha software interface. The main window shows a network graph with 77 nodes and 254 edges, visualized as a dense, interconnected web. The interface is divided into several panels:

- Left Panel:** Contains the 'Layout' section with a dropdown menu for selecting layout algorithms. The dropdown is open, showing options: 'Yifan Hu', 'Yifan Hu Proportional', 'Force Atlas', 'ForceAtlas 2', 'Fruchterman Reingold', 'Label Adjust', and 'YifanHu's Multilevel'. Below the dropdown is an 'Apply' button.
- Top Panel:** Includes the 'Overview' tab and the 'Data Laboratory' section with 'Partition' and 'Ranking' buttons.
- Right Panel:** Contains the 'Context' section with 'Nodes: 77' and 'Edges: 254'. Below this is the 'Settings' section, which is divided into three sub-sections: 'Network Overview', 'Node Overview', and 'Edge Overview'. Each sub-section lists various metrics and their corresponding 'Run' buttons.

Red arrows point from the text labels 'layout algorithms' and 'network' to the respective elements in the interface: the layout algorithms dropdown and the network graph.

Network Overview	
Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
HITS	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview	
Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview	
Avg. Path Length	Run

2. layout (2)

adjust parameters

The screenshot displays the Gephi 0.8 alpha software interface. The main window shows a graph visualization with a small cluster of nodes and edges. The 'Layout' panel on the left is active, showing the 'Force Atlas' layout settings. A red box highlights the 'adjust parameters' text, and a red arrow points from it to the 'Force Atlas' settings table. The 'Force Atlas' settings table includes the following parameters:

Force Atlas	
Inertia	0.1
Repulsion strength	200.0
Attraction strength	10.0
Maximum displacement	10.0
Auto stabilize function	<input checked="" type="checkbox"/>
Autostab Strength	80.0
Autostab sensibility	0.2
Gravity	30.0

The 'Context' panel on the right shows the graph statistics: 77 Nodes, 254 Edges, and a Directed Graph. The 'Settings' panel on the right lists various network and node metrics, each with a 'Run' button.

Network Overview

- Average Degree Run
- Avg. Weighted Degree Run
- Network Diameter Run
- Graph Density Run
- HITS Run
- Modularity Run
- PageRank Run
- Connected Components Run

Node Overview

- Avg. Clustering Coefficient Run
- Eigenvector Centrality Run

Edge Overview

- Avg. Path Length Run

zoom & pan

zoom: mouse wheel
pan: right click & drag

The screenshot displays the Gephi 0.8 alpha software interface. The central workspace shows a network graph with numerous nodes and edges. A red box labeled "centering" points to the centering tool icon in the left sidebar. Another red box labeled "zoom: mouse wheel" and "pan: right click & drag" points to the graph area. The interface includes a top menu bar, a left sidebar with various tool panels (Overview, Data Laboratory, Graph, Layout, Force Atlas), and a right sidebar with context and settings panels. The Force Atlas layout settings are visible in the bottom left, and the Network Overview settings are visible in the bottom right.

Force Atlas Settings:

Parameter	Value
Inertia	0.1
Repulsion strength	200.0
Attraction strength	10.0
Maximum displacement	10.0
Auto stabilize function	<input checked="" type="checkbox"/>
Autostab Strength	80.0
Autostab sensibility	0.2
Gravity	30.0

Network Overview Settings:

Setting	Status
Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
HITS	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview Settings:

Setting	Status
Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview Settings:

