

# Complex Networks

## tools for analyzing networks (Gephi)

2015.10.05(Mon)

# 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”

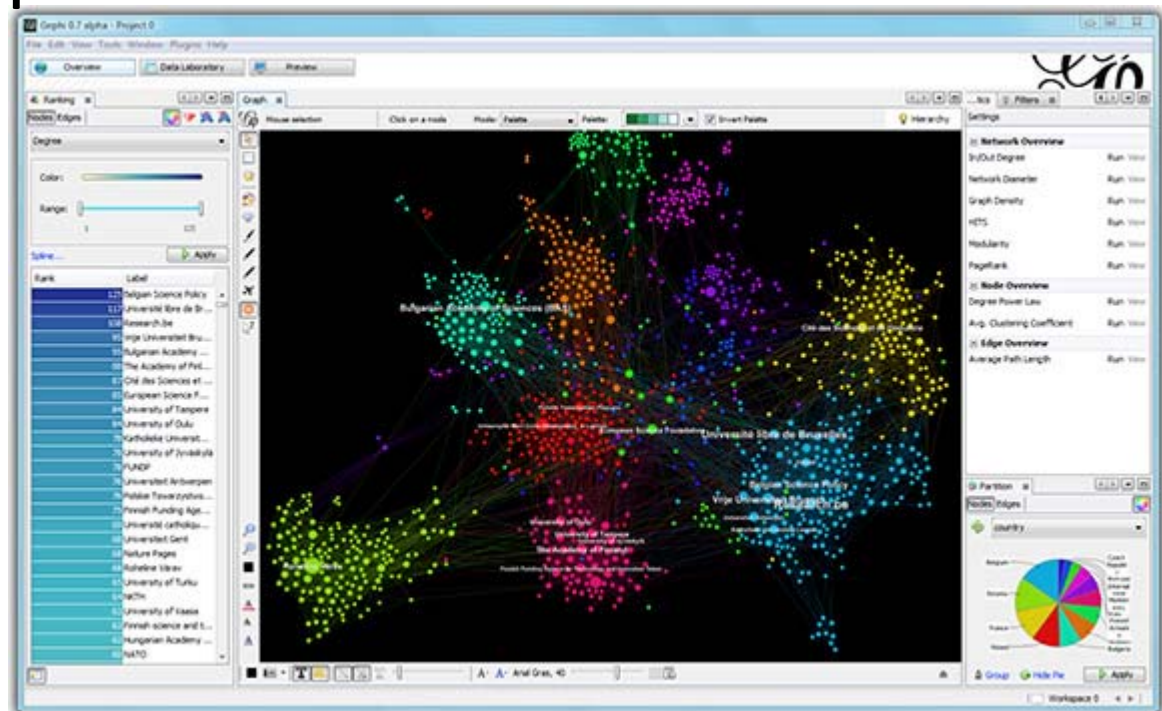
Sorn JARUKASEMRATANA, Tsuyoshi MURATA, Computer Software Vol. 30, No. 2 pp.159-175, 2013.

[https://www.jstage.jst.go.jp/article/jssst/30/2/30\\_2\\_159/\\_article](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

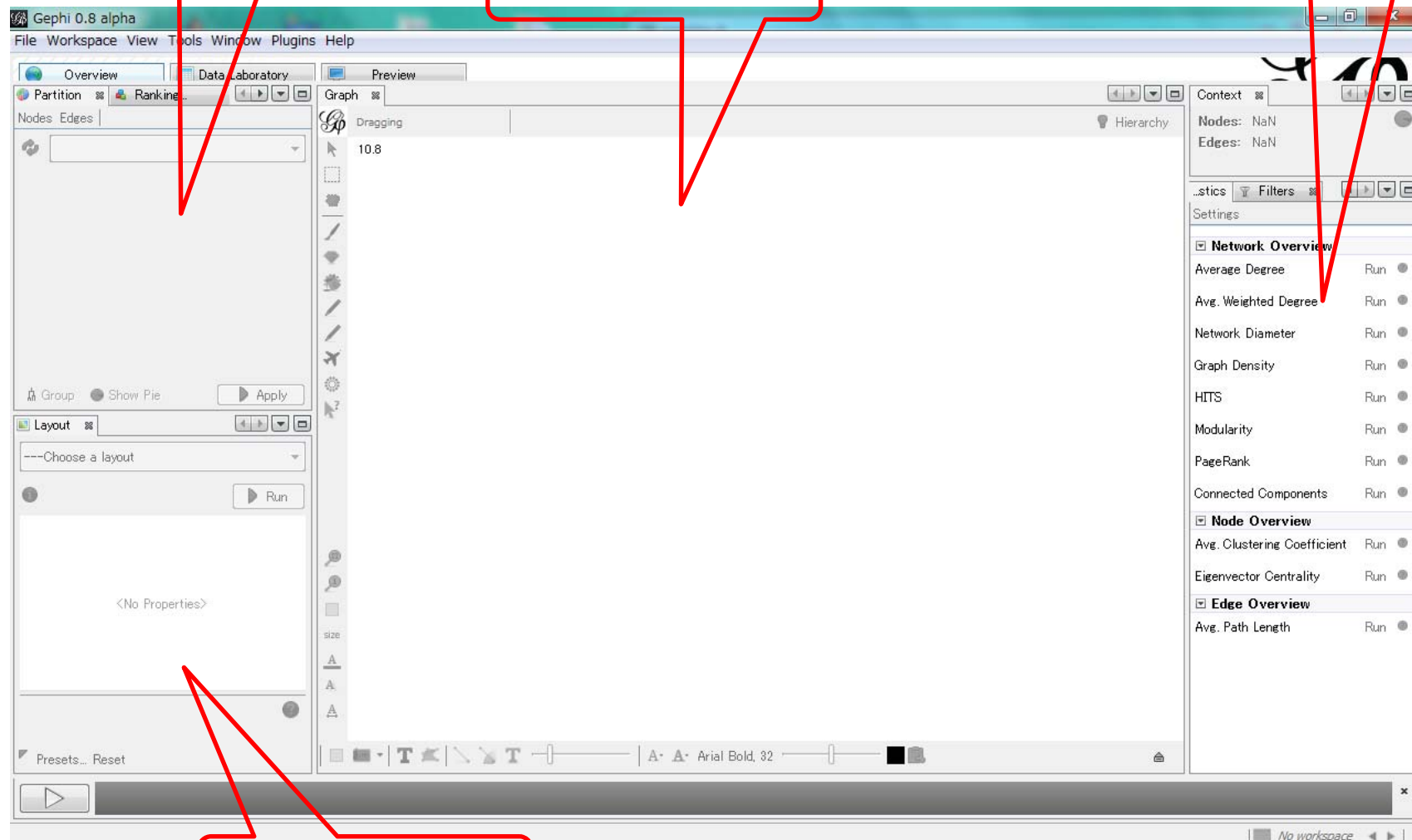
1. import file LesMiserables.gexf  
(<http://gephi.org/datasets/LesMiserables.gexf>)
2. layout the network
3. ranking
4. metrics
5. community detection
6. export

