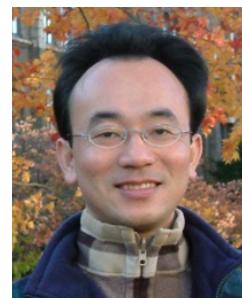




Practices of Business Intelligence

社會網絡分析 (Social Network Analysis)

1071BI09
MI4 (M2084) (2888)
Wed, 7, 8 (14:10-16:00) (B217)



Min-Yuh Day
戴敏育
Assistant Professor
專任助理教授

Dept. of Information Management, Tamkang University
淡江大學 資訊管理學系

<http://mail.tku.edu.tw/myday/>

2018-11-28



課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容 (Subject/Topics)

- 1 2018/09/12 商業智慧實務課程介紹
(Course Orientation for Practices of Business Intelligence)
- 2 2018/09/19 商業智慧、分析與資料科學
(Business Intelligence, Analytics, and Data Science)
- 3 2018/09/26 人工智慧、大數據與雲端運算
(ABC: AI, Big Data, and Cloud Computing)
- 4 2018/10/03 描述性分析I：數據的性質、統計模型與可視化
(Descriptive Analytics I: Nature of Data, Statistical Modeling, and Visualization)
- 5 2018/10/10 國慶紀念日 (放假一天) (National Day) (Day off)
- 6 2018/10/17 描述性分析II：商業智慧與資料倉儲
(Descriptive Analytics II: Business Intelligence and Data Warehousing)

課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容 (Subject/Topics)

7 2018/10/24 預測性分析I：資料探勘流程、方法與演算法
(Predictive Analytics I: Data Mining Process,
Methods, and Algorithms)

8 2018/10/31 預測性分析II：文本、網路與社群媒體分析
(Predictive Analytics II: Text, Web, and
Social Media Analytics)

9 2018/11/07 期中報告 (Midterm Project Report)

10 2018/11/14 期中考試 (Midterm Exam)

11 2018/11/21 處方性分析：最佳化與模擬
(Prescriptive Analytics: Optimization and Simulation)

12 2018/11/28 社會網絡分析
(Social Network Analysis)

課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容 (Subject/Topics)

13 2018/12/05 機器學習與深度學習
(Machine Learning and Deep Learning)

14 2018/12/12 自然語言處理
(Natural Language Processing)

15 2018/12/19 AI交談機器人與對話式商務
(AI Chatbots and Conversational Commerce)

16 2018/12/26 商業分析的未來趨勢、隱私與管理考量
(Future Trends, Privacy and
Managerial Considerations in Analytics)

17 2019/01/02 期末報告 (Final Project Presentation)

18 2019/01/09 期末考試 (Final Exam)

Business Intelligence (BI)

1 Introduction to BI and Data Science

2 Descriptive Analytics

3 Predictive Analytics

4 Prescriptive Analytics

5 Big Data Analytics

6 Future Trends

Social Network Analysis

Outline

- Social Computing and Social Network Analysis (SNA)
- Social Network Analysis with Gephi
- Applications of SNA

Social Computing

Social Network Analysis (SNA)

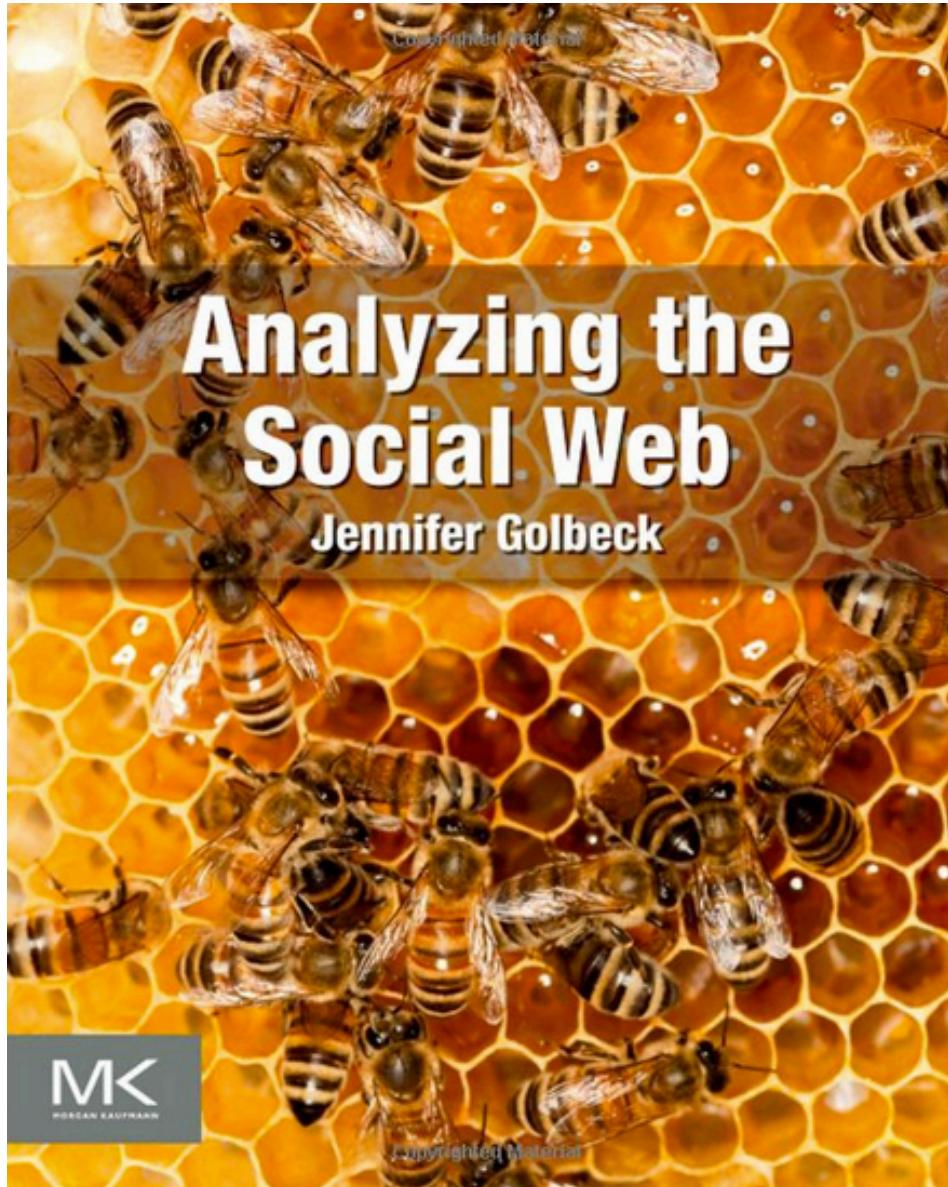
Social Computing

- Social Network Analysis
- Link mining
- Community Detection
- Social Recommendation

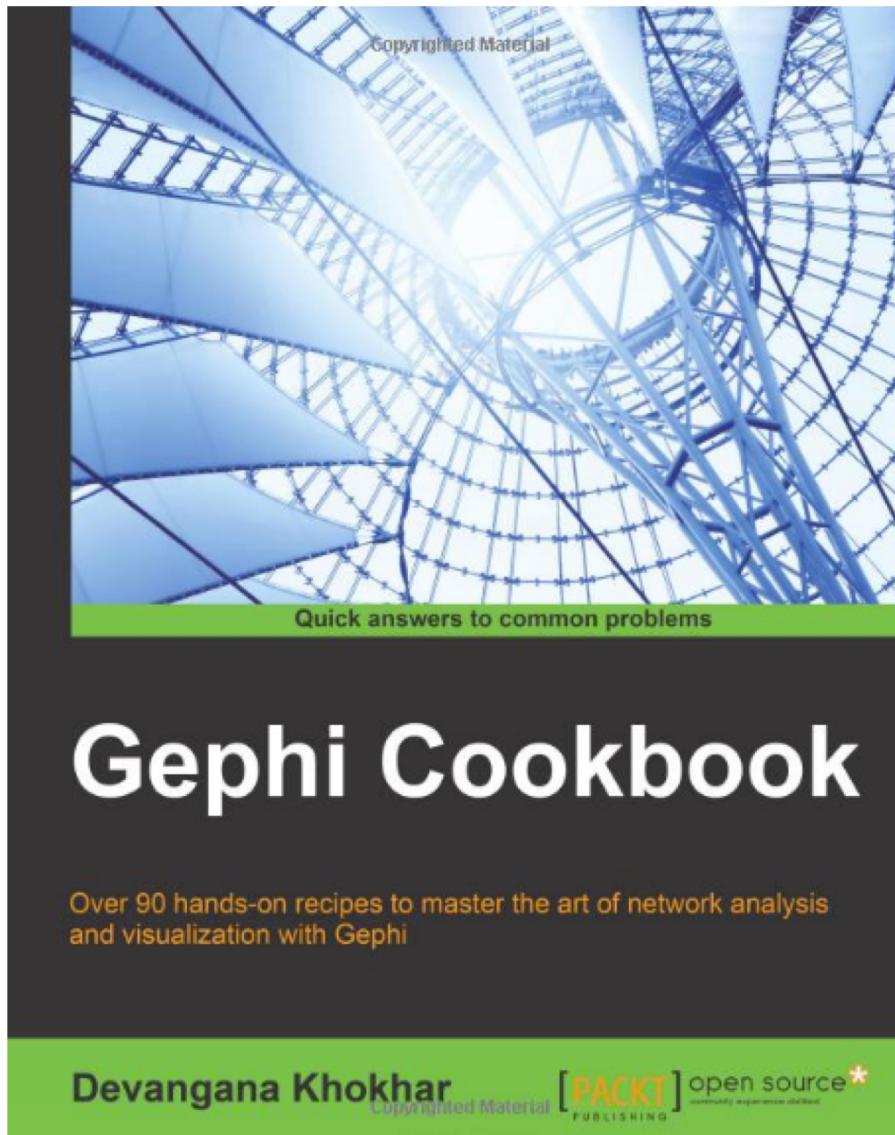
Business Insights with Social Analytics

Analyzing the Social Web: Social Network Analysis

Jennifer Golbeck (2013), **Analyzing the Social Web**, Morgan Kaufmann

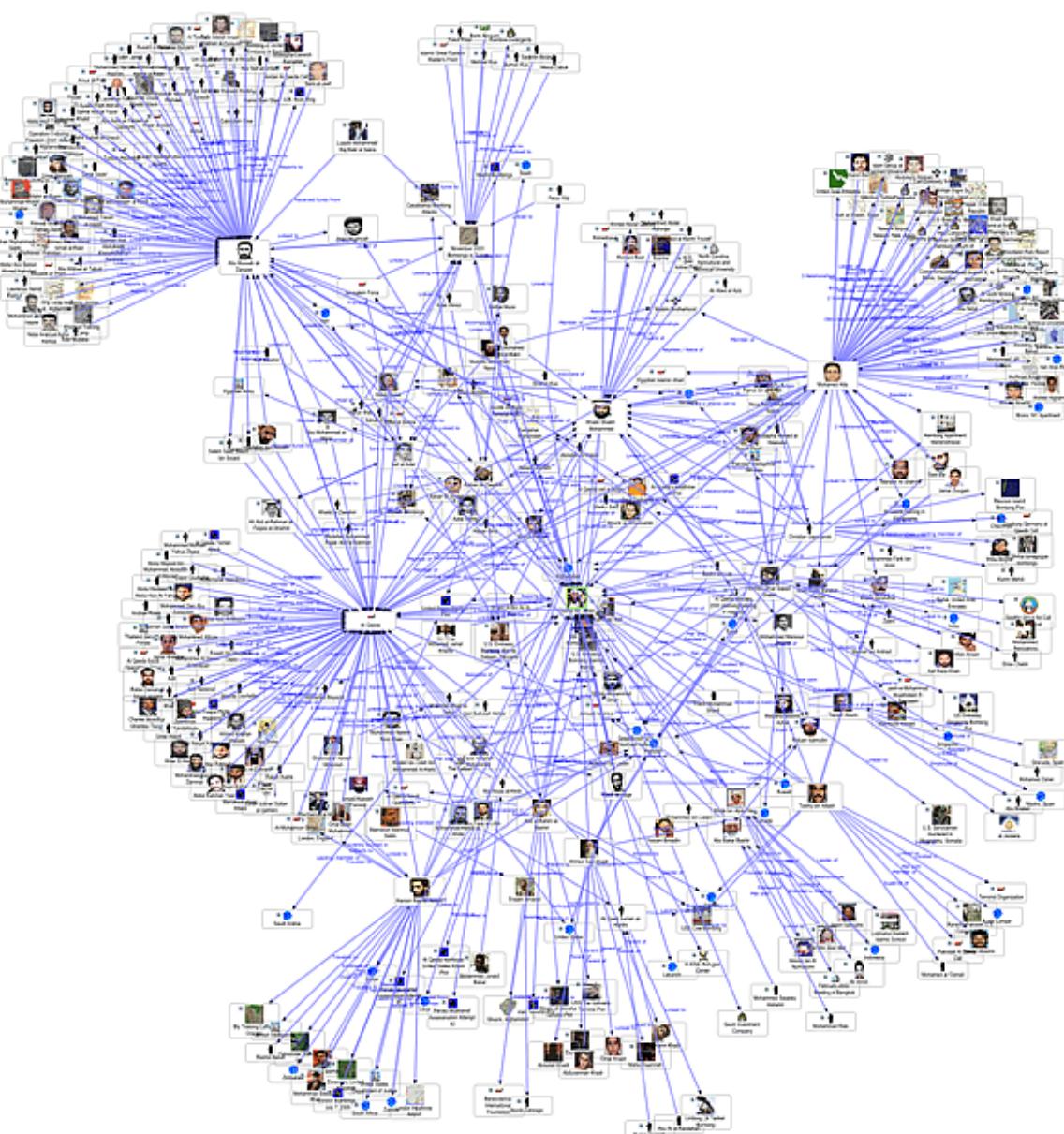


Devangana Khokhar (2015), Gephi Cookbook, Packt Publishing



Source: <http://www.amazon.com/Gephi-Cookbook-Devangana-Khokhar/dp/1783987405>

Social Network Analysis

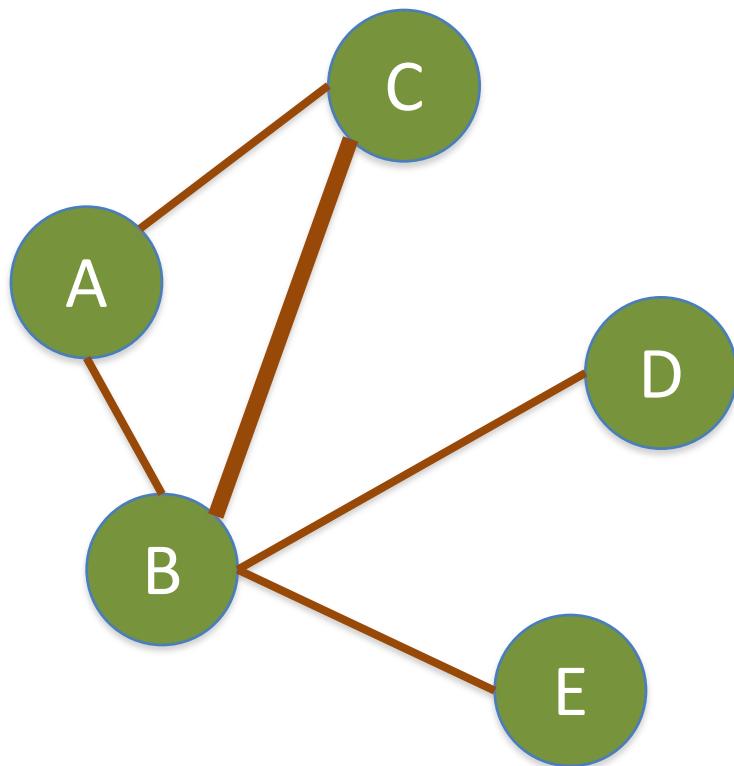


Social Network Analysis

- A **social network** is a social structure of people, related (**directly** or **indirectly**) to each other through a common relation or interest
- **Social network analysis (SNA)** is the study of social networks to understand their **structure** and **behavior**

Graph Theory

Graph



Graph

$$g = (V, E)$$

Vertex (Node)



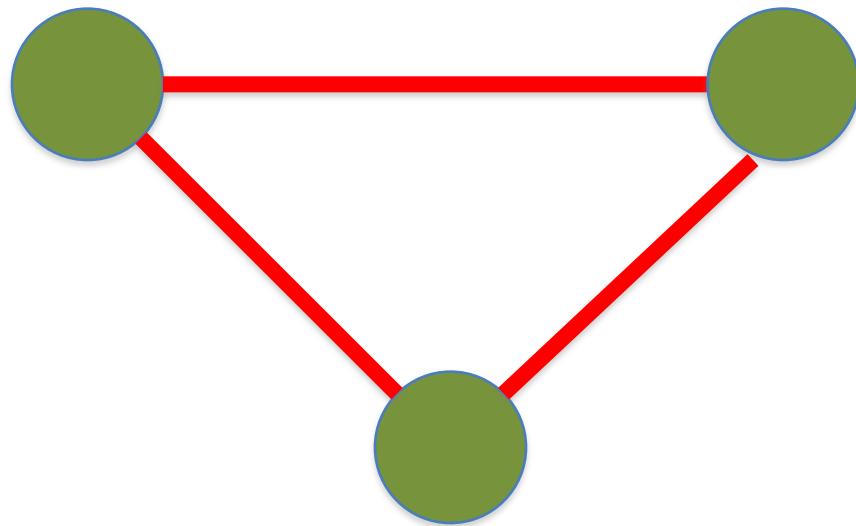
Vertices (Nodes)



Edge



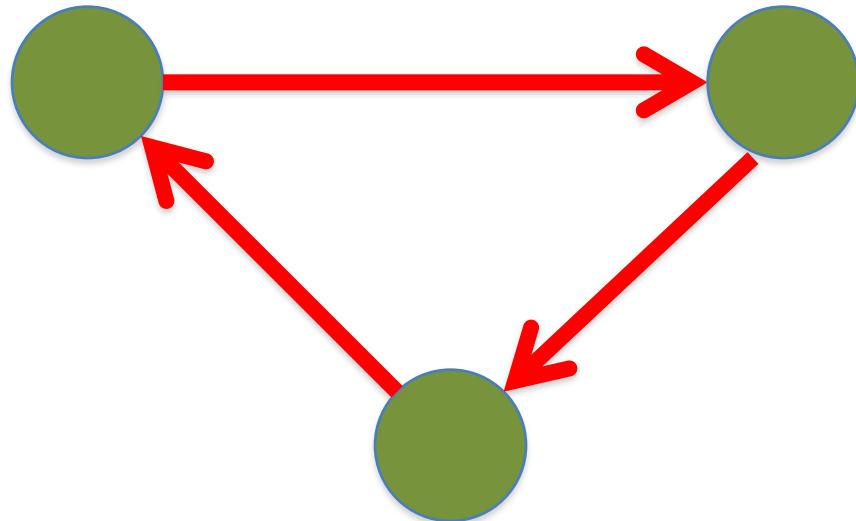
Edges



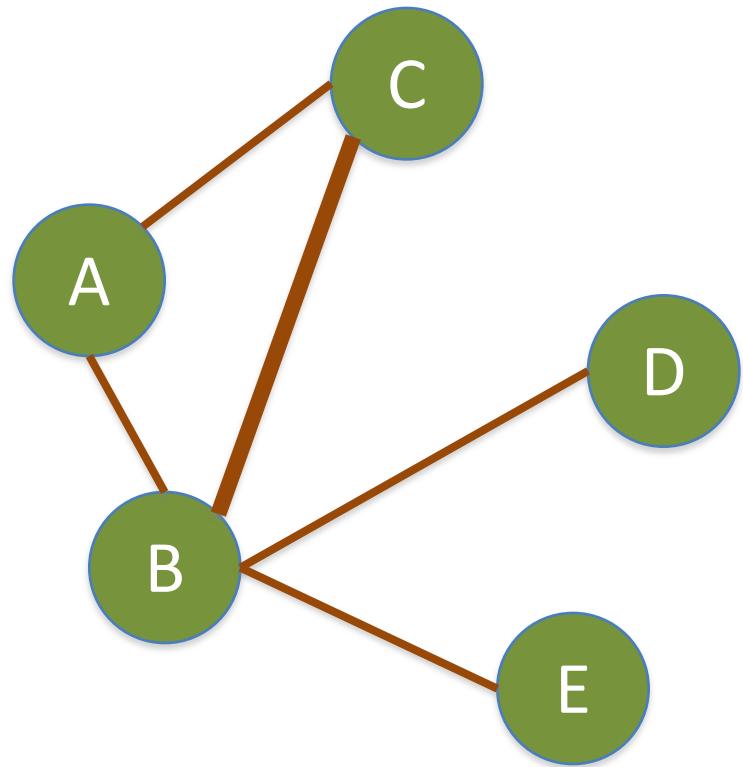
Arc



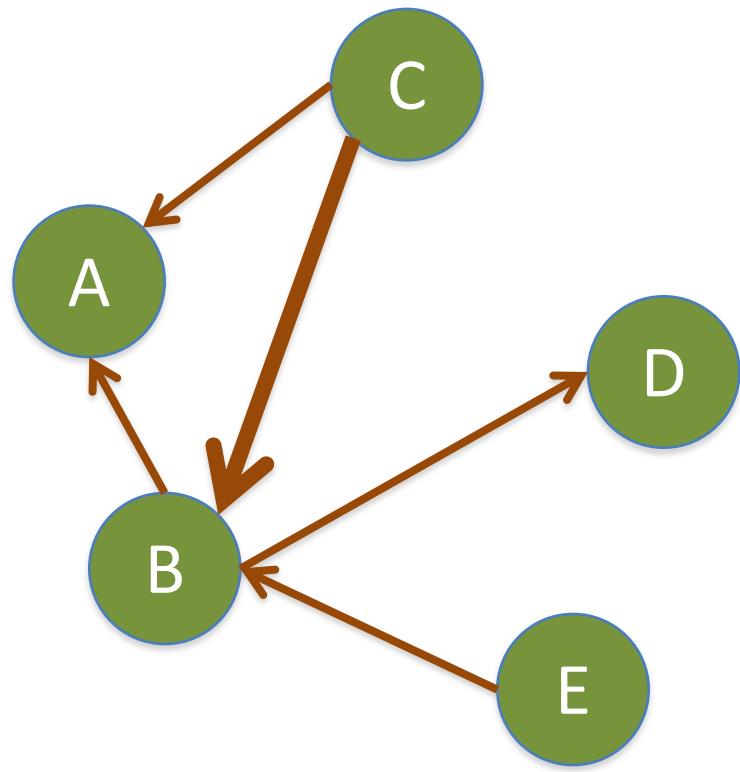
Arcs



Undirected Graph

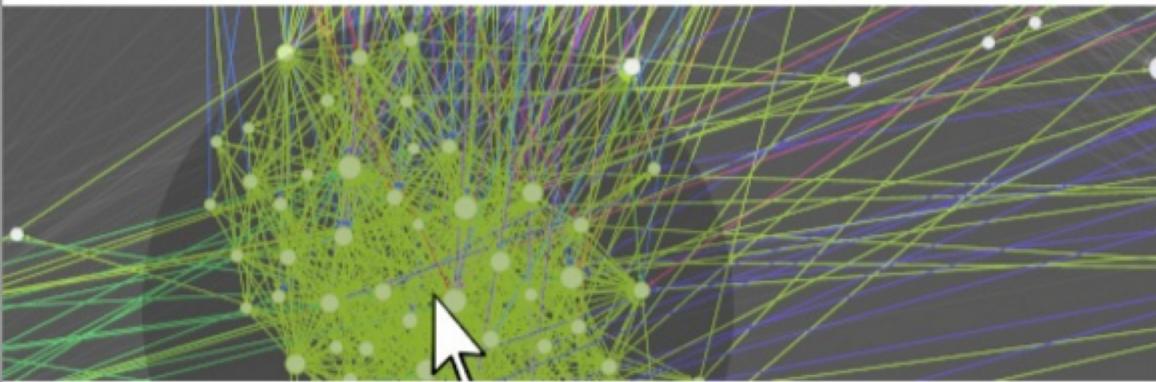
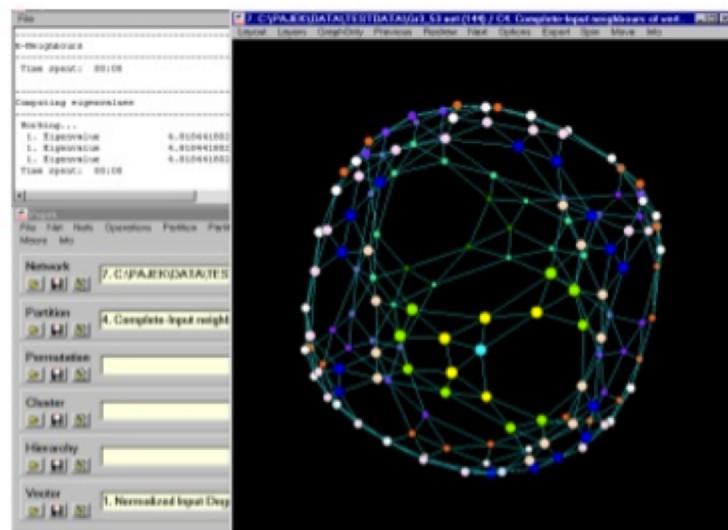