Setting	Status
Avg. Path Length	Run

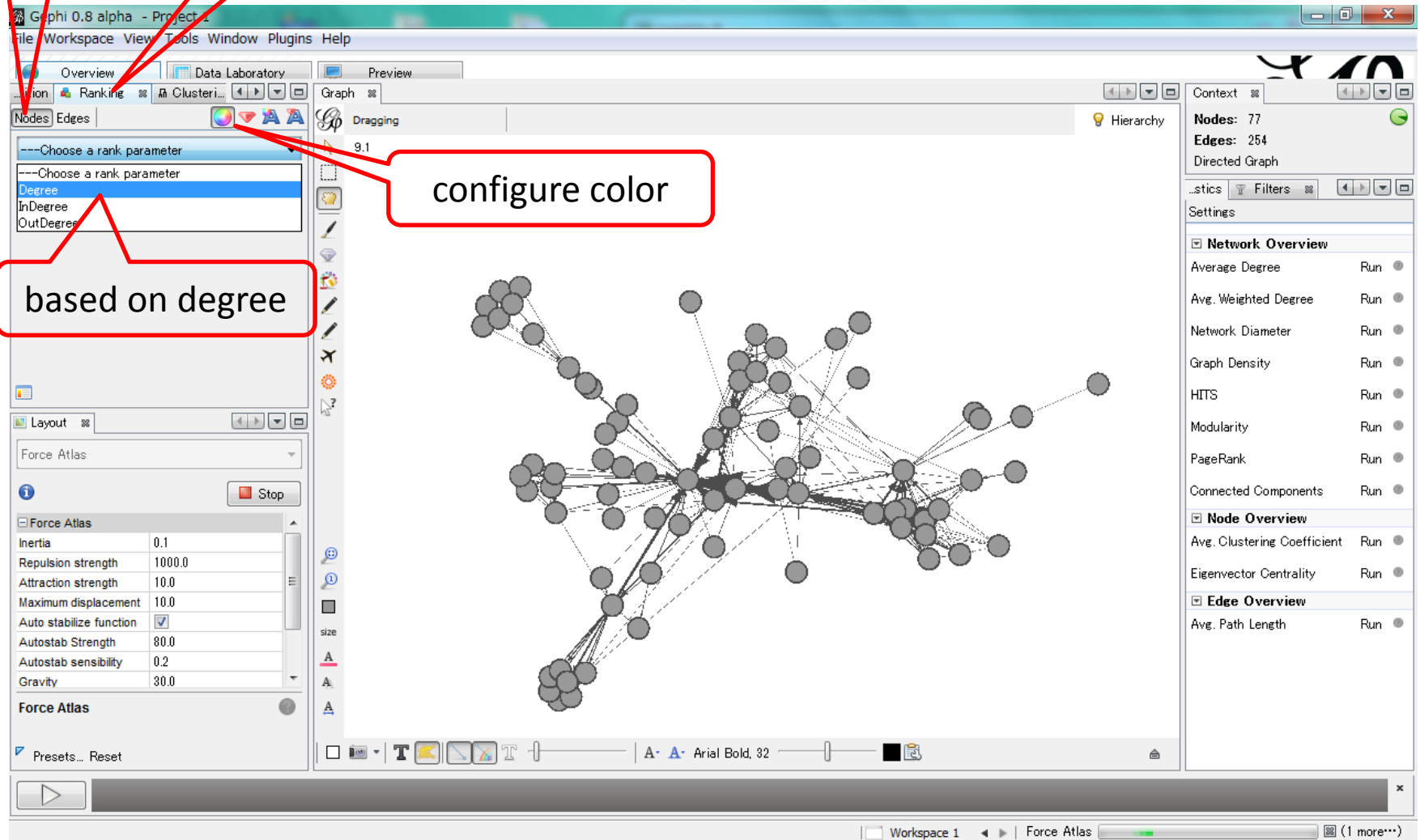
3. ranking (1)

