

Complex Networks

tools for analyzing networks (Gephi)

2018.11.29(Thu)

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,...

For more information:

“Recent Large Graph Visualization Tools : A Review”

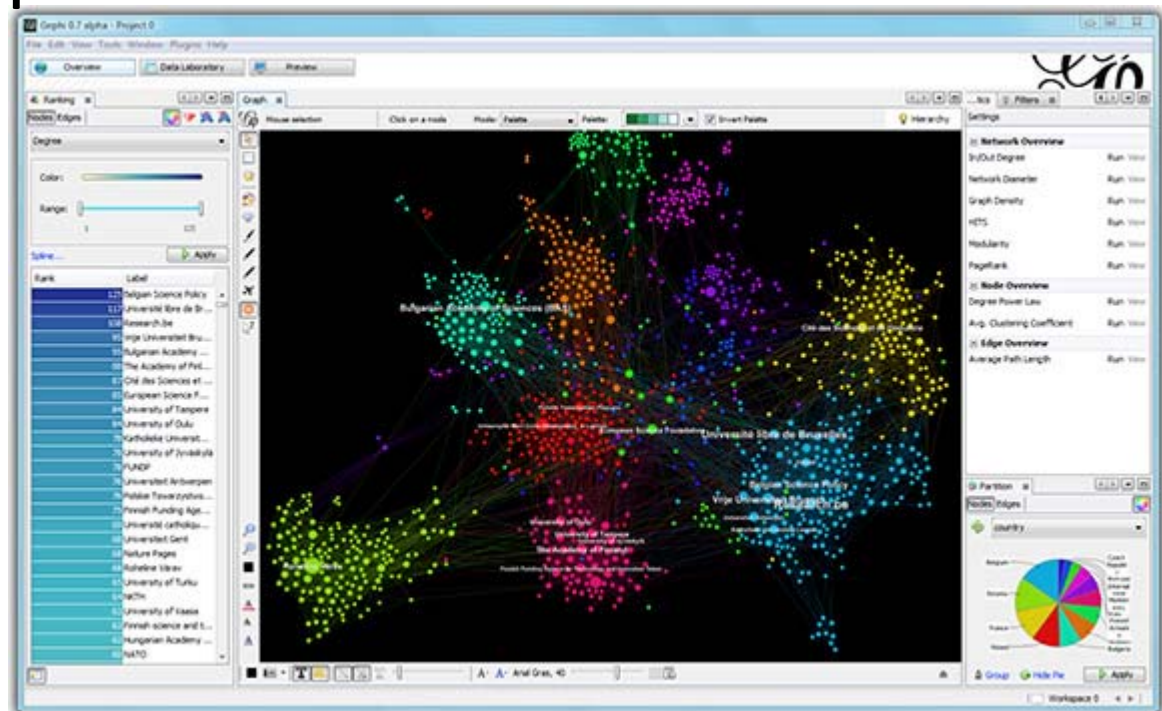
Sorn JARUKASEMRATANA, Tsuyoshi MURATA, Computer Software Vol. 30, No. 2 pp.159-175, 2013.

https://www.jstage.jst.go.jp/article/jssst/30/2/30_2_159/_article

Gephi

<https://gephi.github.io/>

- 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
 - <https://gephi.github.io/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

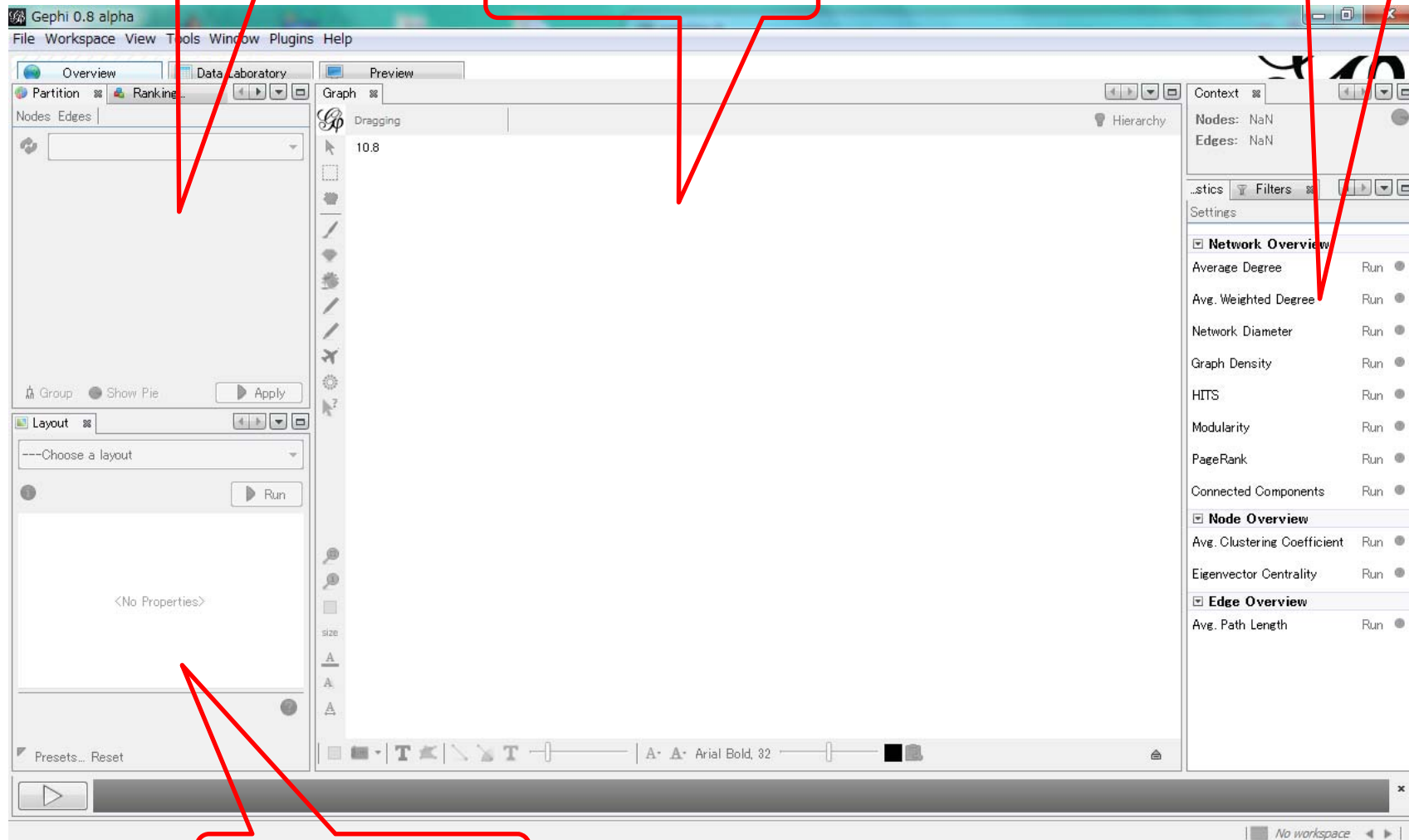
1. import file LesMiserables.gexf
(<http://gephi.org/datasets/LesMiserables.gexf>)
2. layout the network
3. ranking
4. metrics
5. community detection
6. export