# 0. starting Gephi

ranking/partition

main

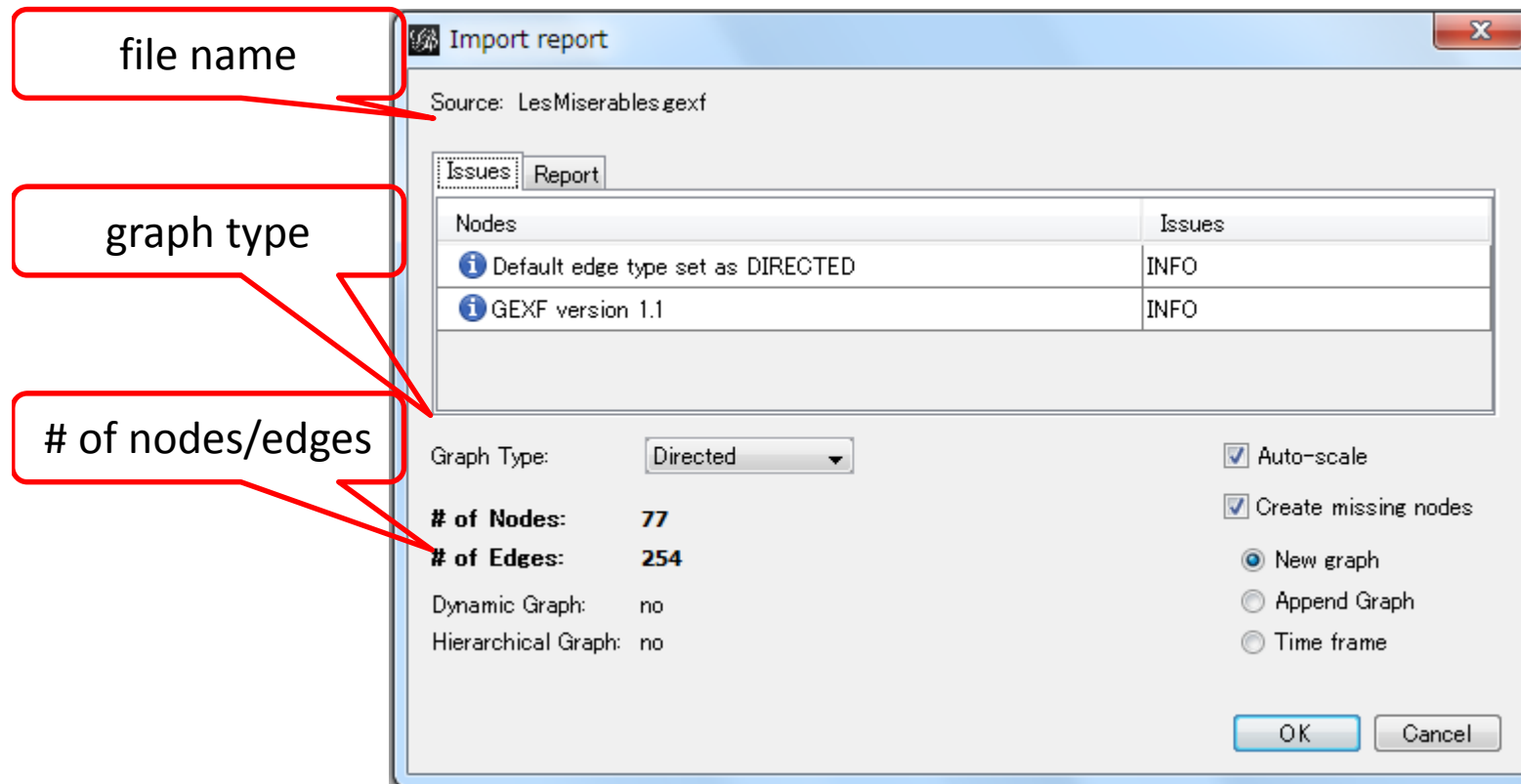
metrics



layout

# 1. import

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

