tools for analyzing networks (Gephi)

2011.10.03

tools for analyzing networks

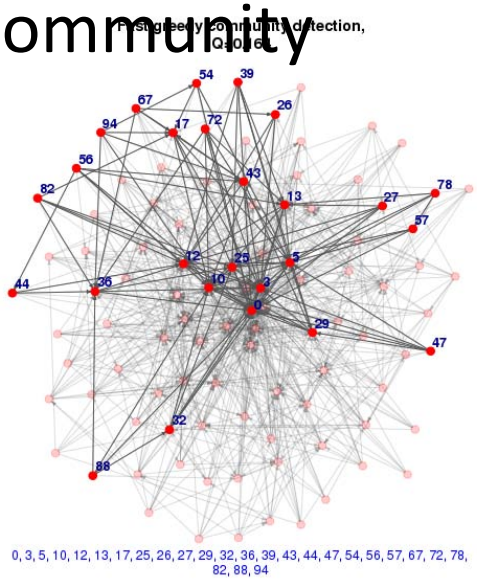
- (static) visualization
  - graphvis
  - LGL (Large Graph Layout)
- domain-specific tools
  - Pajek, UCINet: social network analysis
  - Cytoscape: bioinformatics
- interactive visualization
  - JUNG, Netminer, igraph, SONIVIS, Commetrix, NetworkWorkbench, visone, CFinder,...

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://cneurocvs.rmki.kfki.hu/igraph/

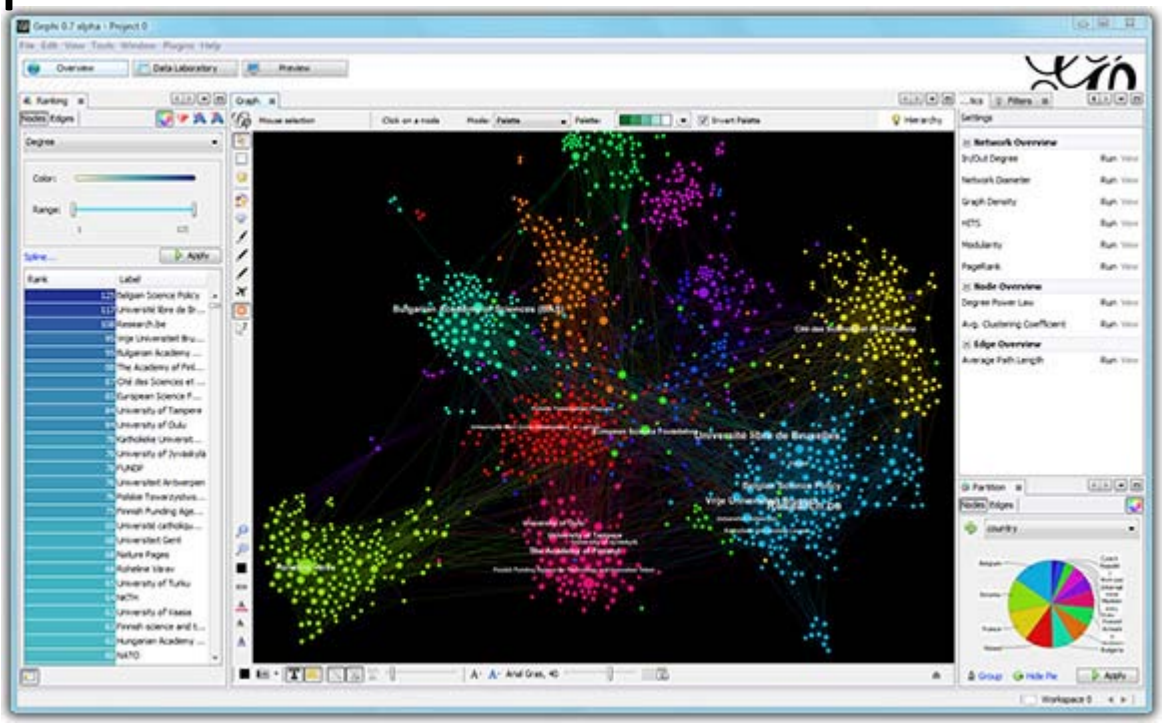
- igraph is a free software package for creating and manipulating undirected and directed graphs. It includes implementations for classic graph theory problems like minimum spanning trees and network flow, and also implements algorithms for some recent network analysis methods, like community structure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