0. starting Gephi

ranking/partition

main

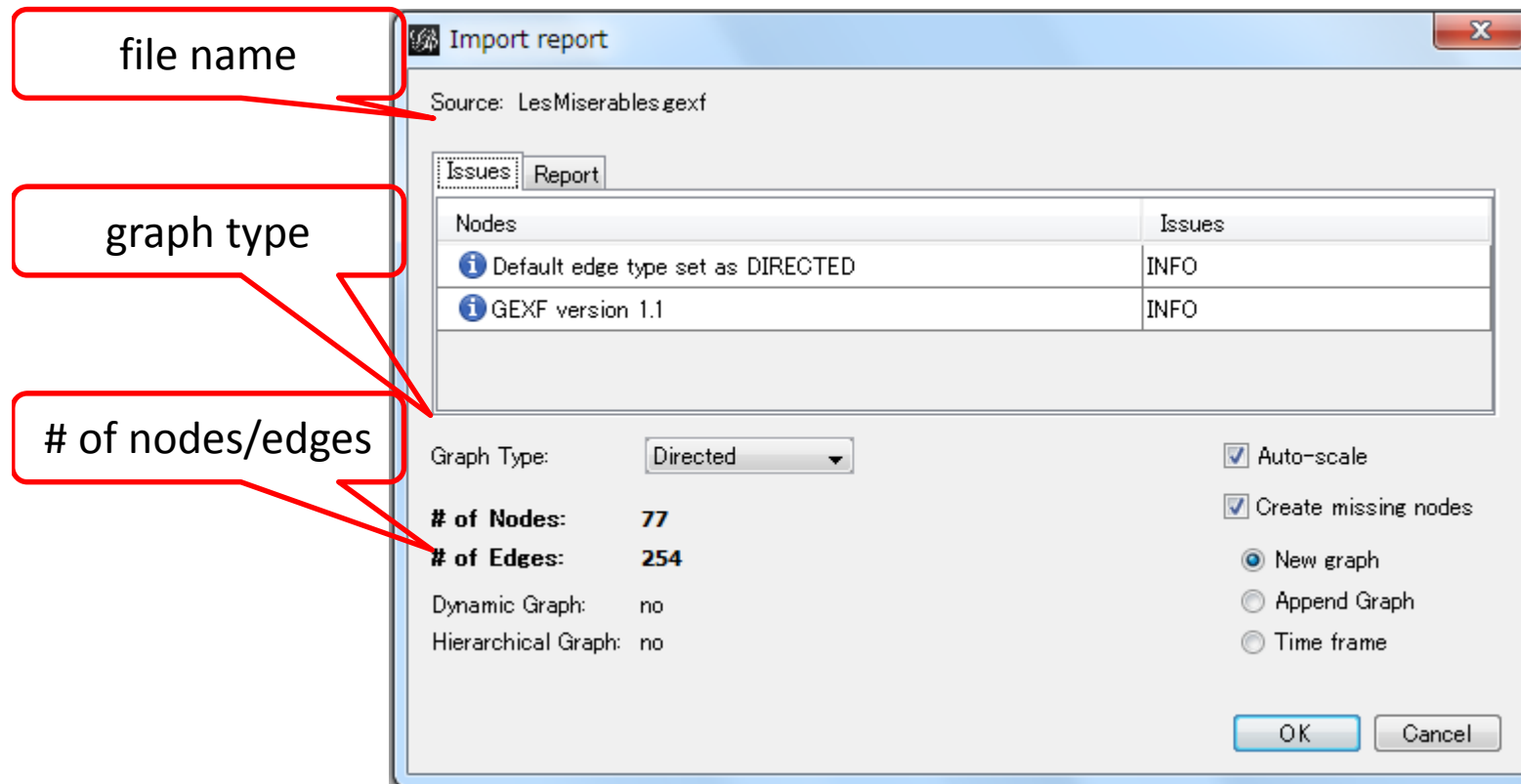
metrics



layout

1. import

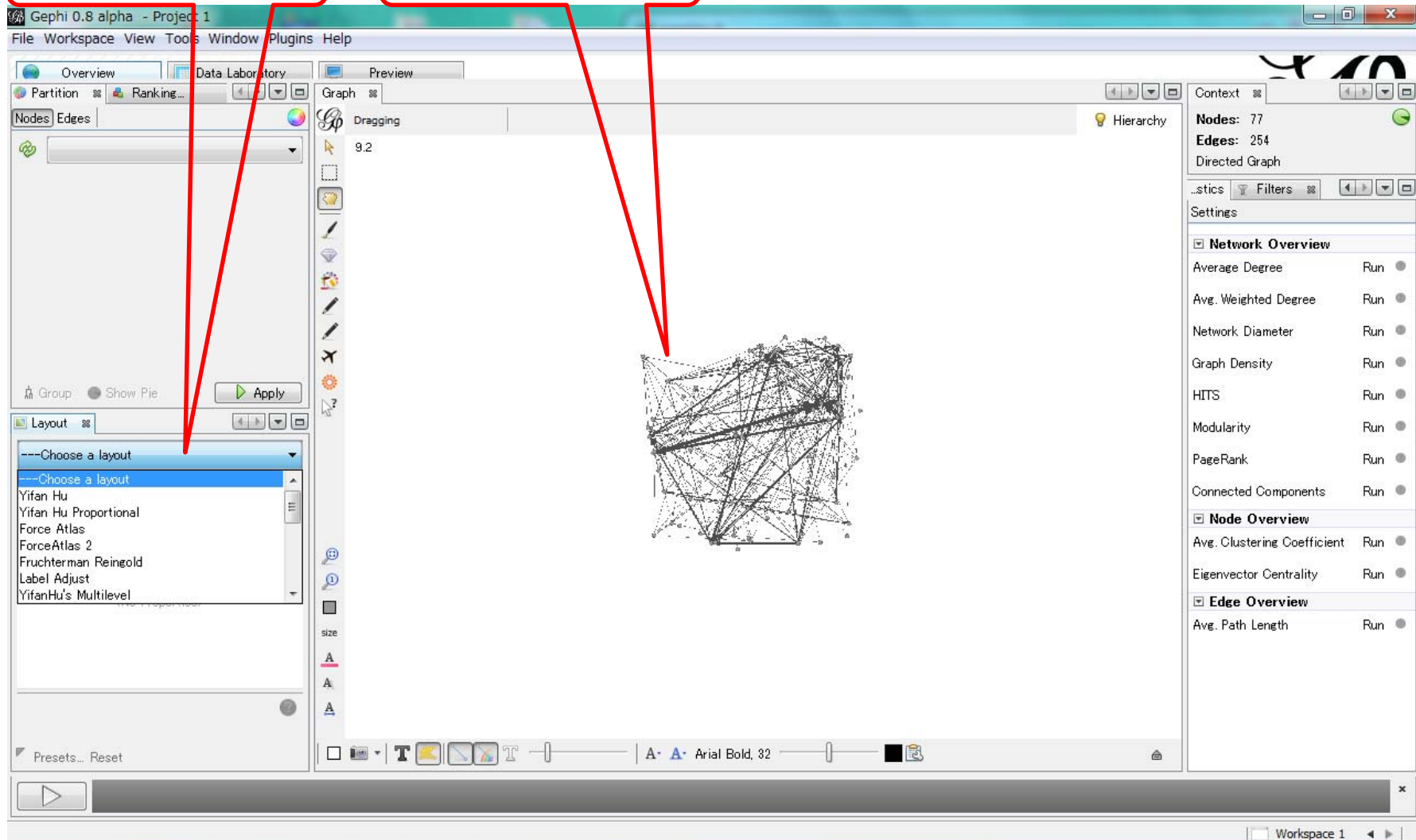
- In the menu bar, go to File Menu and Open
- import report (summary) appears



2. layout (1)

layout algorithms

network



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. The left sidebar contains the 'Layout' panel, which is currently set to 'Force Atlas'. A red box highlights the 'adjust parameters' text, with a red arrow pointing to the 'Force Atlas' settings table. The table lists various parameters for the Force Atlas layout algorithm, including