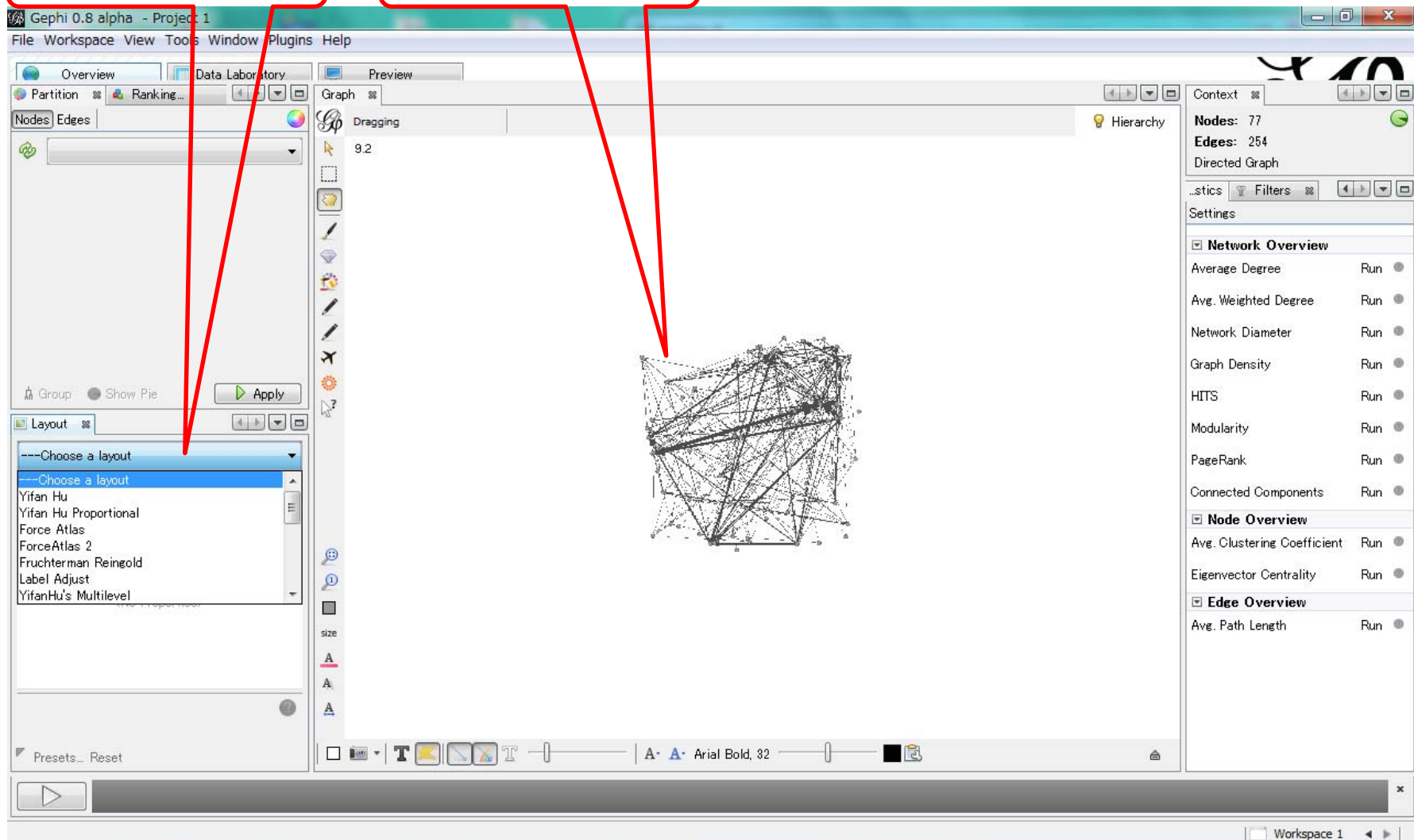




## 2. layout (1)

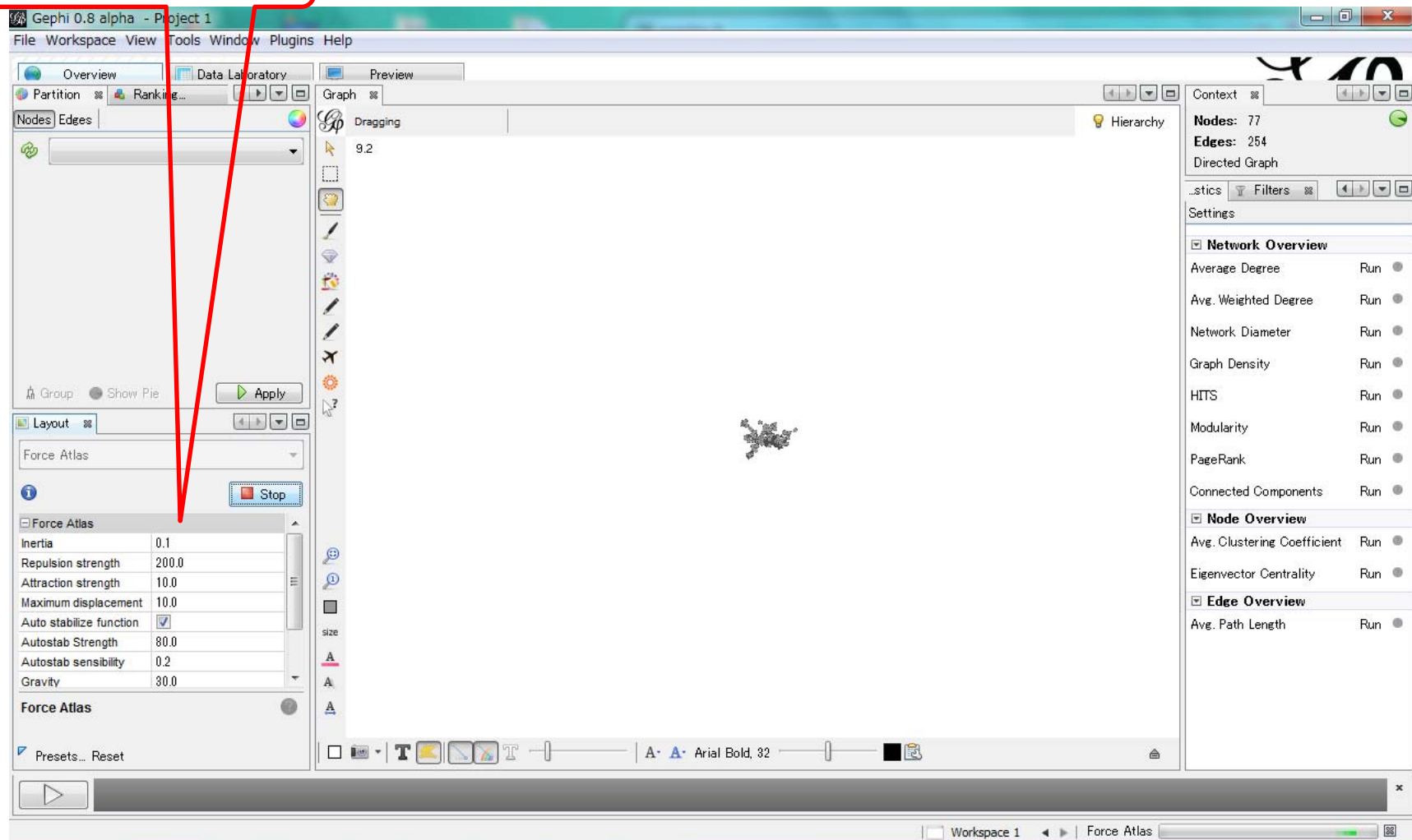
layout algorithms

network



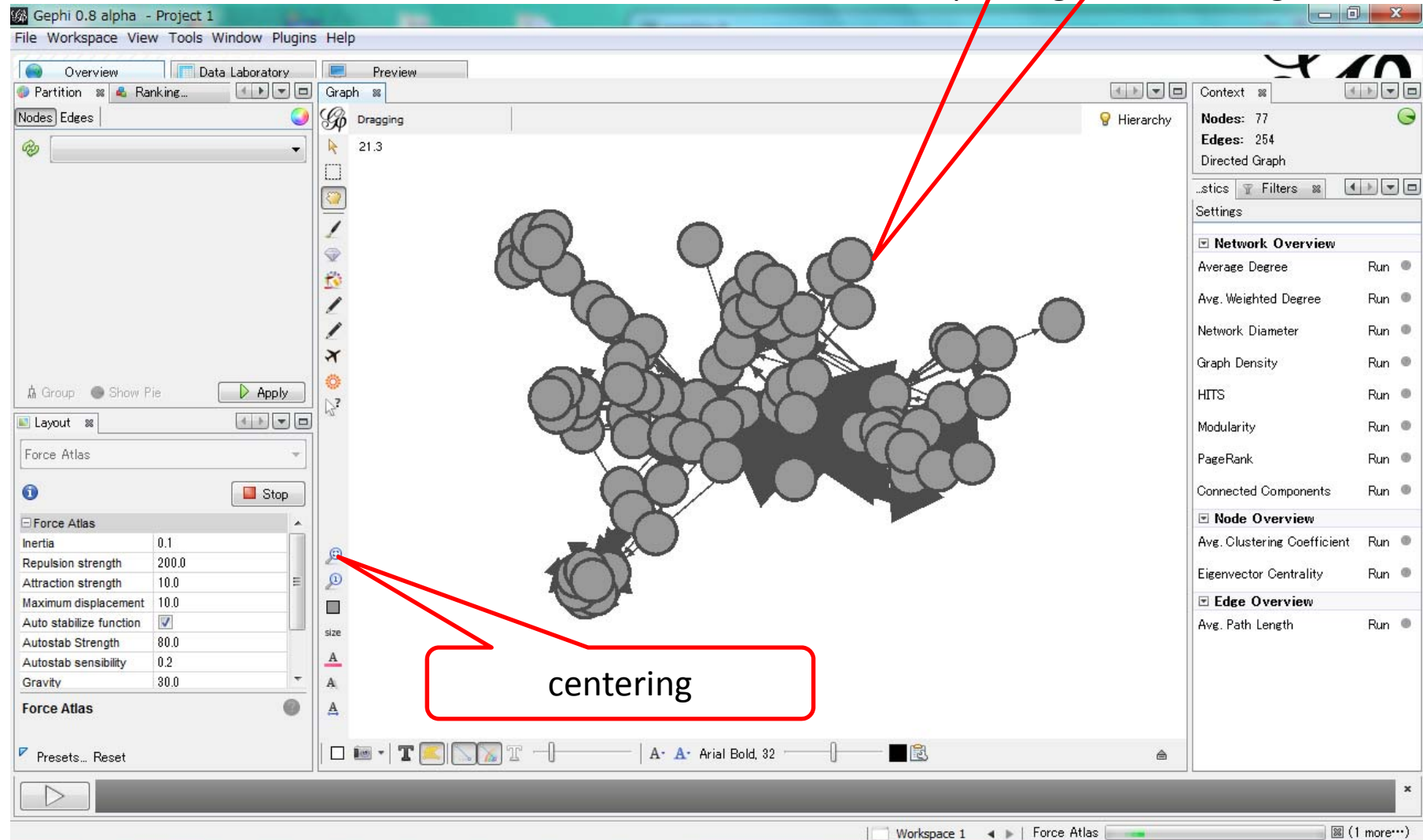