nodes

ranking

configure color

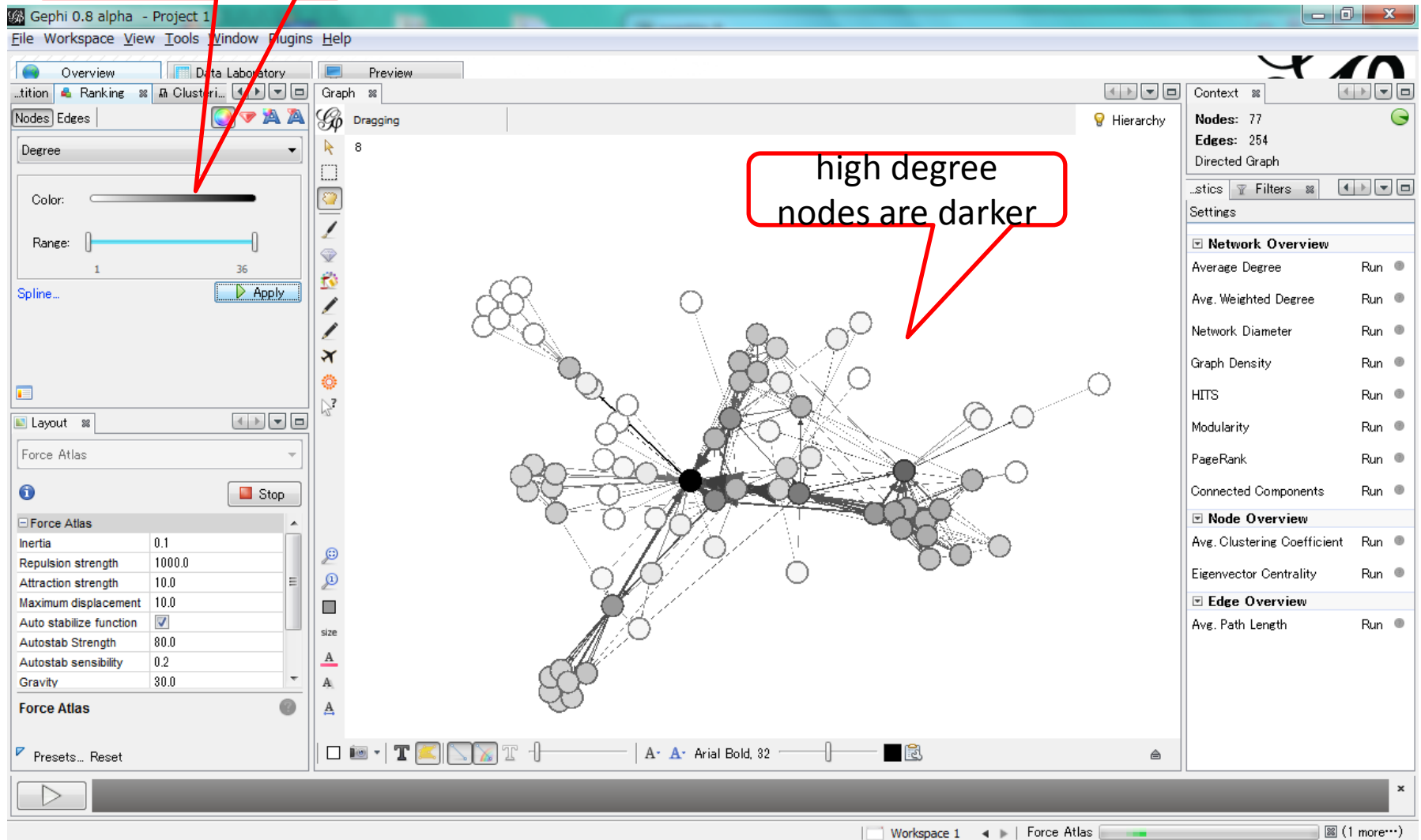
based on degree



3. ranking (2)

set color

high degree
nodes are darker



labeling nodes

The screenshot displays the Gephi 0.8 alpha software interface. The central workspace shows a network graph with nodes labeled with names (e.g., Champ, Boulatruelle, MmePontmercy) and edges of varying thickness. The interface is divided into several panels:

- Left Panel:** Contains the 'Overview' tab, 'Nodes' and 'Edges' filters, a 'Color' slider, a 'Range' slider, and a 'Layout' section with 'Force Atlas' settings (Inertia, Repulsion strength, Attraction strength, Maximum displacement, Auto stabilize function, Autostab Strength, Autostab sensibility, Gravity).
- Top Panel:** Includes 'File', 'Workspace', 'View', 'Tools', 'Window', 'Plugins', and 'Help' menus. The 'Preview' tab is active, showing a 'Graph' view with a 'Dragging' status and a 'Hierarchy' button.
- Right Panel:** Displays 'Context' information (Nodes: 77, Edges: 254, Directed Graph) and 'Settings' for 'Network Overview' (Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, HITS, Modularity, PageRank, Connected Components), 'Node Overview' (Avg. Clustering Coefficient, Eigenvector Centrality), and 'Edge Overview' (Avg. Path Length).