Inertia, Repulsion strength, Attraction strength, Maximum displacement, Auto stabilize function (checked), Autostab Strength, Autostab sensibility, and Gravity. The right sidebar shows the 'Context' panel with statistics for Nodes (77) and Edges (254), and a 'Settings' panel with various network and node overview metrics.

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

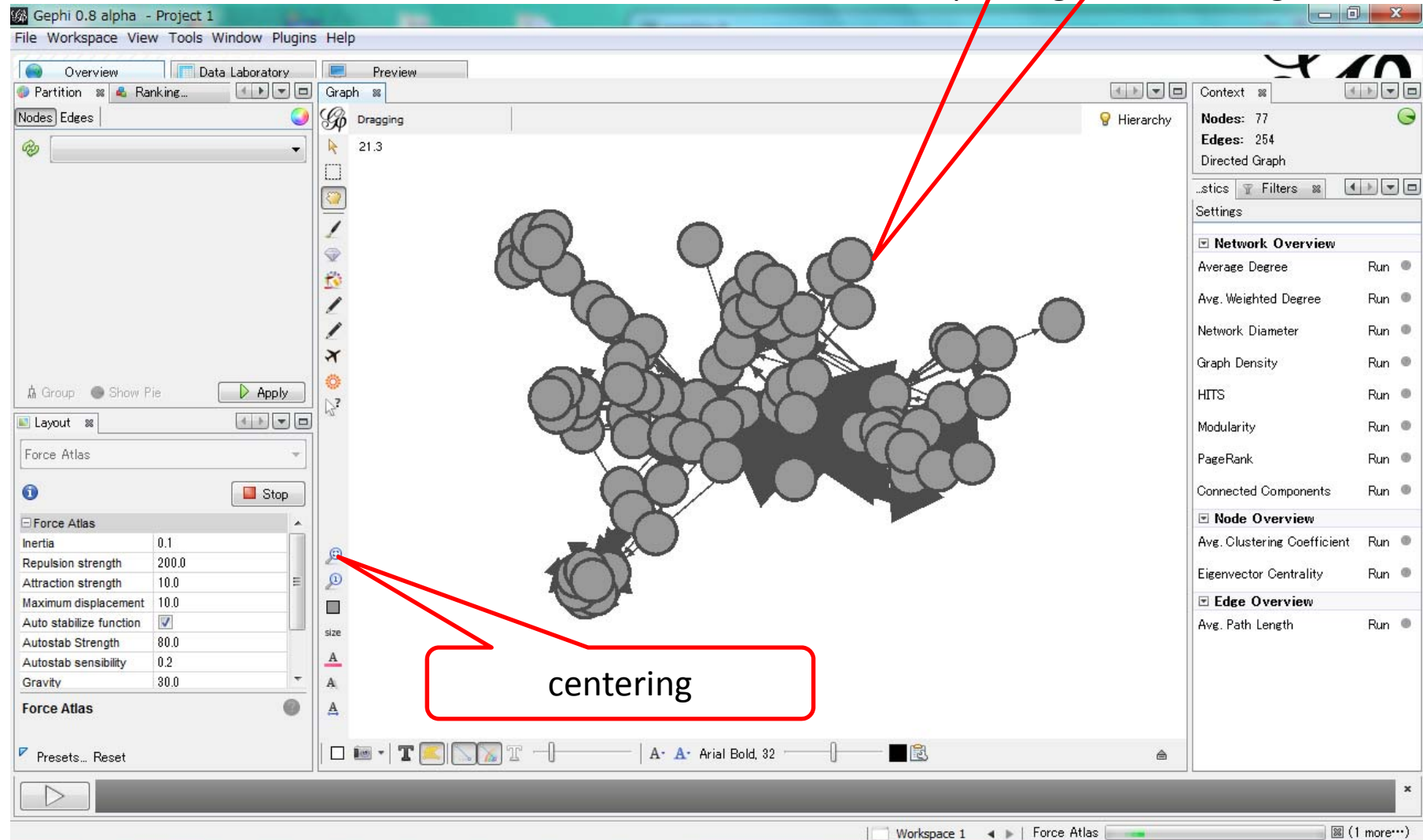
Network Overview	
Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
HITS	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview	
Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview	
Avg. Path Length	Run