## 2. layout (2)

adjust parameters



# zoom & pan

zoom: mouse wheel  
pan: right click & drag



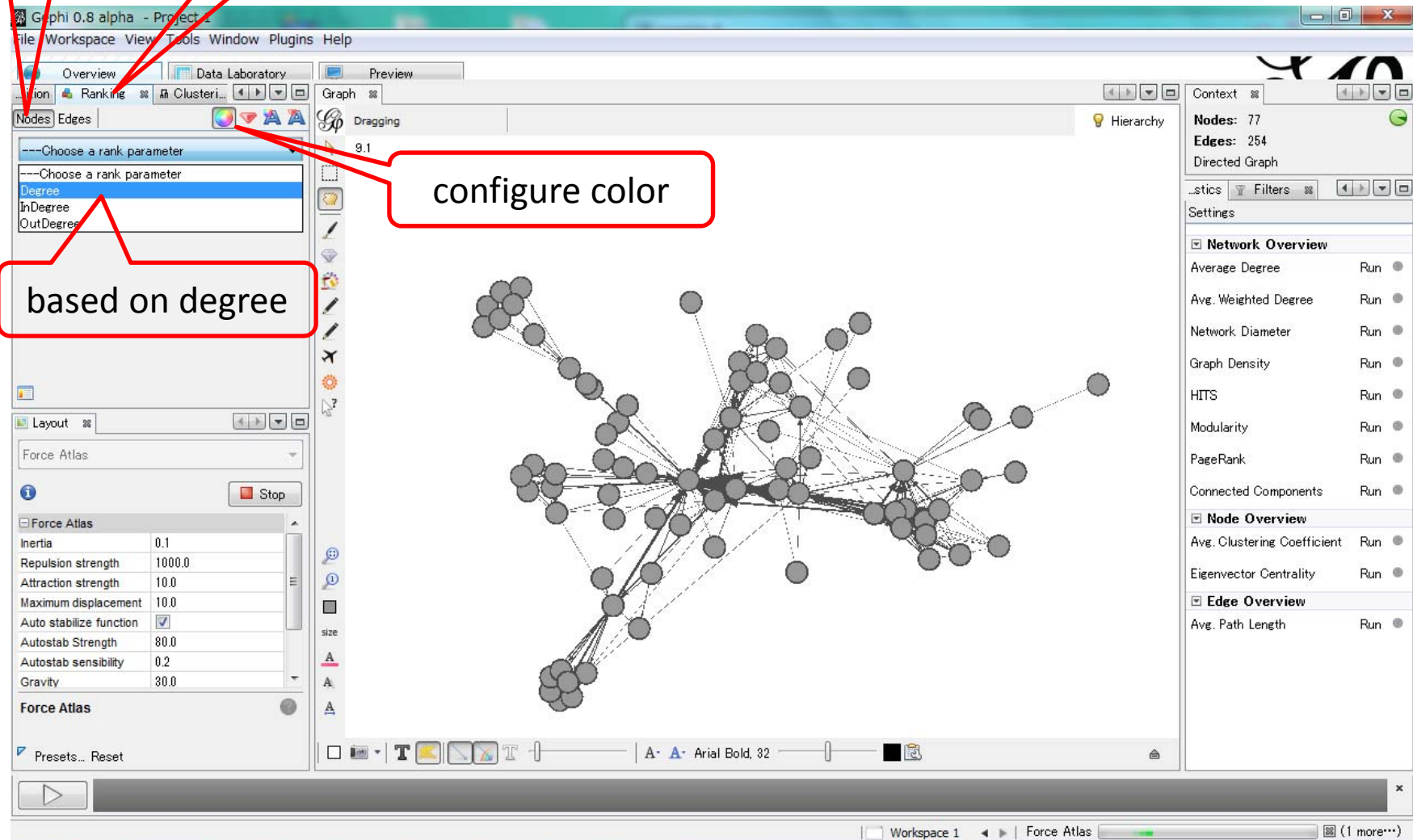
# 3. ranking (1)