Directed Graph



Measurements of Social Network Analysis

Exploratory Network Analysis

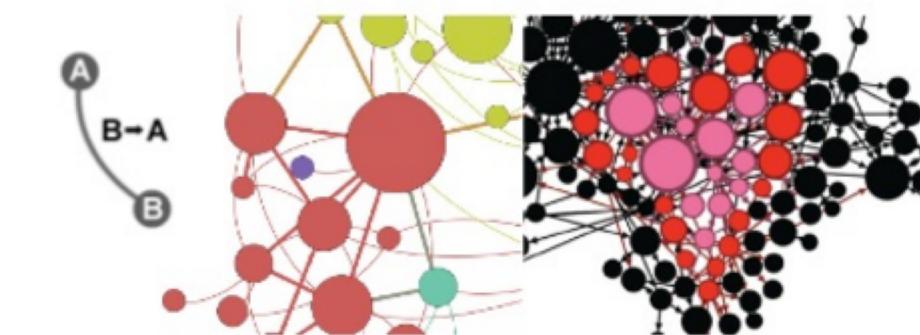
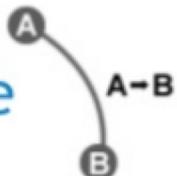


1 see the network

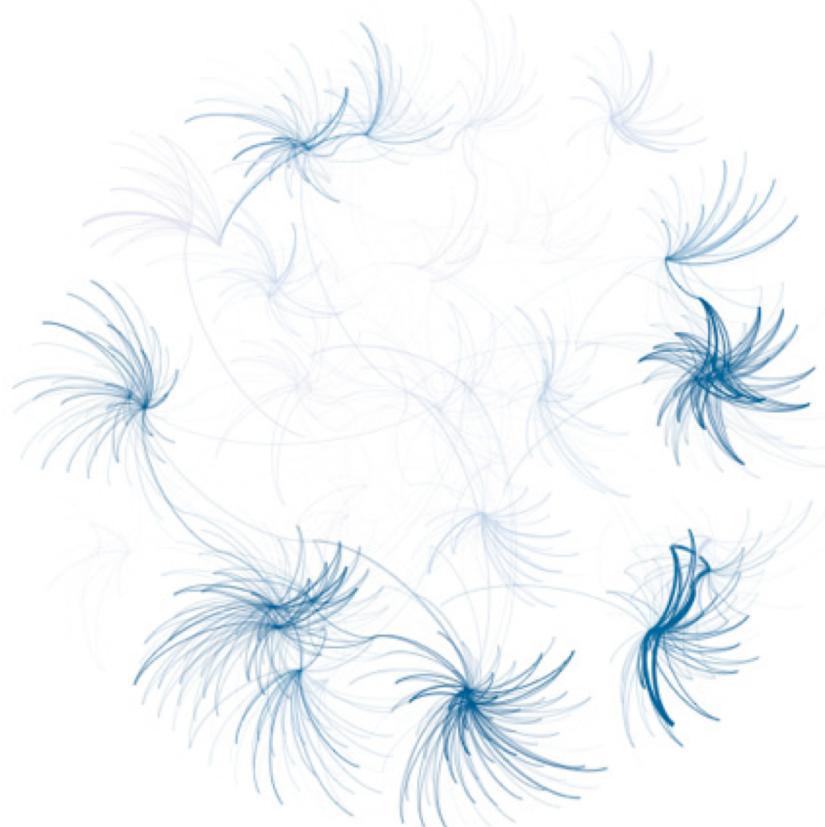
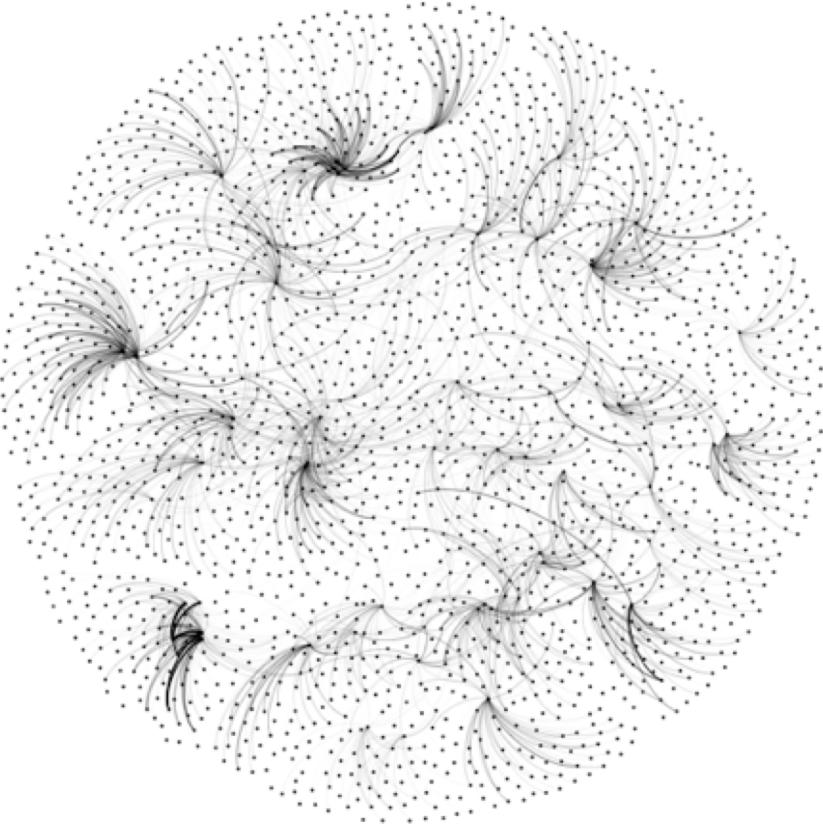
1st graph viz tool: Pajek (1996)
Vladimir Batagelj, Andrej Mrvar

3 build a visual language

size by rank, color by partition,
label, curved edges, thickness...



Looking for a “Simple Small Truth”? What Data Visualization Should Do?



1. Make complex things **simple**
2. Extract **small** information from large data
3. Present **truth**, do not deceive

Measurements

Looking for Orderness in Data

Make varying 3 cursors simultaneously to extract **meaningful patterns**



at different levels



on multiple dimensions

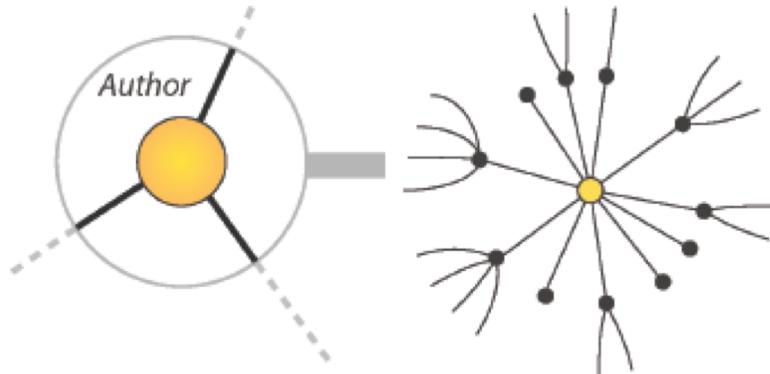
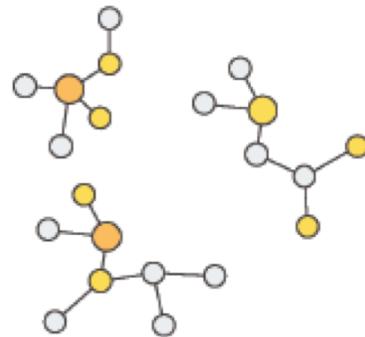


at time scale

“Zoom” cursor on Quantitative Data

MICRO level

MACRO level



Global

- connectivity
- density
- centralization

Local

- communities
- bridges between communities
- local centers vs periphery

Individual

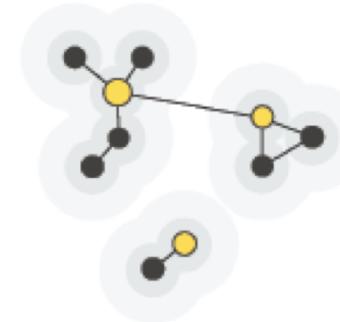
- centrality
- distances
- neighborhood
- location
- local authority vs hub

“Crossing” cursor on Quantitative Data



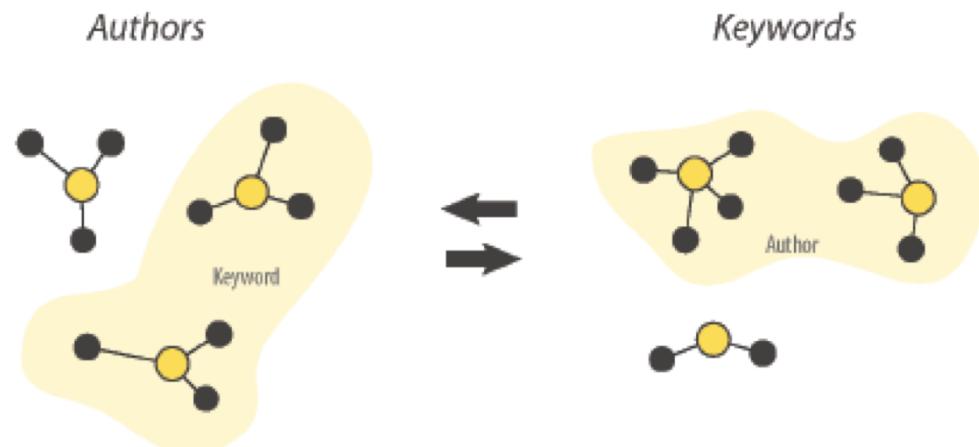
Social

- who with whom
- communities
- brokerage
- influence and power
- homophily



Semantic

- topics
- thematic clusters



Geographic

- spatial phenomena

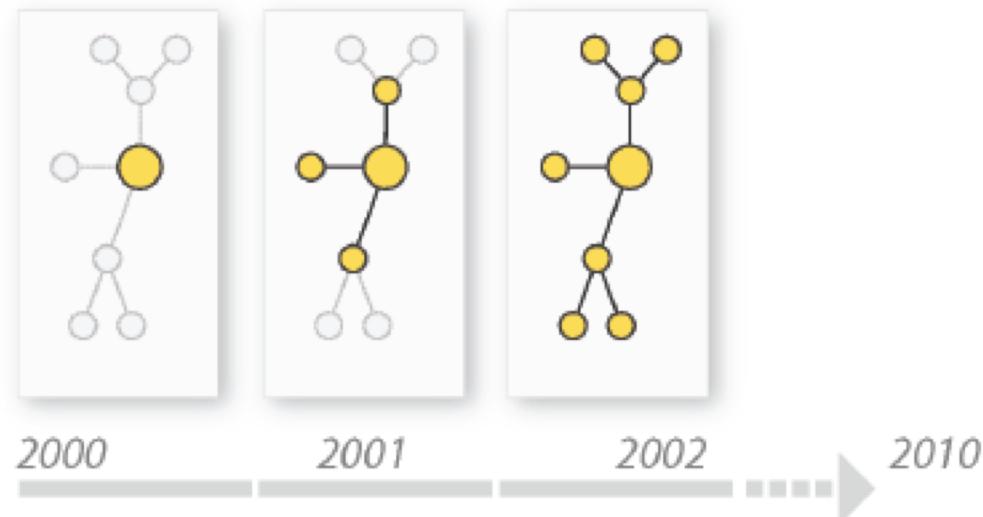
“Timeline” cursor on Temporal Data



Evolution of social ties

Evolution of communities

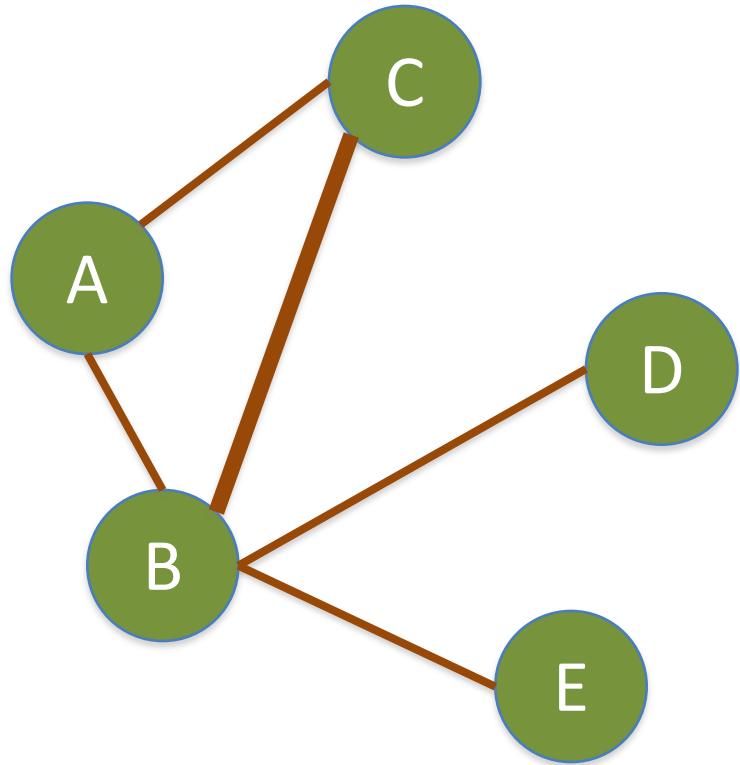
Evolution of topics



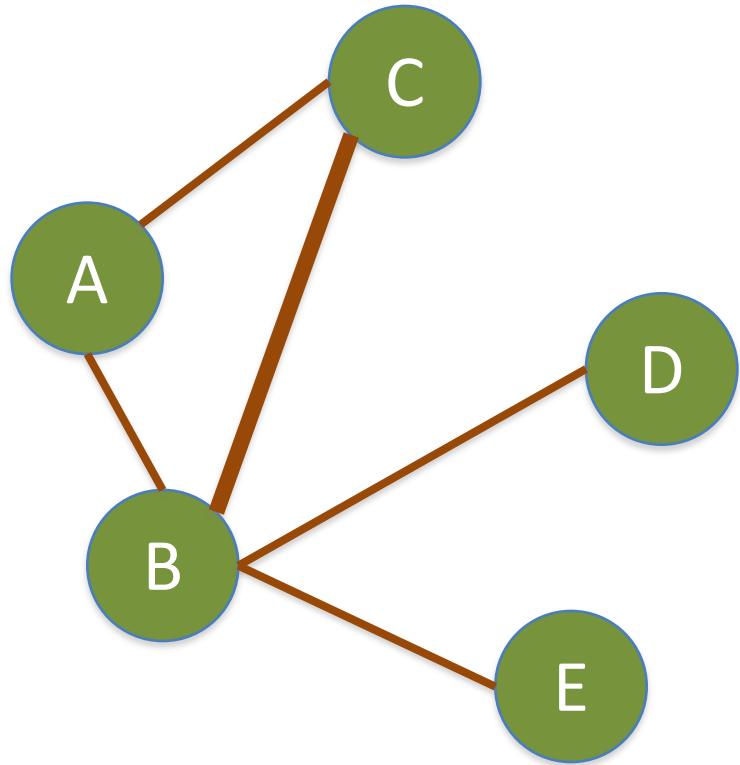
SNA Guideline

# nodes	
1 - 100	lists + edges in bonus, focus on qualitative data
100 - 1,000	<p>How attributes explain the structure?</p> <ul style="list-style-type: none">• easy to read, “obvious” patterns• focus on entities (in context)• metrics are tools to describe the graph (centrality, bridging...)• links help to build and interpret categories of entities <p>challenge: mix attribute crossing and connectivity</p>
1,000 - 50,000	<p>How the structure explains attributes?</p> <ul style="list-style-type: none">• hard to read, problem of “hidden signals”: track patterns with various layouts and filtering• focus on structures• metrics are tools to build the graph (cosine similarity...)• categories help to understand the structure <p>challenge: pattern recognition</p>
> 50,000	require high computational power