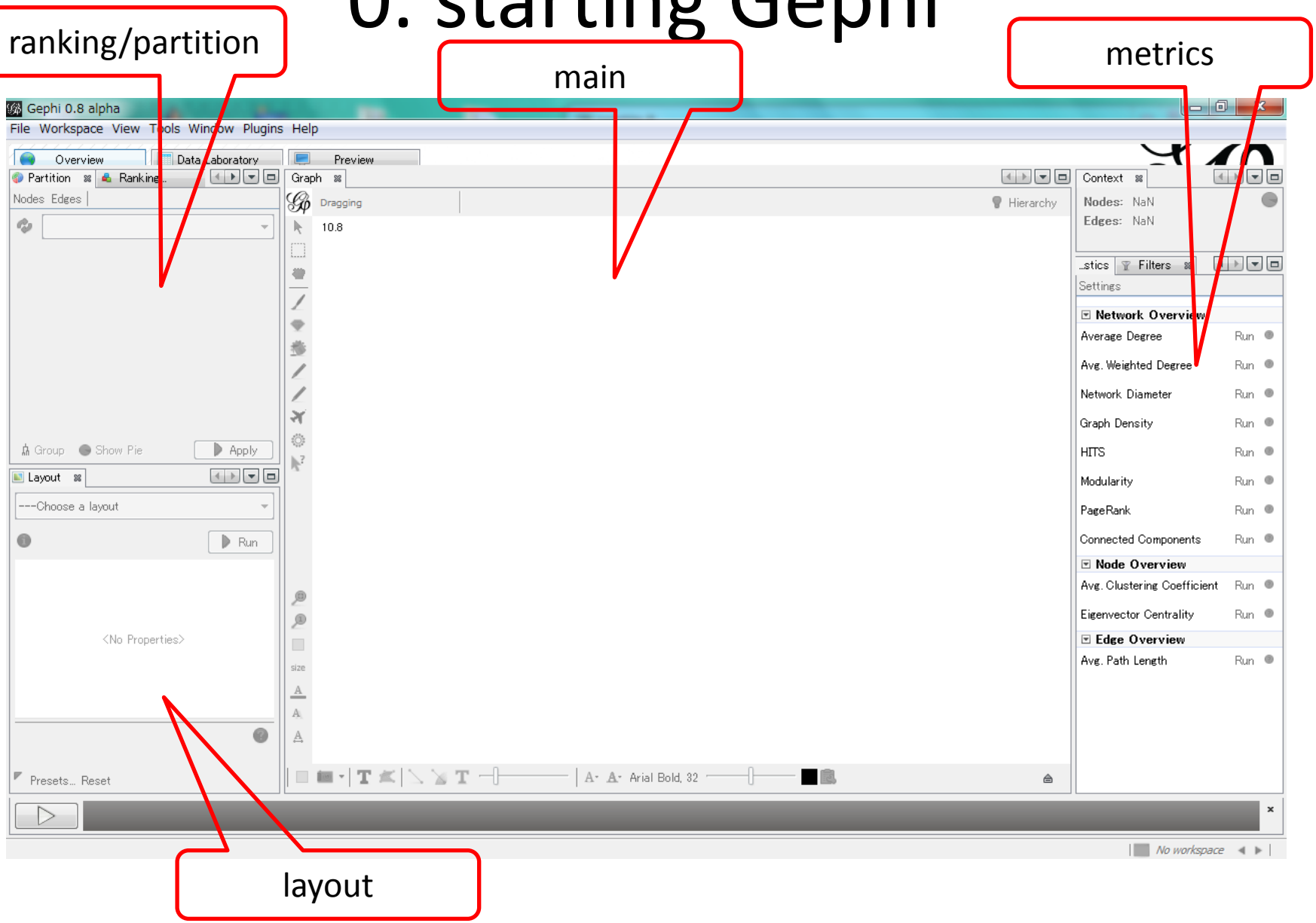
Input/output

- 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



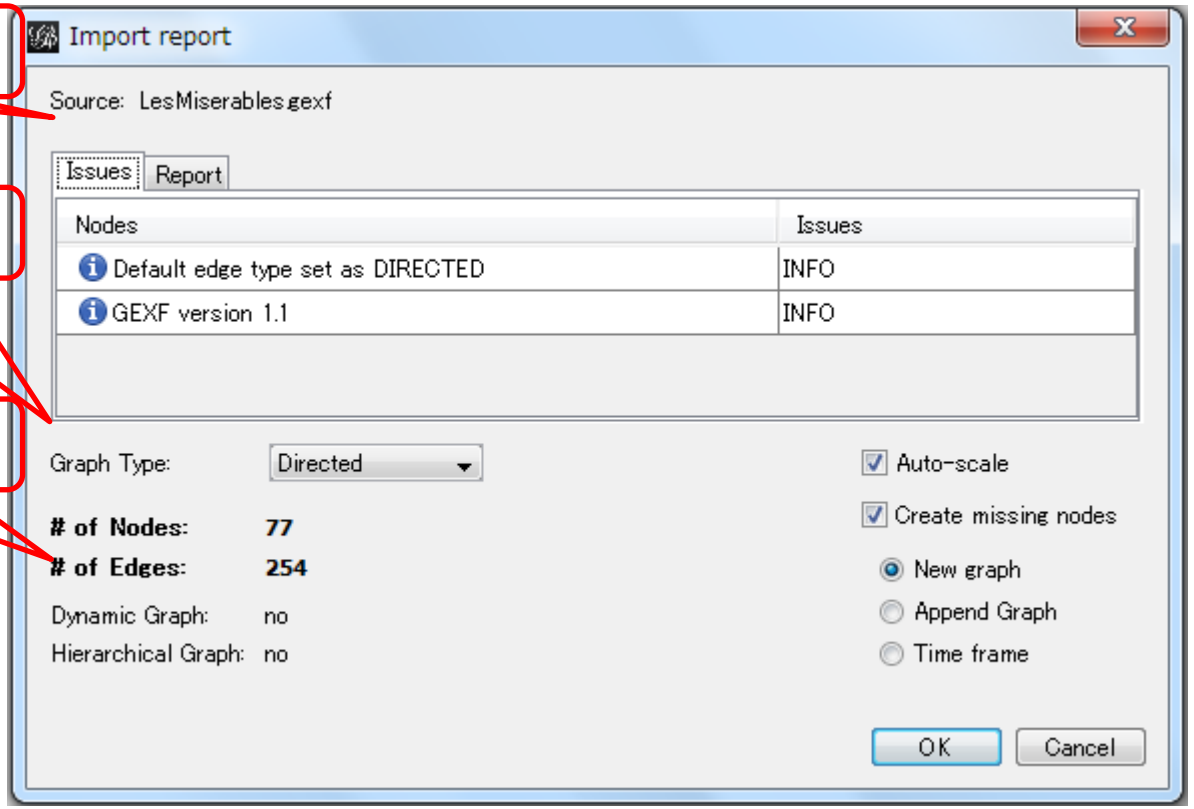
1. import

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

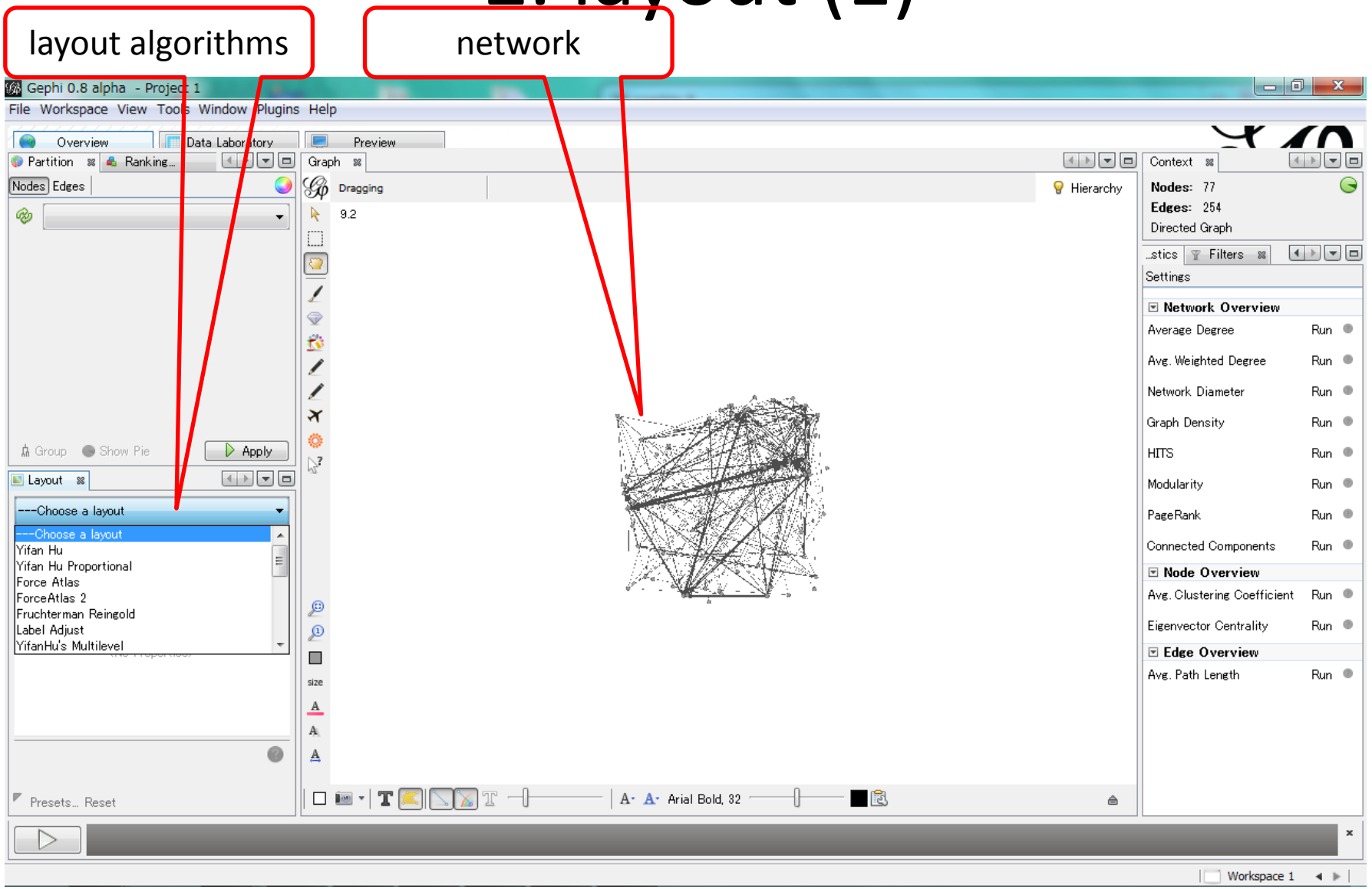
file name

graph type

# of nodes/edges

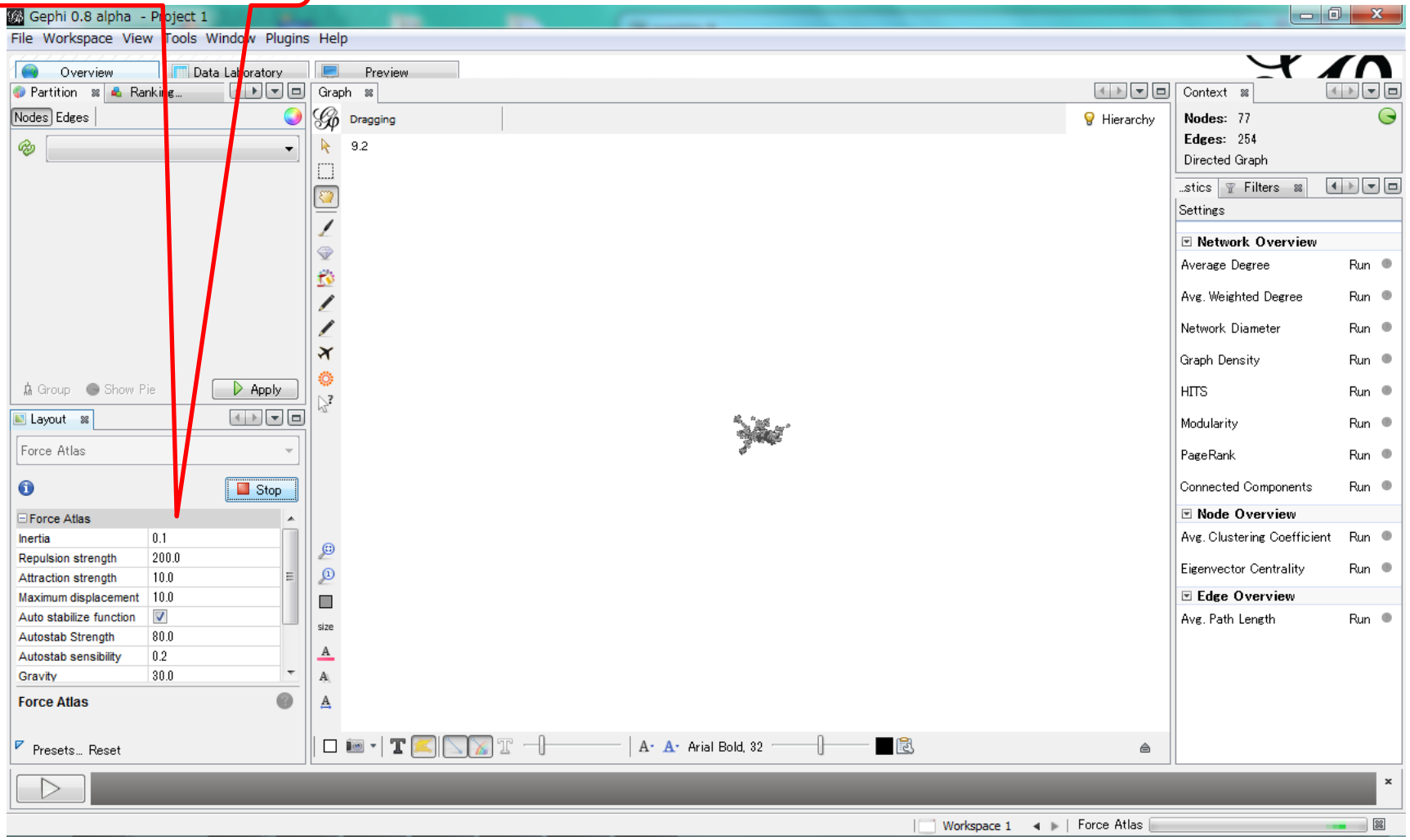


2. layout (1)

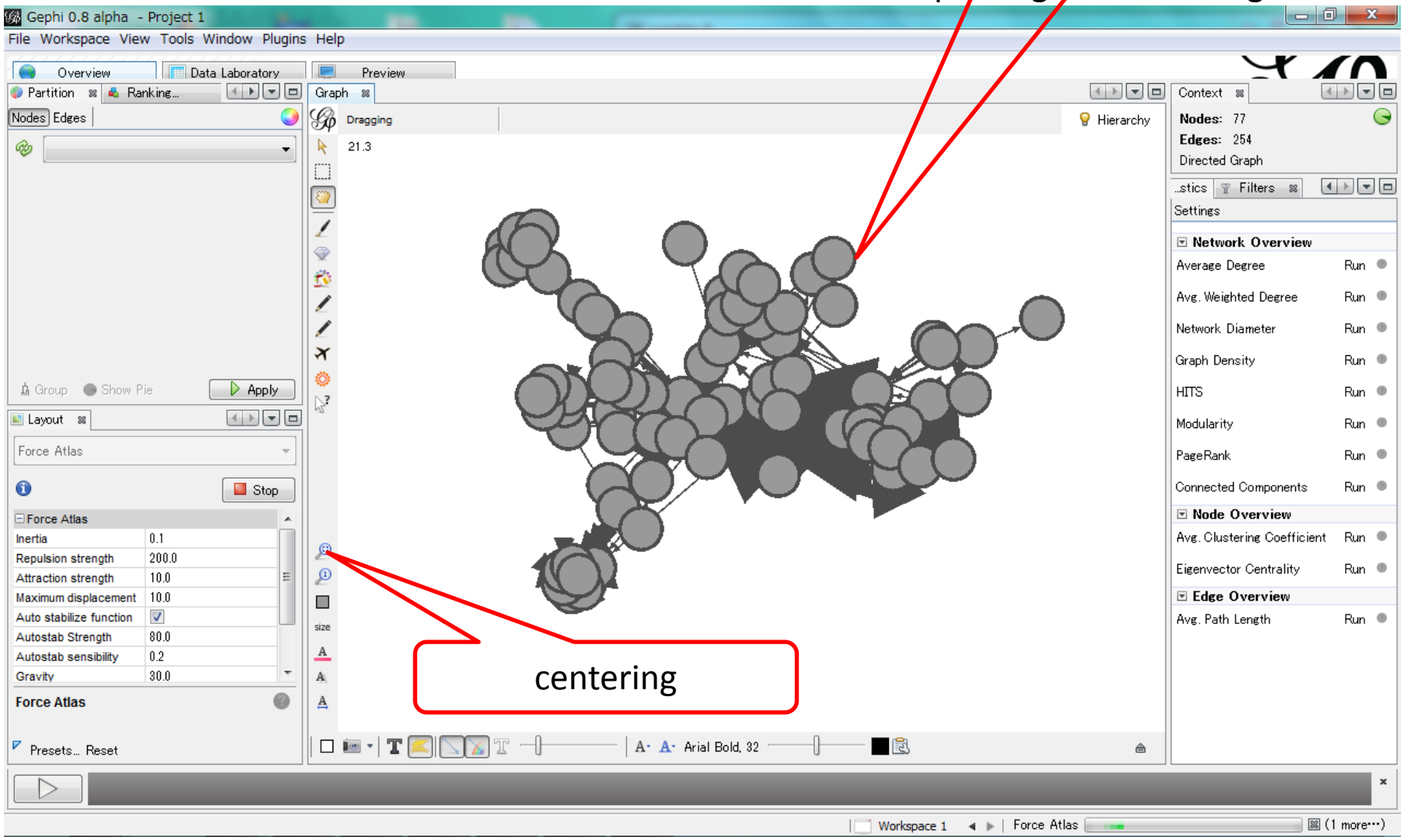

layout algorithms
network
Gephi 0.8 alpha - Project 1
File Workspace View Tools Window Plugins Help
Overview
Data Laboratory
Preview
Partition
Ranking...
Nodes Edges
Group
Show Pie
Apply
Layout
---Choose a layout
---Choose a layout
Yifan Hu
Yifan Hu Proportional
Force Atlas
ForceAtlas 2
Fruchterman Reingold
Label Adjust
YifanHu's Multilevel
Presets... Reset
Graph
Dragging
9.2
Hierarchy
size
Arial Bold, 32
Context
Nodes: 77
Edges: 254
Directed Graph
Filters
Settings
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
Workspace 1

2. layout (2)