nodes

ranking

configure color

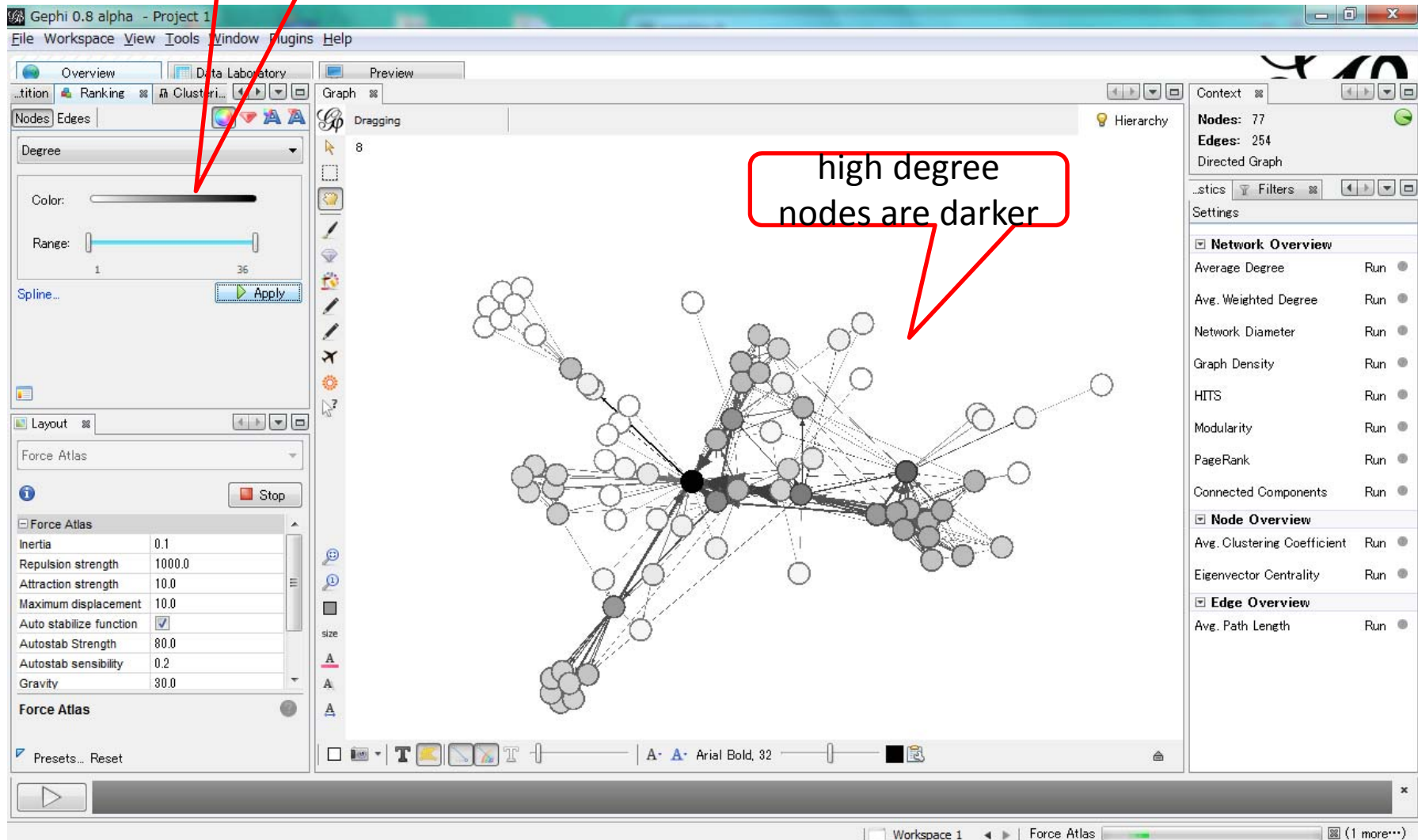
based on degree



## 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), 'Data Laboratory', 'Preview', 'Graph' (with 'Dragging' and 'Hierarchy' options), 'Nodes' (with 'Degree' and 'Color' settings), 'Layout' (with 'Force Atlas' settings), and 'Force Atlas' (with various parameters like Inertia, Repulsion strength, Attraction strength, Maximum displacement, Auto stabilize function, Autostab Strength, Autostab sensibility, and Gravity). The right sidebar contains 'Context' (with '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'.