Degree

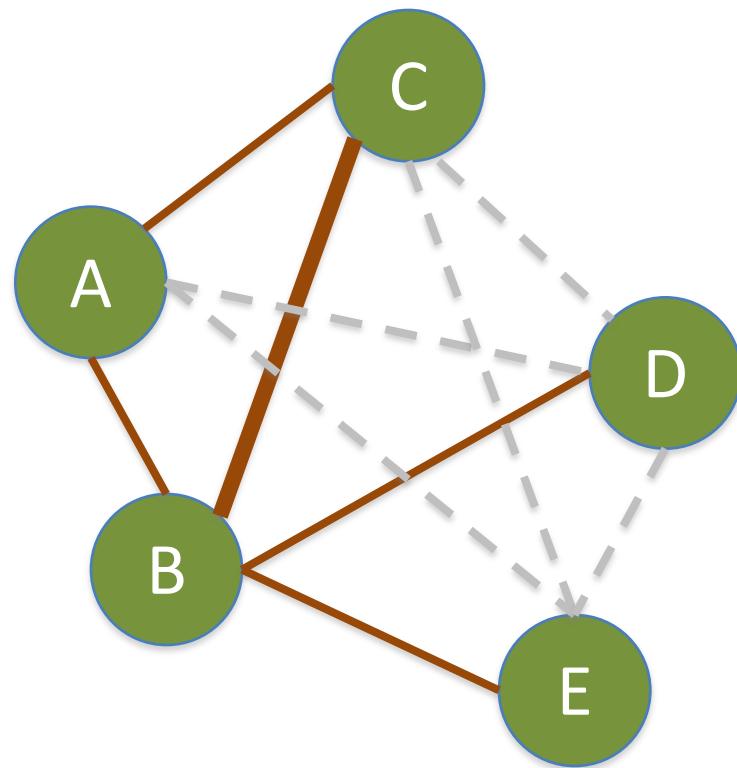


Degree



A: 2
B: 4
C: 2
D: 1
E: 1

Density

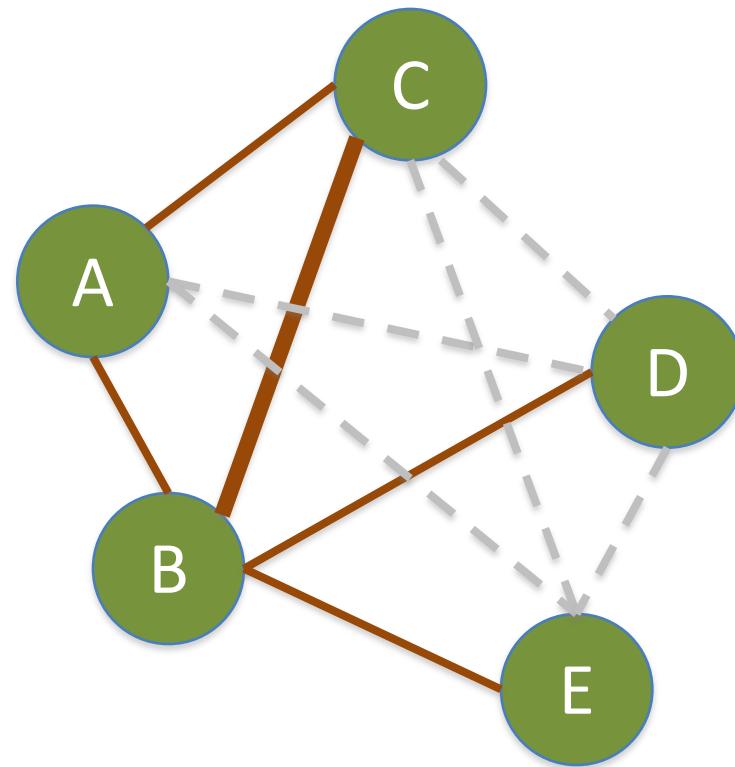


Density

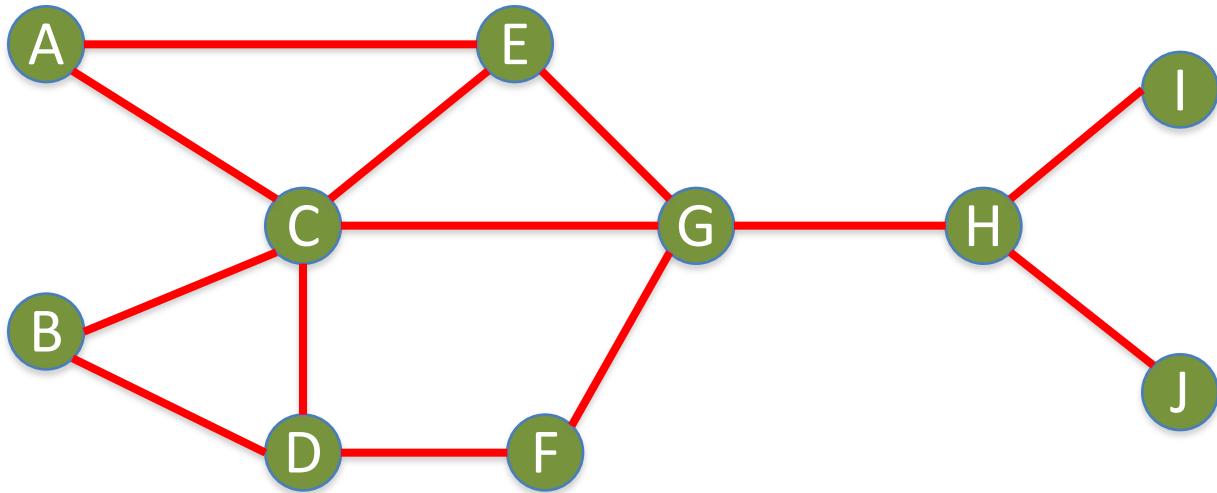
Edges (Links): 5

Total Possible Edges: 10

Density: $5/10 = 0.5$



Density



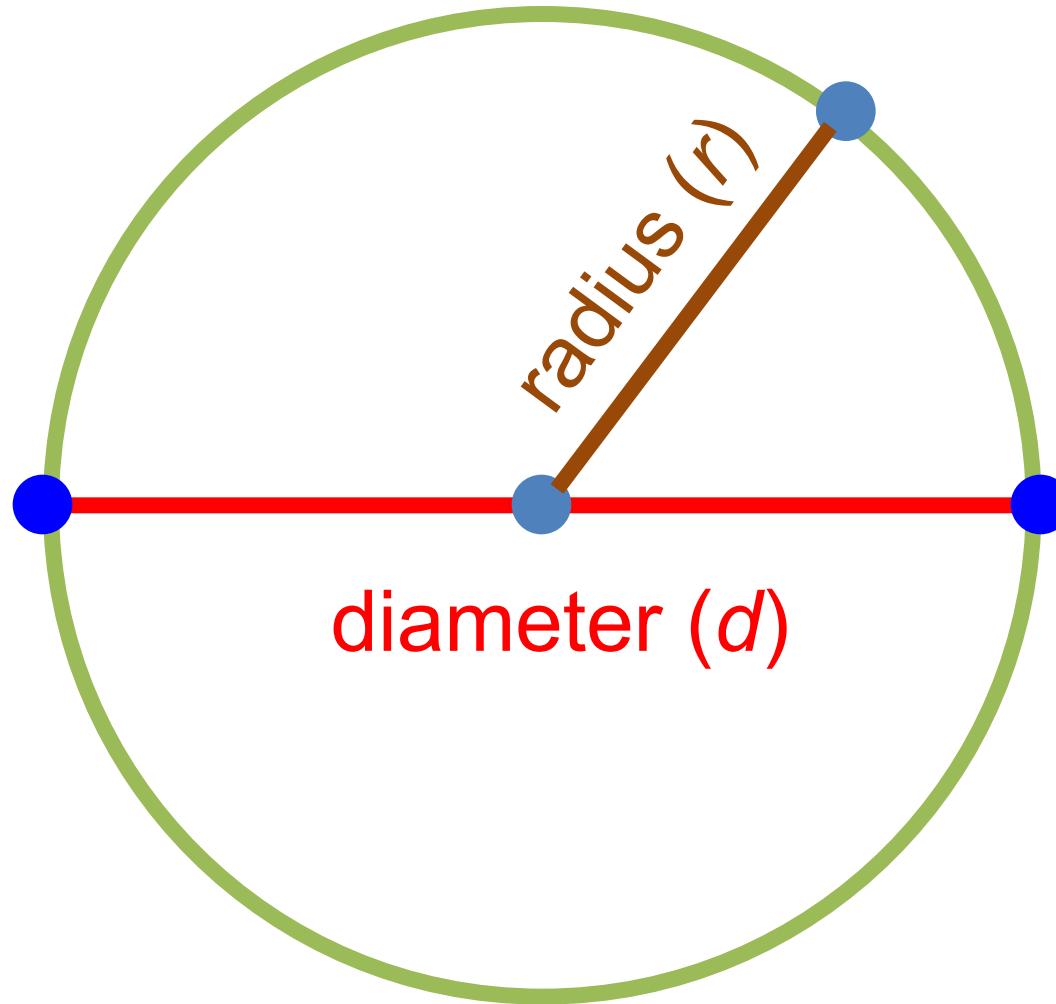
Nodes (n): 10

Edges (Links): 13

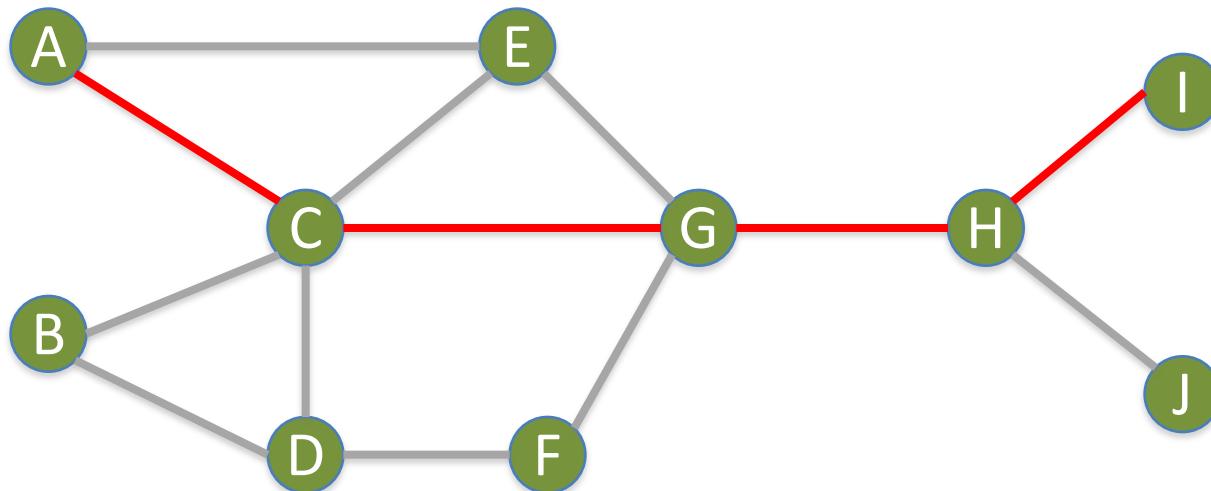
Total Possible Edges: $(n * (n-1)) / 2 = (10 * 9) / 2 = 45$

Density: $13/45 = 0.29$

Diameter

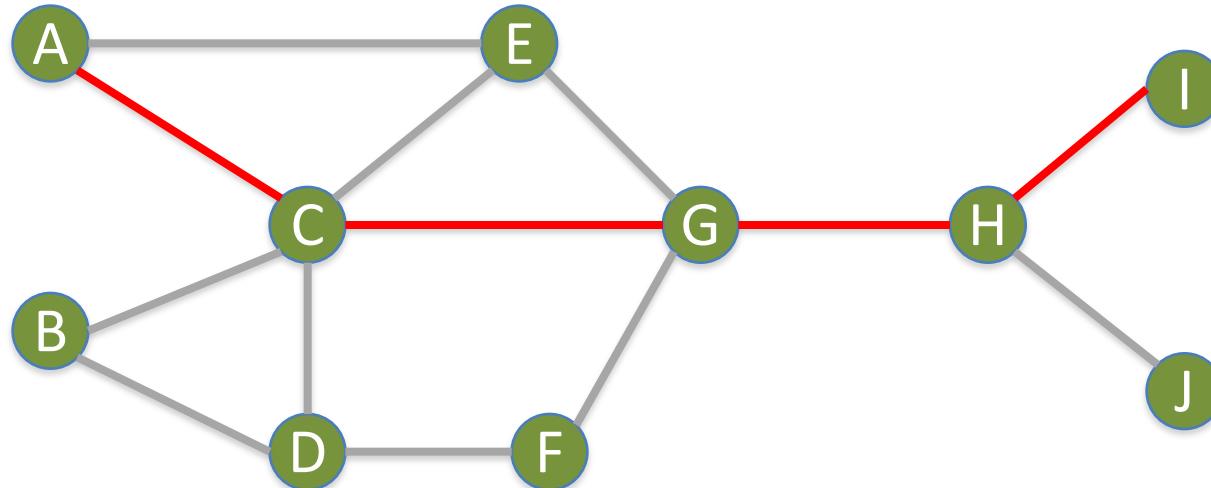


Diameter



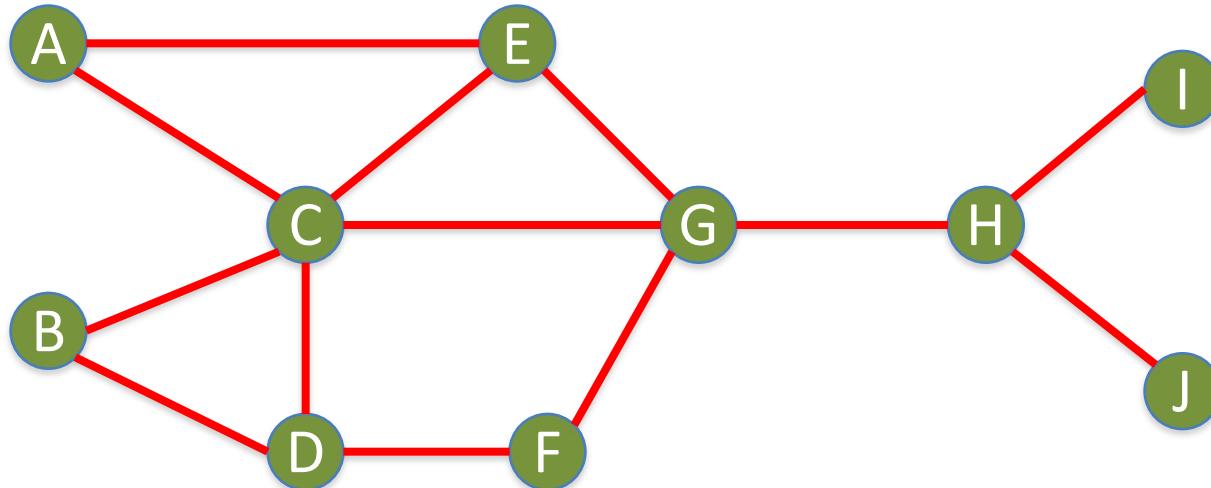
Diameter

Geodesic Path (Shortest Path)



$A \rightarrow I$: Diameter = 4

Which Node is Most Important?



Centrality

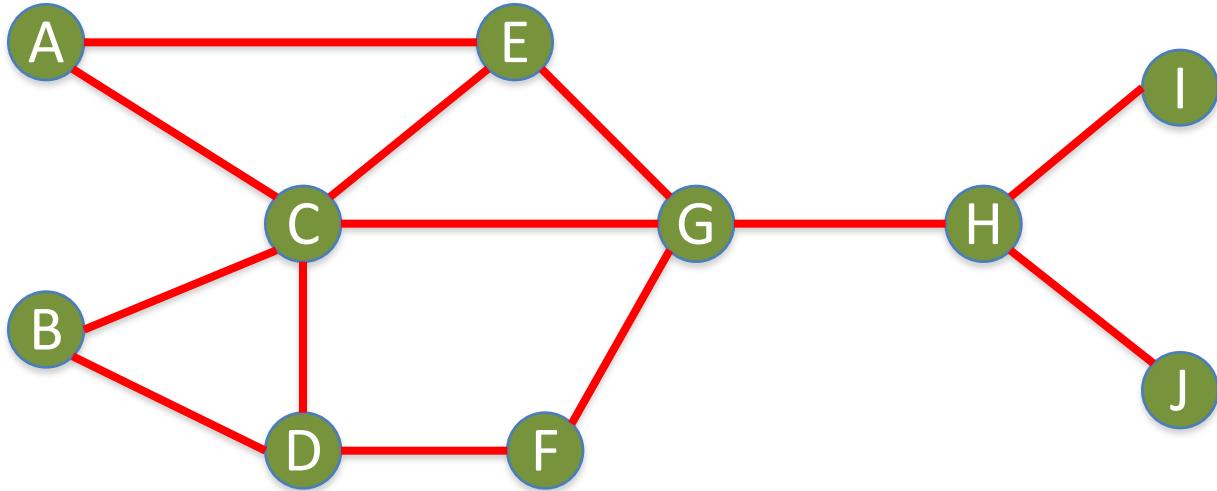
- Important or prominent actors are those that are linked or involved with other actors extensively.
- A person with extensive contacts (links) or communications with many other people in the organization is considered more important than a person with relatively fewer contacts.
- The links can also be called **ties**.
A **central actor** is one involved in many ties.

Social Network Analysis (SNA)

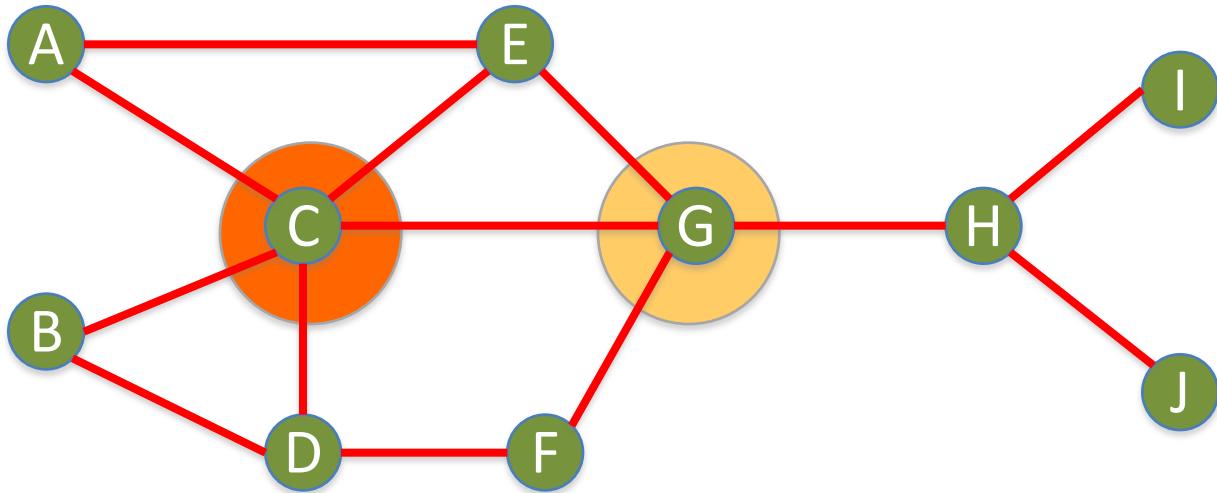
- Degree Centrality
- Betweenness Centrality
- Closeness Centrality

Degree Centrality

Social Network Analysis: Degree Centrality



Social Network Analysis: Degree Centrality



Node	Score	Standardized Score
A	2	$2/10 = 0.2$
B	2	$2/10 = 0.2$
C	5	$5/10 = 0.5$
D	3	$3/10 = 0.3$
E	3	$3/10 = 0.3$
F	2	$2/10 = 0.2$
G	4	$4/10 = 0.4$
H	3	$3/10 = 0.3$
I	1	$1/10 = 0.1$
J	1	$1/10 = 0.1$

Betweenness Centrality

Betweenness centrality: Connectivity

Number of shortest paths
going through the actor

Betweenness Centrality

$$C_B(i) = \sum_{j < k} g_{ik}(i) / g_{jk}$$

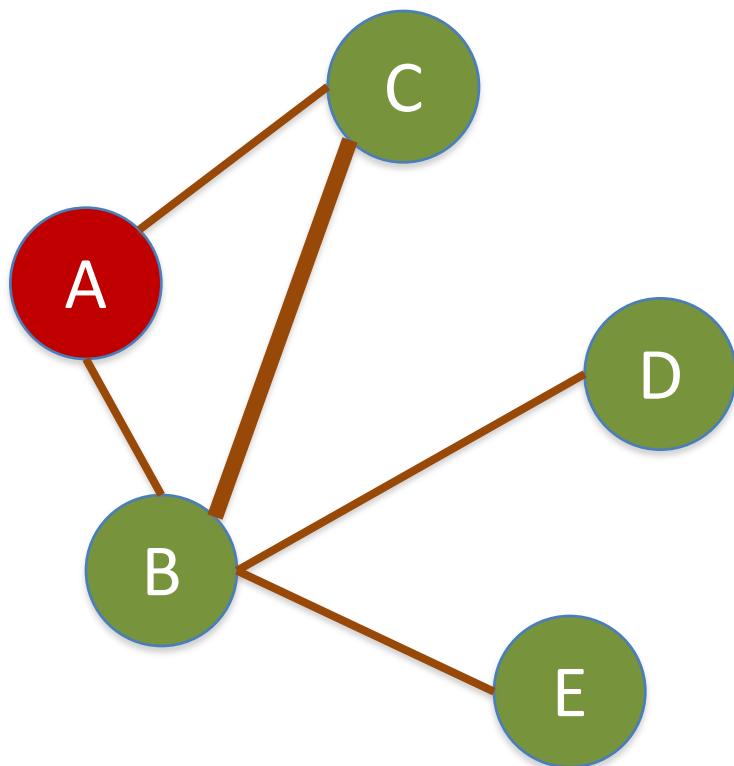
Where g_{jk} = the number of shortest paths connecting jk
 $g_{jk}(i)$ = the number that actor i is on.

Normalized Betweenness Centrality

$$C'_B(i) = C_B(i) / [((n-1)(n-2)/2)]$$

Number of pairs of vertices
excluding the vertex itself

Betweenness Centrality



A:

$$B \rightarrow C: 0/1 = 0$$

$$B \rightarrow D: 0/1 = 0$$

$$B \rightarrow E: 0/1 = 0$$

$$C \rightarrow D: 0/1 = 0$$

$$C \rightarrow E: 0/1 = 0$$

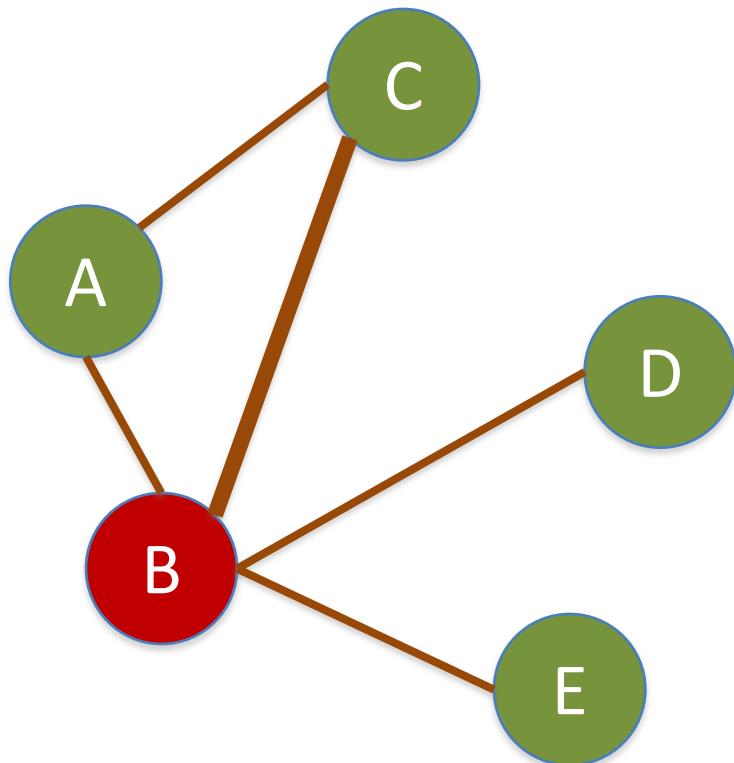
$$D \rightarrow E: 0/1 = 0$$

—

Total: 0

A: Betweenness Centrality = 0

Betweenness Centrality



B:

$$A \rightarrow C: 0/1 = 0$$

$$A \rightarrow D: 1/1 = 1$$

$$A \rightarrow E: 1/1 = 1$$

$$C \rightarrow D: 1/1 = 1$$

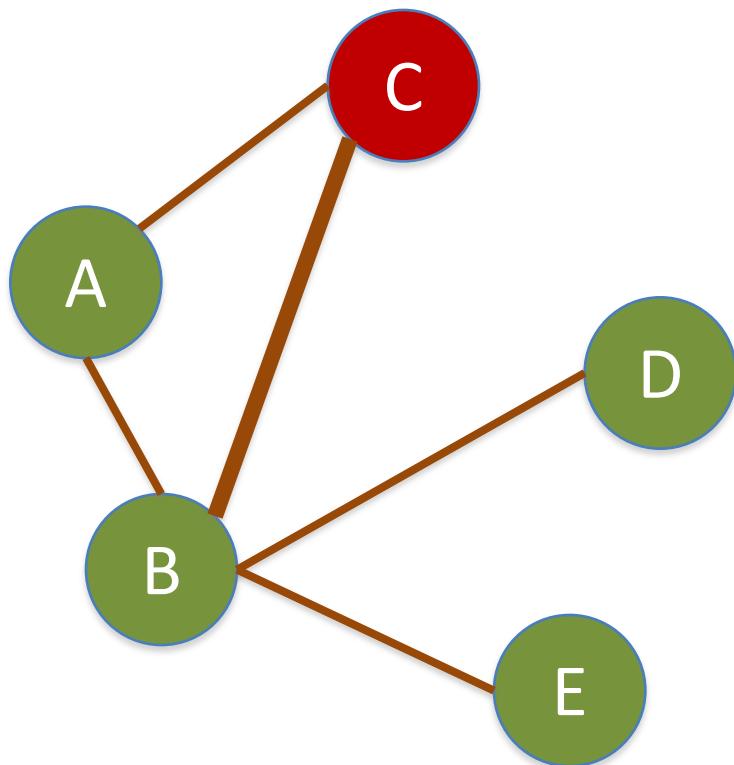
$$C \rightarrow E: 1/1 = 1$$

$$D \rightarrow E: 1/1 = 1$$

Total: 5

B: Betweenness Centrality = 5

Betweenness Centrality



C:

$$A \rightarrow B: 0/1 = 0$$

$$A \rightarrow D: 0/1 = 0$$

$$A \rightarrow E: 0/1 = 0$$

$$B \rightarrow D: 0/1 = 0$$

$$B \rightarrow E: 0/1 = 0$$

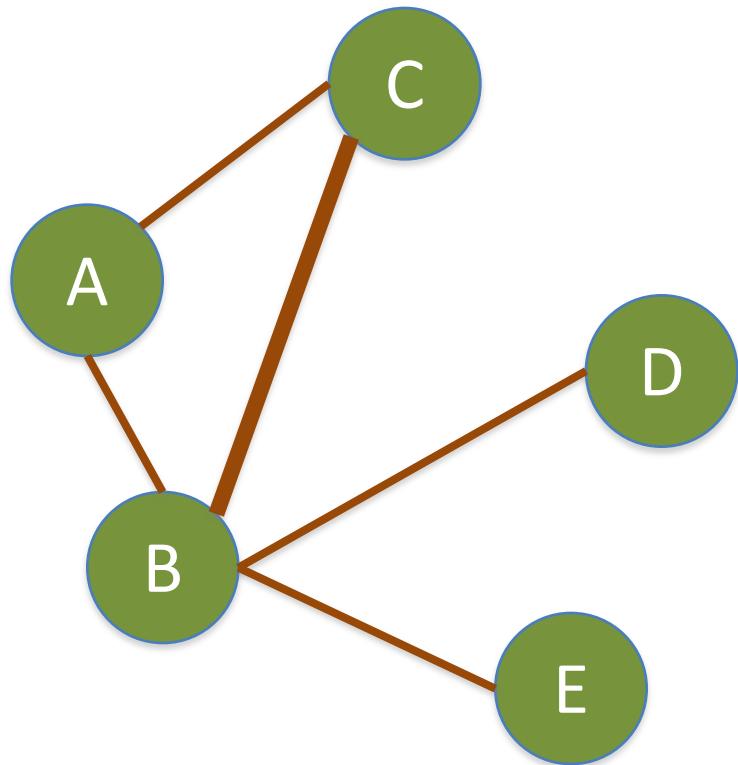
$$D \rightarrow E: 0/1 = 0$$

—

Total: 0

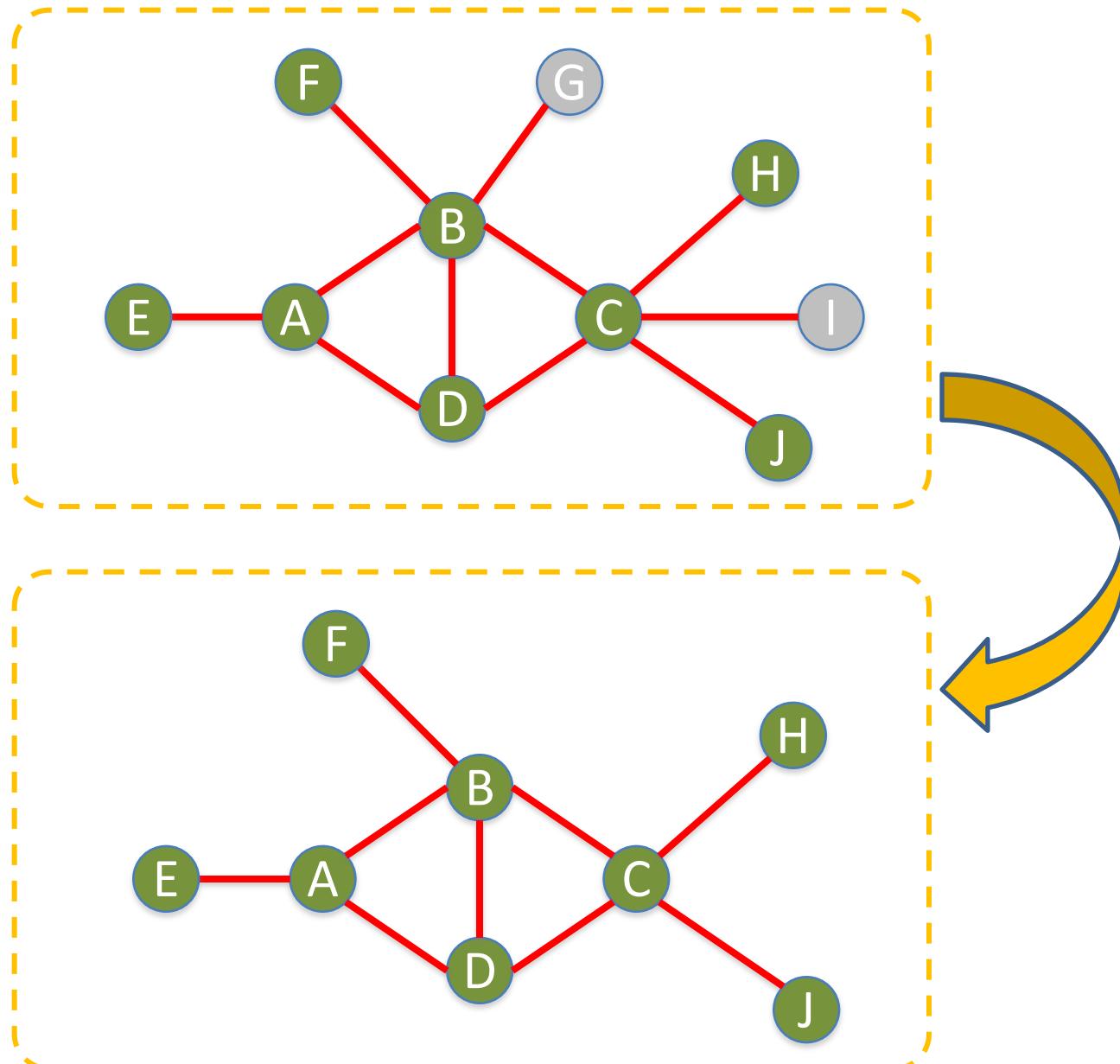
C: Betweenness Centrality = 0

Betweenness Centrality

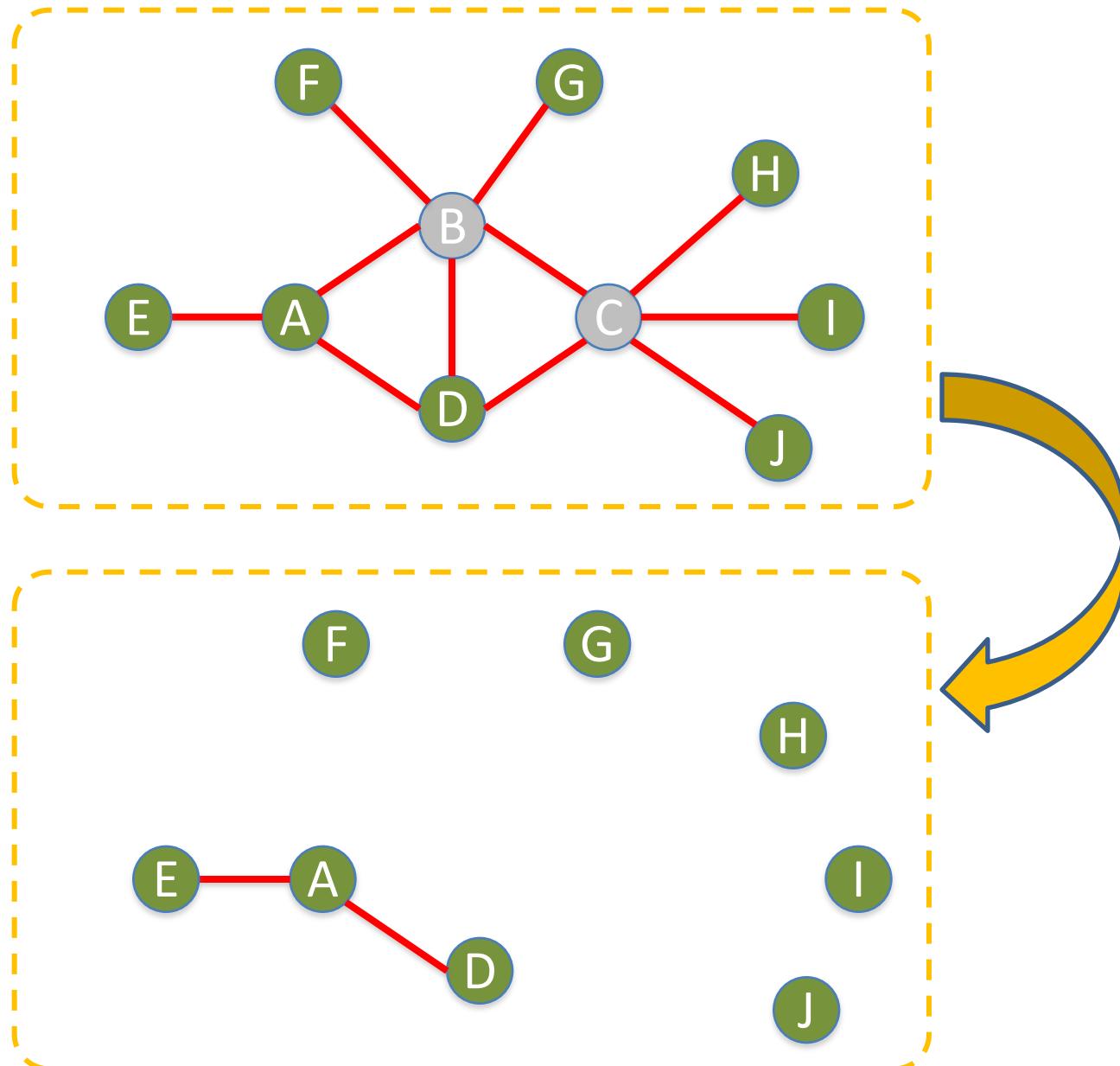


A: 0
B: 5
C: 0
D: 0
E: 0

Which Node is Most Important?

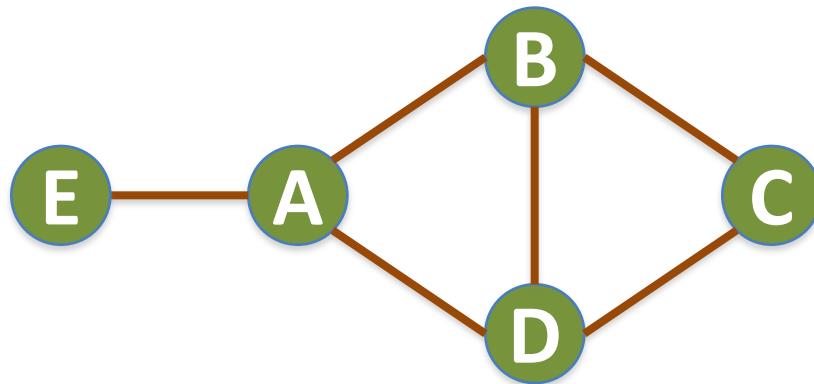


Which Node is Most Important?

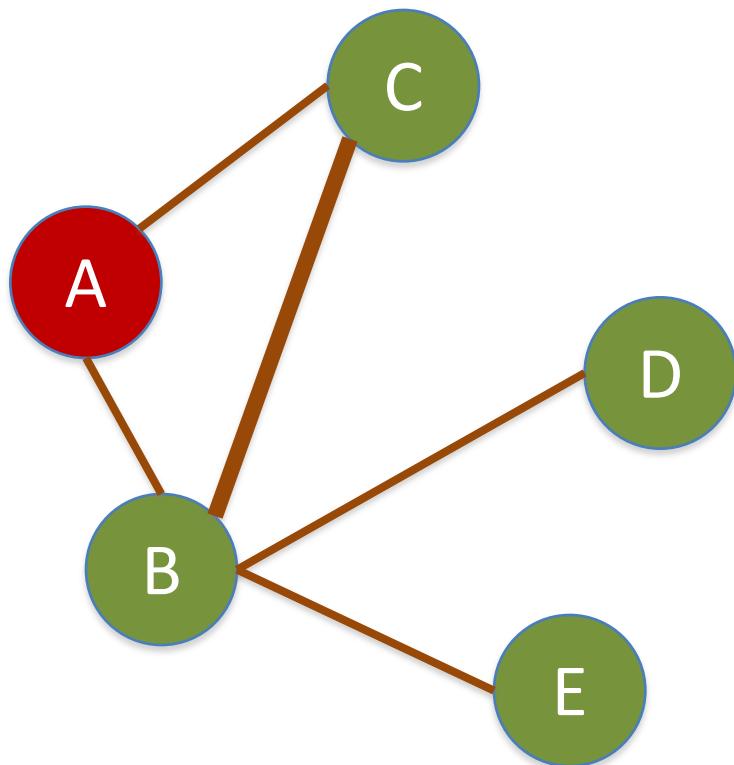


Betweenness Centrality

$$C_B(i) = \sum_{j < k} g_{ik}(i) / g_{jk}$$



Betweenness Centrality



A:

$$B \rightarrow C: 0/1 = 0$$

$$B \rightarrow D: 0/1 = 0$$

$$B \rightarrow E: 0/1 = 0$$

$$C \rightarrow D: 0/1 = 0$$

$$C \rightarrow E: 0/1 = 0$$

$$D \rightarrow E: 0/1 = 0$$

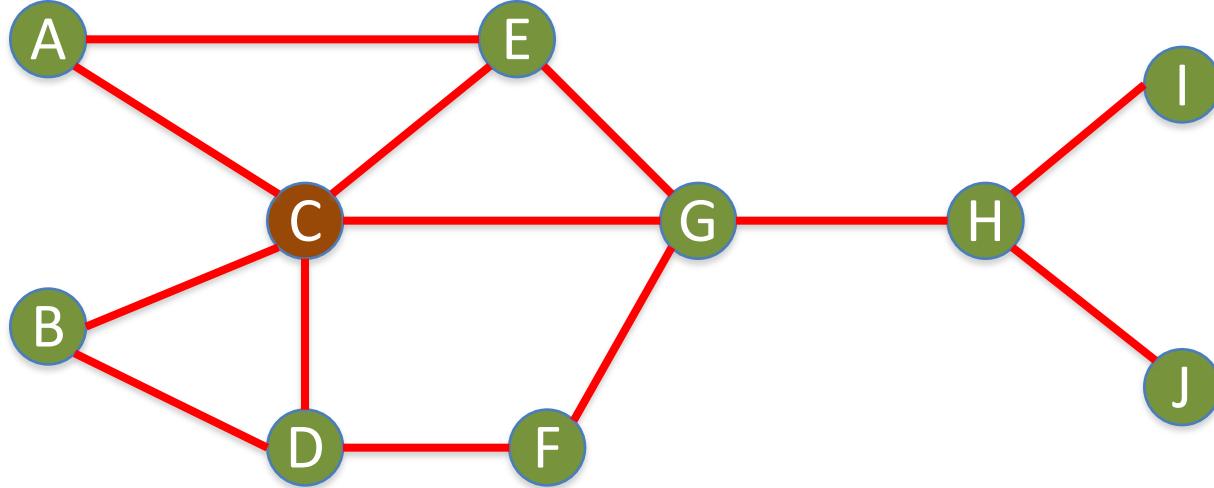
—

Total: 0

A: Betweenness Centrality = 0

Closeness Centrality

Social Network Analysis: Closeness Centrality

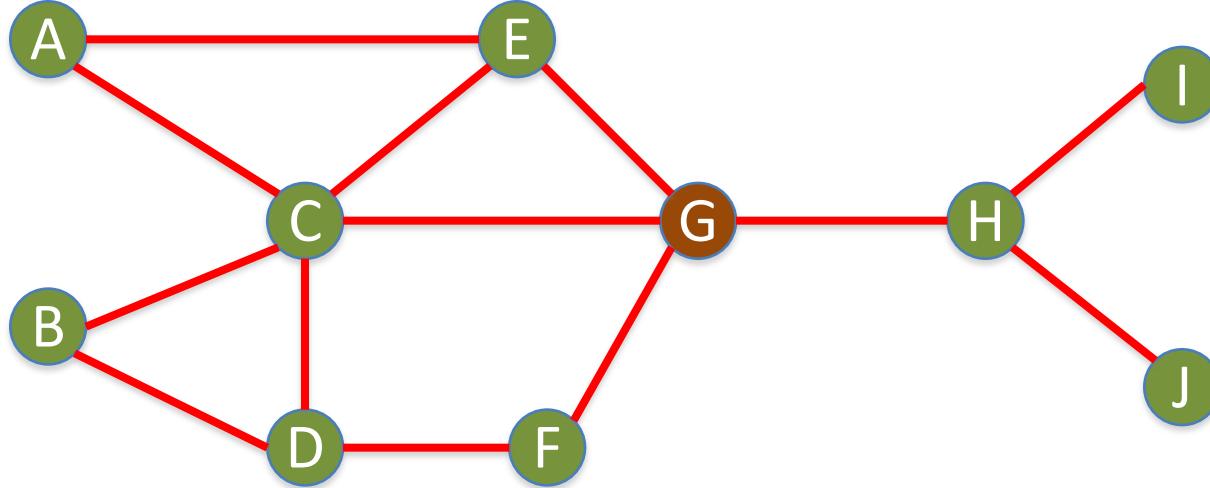


C→A:	1
C→B:	1
C→D:	1
C→E:	1
C→F:	2
C→G:	1
C→H:	2
C→I:	3
C→J:	3

Total=15

C: Closeness Centrality = $15/9 = 1.67$

Social Network Analysis: Closeness Centrality

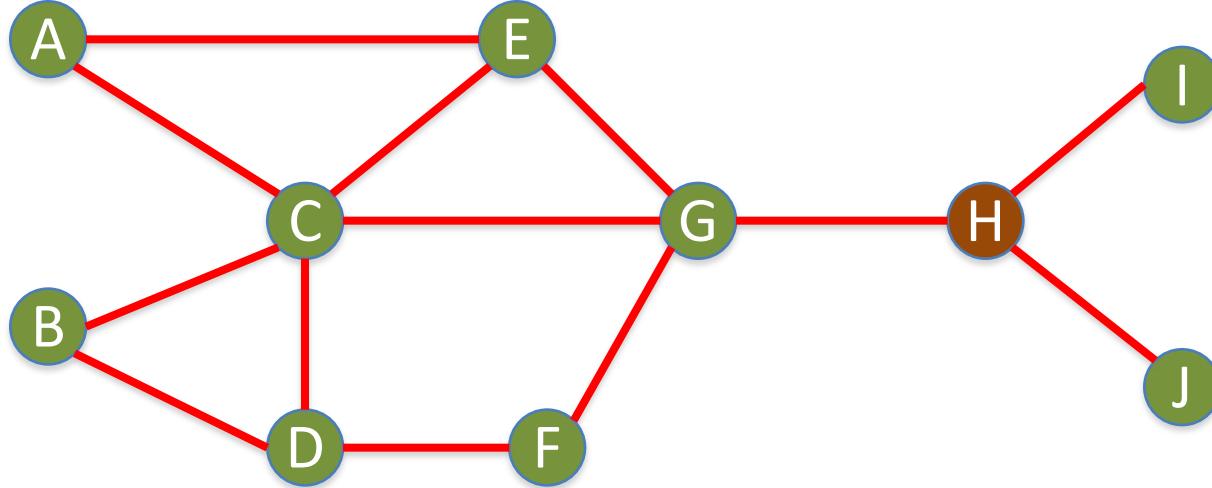


G→A:	2
G→B:	2
G→C:	1
G→D:	2
G→E:	1
G→F:	1
G→H:	1
G→I:	2
G→J:	2

Total=14

G: Closeness Centrality = $14/9 = 1.56$

Social Network Analysis: Closeness Centrality

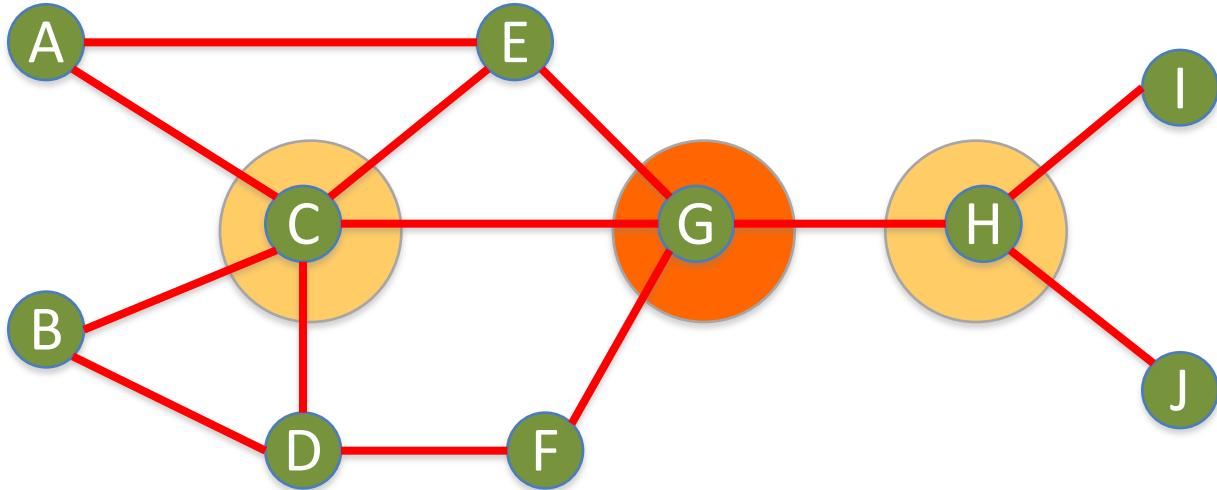


H→A:	3
H→B:	3
H→C:	2
H→D:	2
H→E:	2
H→F:	2
H→G:	1
H→I:	1
H→J:	1

Total=17

H: Closeness Centrality = $17/9 = 1.89$

Social Network Analysis: Closeness Centrality



G: Closeness Centrality = $14/9 = 1.56$ 1

C: Closeness Centrality = $15/9 = 1.67$ 2

H: Closeness Centrality = $17/9 = 1.89$ 3

Social Network Analysis (SNA)

importance of neighbors

Eigenvector centrality

Eigenvector centrality:
Importance of a node
depends on
the importance of its neighbors

Social Network Analysis: Closeness Centrality

Sum of the reciprocal distances

$$C_C(p_k) = \sum_{i=1}^n d(p_i, p_k)^{-1}$$

where $d(p_j, p_k)$ is the geodesic distance (shortest paths) linking p_j, p_k

Social Network Analysis: Betweenness Centrality

$$C_B(p_k) = \sum_{i < j}^n \frac{g_{ij}(p_k)}{g_{ij}}; \quad i \neq j \neq k$$

where g_{ij} is the geodesic distance (shortest paths) linking p_i and p_j and $g_{ij}(p_k)$ is the geodesic distance linking p_i and p_j that contains p_k .

Social Network Analysis: Degree Centrality

$$C_D(p_k) = \sum_{i=1}^n a(p_i, p_k)$$

where $a(p_i, p_k) = 1$ if and only if p_i and p_k are connected by a line
0 otherwise

$$C'_D(p_k) = \frac{\sum_{i=1}^n a(p_i, p_k)}{n-1}$$

Social Networks, 1 (1978/79) 215–239
©Elsevier Sequoia S.A., Lausanne – Printed in the Netherlands

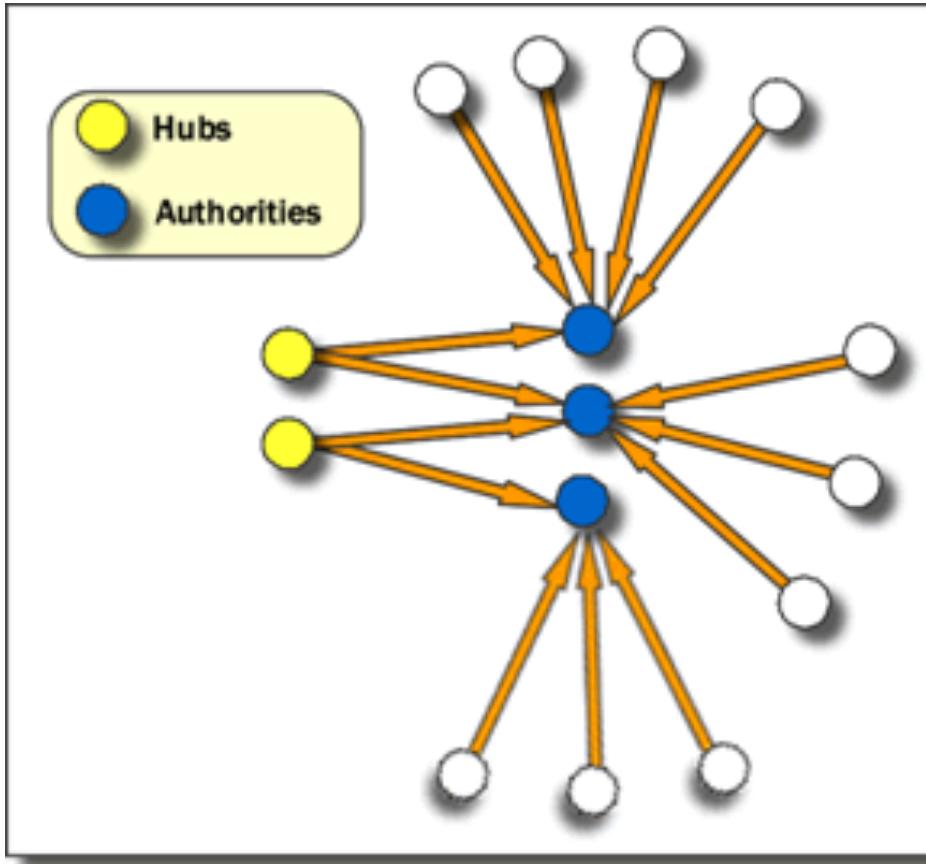
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Centrality in Social Networks Conceptual Clarification

Linton C. Freeman

Lehigh University *

Social Network Analysis: Hub and Authority



Hubs are entities that point to a relatively large number of authorities. They are essentially the mutually reinforcing analogues to authorities. Authorities point to high hubs. Hubs point to high authorities. You cannot have one without the other.

Tools of Social Network Analysis

Social Network Analysis (SNA) Tools

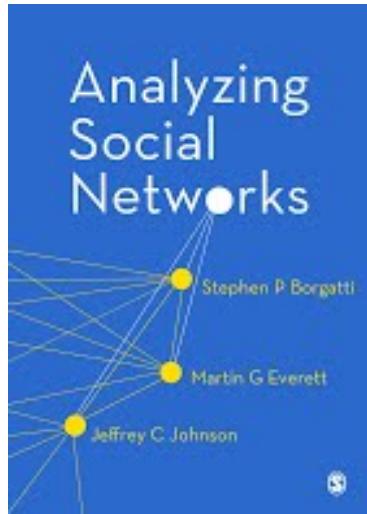
- **NetworkX**

- **igraph**

- **Gephi**

- **UCINet**

- **Pajek**



Tools of Social Network Analysis

- Focused Desktop Tools

- Gephi**

- Ucinet

- Pajek

- NodeXL

- Cytoscape

Tools of Social Network Analysis

- Developer Tools
 - NetworkX
 - iGraph
 - SNAP
 - sigma.js

Gephi



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The Open Graph Viz Platform

Gephi is the leading visualization and exploration software for all kinds of graphs and networks. Gephi is open-source and free.

Runs on Windows, Mac OS X and Linux.