zoom & pan

zoom: mouse wheel
pan: right click & drag



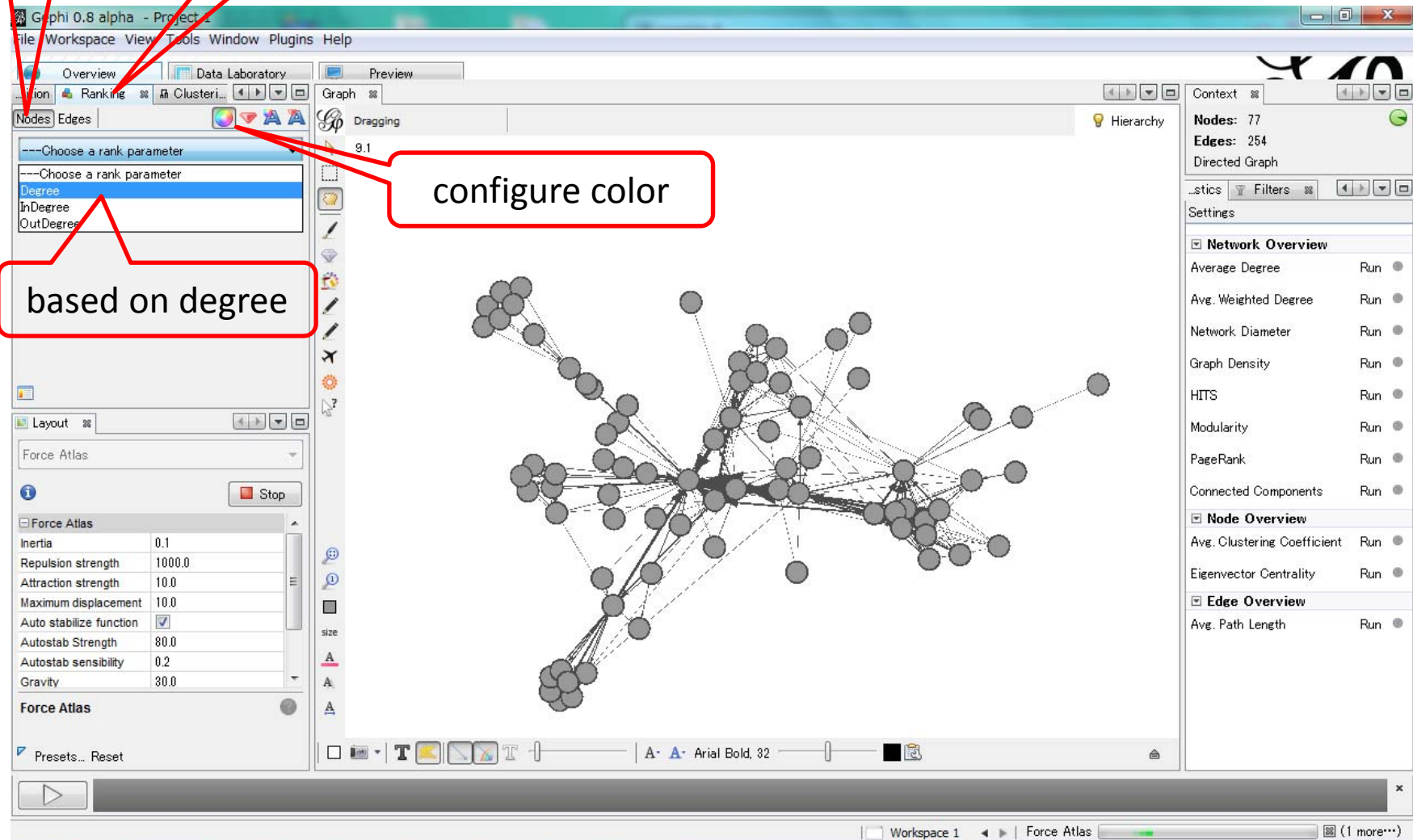
3. ranking (1)