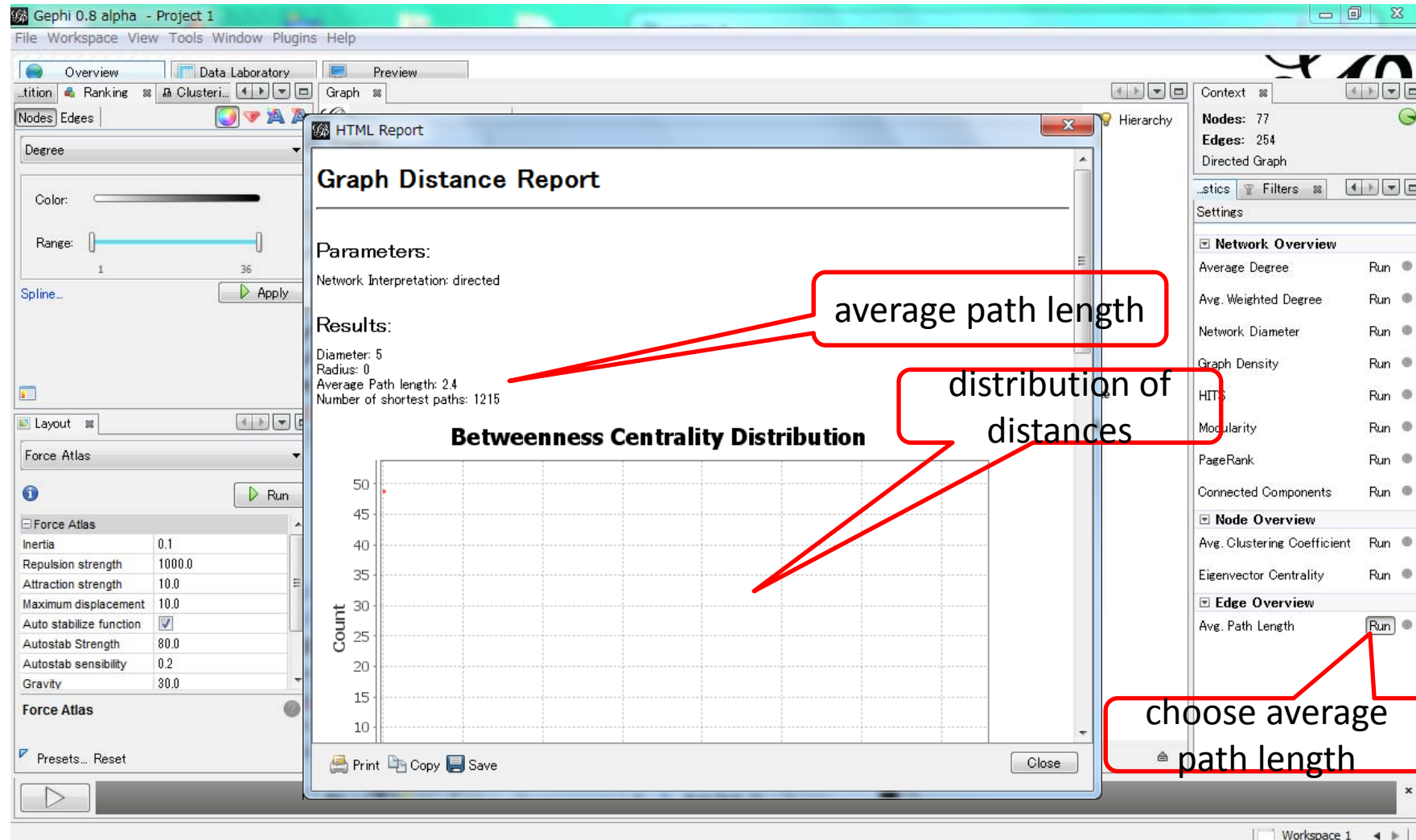
Annotations with red boxes and arrows point to specific features:

- change edge thickness**: Points to the 'Edge' tab in the 'Overview' panel.
- show labels**: Points to the 'Labels' icon in the bottom toolbar.
- change label size**: Points to the 'Text' icon in the bottom toolbar.
- misc settings**: Points to the 'Settings' panel on the right.

## 4. metrics

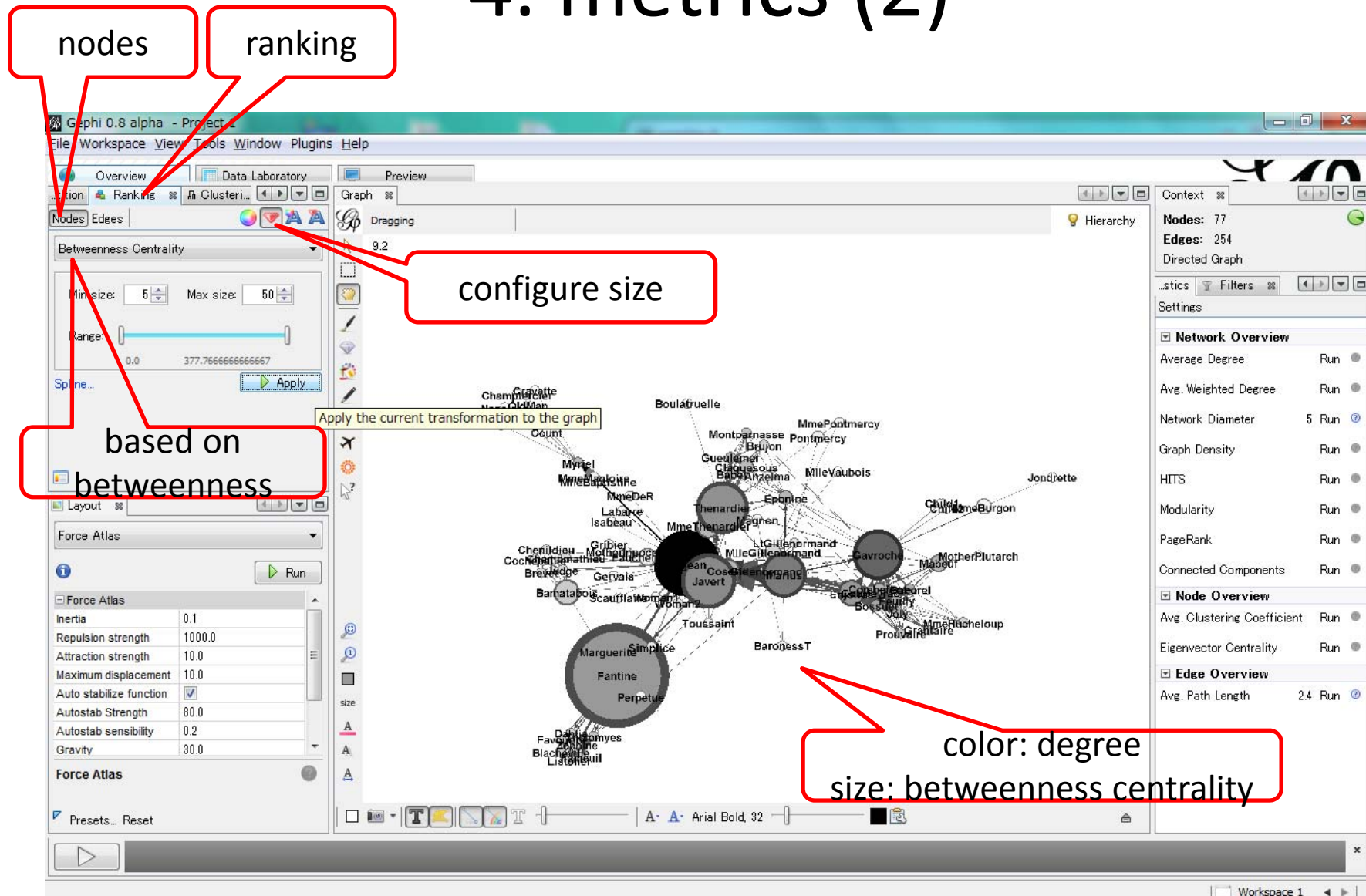
- for networks
  - diameter
  - density
  - average path length
  - clustering coefficient
  - modularity (community detection)
  - ...
- for nodes
  - PageRank
  - HITS
  - betweenness centrality
  - closeness centrality
  - ...