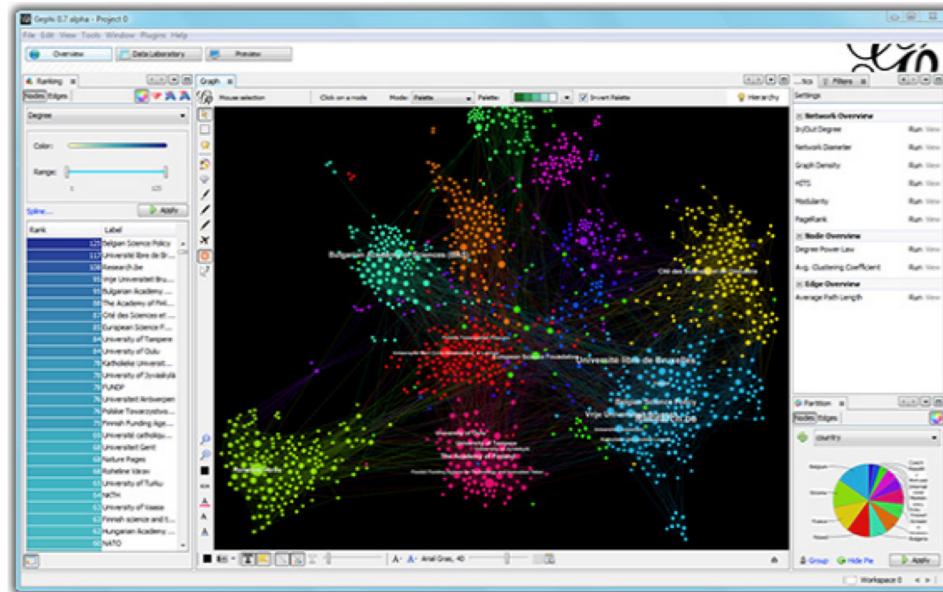
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Gephi 0.9.1

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APPLICATIONS

- ✓ **Exploratory Data Analysis:** intuition-oriented analysis by networks manipulations in real time.
- ✓ **Link Analysis:** revealing the underlying structures of associations between objects.
- ✓ **Social Network Analysis:** easy creation of social

Like Photoshop™ for graphs.

— the Community

LATEST NEWS

► Gephi updates with 0.9.1 version

PAPERS

[Gephi: An Open Source Software for Exploring and Manipulating Networks](#)

Matthias Boon and Sébastien Heyman
Méthodes et Algorithmes
Université Paris-Est
Institut Galilée, Université Paris-Est Marne-la-Vallée

Mathieu Salvetat
Méthodes d'exploration et de manipulation
de réseaux
Institut Galilée, Université Paris-Est Marne-la-Vallée

Abstract
Gephi is an open source Java-based software for exploring and manipulating networks. It has a UI that makes it simple to define large complex networks and allows users to quickly analyze them. It also provides a rich set of features for creating and manipulating networks. Gephi is used in a wide variety of applications, from social network analysis to molecular biology. It is built on top of the JUNG library, which provides a powerful API for working with graphs. Gephi's interface is designed to be intuitive and easy to use. Predictive search can be performed, instead of a classical

<https://gephi.org/>

UCINET



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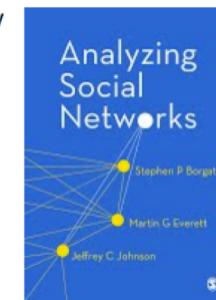
New! UCINET-oriented book on social network analysis now available! See [details](#).

UCINET 6 for Windows is a software package for the analysis of social network data. It was developed by Lin Freeman, Martin Everett and Steve Borgatti. It comes with the NetDraw network visualization tool.

If you use the software, please cite it. Here is a sample citation:

- **Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.**

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- For more details, including questions about taxes, shipping costs, payment methods, etc., please visit the [Order Info](#) page.

News

[Week-long workshop on SNA](#)
The LINKS Center at the University of Kentucky is offering its annual 1-week summer workshop on social network analysis June 6-10, 2016 on the University of Kentucky campus ...
Posted Mar 15, 2016, 12:54 PM by Steve Borgatti

Showing posts 1 - 1 of 9.
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Current Version

[Version 6.614 | 22 May 2016](#) Changed Network|Compare aggregate proximity matrices|partition to be able to handle missing valuesChanged the CLI's IPF routine to default to treating diagonal values

Pajek



Networks / Pajek



Program for Large Network Analysis

In January 2008 this page was replaced by [Pajek Wiki](#).

Pajek runs on Windows and is free for noncommercial use.

[DOWNLOAD Pajek](#)

Data: [test networks](#), [GPHs](#), [GEDs](#), [PDB files](#).

[Screenshots](#); [History](#); [Manual \(pdf\)](#); [Papers/presentations](#); [Applications](#); [in News](#); Examples: [SVG](#), [PDF](#).

How to ? English / Slovene / Japanese (problems with IE - download and use Acrobat reader).

Pajek nicely runs on Linux via Wine, Converting Excel/text into Pajek format.

Pajek to SVG animation. WoS to Pajek.

Slides from [NICTA workshop](#), Sydney, Australia, June 14-17, 2005.

Slides from [workshop at GD'05](#), Limerick, Ireland, Sept 11-14, 2005.

Pajek workshop at [XXVIII Sunbelt Conference](#), St. Pete Beach, Florida, USA, January 22-27, 2008; [slides](#).

[Network analysis course at ECPR Summer School in Methods and Techniques](#), Ljubljana, Slovenia, July 30 - August 16, 2008.

W. de Nooy, A. Mrvar, V. Batagelj: *Exploratory Social Network Analysis with Pajek*, CUP, January 2005; ESNA page.
P. Doreian, V. Batagelj, A. Ferligoj: *Generalized Blockmodeling*, CUP, November 2004.

Chapter about Pajek: V. Batagelj, A. Mrvar: *Pajek - Analysis and Visualization of Large Networks*.
in Jünger, M., Mutzel, P., (Eds.) *Graph Drawing Software*. Springer, Berlin 2003. p. 77-103 / [Amazon](#).

An improved version of the paper presented at [Sunbelt'97](#) was published in [Connections](#) 21(1998)2, 47-57 - V. Batagelj,
A. Mrvar: *Pajek - Program for Large Network Analysis* ([PDF](#); [PRISON.KIN](#)).

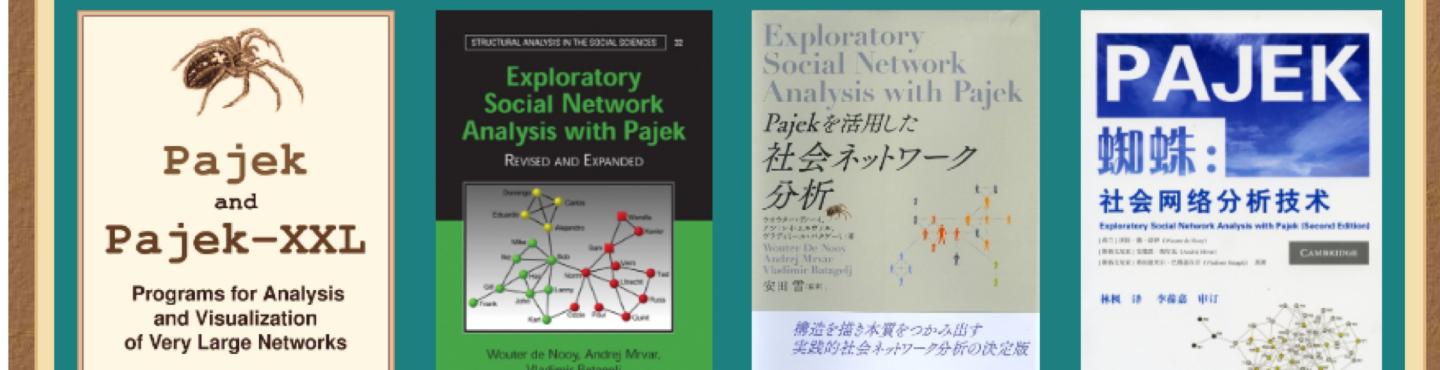
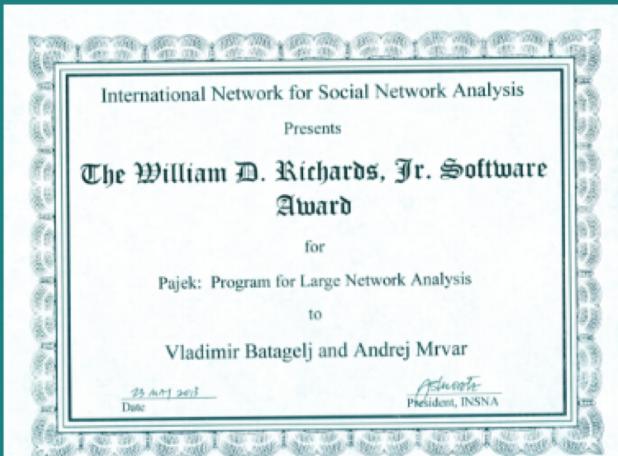
Our layouts for *Graph-Drawing Competitions*: [GD95](#), [GD96](#), [GD97](#), [GD98](#), [GD99](#), [GD00](#), [GD01](#) and [GD05](#).

<http://vlado.fmf.uni-lj.si/pub/networks/pajek/>

Pajek

Pajek: analysis and visualization of large networks

	Ver.	32 bit	64 bit
May 10, 2016	4.10	Web Start  Install Shield Install-Zip Portable	Web Start  Install Shield Install-Zip Portable
March 1, 2016	4.09	Install Shield Install-Zip Portable	Install Shield Install-Zip Portable
Sept. 25, 2011	2.05	zip	zip
Pajek mailing list		Datasets	



Pajek and Pajek-XXL
Programs for Analysis and Visualization of Very Large Networks

STRUCTURAL ANALYSIS IN THE SOCIAL SCIENCES
Exploratory Social Network Analysis with Pajek
REVISED AND EXPANDED
Wouter de Nooy, Andrej Mrvar, Vladimir Batagelj
Wouter De Nooy, Andrej Mrvar, Vladimir Batagelj
安田 雪奈編
構造を描き水質をつかみ出す 実践的・社会ネットワーク分析の決定版

PAJEK 蜘蛛: 社会网络分析技术
Exploratory Social Network Analysis with Pajek (Second Edition)
Wouter De Nooy, Andrej Mrvar, Vladimir Batagelj
林樹一著 李荷露、申利行翻譯
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NodeXL: Network Overview, Discovery and Exploration for Excel

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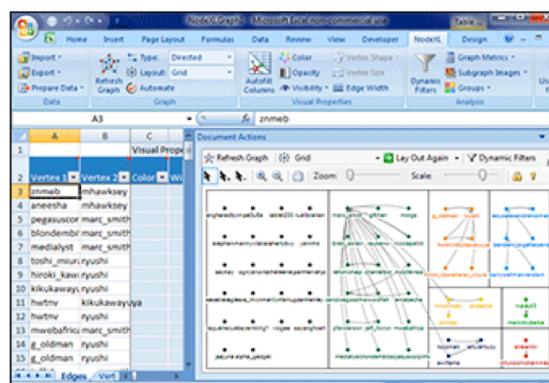
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OPEN TOOLS, OPEN DATA, OPEN SCHOLARSHIP FOR SOCIAL MEDIA

NodeXL Basic is a free, open-source template for Microsoft® Excel® 2007, 2010, 2013 and 2016 that makes it easy to explore network graphs. With NodeXL, you can enter a network edge list in a worksheet, click a button and see your graph, all in the familiar environment of the Excel window.

NodeXL Pro offers additional features that extend NodeXL Basic, providing easy access to social media network data streams, advanced network metrics, and text and sentiment analysis, and



<https://nodelx.codeplex.com/>

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Cytoscape

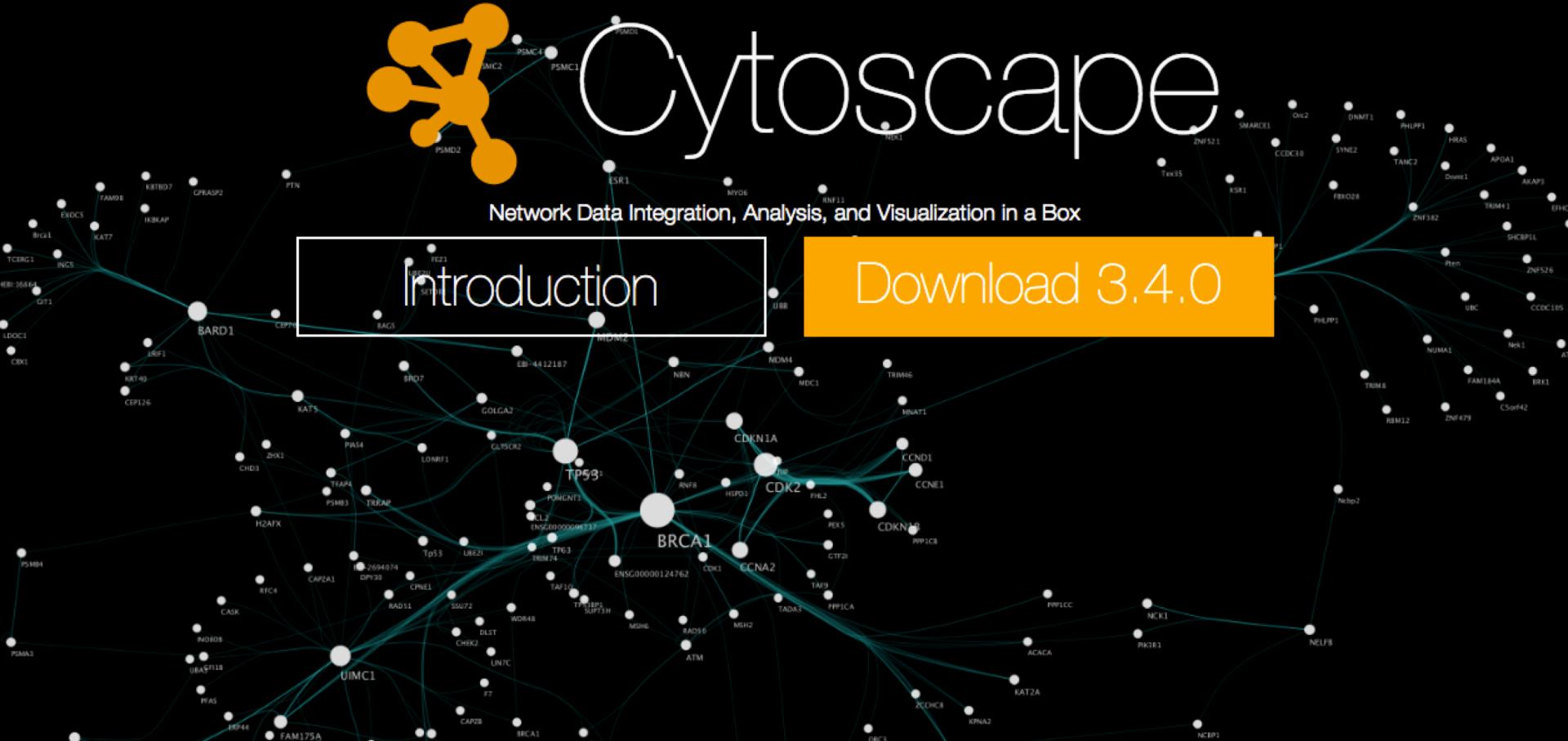
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Cytoscape

Network Data Integration, Analysis, and Visualization in a Box

[Introduction](#)[Download 3.4.0](#)

<http://www.cytoscape.org/>

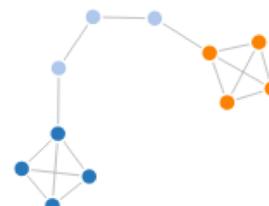
NetworkX

NetworkX

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High-productivity software for complex networks

NetworkX is a Python language software package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.



[Documentation](#)

all documentation

[Examples](#)

using the library

[Reference](#)

all functions and methods

Features

- Python language data structures for graphs, digraphs, and multigraphs.
- Many standard graph algorithms
- Network structure and analysis measures
- Generators for classic graphs, random graphs, and synthetic networks
- Nodes can be "anything" (e.g. text, images, XML records)
- Edges can hold arbitrary data (e.g. weights, time-series)
- Open source [BSD license](#)
- Well tested: more than 1800 unit tests, >90% code coverage
- Additional benefits from Python: fast prototyping, easy to teach, multi-platform

Versions

Latest Release

networkx-1.11
30 January 2016
[downloads](#) | [docs](#) | [pdf](#)

Development

2.0dev
[github](#) | [docs](#) | [pdf](#)
[build](#) passing
[coverage](#) 94%

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

igraph

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igraph – The network analysis package

igraph is a collection of network analysis tools with the emphasis on **efficiency, portability** and ease of use. igraph is **open source** and free. igraph can be programmed in **R, Python** and **C/C++**.

[igraph R package](#)[python-igraph](#)[igraph C library](#)[R/igraph 1.0.0](#)[Repositories at Github](#)[R/igraph 0.7.1](#)[C/igraph 0.7.1](#)[R/igraph 0.7.0](#)[python-igraph 0.7.0](#)[C/igraph 0.7.0](#)[R/igraph 0.6.5](#)

Recent news

[R/igraph 1.0.0](#)

June 24, 2015

[Release Notes](#)

This is a new major release, with a lot of UI changes. We tried to make it easier to use, with short and easy to remember, consistent function names. Unfortunately

<http://igraph.org/redirect.html>

SNAP

By Jure Leskovec

STANFORD
UNIVERSITY



Stanford Network Analysis Project

• **SNAP for C++: Stanford Network Analysis Platform**

Stanford Network Analysis Platform (**SNAP**) is a general purpose network analysis and graph mining library. It is written in C++ and easily scales to massive networks with hundreds of millions of nodes, and billions of edges. It efficiently manipulates large graphs, calculates structural properties, generates regular and random graphs, and supports attributes on nodes and edges. SNAP is also available through the [NodeXL](#) which is a graphical front-end that integrates network analysis into Microsoft Office and Excel.

• **Snap.py: SNAP for Python**

Snap.py is a Python interface for SNAP. It provides performance benefits of SNAP, combined with flexibility of Python. Most of the SNAP C++ functionality is available via Snap.py in Python.

• **Stanford Large Network Dataset Collection**

A collection of more than 50 large network datasets from tens of thousands of nodes and edges to tens of millions of nodes and edges. It includes social networks, web graphs, road networks, internet networks, citation networks, collaboration networks, and communication networks.

• **Tutorials**

Tutorials on using SNAP, on methods to analyze large network data, on ways how to think about networks and how to model them at the level of network structure, and on methods to study evolution and dynamics of diffusion and cascading behavior in networks.

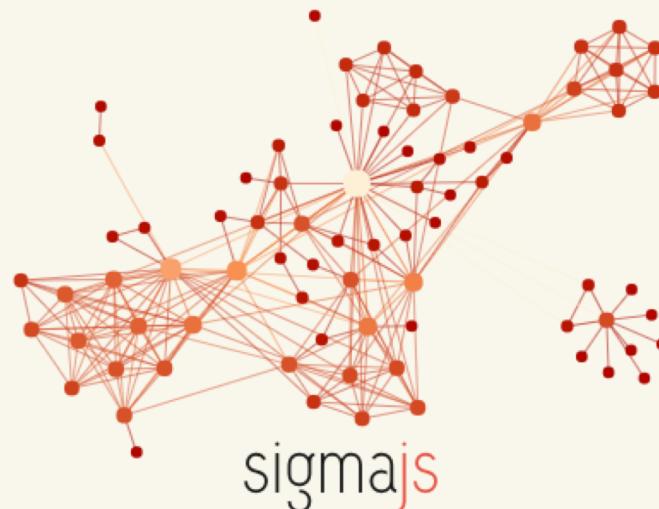
- Tutorial on [Large Scale Network Analytics with SNAP](#) will be held at [WWW-15](#) conference, Florence, Italy, May 18, 2015. [More info](#).

<http://snap.stanford.edu/>

sigma.js

 sigma.js

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v1.1.0

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Sigma is a JavaScript library **dedicated to graph drawing**. It makes easy to publish networks on Web pages, and allows developers to integrate network exploration in rich Web applications.

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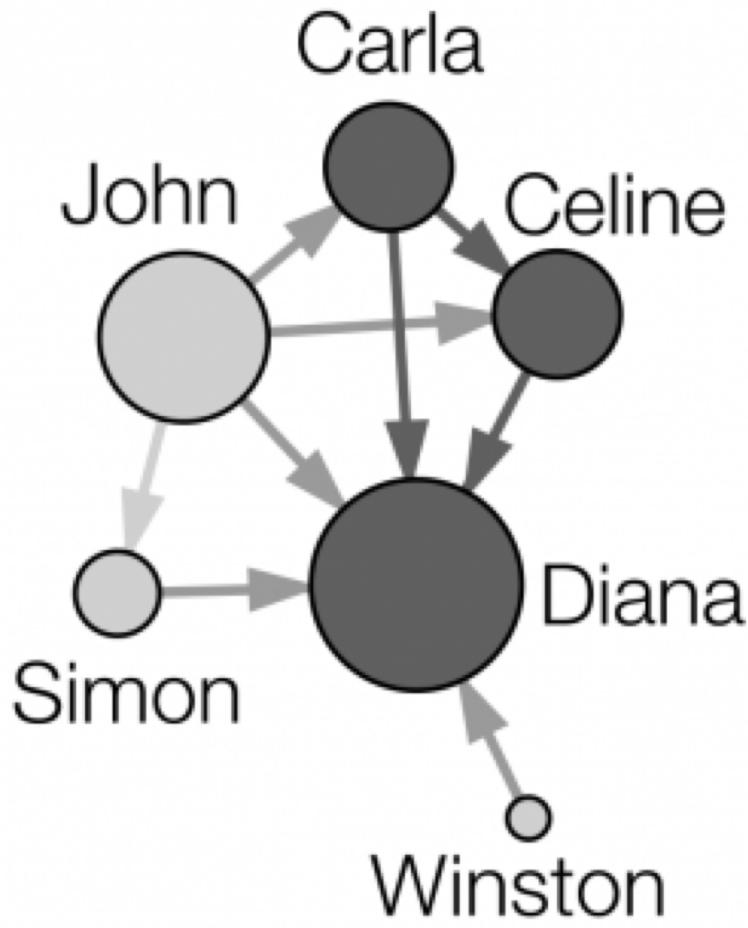
Gephi



Gephi.app

Gephi: Social Network Analysis and Visualization

Network Analysis and Visualization with Gephi



Nodes	Edges
Id,Label,Attribute	Source,Target
1,John,1	1,2
2,Carla,2	1,3
3,Simon,1	1,4
4,Celine,2	1,6
5,Winston,1	2,4
6,Diana,2	2,6
	3,6
	4,6
	5,6

Nodes and Edges

CSV Text Data for Gephi

Nodes1.csv

Id,Label,Attribute
1,John,1
2,Carla,2
3,Simon,1
4,Celine,2
5,Winston,1
6,Diana,2

Nodes1.csv

*

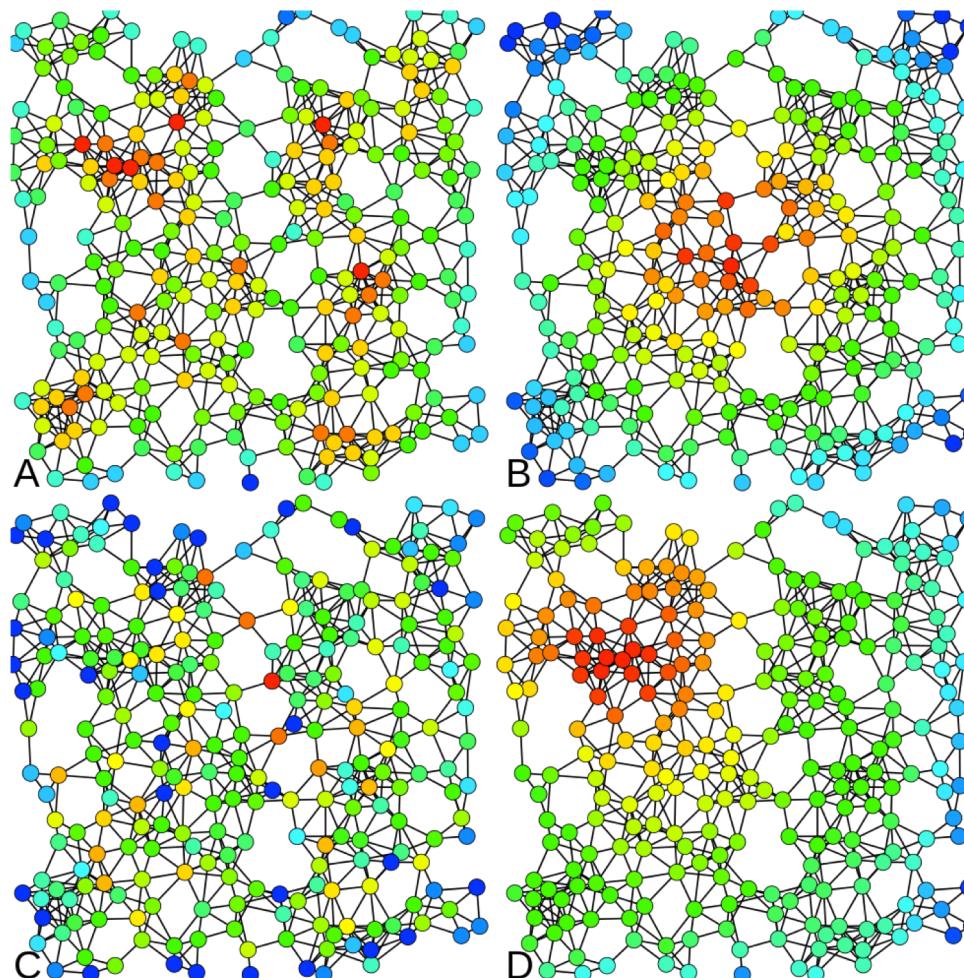
Id,Label,Attribute
1,John,1
2,Carla,2
3,Simon,1
4,Celine,2
5,Winston,1
6,Diana,2