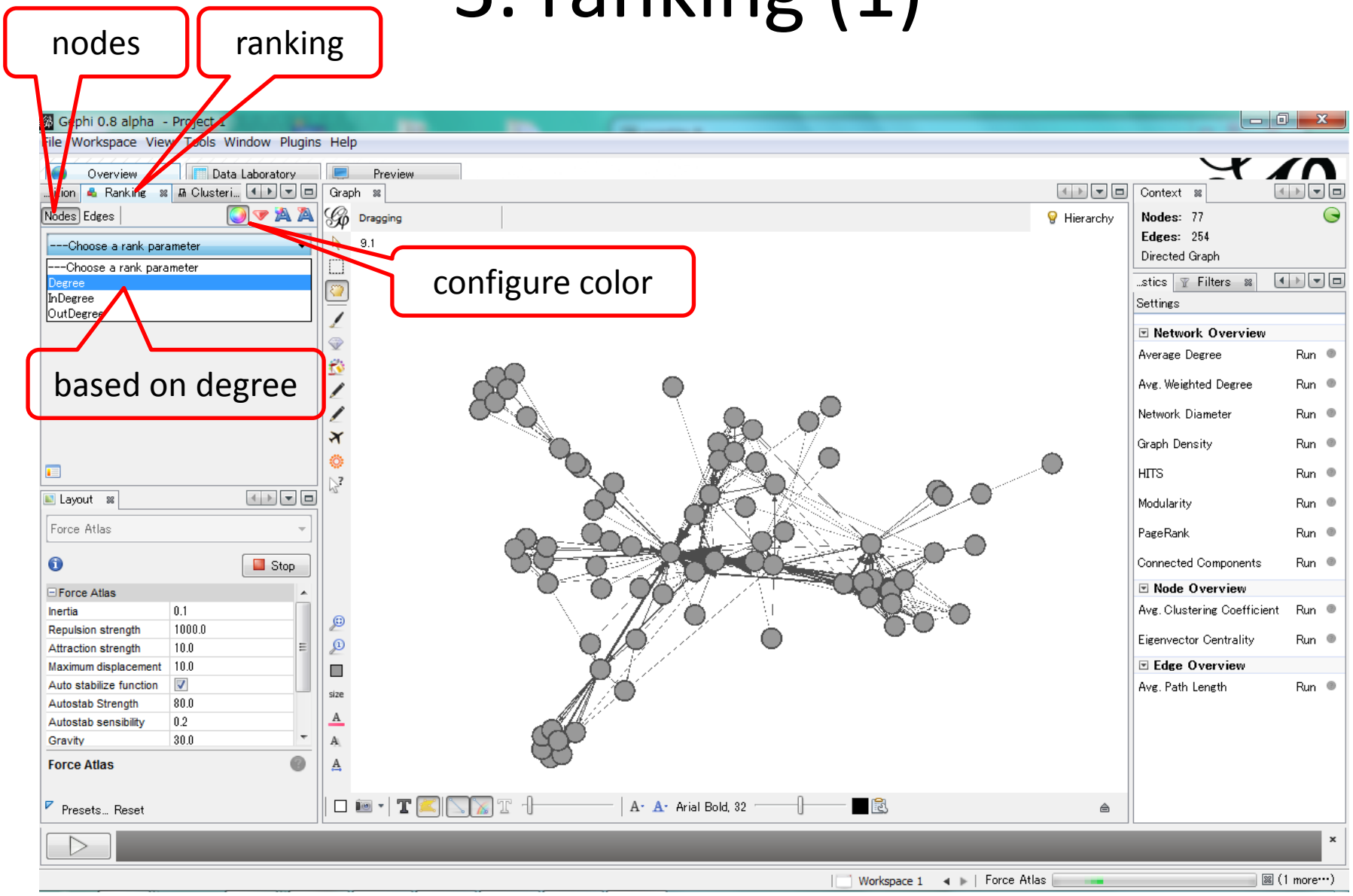
adjust parameters



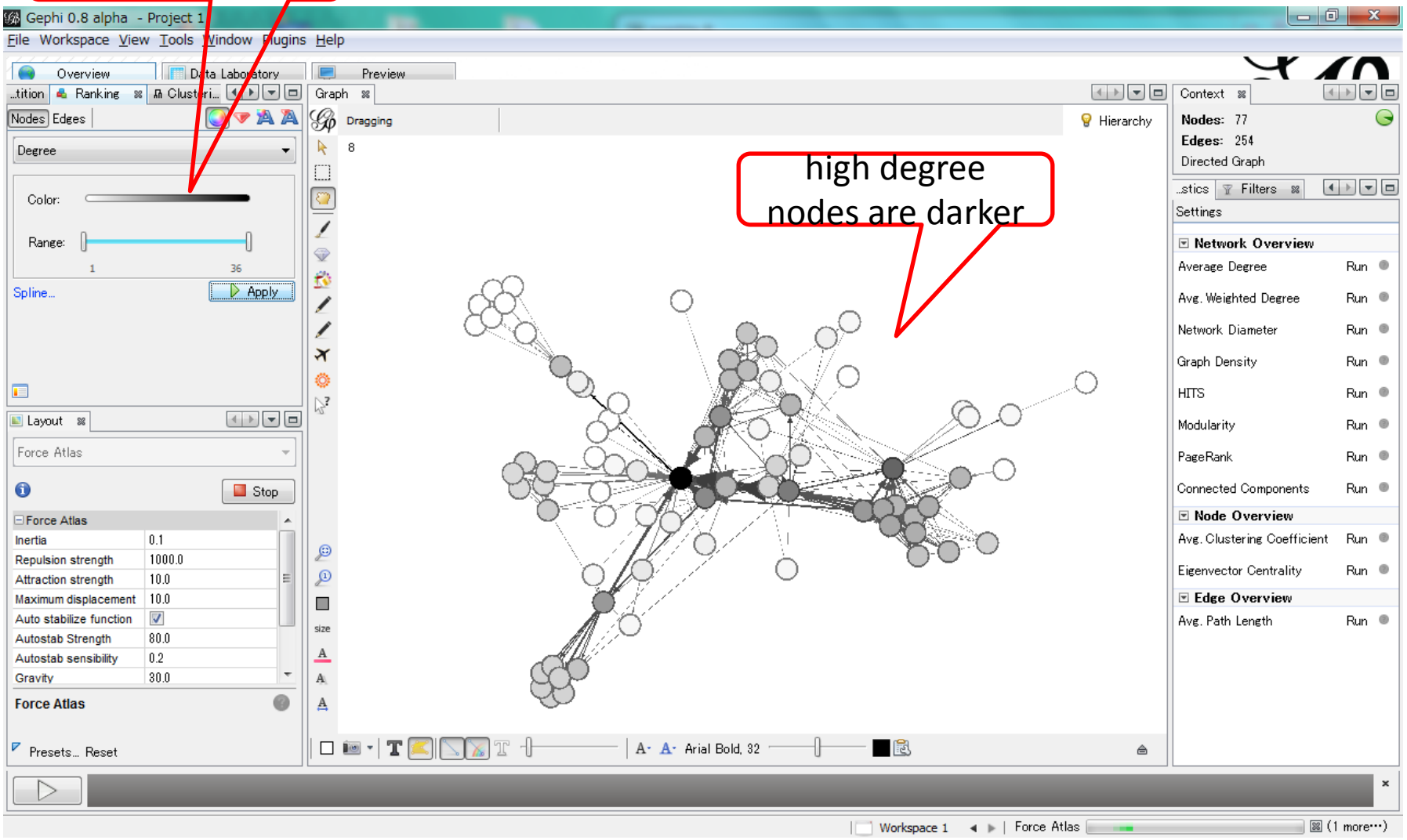
zoom & pan


zoom: mouse wheel
pan: right click & drag
centering
Gephi 0.8 alpha - Project 1
File Workspace View Tools Window Plugins Help
Overview
Data Laboratory
Preview
Partition
Ranking...
Nodes Edges
Group
Show Pie
Apply
Layout
Force Atlas
Stop
Force Atlas
Inertia 0.1
Repulsion strength 200.0
Attraction strength 10.0
Maximum displacement 10.0
Auto stabilize function
Autostab Strength 80.0
Autostab sensibility 0.2
Gravity 30.0
Force Atlas
Presets... Reset
Graph
Dragging
21.3
Hierarchy
size
Arial Bold, 32
Context
Nodes: 77
Edges: 254
Directed Graph
Filters
Settings
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
Workspace 1
Force Atlas
(1 more...)