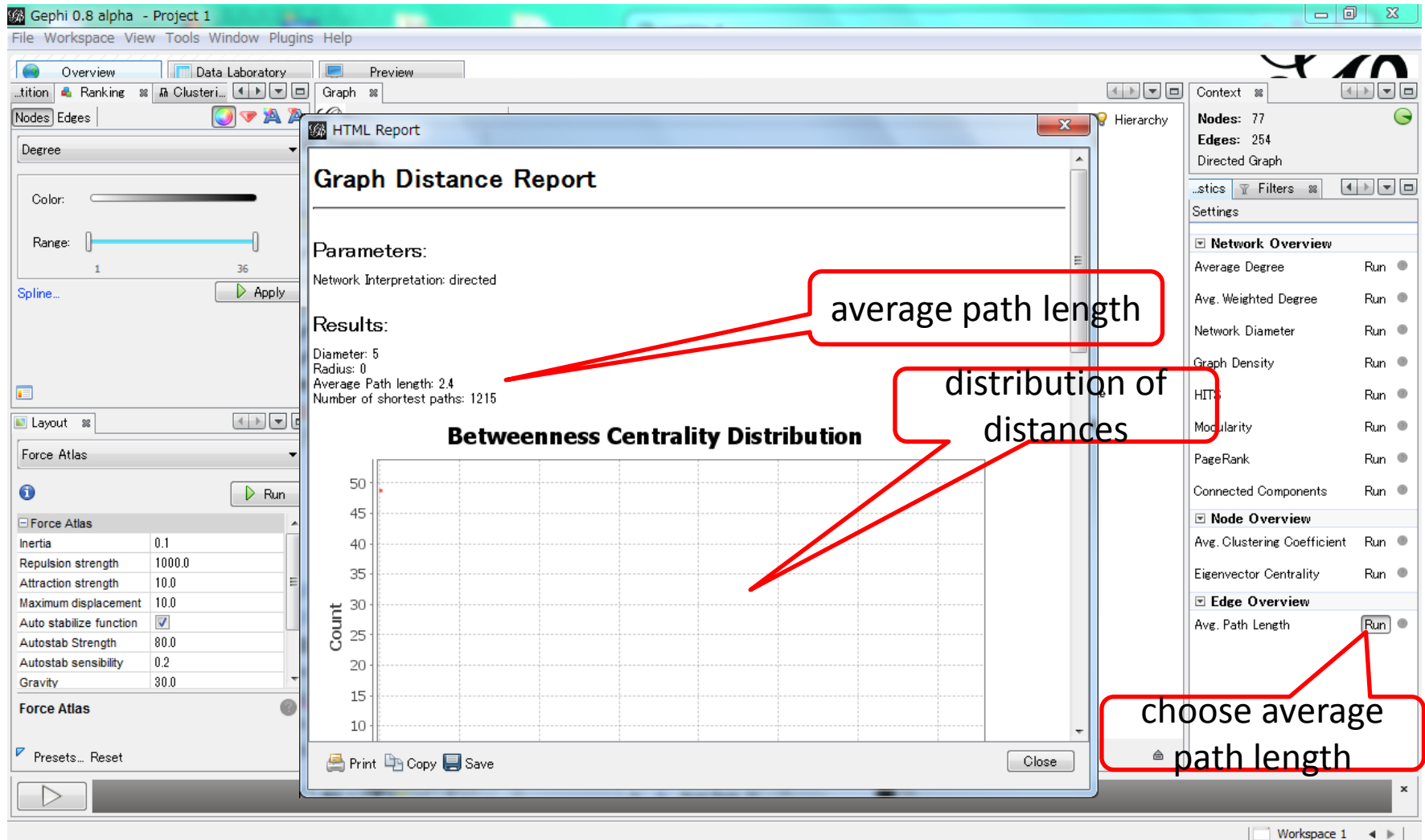
Three red callout boxes with arrows point to specific interface elements:

- show labels:** Points to the 'T' icon in the bottom toolbar.
- change label size:** Points to the 'A' icon in the bottom toolbar.
- change edge thickness:** Points to the 'edge thickness' slider in the bottom toolbar.
- misc settings:** Points to the 'Settings' button in the bottom toolbar.