nodes

ranking

configure color

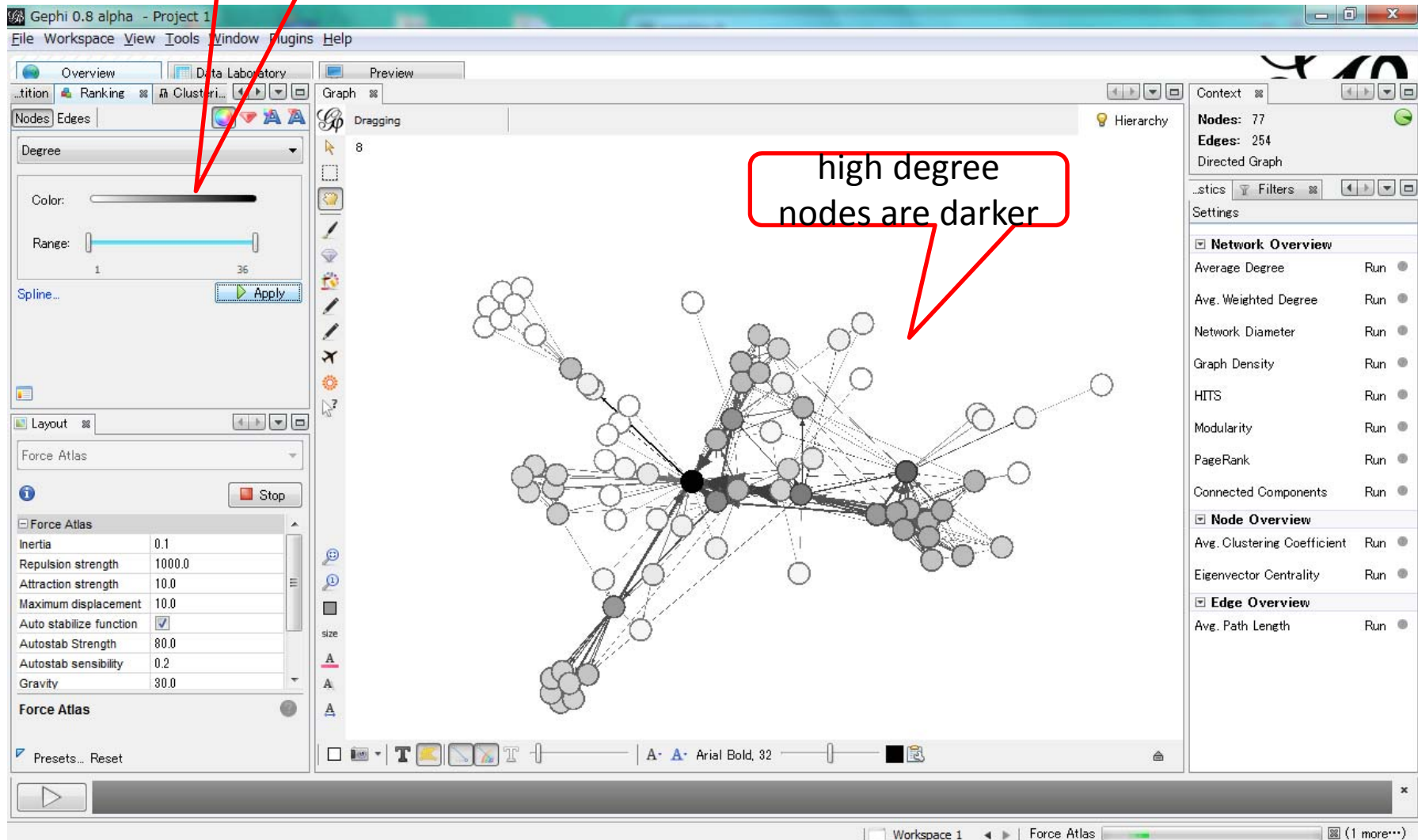
based on degree



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 and edges. The left sidebar contains several panels: 'Overview' (with 'Nodes' and 'Edges' tabs), 'Layout' (with 'Force Atlas' settings), and 'Preview' (with 'Graph' and 'Hierarchy' tabs). The right sidebar contains 'Context' (showing 'Nodes: 77' and 'Edges: 254') and 'Settings' (with 'Network Overview', 'Node Overview', and 'Edge Overview' sections). The bottom status bar shows 'Workspace 1' and 'Force Atlas'.

Annotations with red boxes and arrows point to specific features:

- show labels**: Points to the 'show labels' icon in the bottom toolbar.
- change edge thickness**: Points to the 'change edge thickness' icon in the bottom toolbar.
- change label size**: Points to the 'change label size' icon in the bottom toolbar.
- misc settings**: Points to the 'misc settings' icon in the bottom toolbar.

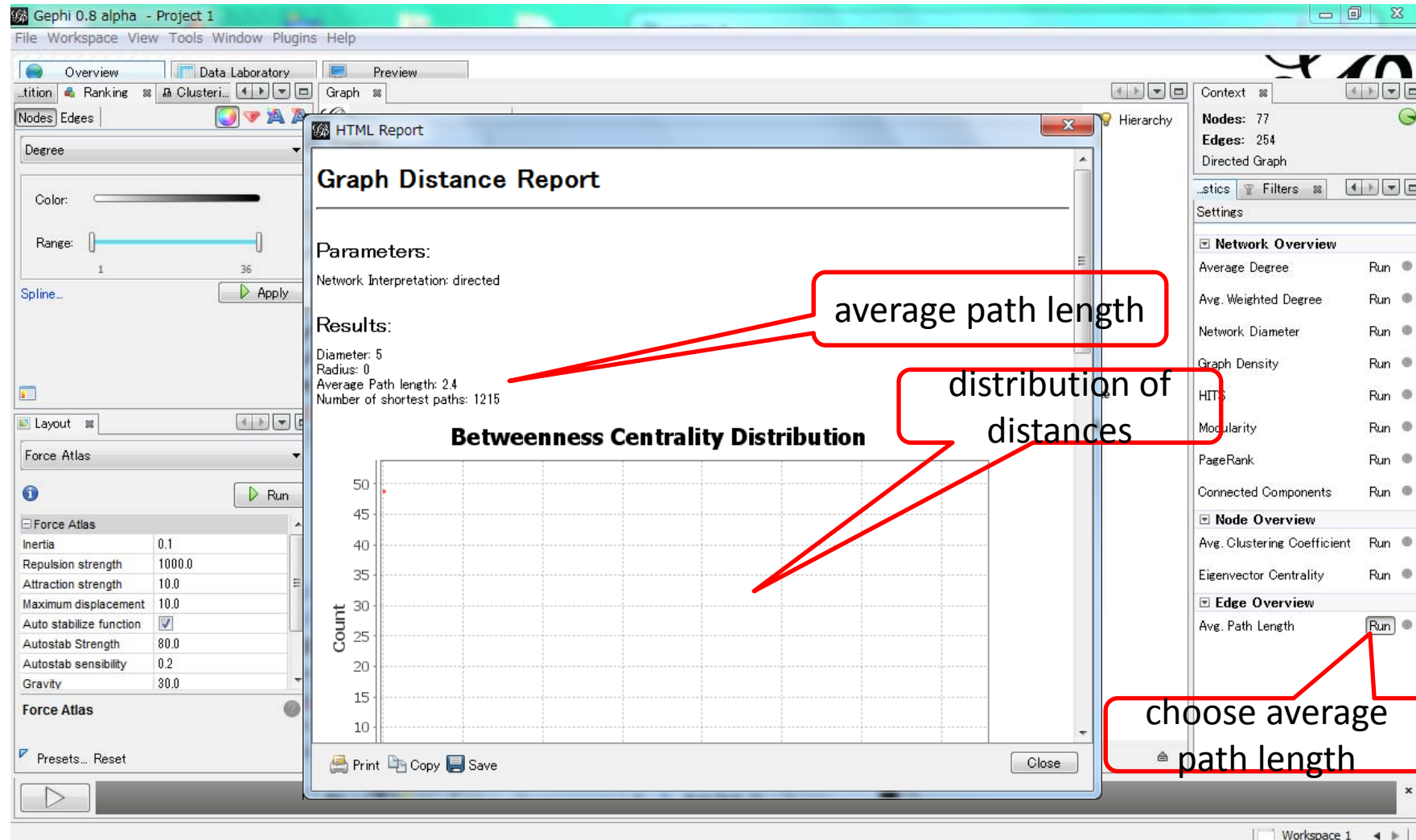
The 'Force Atlas' settings panel on the left includes the following values:

Force Atlas	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

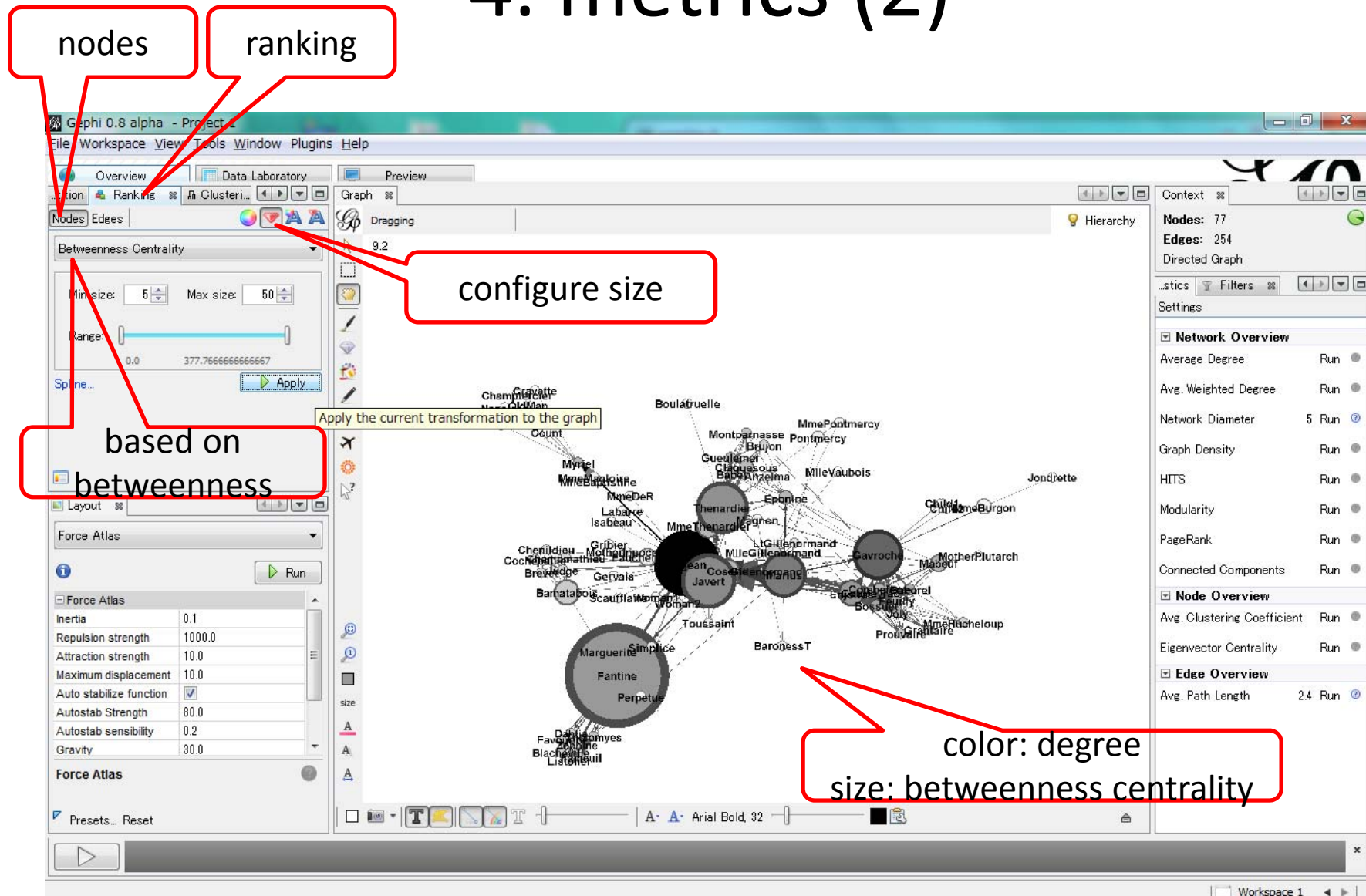
4. metrics

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

4. metrics (1)