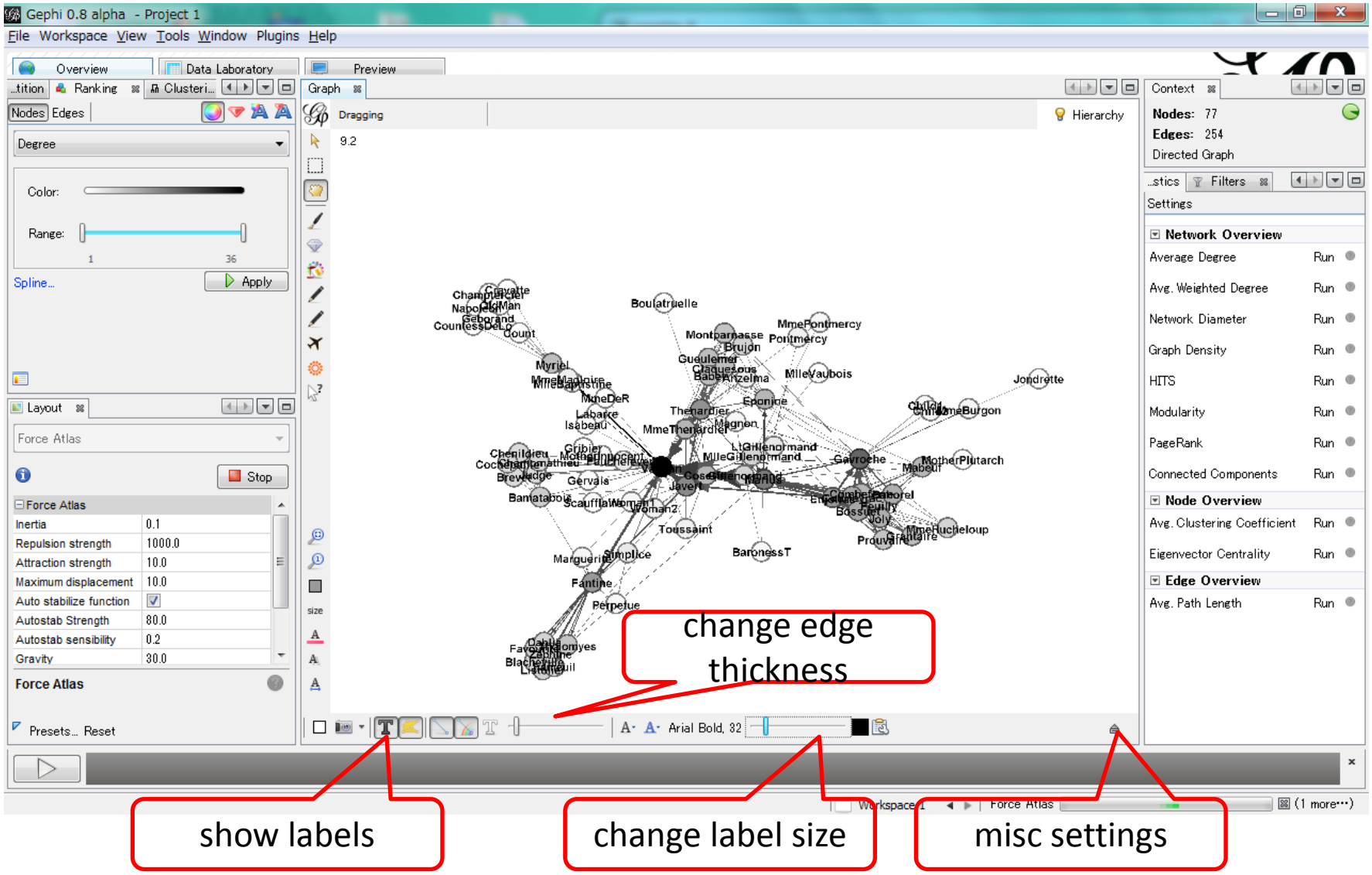
3. ranking (1)


nodes
ranking
configure color
based on degree
Gephi 0.8 alpha - Project 1
File Workspace View Tools Window Plugins Help
Overview
Data Laboratory
Preview
Ranking
Nodes Edges
---Choose a rank parameter
---Choose a rank parameter
Degree
InDegree
OutDegree
Graph
Dragging
Hierarchy
Context
Nodes: 77
Edges: 254
Directed Graph
Filters
Settings
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
Layout
Force Atlas
Stop
Force Atlas
Inertia 0.1
Repulsion strength 1000.0
Attraction strength 10.0
Maximum displacement 10.0
Auto stabilize function
Autostab Strength 80.0
Autostab sensibility 0.2
Gravity 30.0
Force Atlas
Presets... Reset
Arial Bold, 32
Workspace 1
Force Atlas
(1 more...)

3. ranking (2)


set color
high degree nodes are darker
Gephi 0.8 alpha - Project 1
File Workspace View Tools Window Plugins Help
Overview
Data Laboratory
Preview
Ranking
Nodes Edges
Degree
Color:
Range:
1
36
Spline...
Apply
Layout
Force Atlas
Stop
Force Atlas
Inertia 0.1
Repulsion strength 1000.0
Attraction strength 10.0
Maximum displacement 10.0
Auto stabilize function
Autostab Strength 80.0
Autostab sensibility 0.2
Gravity 30.0
Force Atlas
Presets... Reset
Graph
Dragging
Hierarchy
8
size
Arial Bold, 32
Context
Nodes: 77
Edges: 254
Directed Graph
Filters
Settings
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
Workspace 1
Force Atlas
(1 more...)