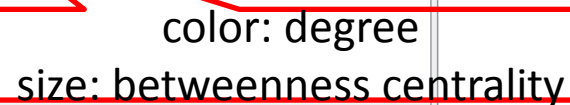
4. metrics

- for networks
 - diameter
 - density
 - average path length
 - clustering coefficient
 - modularity (community detection)
 - ...
- for nodes
 - PageRank
 - HITS
 - betweenness centrality
 - closeness centrality
 - ...

4. metrics (1)



ranking



- dark (degree): many connections
- large: mediator of two groups



5. community detection (1)

choose modularity

The screenshot shows the Gephi 0.8 alpha interface with the 'Modularity Report' dialog box open. The dialog box displays the following information:

- Parameters:** Randomize: On
- Results:** Modularity: 0.557, Number of Communities: 6
- Algorithm:** Vincent D Blondel, Jean-Loup Guillaume, Renaud Lambiotte, Etienne Lefebvre, *Fast unfolding of communities in large networks*, in Journal of Statistical Mechanics: Theory and Experiment 2008 (10), P1000

Red arrows point from the text 'choose modularity' to the 'Modularity' value (0.557) and from the text '# of communities' to the 'Number of Communities' value (6). The background interface shows the 'Force Atlas' layout settings and a 'Network Overview' panel on the right.

Force Atlas Settings:

Parameter	Value
Inertia	0.1
Repulsion strength	1000.0
Attraction strength	10.0
Maximum displacement	10.0
Auto stabilize function	<input checked="" type="checkbox"/>
Autostab Strength	80.0
Autostab sensibility	0.2
Gravity	30.0

Network Overview:

Metric	Value	Action
Average Degree	Run	Run
Avg. Weighted Degree	Run	Run
Network Diameter	5 Run	Run
Graph Density	Run	Run
HITS	Run	Run
Modularity	0.557	Run
PageRank	Run	Run
Connected Components	Run	Run

Node Overview:

Metric	Value	Action
Avg. Clustering Coefficient	Run	Run
Eigenvector Centrality	Run	Run

Edge Overview:

Metric	Value	Action
Avg. Path Length	2.4	Run

5. community detection (2)