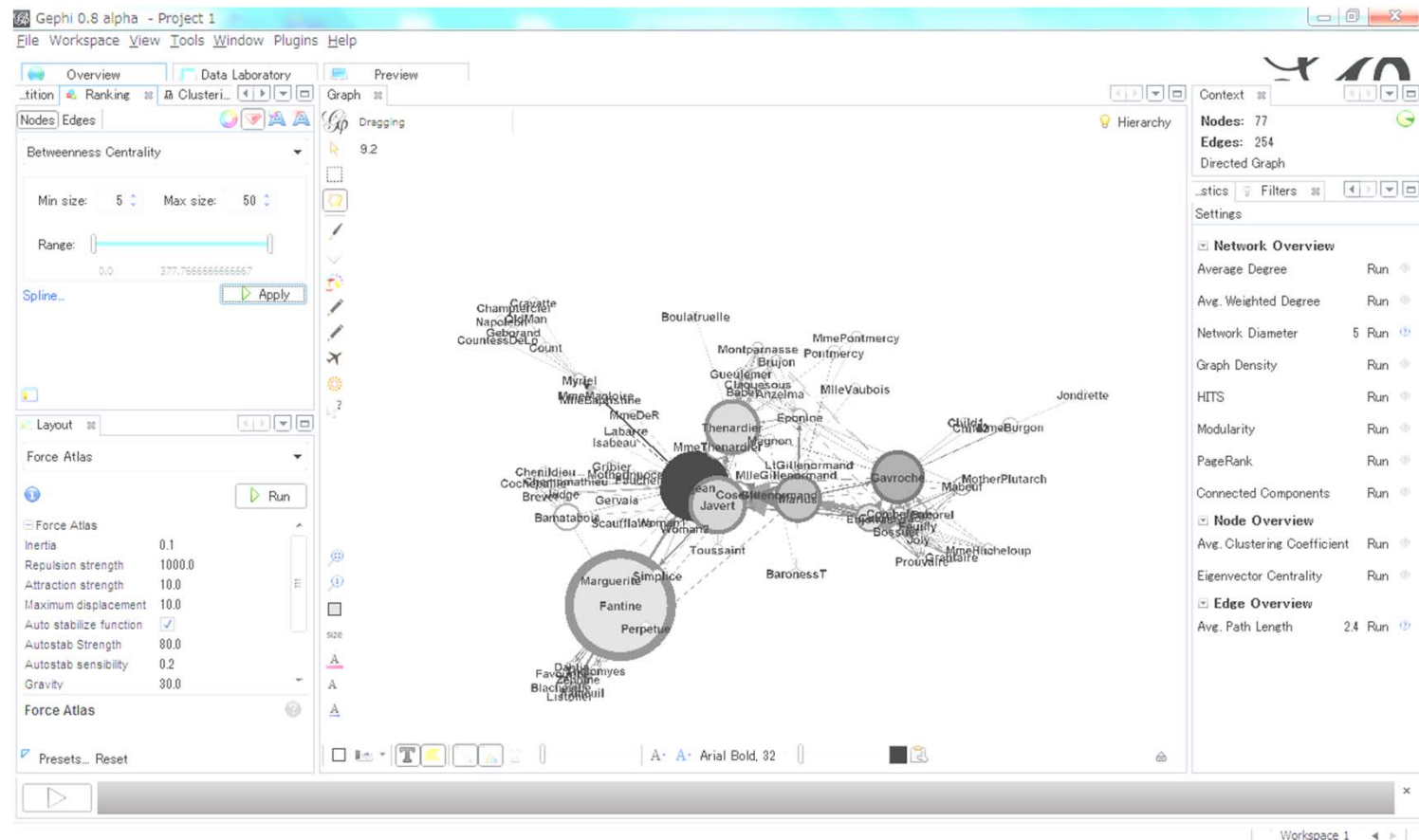
4. metrics (2)



two metrics

visualize 两个 matrices, 同时

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



5. community detection (1)

choose modularity

The screenshot displays the Gephi 0.8 alpha software interface. The main window is titled 'Gephi 0.8 alpha - Project 1'. The 'Overview' tab is selected, showing a network graph. The 'Betweenness Centrality' layout is applied, with 'Min size' set to 5 and 'Max size' set to 50. The 'Force Atlas' layout is also visible, with various parameters like 'Inertia' (0.1), 'Repulsion strength' (1000.0), and 'Attraction strength' (10.0) listed. A 'Modularity Report' window is open in the center, displaying the following information:

Modularity Report

Parameters:
Randomize: On

Results:
Modularity: 0.557
Number of Communities: 6

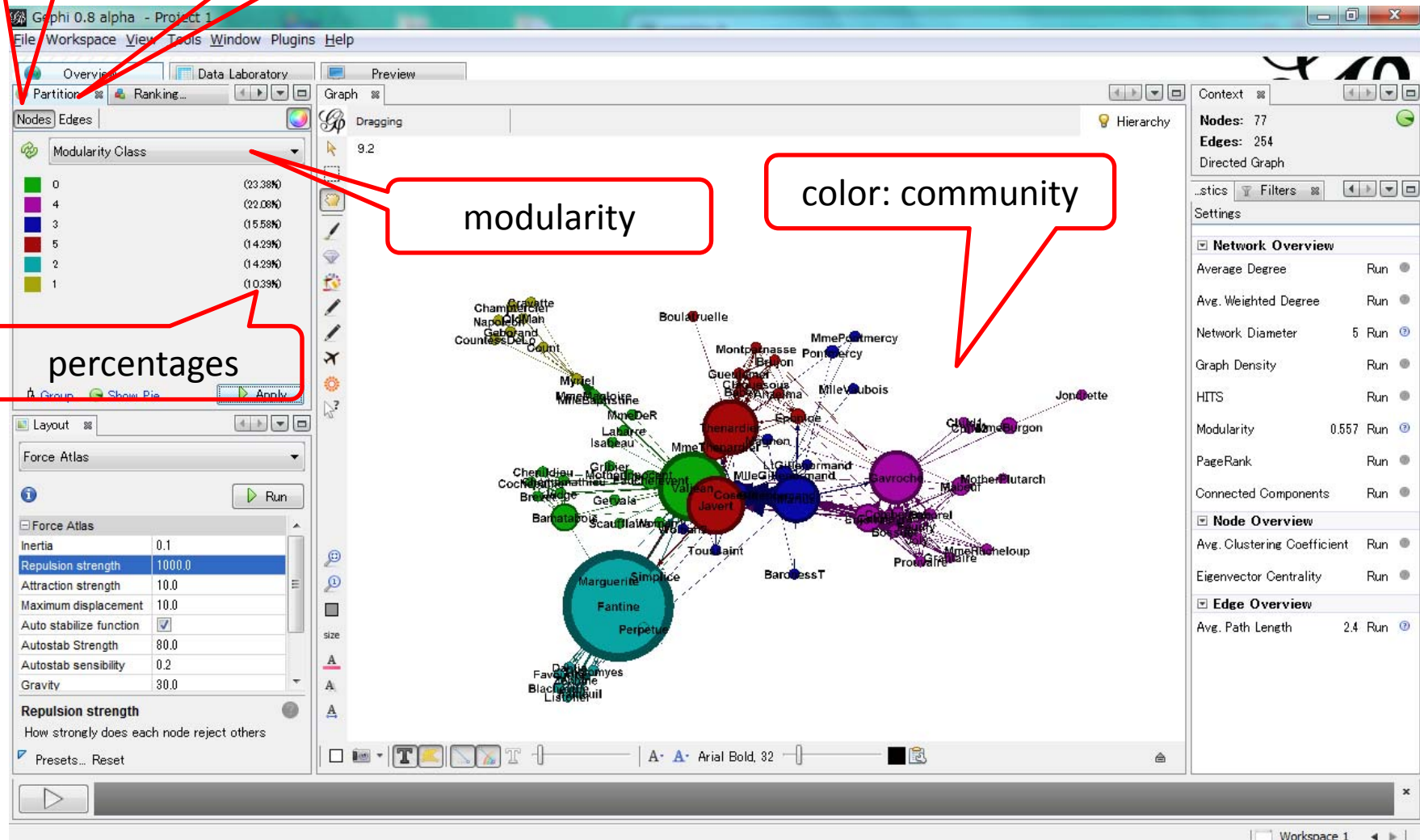
Algorithm:
Vincent D Blondel, Jean-Loup Guillaume, Renaud Lambiotte, Etienne Lefebvre, *Fast unfolding of communities in large networks*, in Journal of Statistical Mechanics: Theory and Experiment 2008 (10), P1000