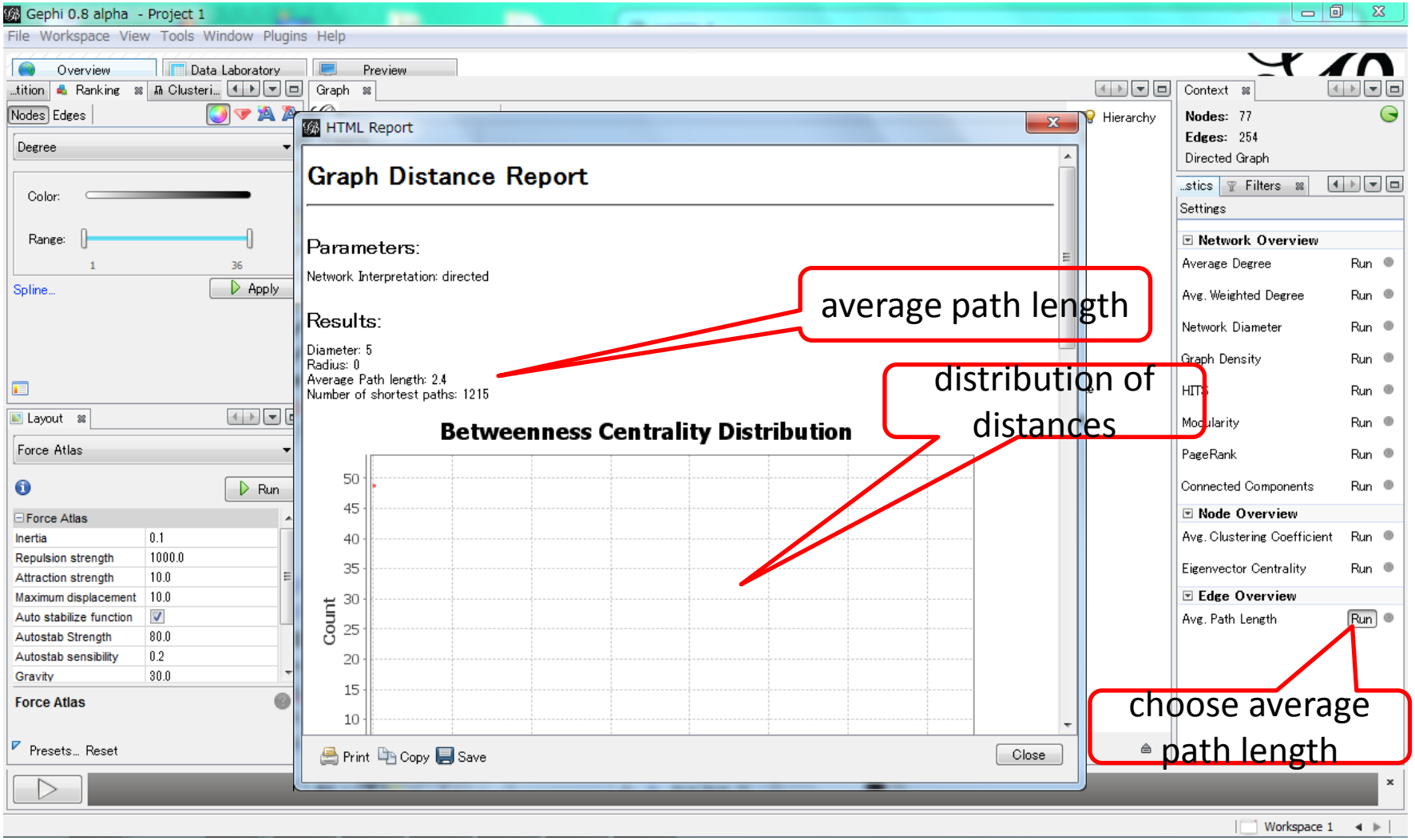
labeling nodes



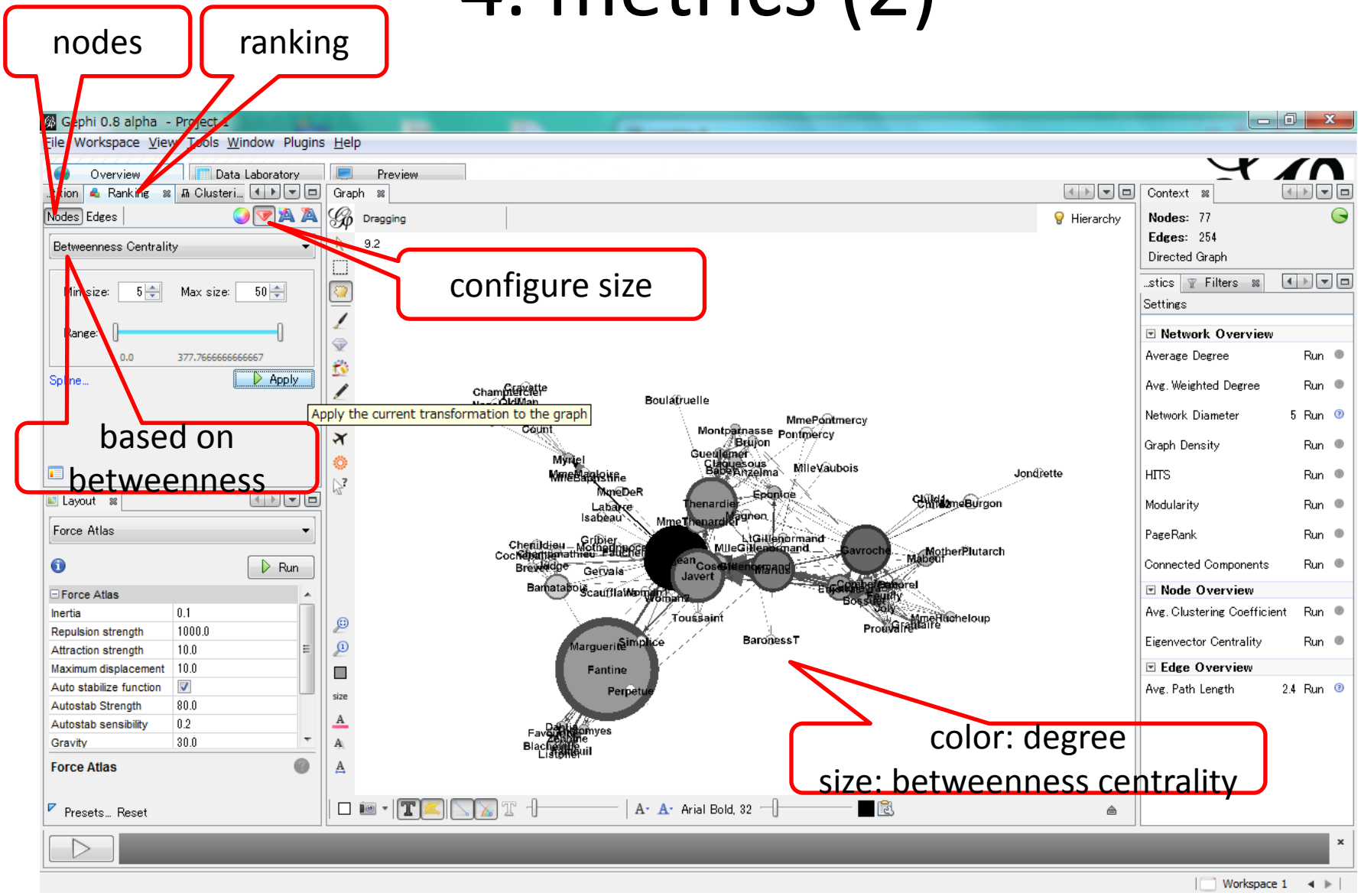
4. metrics

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

4. metrics (1)