Edges1.csv

Source,Target
1,2
1,3
1,4
1,6
2,4
2,6
3,6
4,6
5,6

A = Degree centrality
number of connexions

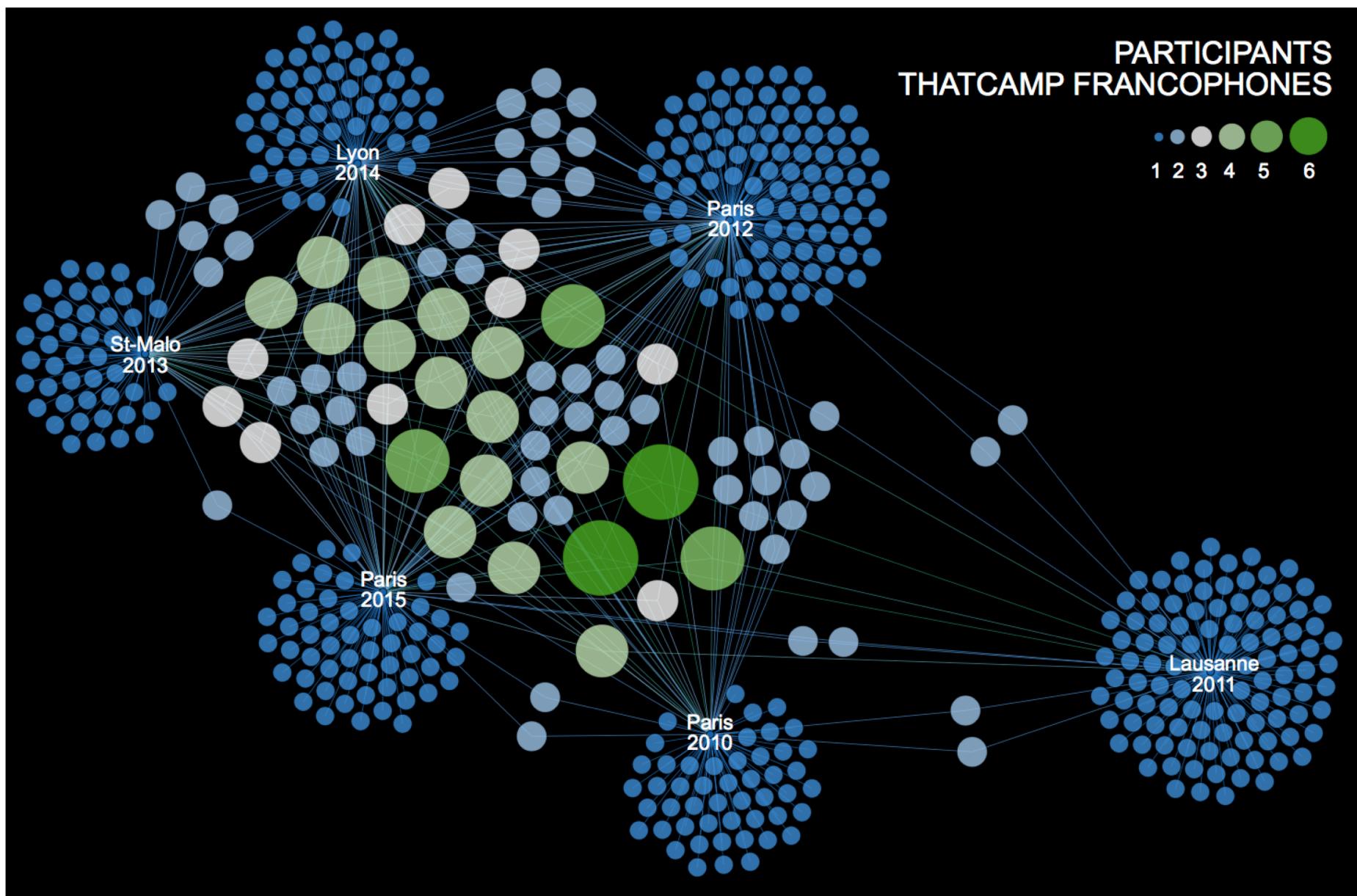
B = Closeness centrality
closeness to the entire network



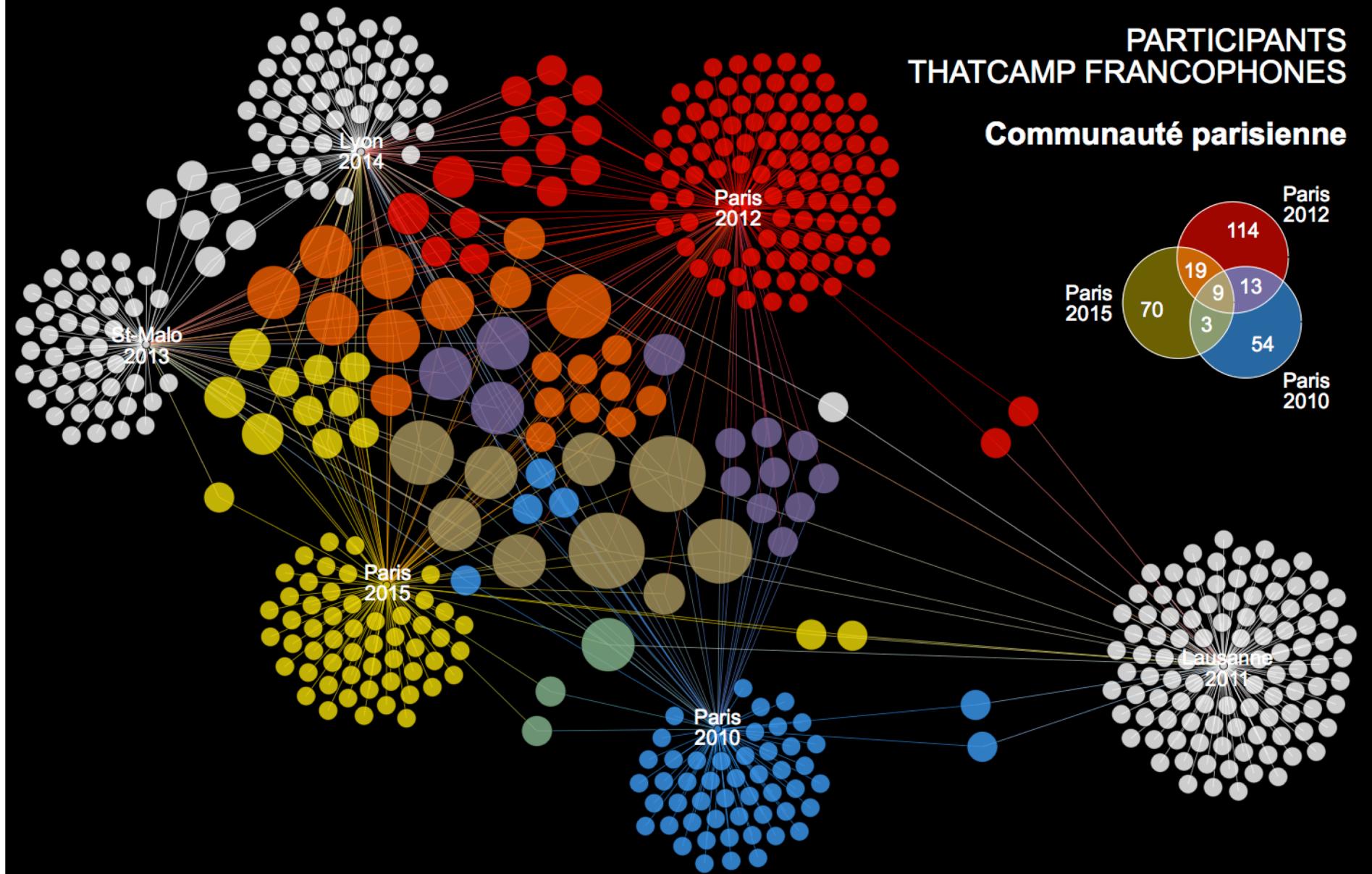
C = Betweenness centrality
bridges nodes

D = Eigenvector centrality
connection to well-connected nodes

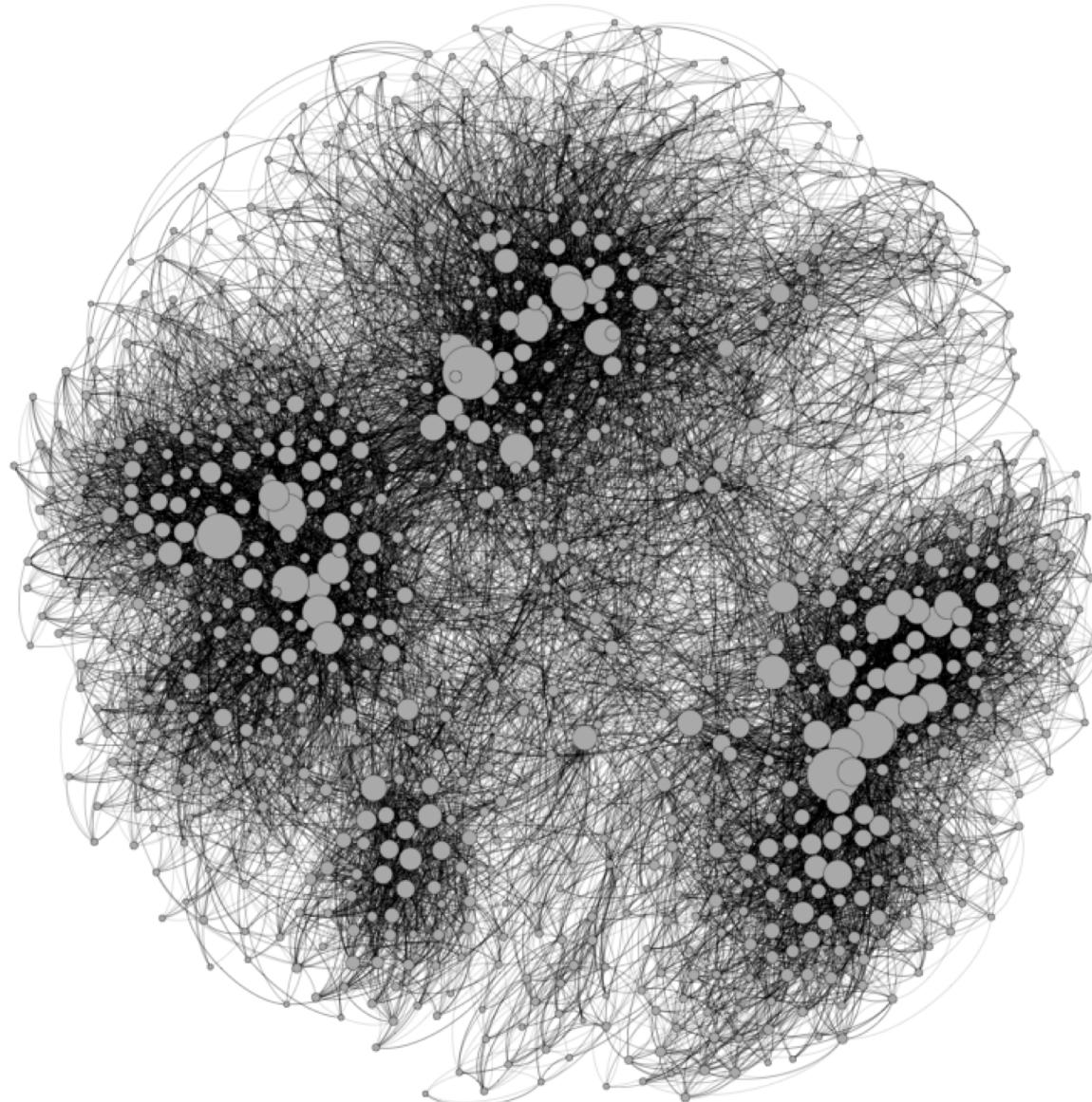
Conference Participants



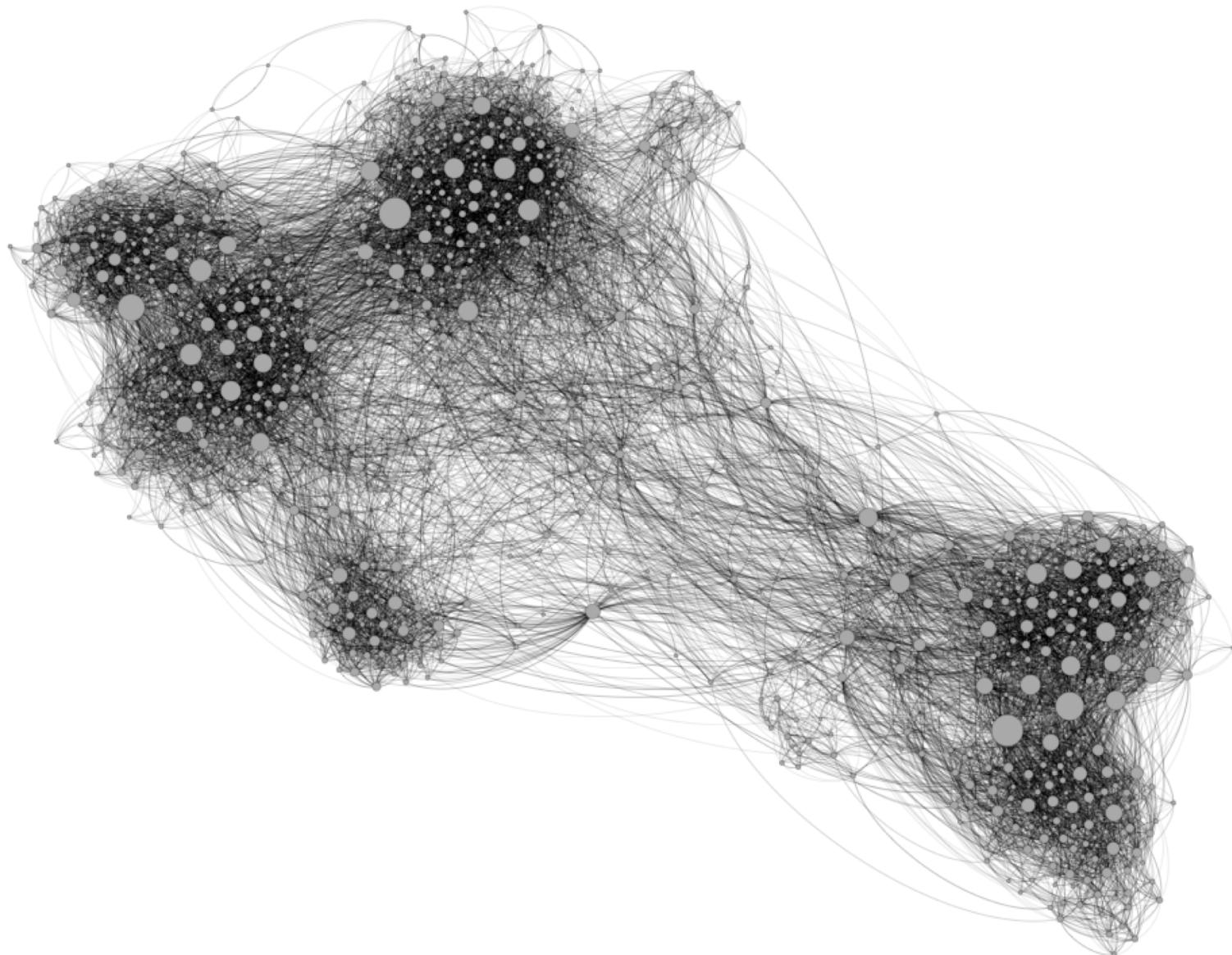
Conference Participants



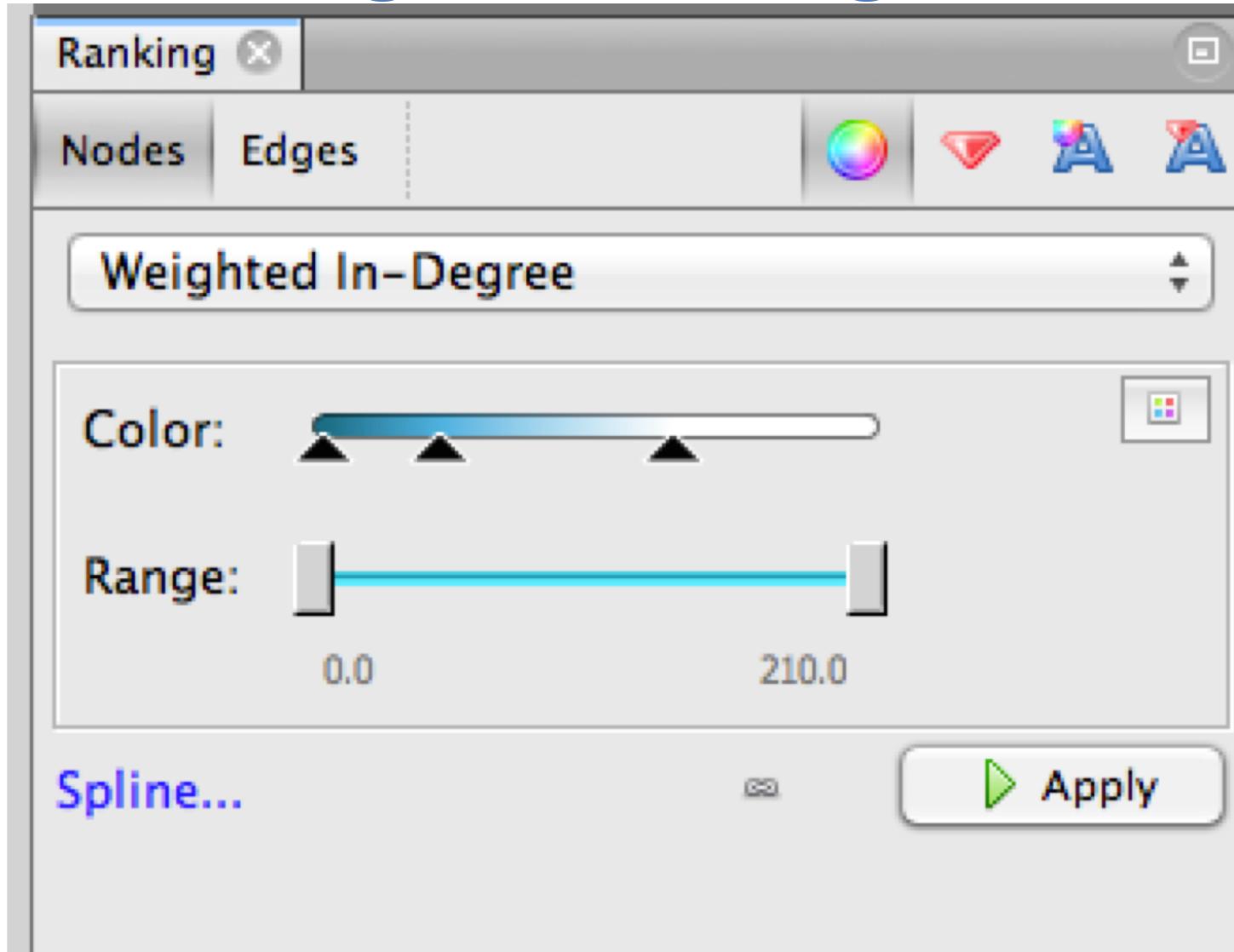
Fruchterman Reingold



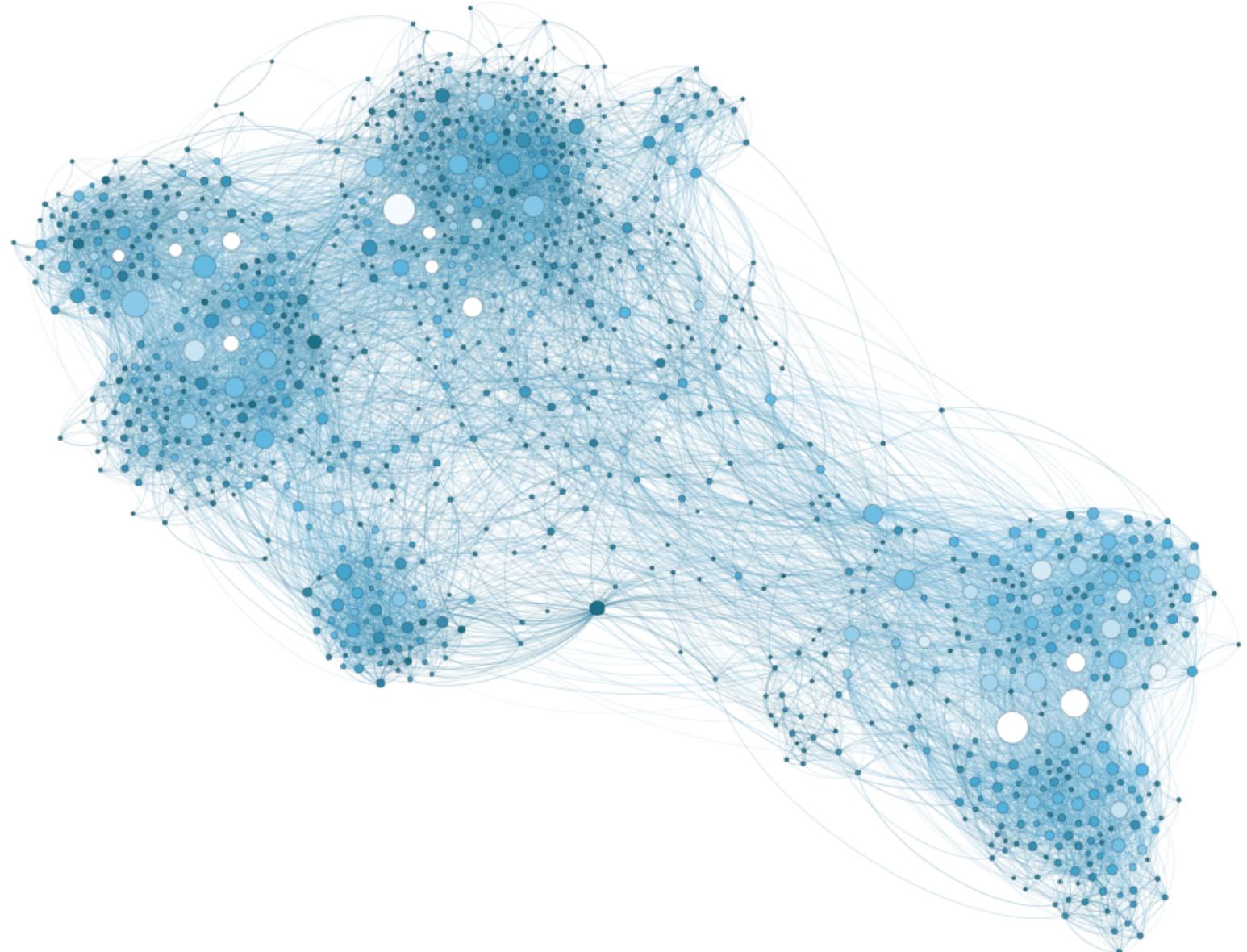
Force Atlas 2



Nodes' color Weighted In-Degree



Weighted In-Degree



Network Diameter

Betweenness Centrality

Closeness Centrality

Graph Distance settings

Distance
The average graph-distance between all pairs of nodes. Connected nodes have graph distance 1. The diameter is the longest graph distance between any two nodes in the network. (i.e. How far apart are the two most distant nodes).