Red arrows point from the text 'choose modularity' to the 'Modularity' value (0.557) in the report and from the text '# of communities' to the 'Number of Communities: 6' in the report. The right sidebar shows the 'Context' tab with 'Nodes: 77' and 'Edges: 254'. The 'Network Overview' section lists various metrics like 'Average Degree', 'Avg. Weighted Degree', 'Network Diameter', 'Graph Density', 'HITS', 'Modularity' (0.557), 'PageRank', and 'Connected Components'. The 'Node Overview' section lists 'Avg. Clustering Coefficient' and 'Eigenvector Centrality'. The 'Edge Overview' section lists 'Avg. Path Length' (2.4).

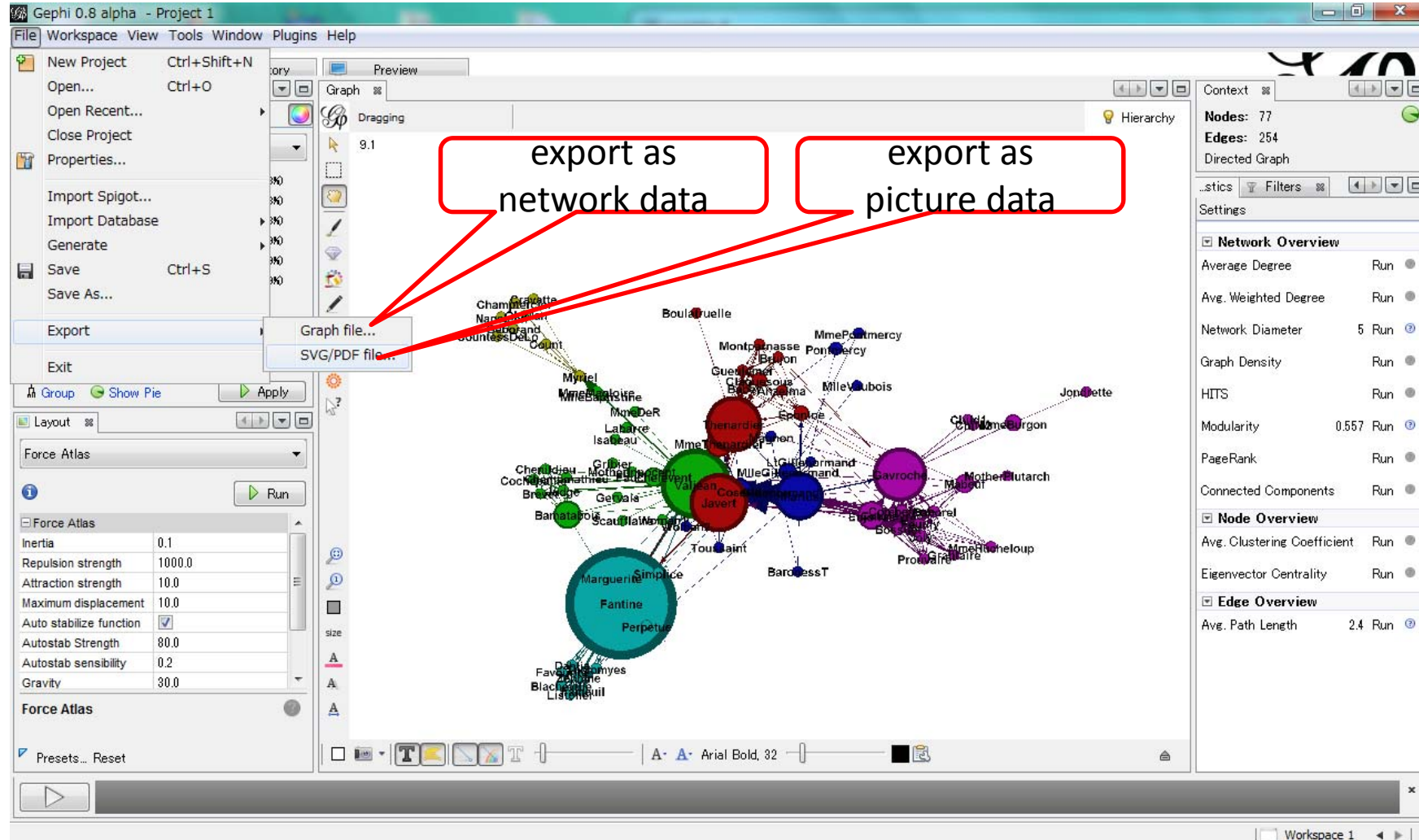
5. community detection (2)

nodes

partition



6. export



for more information

- visit “Gephi Tutorial Quick Start”
 - <https://gephi.github.io/users/>