# 4. metrics (1)



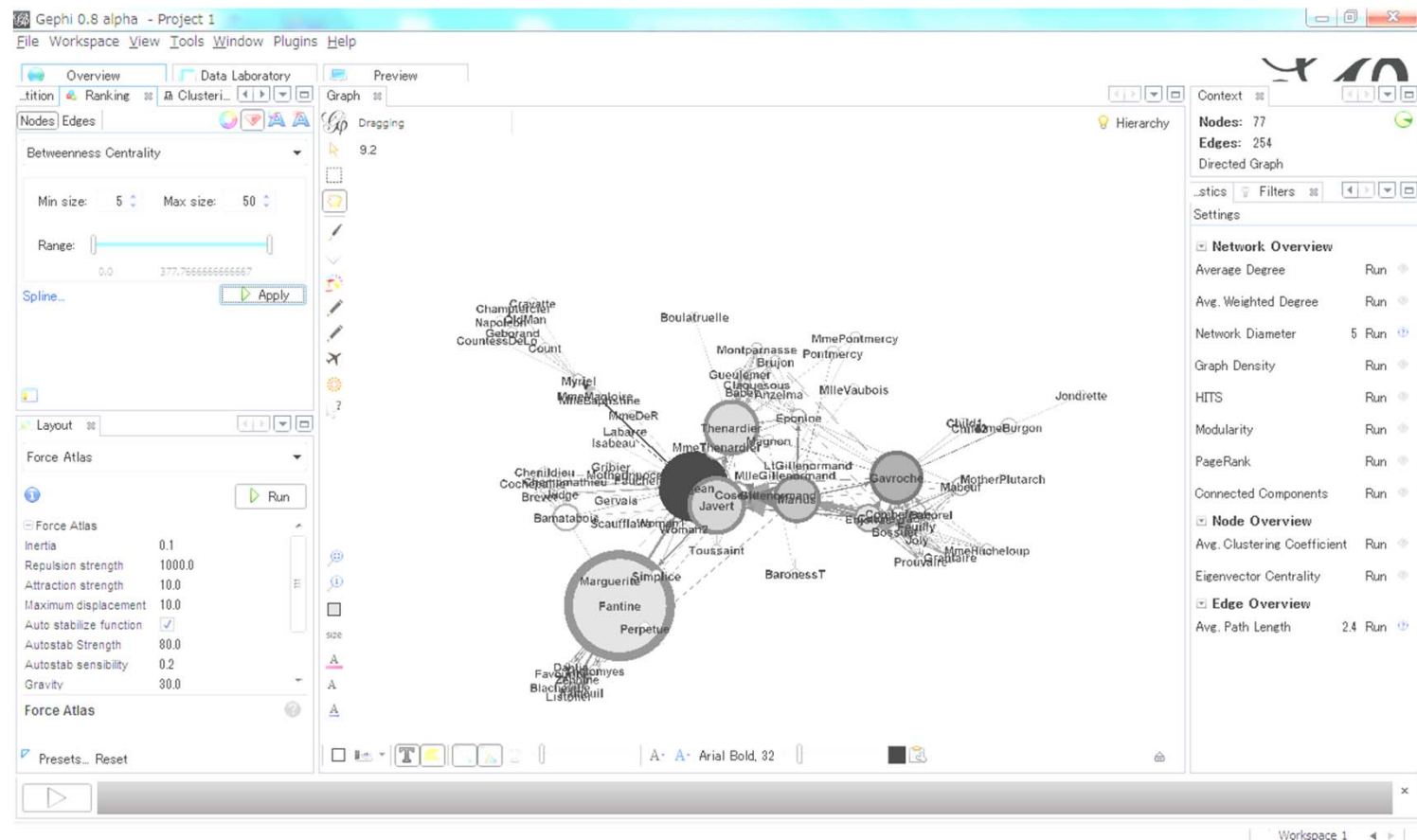


## 4. metrics (2)



# two metrics

- 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 'HTML Report' window open, displaying the 'Modularity Report'. The report includes 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

The settings panel on the right shows the 'Network Overview' section with the following values:

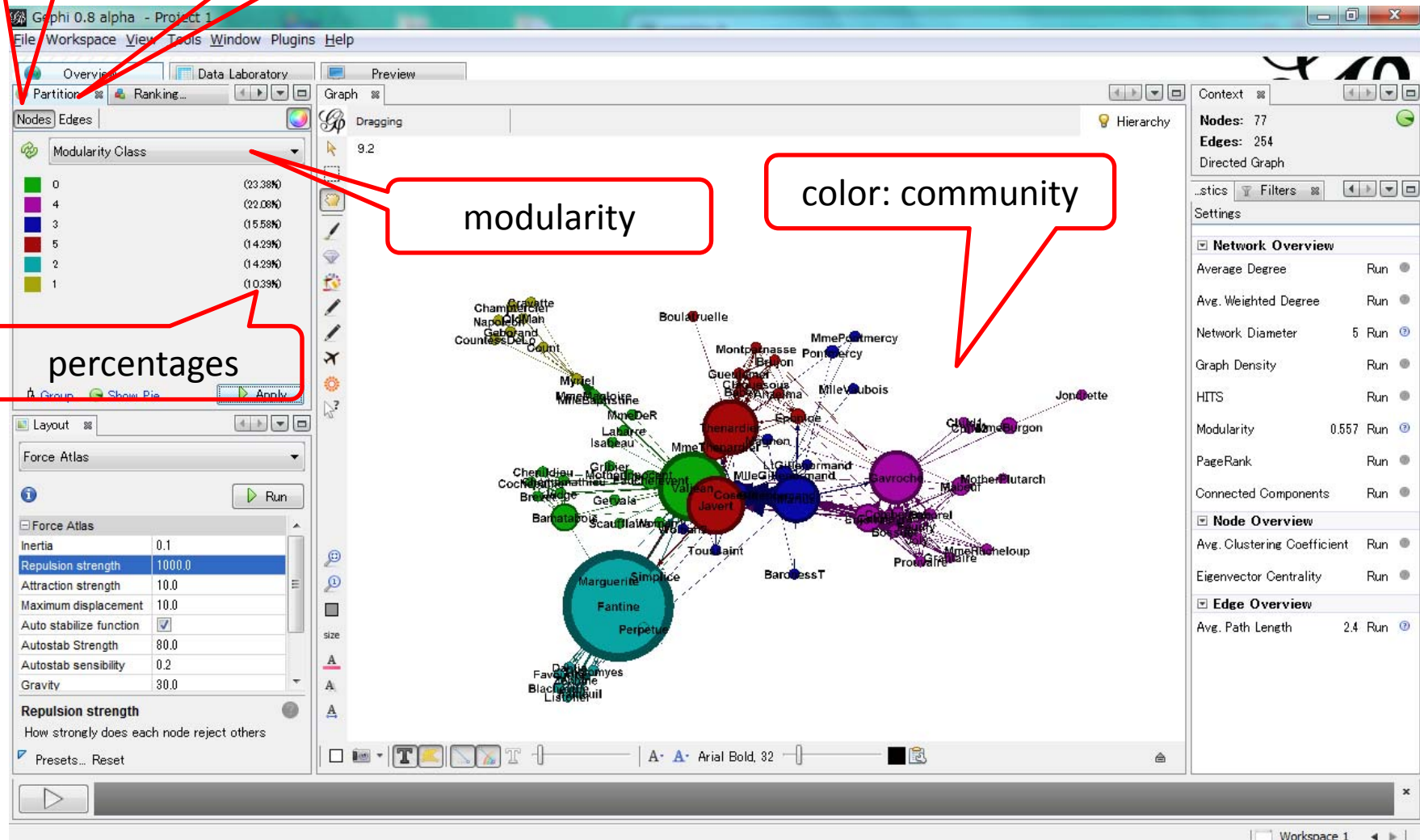
Metric	Value	Action
Average Degree	Run	Run
Avg. Weighted Degree	Run	Run
Network Diameter	5	Run
Graph Density	Run	Run
HITS	Run	Run
Modularity	0.557	Run
PageRank	Run	Run
Connected Components	Run	Run

The 'Force Atlas' layout settings are visible on the left, and the 'Workspace 1' tab is active at the bottom.

# 5. community detection (2)

nodes

partition



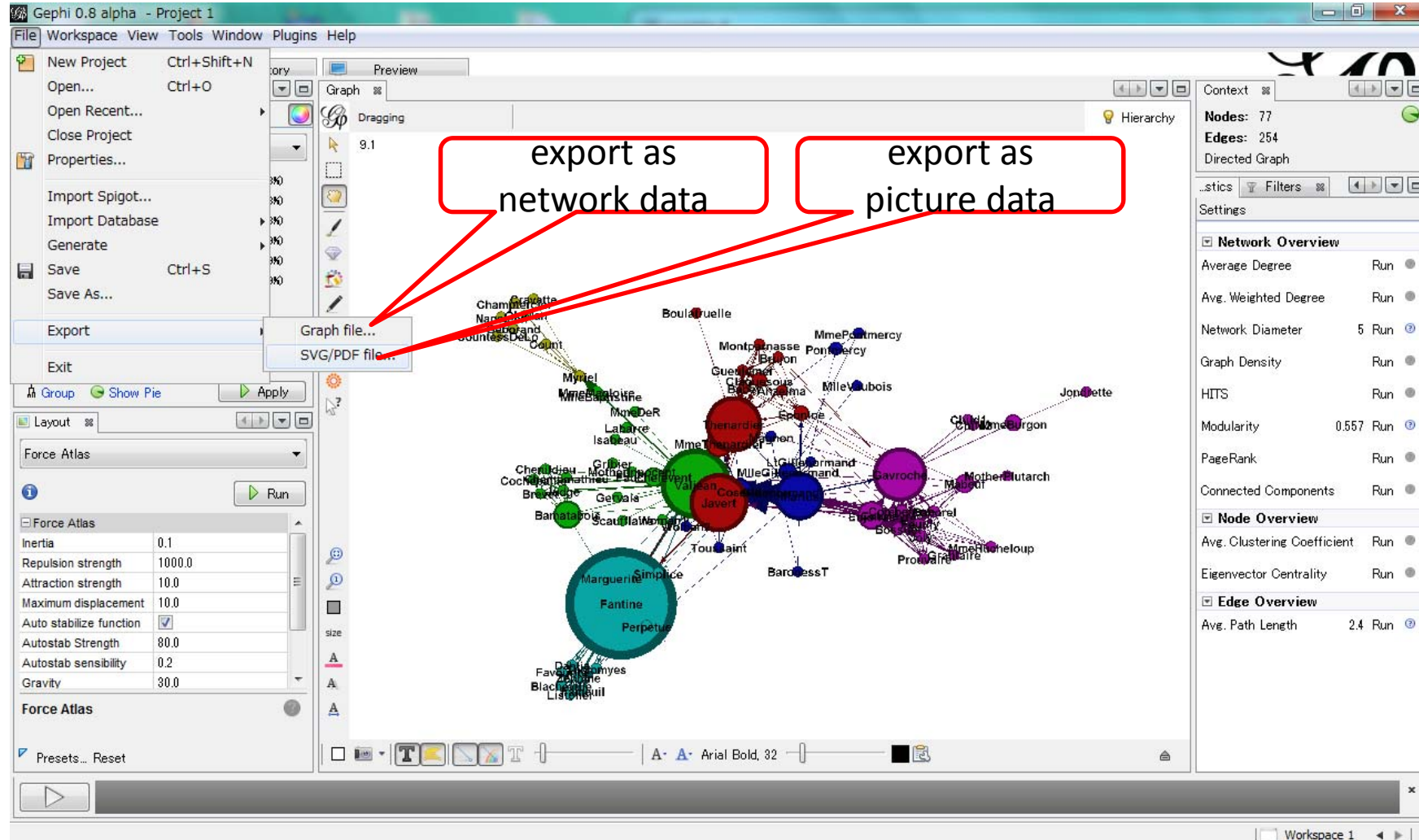
modularity

color: community

percentages



# 6. export



# for more information

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