Directed Normalize Centralities in [0,1]

UnDirected

Betweenness Centrality: Measures how often a node appears on shortest paths between nodes in the network.

Closeness Centrality: The average distance from a given starting node to all other nodes in the network.

Eccentricity: The distance from a given starting node to the farthest node from it in the network.

Cancel OK

Statistics Filters

Settings

Network Overview

Average Degree Run

Avg. Weighted Degree 25.486 Run

Network Diameter Run

Graph Density Run

HITS Run

Modularity 0.57 Run

PageRank Run

Connected Components Run

Node Overview

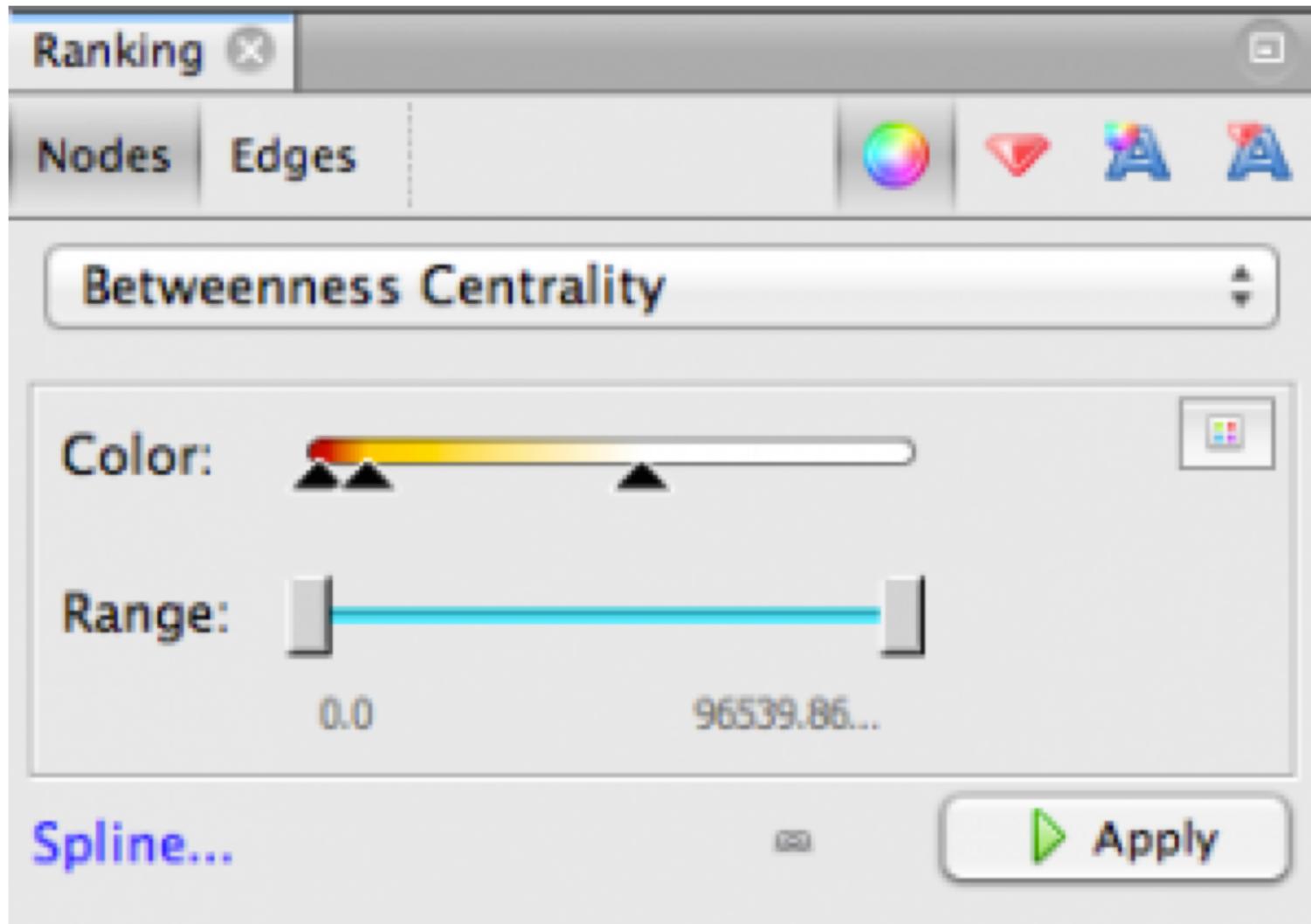
Avg. Clustering Coefficient Run

Eigenvector Centrality Run

Edge Overview



Nodes' color Betweenness Centrality

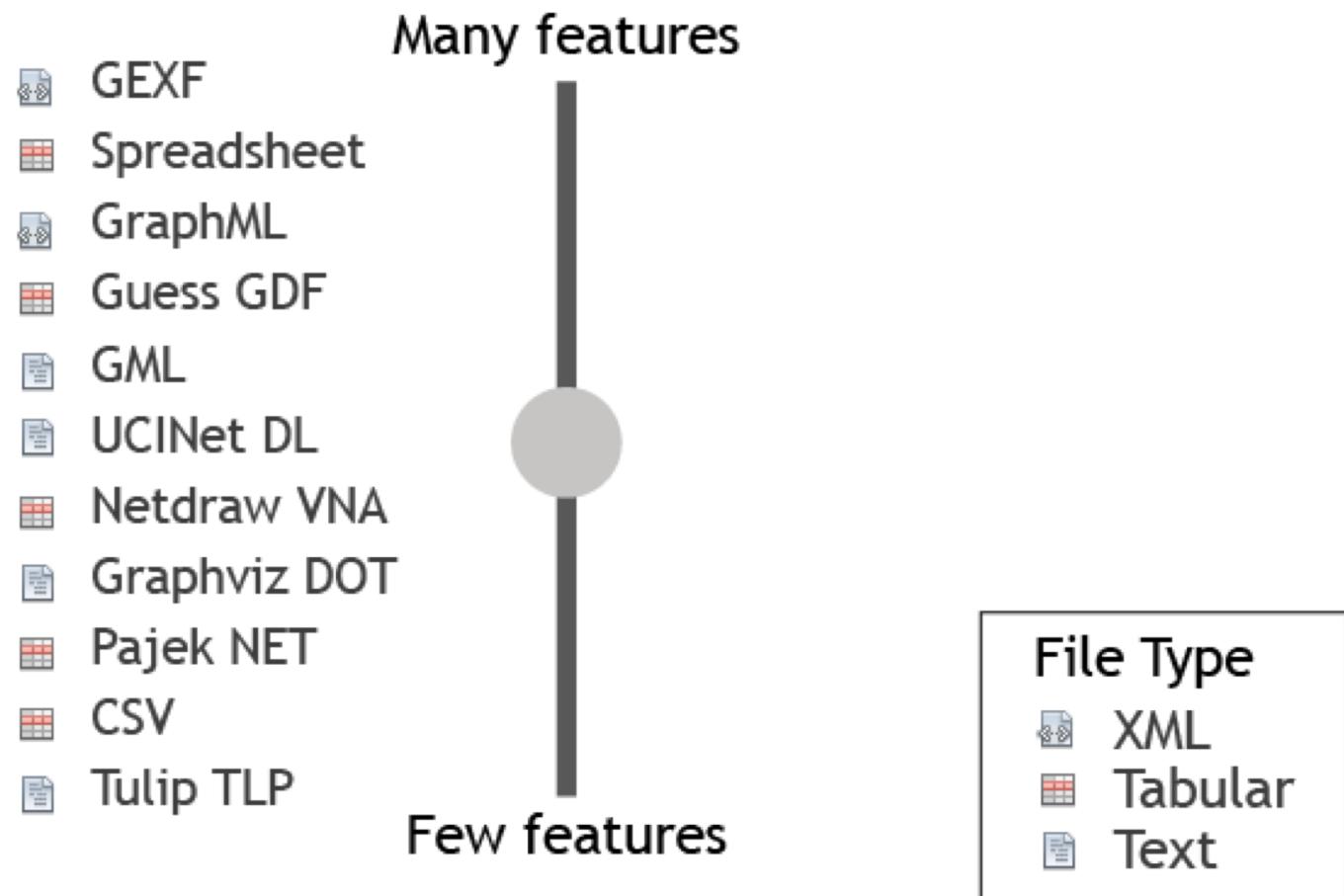


Gephi Supported Graph Formats

	Edge List/Matrix Structure	XML Structure	Edge Weight	Attributes	Visualization Attributes	Attribute Default Value	Hierarchical Graphs	Dynamics
CSV	■							
DL Ucinet	■		■					
DOT Graphviz		■		■				
GDF		■	■	■	■			
GEXF		■	■	■	■	■		
GML			■	■				
GraphML		■	■	■	■			
NET Pajek	■			■				
TLP Tulip								
VNA Netdraw		■	■					
Spreadsheet*						■		

Gephi Supported Graph Formats

Do you need...



Gephi



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The Open Graph Viz Platform

Gephi is the leading visualization and exploration software for all kinds of graphs and networks. Gephi is open-source and free.

Runs on Windows, Mac OS X and Linux.

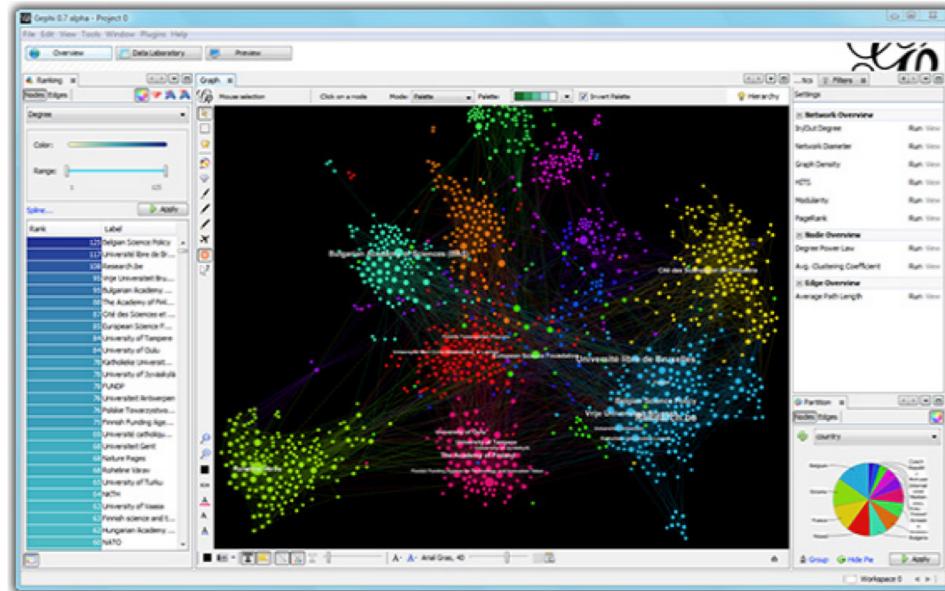
[Learn More on Gephi Platform »](#)

A white rectangular button with rounded corners and a thin orange border. Inside, there is a large orange downward-pointing arrow icon on the left, followed by the text "Download FREE Gephi 0.9.1" in a black sans-serif font.

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APPLICATIONS

- ✓ **Exploratory Data Analysis:** intuition-oriented analysis by networks manipulations in real time.
 - ✓ **Link Analysis:** revealing the underlying structures of associations between objects.
 - ✓ **Social Network Analysis:** easy creation of social

Like Photoshop™ for graphs.

— the Community

LATEST NEWS

➤ Genbi updates with 0.9.1 version

PAPERS



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makes graphs handy

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Download

Gephi is an open-source and multiplatform software distributed under the dual license [CDDL 1.0](#) and [GNU General Public License v3](#).

Official Releases

[Release Notes](#) | [System Requirements](#) | [Installation instructions](#)

Gephi 0.9.1 is the latest stable release.

[Download Gephi for Mac OSX](#)

Version 0.9.1

If you have an older Gephi on your computer, you should uninstall it first, see the [installation instructions](#).

All downloads:

[Download Gephi 0.9.1 for Mac OS X](#)

[Download Gephi 0.9.1 for Windows](#)

[Download Gephi 0.9.1 for Linux](#)

[Download Gephi 0.9.1 sources](#)

[Download Older Versions](#)

Sources:

Gephi uses [GitHub](#) to host the source code and track issues. The [trunk](#) repository is the most up-to-date version but may be unstable. The last stable version is located in the release tab on GitHub.

Localization

Localization is available in **French, Spanish, Japanese, Brazilian Portuguese, Russian, Chinese, Czech and German**. In Gephi, simply go to **Tools -> Languages** to switch.

<https://gephi.org/users/download/>

Stay informed
blog, twitter & more

Contribute
code, doc, test & more

Report a Bug

Request a Feature

Share your ideas

Ways to get help

- 2) Get Personal Help
- 3) Other Gephi Support
- 4) Get Professional Training Courses

New to Gephi?

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- [Quick Start Guide](#)
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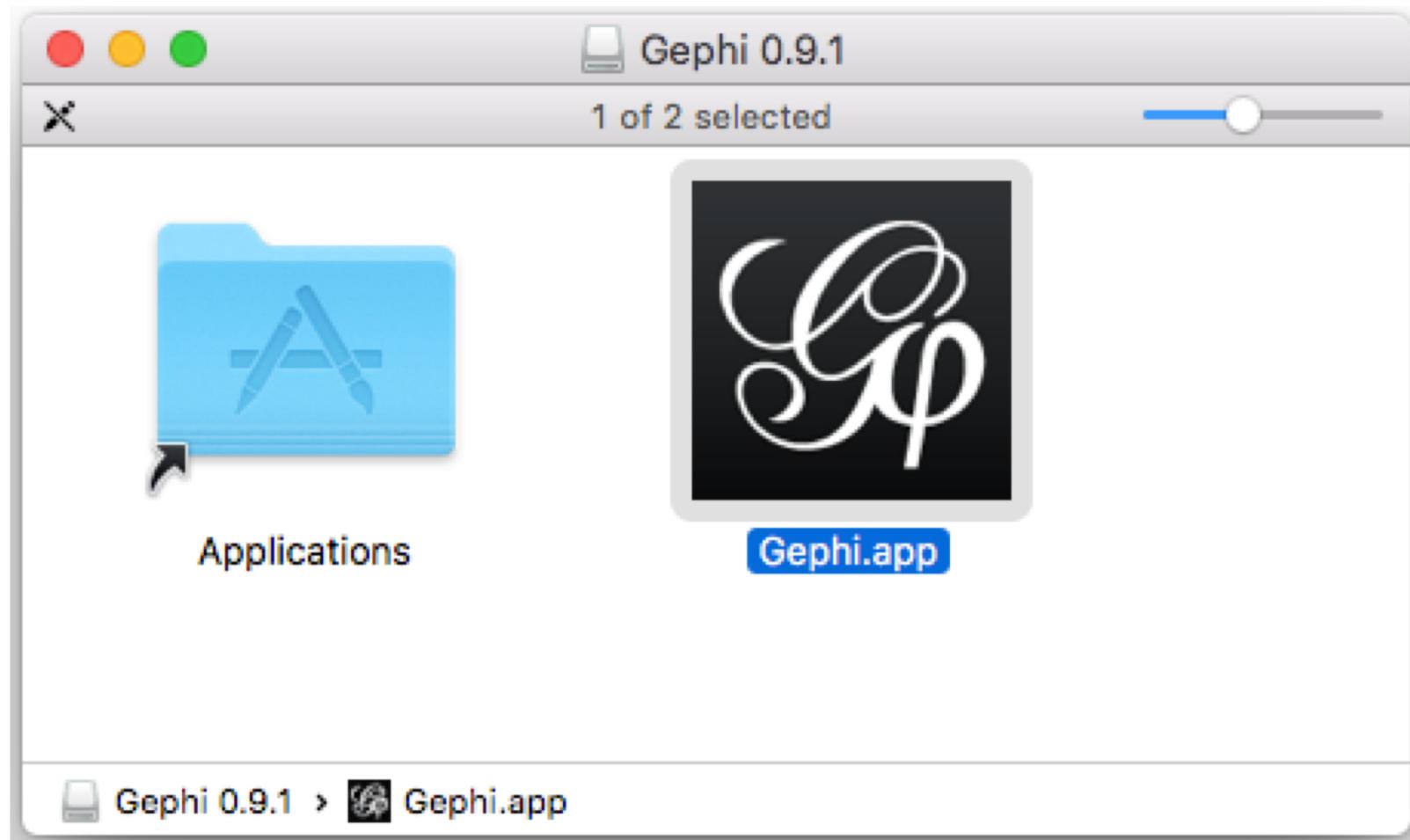
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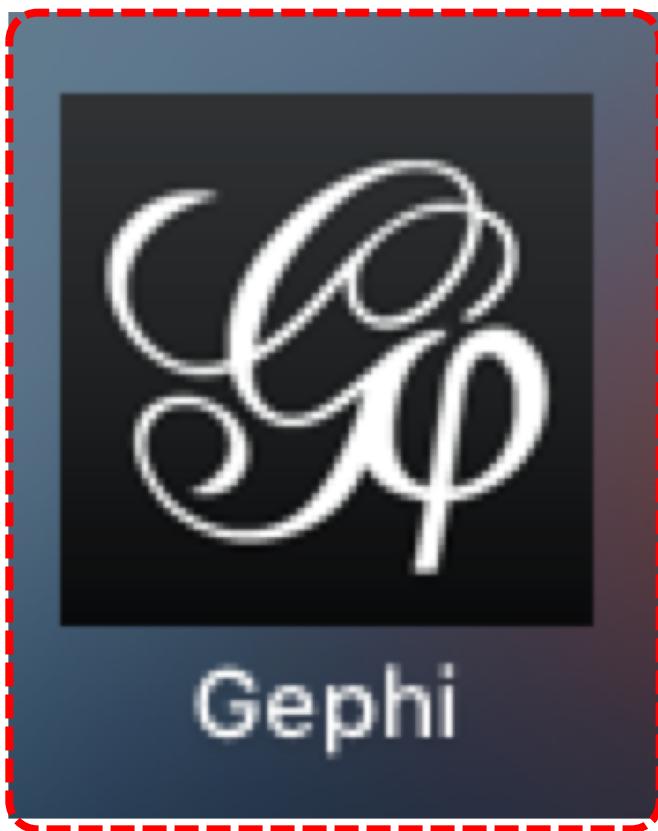
[**gephi-0.9.1-macos.dmg**](#)

Disk Image - 121.1 MB

Gephi 0.9.1



Gephi



Gephi



Gephi.app

Gephi:
New Project
Import
Nodes1.csv and
Edges1.csv
to Gephi

Gephi New Project



A screenshot of the Gephi software interface. At the top, there is a navigation bar with three tabs: "Overview" (selected), "Data Laboratory", and "Preview". Below the navigation bar is a "Data Table" panel with tabs for "Nodes", "Edges", and "Configuration". A "Filter:" input field and some other UI elements are visible in this panel. In the center, a "Welcome" dialog box is displayed. The dialog has a title bar "Welcome" and a "Welcome to Gephi" message. It contains sections for "Open recent" (empty), "New Project" (with "New Project" and "Open Graph File..." options), and "Samples" (listing "Les Miserables.gexf", "Java.gexf", and "Power Grid.gml"). At the bottom of the dialog is a checked checkbox labeled "Open at startup".

Gephi Overview

The screenshot shows the Gephi interface with several panels:

- Appearance** panel (red box): Contains tabs for Nodes and Edges, and buttons for Unique and Attribute. A color preview is shown (#c0c0c0). Sub-sections include Nodes and Edges.
- Layout** panel (red box): Shows a dropdown menu for "Choose a layout" and a "Run" button. Below it is a section titled "<No Properties>".
- Graph** panel (red box): Shows a workspace with a toolbar on the left containing icons for selection, zoom, and drawing tools. A status bar at the bottom indicates "Dragging (Configure)".
- Context** panel (red box): Shows network statistics: Nodes: 0, Edges: 0, and Type: Directed Graph. It also includes a "Filters" tab and a "Statistics" tab with various metrics like Average Degree, Avg. Weighted Degree, Network Diameter, etc., each with a "Run" button.
- Statistics** panel (red box): Shows metrics under sections like Node Overview, Edge Overview, and Dynamic, each with a "Run" button.

4. Context and **5. Statistics** are overlaid text labels in red on the right side of the Context and Statistics panels respectively.

3. Graph

5. Statistics
Filters

Gephi Data Laboratory: Import Spreadsheet



Screenshot of the Gephi Data Laboratory interface showing the "Import Spreadsheet" feature highlighted with a red box.

The interface includes:

- Top navigation bar with tabs: Overview, Data Laboratory (highlighted), Preview.
- Left sidebar: Workspace 1, Data Table.
- Toolbar buttons: Nodes, Edges, Configuration, Add node, Add edge, Search/Replace, Import Spreadsheet (highlighted), Export table, More actions, Filter, Id, and a lightbulb icon.
- Table view with columns: Id, Label, Interval.
- Bottom toolbar with column management icons:

Add column	Merge columns	Delete column ▾	Clear column ▾	Copy data to other column ▾	Fill column with a value ▾	Duplicate column ▾	Create a boolean column from regex match ▾	Create column with list of regex matching groups ▾	
------------	---------------	-----------------	----------------	-----------------------------	----------------------------	--------------------	--	--	--

Gephi Data Laboratory: Import Spreadsheet



Screenshot of the Gephi Data Laboratory interface showing the "Import Spreadsheet" dialog box.

The "Import Spreadsheet" dialog box is open and highlighted with a red border. It contains the following fields:

- Steps:** 1. General options, 2. Import settings.
- General options:** Choose a CSV file to import (file input field with a "..."), Separator (set to "Comma"), As table (set to "Edges table"), Charset (set to "UTF-8").
- Preview:** A large empty rectangular area.
- Message:** An error message "Invalid CSV file" with an exclamation mark icon.
- Buttons:** Help, < Back, Next >, Finish, Cancel.

The Gephi interface background shows tabs like Overview, Data Laboratory, Preview, and a workspace tab labeled "Workspace 1". The toolbar includes buttons for Nodes, Edges, Configuration, Add node, Add edge, Search/Replace, Import Spreadsheet (which is also highlighted with a red border), Export table, More actions, Filter, and Id.

At the bottom, there is a toolbar with various data manipulation icons:

- Add column
- Merge columns
- Delete column
- Clear column
- Copy data to other column
- Fill column with a value
- Duplicate column
- Create a boolean column from regex match
- Create column with list of regex matching groups

Import Nodes1.csv to Gephi

The screenshot shows the Gephi interface with the 'Data Laboratory' tab selected (highlighted by a red dashed box). A file browser window is open, also highlighted with a red dashed box, showing the path '/imyday/Documents/SCDBA/SNA_Data/Nodes1.csv'. The 'Nodes1.csv' file is selected and highlighted with a blue selection bar. The 'Open' button at the bottom right of the file browser is also highlighted with a red dashed box. To the left, a preview of the CSV file content is shown:

Nodes1.csv

	Id	Label	Attribute
1	1	John	1
2	2	Carla	2
3	3	Simon	1
4	4	Celine	2
5	5	Winston	1
6	6	Diana	2

Below the preview are several data manipulation tools:

- Add column
- Merge columns
- Delete column ▾
- Clear column ▾
- Copy data to other column ▾
- Fill column with a value ▾
- Duplicate column ▾
- Create a boolean column from regex match ▾
- Create column with list of regex matching groups ▾

Import Nodes1.csv to Gephi

Screenshot of the Gephi Data Laboratory interface showing the "Import spreadsheet" dialog.