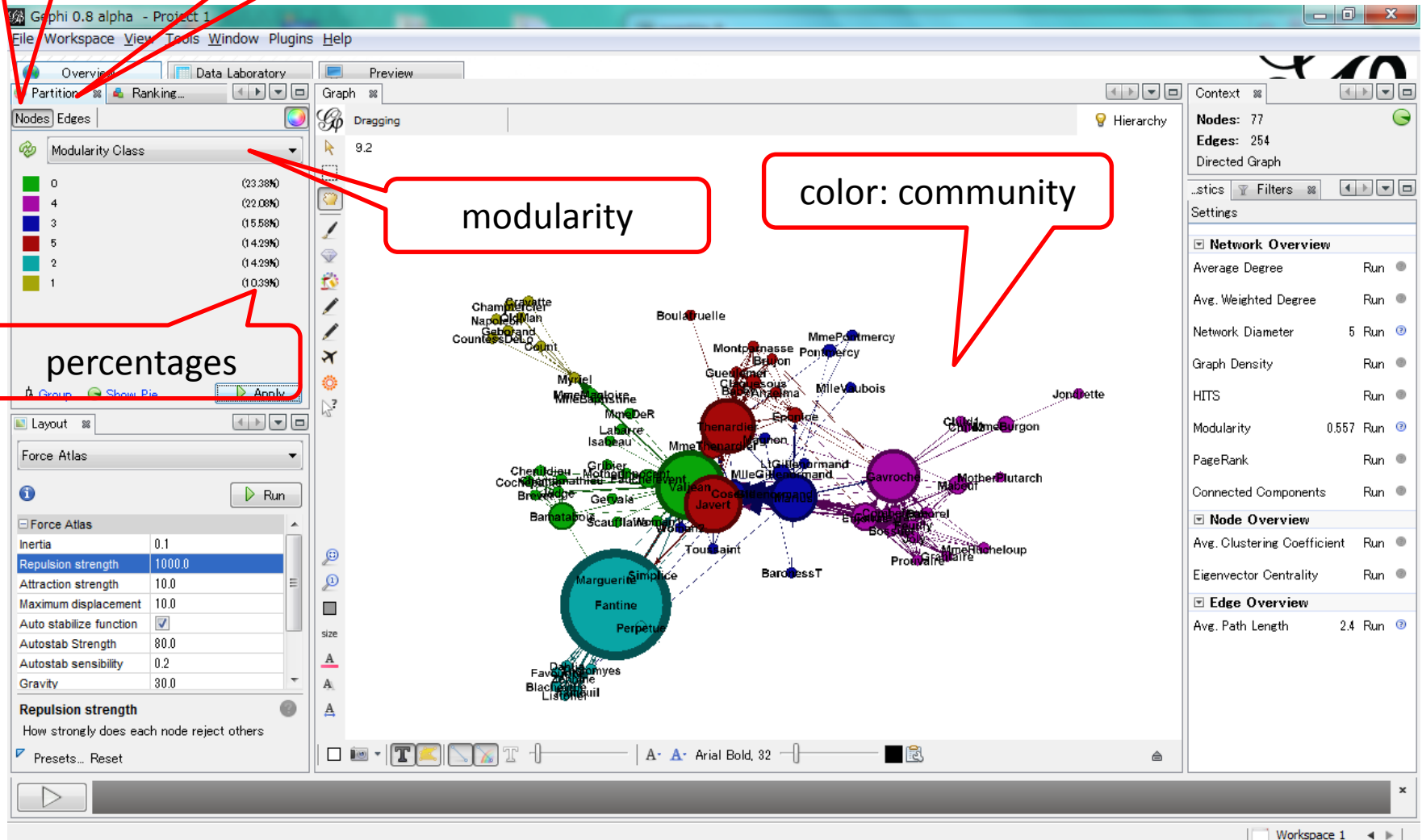
nodes

partition

modularity

color: community

percentages



6. export

The screenshot displays the Gephi 0.8 alpha software interface. The 'File' menu is open, showing the 'Export' option. Two red callout boxes highlight the export options: 'export as network data' pointing to 'Graph file...' and 'export as picture data' pointing to 'SVG/PDF file...'. The main workspace shows a network graph with nodes and edges. The right sidebar contains a 'Context' panel with statistics (Nodes: 77, Edges: 254, Directed Graph) and a 'Settings' panel with various network and node overview metrics.

export as network data

export as picture data

File Workspace View Tools Window Plugins Help

- New Project Ctrl+Shift+N
- Open... Ctrl+O
- Open Recent...
- Close Project
- Properties...
- Import Spigot...
- Import Database
- Generate
- Save Ctrl+S
- Save As...
- Export
 - Graph file...
 - SVG/PDF file...
- Exit

Layout Force Atlas

Force Atlas

Inertia	0.1
Repulsion strength	1000.0
Attraction strength	10.0
Maximum displacement	10.0
Auto stabilize function	<input checked="" type="checkbox"/>
Autostab Strength	80.0
Autostab sensibility	0.2
Gravity	30.0

Force Atlas

Presets... Reset

Context

Nodes: 77
Edges: 254
Directed Graph

Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	5 Run
Graph Density	Run
HITS	Run
Modularity	0.557 Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	2.4 Run
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for more information

- see “Gephi Tutorial Quick Start”
 - <http://gephi.org/users/>