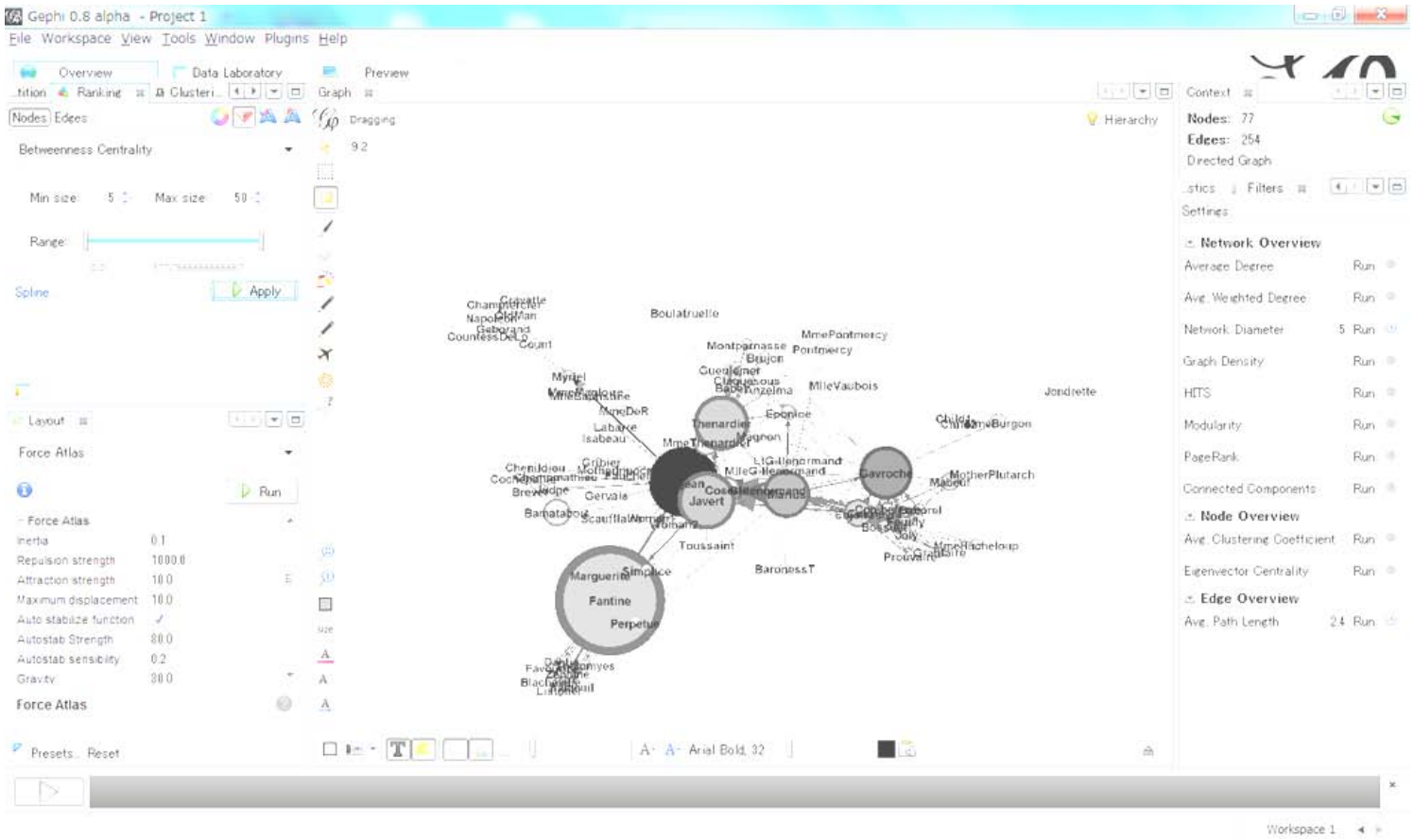

Gephi 0.8 alpha - Project 1
File Workspace View Tools Window Plugins Help
Overview
Data Laboratory
Preview
Graph
Context
Nodes: 77
Edges: 254
Directed Graph
Hierarchy
Degree
Color:
Range:
Spline...
Apply
Layout
Force Atlas
Run
Force Atlas
Inertia 0.1
Repulsion strength 1000.0
Attraction strength 10.0
Maximum displacement 10.0
Auto stabilize function
Autostab Strength 80.0
Autostab sensibility 0.2
Gravity 30.0
Presets... Reset
Filters
Settings
Network Overview
Average Degree Run
Avg. Weighted Degree Run
Network Diameter Run
Graph Density Run
Modularity Run
PageRank Run
Connected Components Run
Node Overview
Avg. Clustering Coefficient Run
Eigenvector Centrality Run
Edge Overview
Avg. Path Length Run
HTML Report
Graph Distance Report
Parameters:
Network Interpretation: directed
Results:
Diameter: 5
Radius: 0
Average Path length: 2.4
Number of shortest paths: 1215
Betweenness Centrality Distribution
Count
Print Copy Save
Close
average path length
distribution of distances
choose average path length
Workspace 1

4. metrics (2)

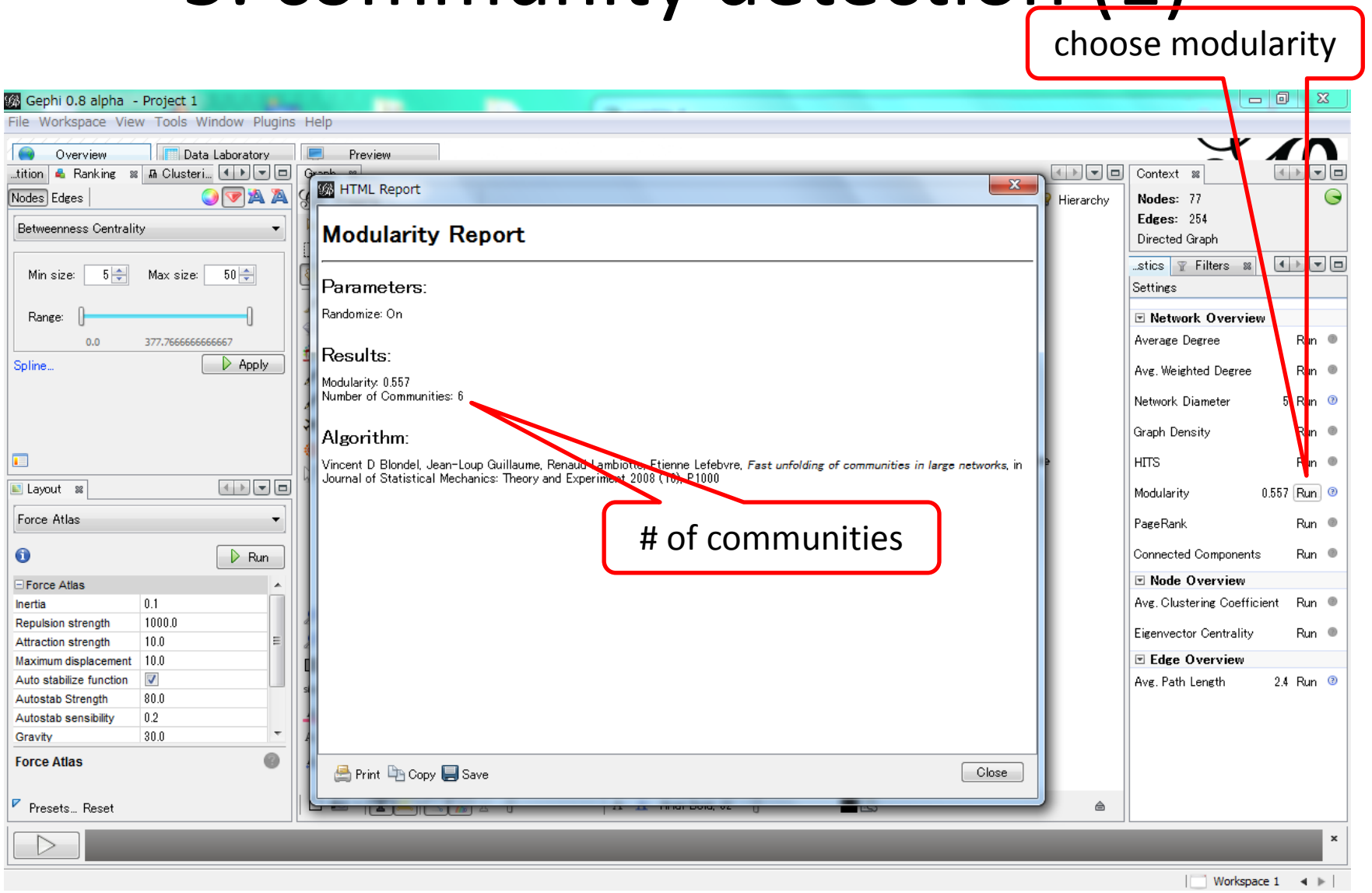

nodes
ranking
configure size
based on betweenness
color: degree
size: betweenness centrality
Gephi 0.8 alpha - Project 1
File Workspace View Tools Window Plugins Help
Overview
Data Laboratory
Preview
Ranking
Nodes Edges
Betweenness Centrality
Min size: 5
Max size: 50
Range:
Apply
Spline...
Apply the current transformation to the graph
Layout
Force Atlas
Run
Inertia 0.1
Repulsion strength 1000.0
Attraction strength 10.0
Maximum displacement 10.0
Auto stabilize function
Autostab Strength 80.0
Autostab sensibility 0.2
Gravity 30.0
Force Atlas
Presets... Reset
Graph
Dragging
Hierarchy
Context
Nodes: 77
Edges: 254
Directed Graph
Filters
Settings
Network Overview
Average Degree Run
Avg. Weighted Degree Run
Network Diameter 5 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 2.4 Run
Arial Bold, 32
Workspace 1

two metrics

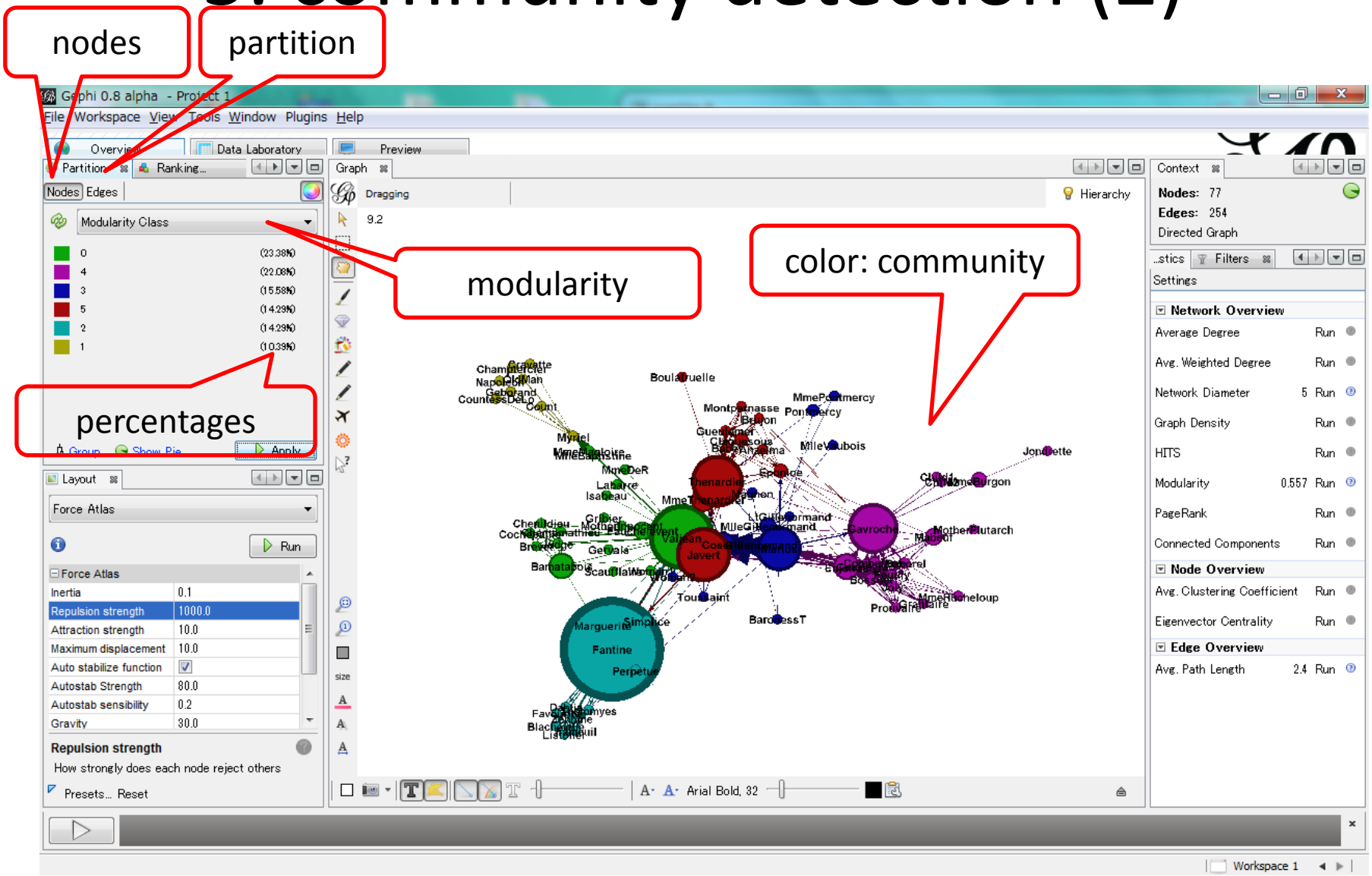
- dark (degree): many connections
- large: mediator of two groups



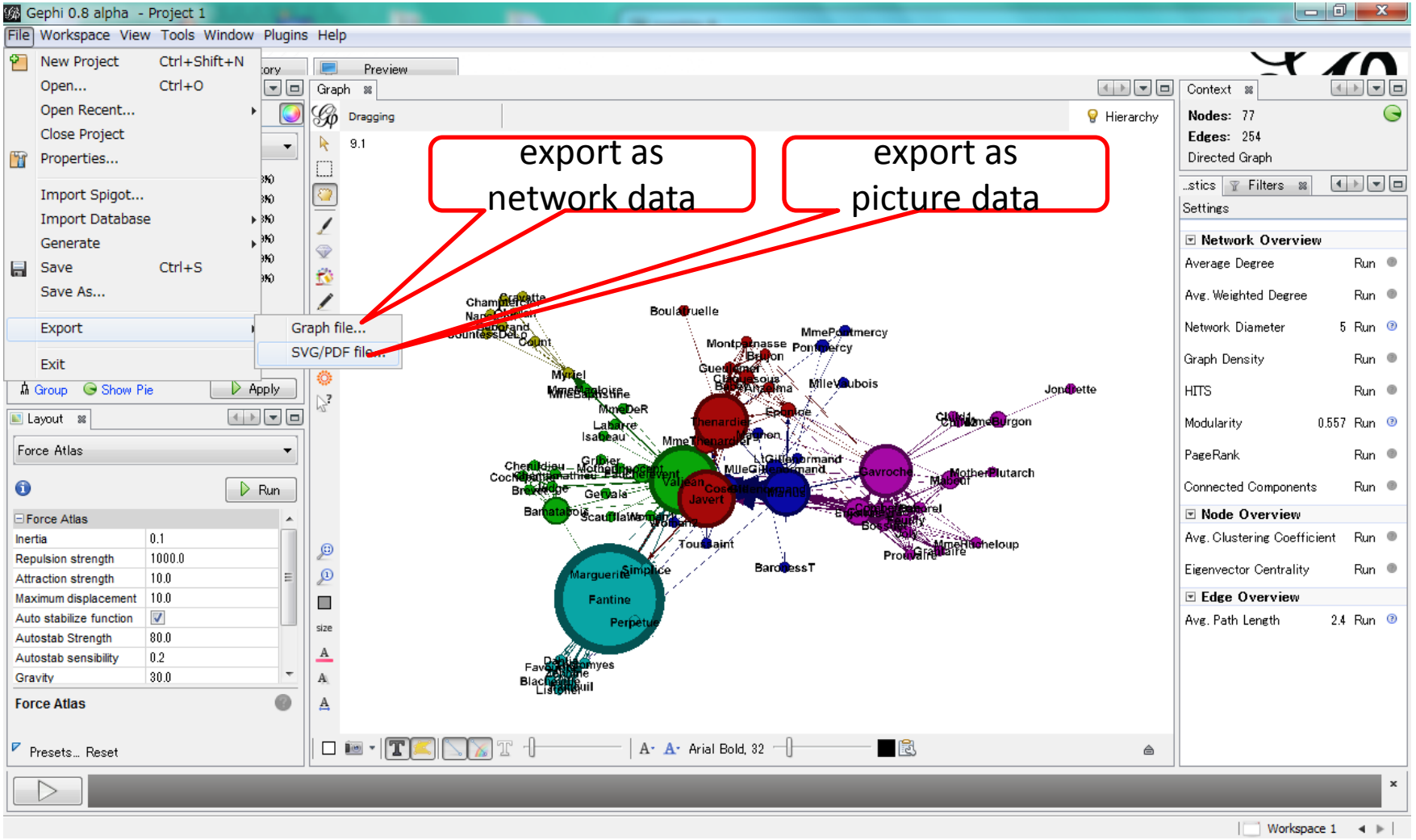
5. community detection (1)



5. community detection (2)



6. export


Gephi 0.8 alpha - Project 1
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
export as network data
export as picture data
Preview
Graph
Dragging
Hierarchy
Context
Nodes: 77
Edges: 254
Directed Graph
Filters
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
Layout
Force Atlas
Run
Inertia 0.1
Repulsion strength 1000.0
Attraction strength 10.0
Maximum displacement 10.0
Auto stabilize function
Autostab Strength 80.0
Autostab sensibility 0.2
Gravity 30.0
Force Atlas
Presets... Reset
Group Show Pie Apply
Arial Bold, 32
Workspace 1

for more information

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