The dialog shows the following settings:

- Steps:** 1. General options (selected), 2. Import settings
- General options:**
 - Choose a CSV file to import: /imyday/Documents/SCDBA/SNA_Data/Nodes1.csv
 - Separator: Co... (dropdown)
 - As table: Nodes ta... (dropdown)
 - Charset: UTF-8 (dropdown)
- Preview:** A table showing the imported data:

ID	Label	Attribute
1	John	1
2	Carla	2
3	Simon	1
4	Celine	2
5	Winston	1
6	Diana	2
- Buttons:** Help, < Back, Next > (highlighted with a red dashed box), Finish, Cancel

Below the dialog, a toolbar provides various data manipulation functions:

- Add column
- Merge columns
- Delete column ▾
- Clear column ▾
- Copy data to other column ▾
- Fill column with a value ▾
- Duplicate column ▾
- Create a boolean column from regex match ▾
- Create column with list of regex matching groups ▾

Import Nodes1.csv to Gephi

Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Id Interval

Import spreadsheet

Steps

1. General options
2. Import settings

Import settings

New columns are created with the specified type.
A generated id is assigned if missing.
Unless the option 'Force nodes to be created as new ones' is en

Imported columns:

Id
String

Label
String

Attribute
String

Force nodes to be created as new ones

Help < Back Next > **Finish** Cancel

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Import Nodes1.csv to Gephi

The screenshot shows the Gephi Data Laboratory interface with the following details:

- Top Bar:** Overview, Data Laboratory (selected), Preview.
- Workspace 1:** Data Table tab is active.
- Data Table:** Shows a table with columns: Id, Label, Interval, and Attribute.

Id	Label	Interval	Attribute
1	John		1
2	Carla		2
3	Simon		1
4	Celine		2
5	Winston		1
6	Diana		2
- Nodes1.csv Content:** A yellow box contains the CSV data:

Id	Label	Attribute
1	John	1
2	Carla	2
3	Simon	1
4	Celine	2
5	Winston	1
6	Diana	2
- Bottom Row Buttons:** Add column, Merge columns, Delete column ▾, Clear column ▾, Copy data to other column ▾, Fill column with a value ▾, Duplicate column ▾, Create a boolean column from regex match ▾, Create column with list of regex matching groups ▾.

Import Edges1.csv to Gephi

The screenshot shows the Gephi Data Laboratory interface. At the top, there are three tabs: Overview, Data Laboratory (selected), and Preview. Below the tabs is a toolbar with various icons and buttons. The 'Data Table' tab is active. The main area is titled 'Workspace 1'. A red box highlights the 'Edges' tab in the toolbar. Another red box highlights the 'Import Spreadsheet' button in the toolbar. The table below has columns: Source, Target, Type, Id, Label, Interval, and Weight. At the bottom, there is a toolbar with several icons for modifying columns.

Source	Target	Type	Id	Label	Interval	Weight
--------	--------	------	----	-------	----------	--------

Bottom toolbar icons (from left to right):

- Add column
- Merge columns
- Delete column ▾
- Clear column ▾
- Copy data to other column ▾
- Fill column with a value ▾
- Duplicate column ▾
- Create a boolean column from regex match ▾
- Create column with list of regex matching groups ▾

Import Edges1.csv to Gephi

Edges1.csv

Source,Target

1,2
1,3
1,4
1,6
2,4
2,6
3,6
4,6
5,6

The screenshot shows the Gephi interface with the 'Data Laboratory' tab selected. A 'Data Table' window is open, displaying columns for Source, Target, Type, Id, Label, Interval, and Weight. A 'Configuration' tab is active. A red box highlights the 'Import Spreadsheet' button in the toolbar. A 'Import spreadsheet' dialog is open, showing 'General options' and a list of files: 'Edges1.csv' and 'Nodes1.csv'. The 'Edges1.csv' file is selected. A red box highlights the '...' button next to the file path and the 'Open' button at the bottom right of the dialog. A file selection dialog is also visible, showing the same two files with 'Edges1.csv' selected. A red box highlights the 'Open' button in this dialog.

Import Edges1.csv to Gephi

Screenshot of the Gephi Data Laboratory interface showing the import of 'Edges1.csv'.

The 'Data Table' tab is selected. The 'Configuration' tab is active. The 'Edges' tab is selected in the main toolbar.

The 'Import spreadsheet' dialog is open, showing the 'General options' step. The CSV file '/Documents/SCDBA/SNA_Data/Edges1.csv' is selected. The separator is set to 'Comma' and the charset to 'UTF-8'. The 'As table' dropdown shows 'Nodes table' and 'Edges table', with 'Edges table' checked. A red box highlights the 'Edges table' option.

The preview table shows the edge data:

Source	Target
1	2
1	3
1	4
1	6
2	4
2	6
3	6
4	6

Buttons at the bottom of the dialog include 'Help', '< Back', 'Next >', 'Finish', and 'Cancel'.

Below the dialog, a row of icons provides various data manipulation functions:

- Add column
- Merge columns
- Delete column
- Clear column
- Copy data to other column
- Fill column with a value
- Duplicate column
- Create a boolean column from regex match
- Create column with list of regex matching groups

A red box highlights the text 'Edges table' in the 'As table' dropdown.

Text 'Edges table' is overlaid in red on the right side of the screenshot.

Import Edges1.csv to Gephi

Screenshot of the Gephi Data Laboratory interface showing the import process for 'Edges1.csv'.

The 'Import spreadsheet' dialog is open, showing the following configuration:

- General options:** CSV file path: /Documents/SCDBA/SNA_Data/Edges1.csv
- Separator:** Comma (Co...)
- As table:** Edges table
- Charset:** UTF-8

The preview shows the following edge data:

Source	Target
1	2
1	3
1	4
1	6
2	4
2	6
3	6
4	6

Buttons at the bottom of the dialog are: Help, < Back, Next > (highlighted with a red dashed box), Finish, Cancel.

Below the dialog, a toolbar provides various column manipulation functions:

- Add column
- Merge columns
- Delete column ▾
- Clear column ▾
- Copy data to other column ▾
- Fill column with a value ▾
- Duplicate column ▾
- Create a boolean column from regex match ▾
- Create column with list of regex matching groups ▾

A large red text overlay on the right side of the dialog reads: **Edges table**.

Import Edges1.csv to Gephi

Overview Data Laboratory Preview

Workspace 1

Data Table Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter Source

Source	Target	Type	Id	Label	Interval	Weight
--------	--------	------	----	-------	----------	--------

Import spreadsheet

Steps

1. General options
2. Import settings

Import settings

New columns are created with the specified type.
A generated id is assigned if missing or already existing.
Edges need 'Source' and 'Target' columns with the id of the nodes.
If no 'Type' column is provided, all edges will be directed.
If an edge already exists, attributes will be ignored, but the edge will be updated.

Imported columns:

Source
String

Target
String

Create missing nodes

Help < Back Next > **Finish** Cancel

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Import Edges1.csv to Gephi

Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Source

Source	Target	Type	Id	Label	Interval	Weight
1	2	Directed	0			1.0
1	3	Directed	1			1.0
1	4	Directed	2			1.0
1	6	Directed	3			1.0
2	4	Directed	4			1.0
2	6	Directed	5			1.0
3	6	Directed	6			1.0
4	6	Directed	7			1.0
5	6	Directed	8			1.0

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Overview

Overview Data Laboratory Preview

Workspace 1

Appearance

Nodes Edges Unique Attribute

#c0c0c0

Apply

Layout

---Choose a layout Run

<No Properties>

Presets... Reset

Graph Dragging (Configure)

Context Nodes: 6
Edges: 9
Directed Graph

Filters Statistics 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

Dynamic

- # Nodes Run
- # Edges Run
- Degree Run
- Clustering Coefficient Run

The screenshot shows the Gephi interface with a network graph containing 6 nodes and 9 edges. The graph is currently set to 'Dragging' mode. The left sidebar includes tabs for Appearance, Layout, and Presets. The Layout tab shows a dropdown menu for choosing a layout and a 'Run' button. The bottom toolbar features various tools for node selection, edge modification, and text entry, along with font settings for 'Arial-BoldMT, 32'.

Gephi Overview: Graph

Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges Unique Attribute #c0c0c0

Graph Dragging (Configure)

Nodes: 6
Edges: 9
Directed Graph

Context

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics Settings

Network Overview

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

Run Run Run Run Run Run Run Run

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Run Run Run Run Run Run Run Run

Edge Overview

- Avg. Path Length

Run Run Run Run Run Run Run Run

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Run Run Run Run Run Run Run Run

Presets... Reset

?

T Arial-BoldMT, 32

Graph window showing a directed graph with 6 nodes and 9 edges. The nodes are arranged in a triangular pattern. One node at the top has three outgoing edges to the bottom-left, bottom-right, and middle nodes. The middle node has two outgoing edges to the bottom-right and bottom-left nodes. The bottom-left node has one outgoing edge to the bottom-right node. The bottom-right node has one outgoing edge to the middle node.

Gephi Overview: Layout

Screenshot of the Gephi software interface showing the Layout panel highlighted with a red dashed border.

The Layout panel (left side) contains a dropdown menu titled "Choose a layout" with the following options:

- Fruchterman Reingold
- Label Adjust
- NoOverlap
- OpenOrd
- Random Layout
- Rotate
- Yifan Hu
- Yifan Hu Proportional** (selected)

Below the dropdown is a note: <No Properties>

The main workspace shows a network graph with 6 nodes and 9 edges. The nodes are black circles, and the edges are thin grey lines. One node at the top has multiple outgoing edges connecting to other nodes.

The Context panel (right side) displays the following information:

- Nodes: 6
- Edges: 9
- Directed Graph

The Context panel also includes sections for Network Overview, Node Overview, Edge Overview, and Dynamic metrics, each with a "Run" button.

At the bottom of the interface are various toolbars and settings for node and edge selection, as well as font and color controls.

Gephi Overview: Layout

Yifan Hu Proportional

Screenshot of the Gephi software interface showing the "Layout" tab selected. A red dashed box highlights the "Layout" panel on the left.

Layout Panel (Left):

- Selected: Yifan Hu Proportional
- Run button (highlighted with a red box)
- Yifan Hu's properties:
 - Optimal Distance: 100.0
 - Relative Strength: 0.2
 - Initial Step size: 20.0
 - Step ratio: 0.95
 - Adaptive Cooling:
 - Convergence Thresh: 1.0E-4
- Barnes-Hut's properties:
 - Quadtree Max Level: 10
 - Theta: 1.2

Graph Panel (Center):

Graph Dragging (Configure)

Context Panel (Right):

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics Settings

Network Overview:

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

Node Overview:

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview:

- Avg. Path Length

Dynamic:

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

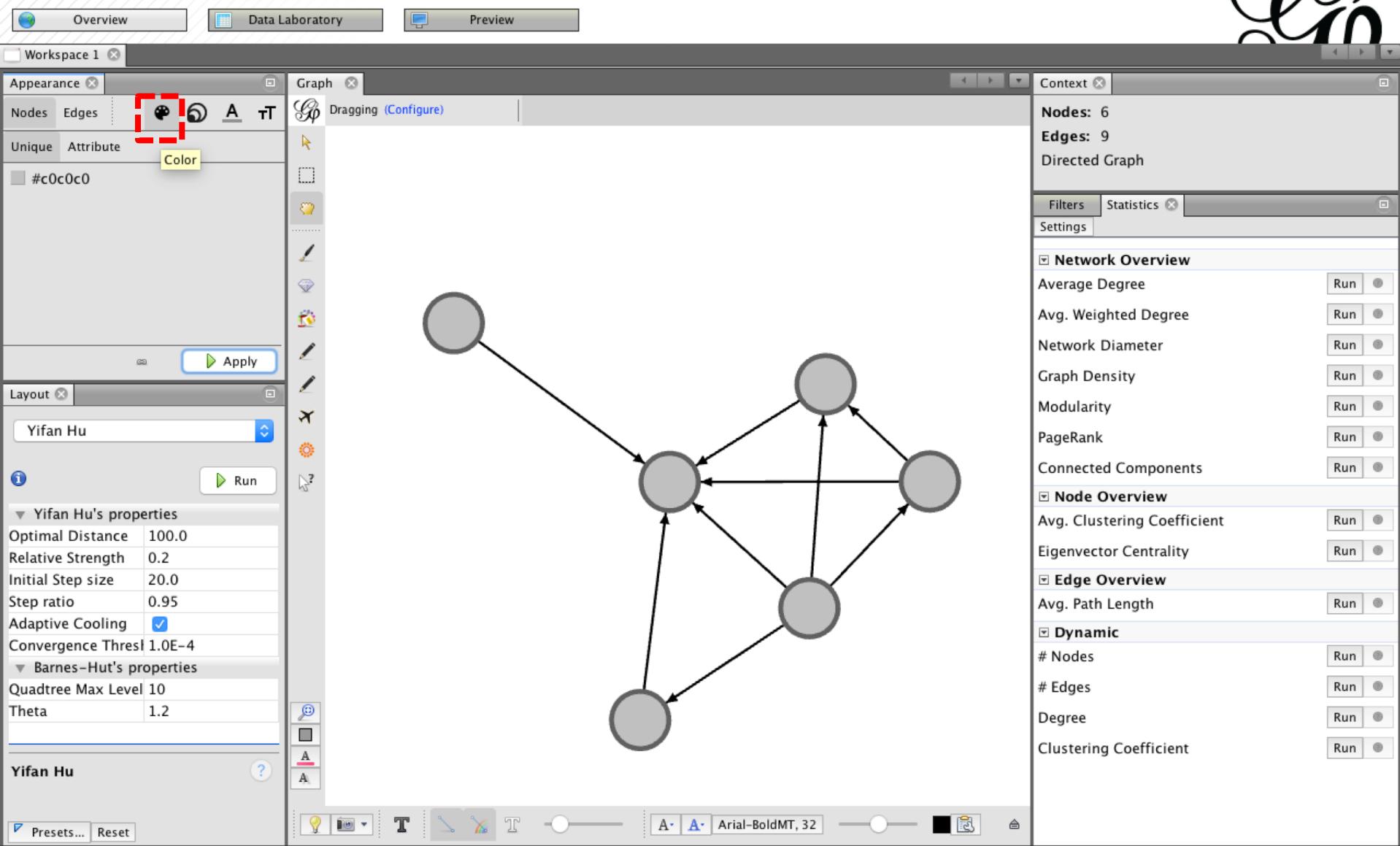
Gephi Overview: Layout

Yifan Hu

The screenshot shows the Gephi software interface with the following components:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Sidebar:** Appearance (Nodes, Edges, Unique, Attribute, color #c0c0c0), Layout (Yifan Hu, Run button highlighted with a red box).
- Graph Area:** A directed graph with 6 nodes and 9 edges. One node is isolated on the left, while the others are interconnected in a cluster on the right.
- Right Sidebar:** Context (Nodes: 6, Edges: 9, Directed Graph), Filters, Statistics, Settings, Network Overview (Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity, PageRank, Connected Components), Node Overview (Avg. Clustering Coefficient, Eigenvector Centrality), Edge Overview (Avg. Path Length), Dynamic (Number of Nodes, Number of Edges, Degree, Clustering Coefficient).
- Bottom Bar:** Presets..., Reset, various icons for file operations.

Appearance: Nodes Color



Nodes Color / Attribute / Apply

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute

2 (50%)
1 (50%)

Palette... Apply

Layout Yifan Hu Run

Yifan Hu's properties

- Optimal Distance 100.0
- Relative Strength 0.2
- Initial Step size 20.0
- Step ratio 0.95
- Adaptive Cooling
- Convergence Thresh 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level 10
- Theta 1.2

Yifan Hu Presets... Reset

Dragging (Configure)

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics 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

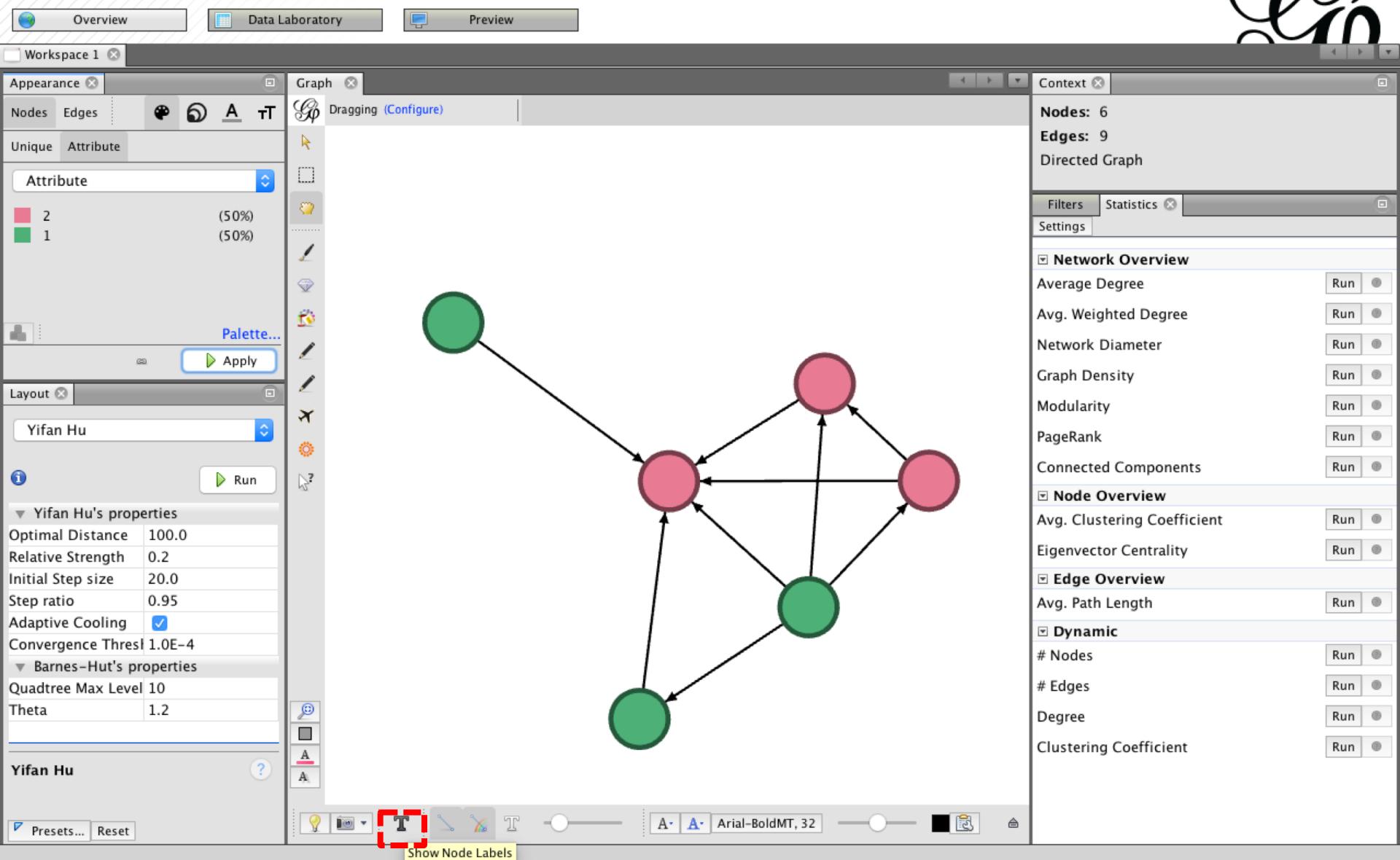
- Avg. Path Length Run

Dynamic

- # Nodes Run
- # Edges Run
- Degree Run
- Clustering Coefficient Run

128

Show Node Labels

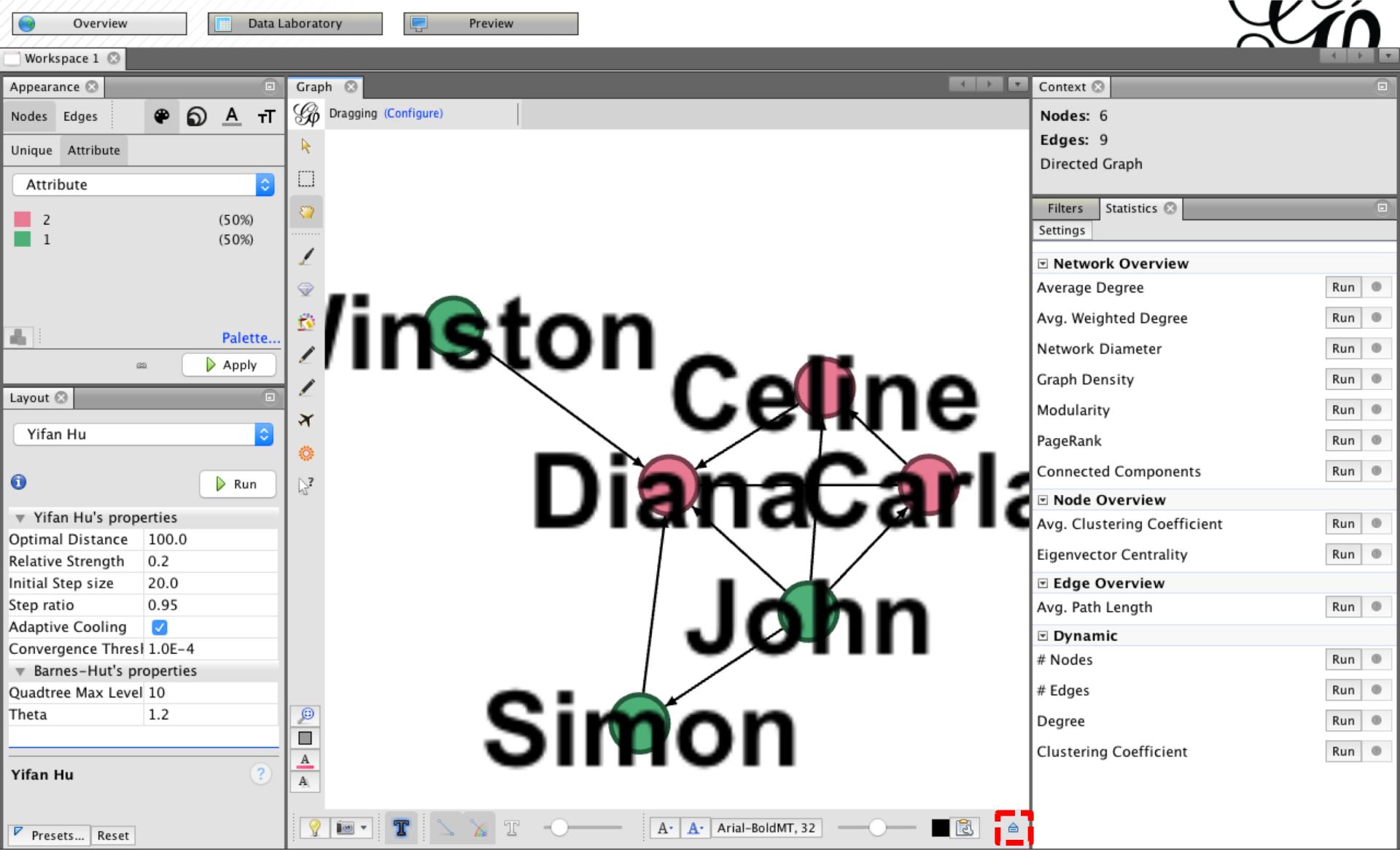


Show Node Labels

The screenshot shows a network analysis software interface with the following components:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Sidebar (Appearance):**
 - Nodes (selected), Edges.
 - Unique: 2 (pink), Attribute: 1 (green).
 - Attribute dropdown: 2 (50%), 1 (50%).
 - Palette... button.
- Layout:** Yifan Hu selected, Run button.
- Properties:**
 - Yifan Hu's properties:
 - Optimal Distance: 100.0
 - Relative Strength: 0.2
 - Initial Step size: 20.0
 - Step ratio: 0.95
 - Adaptive Cooling: checked
 - Convergence Thresh: 1.0E-4
 - Barnes-Hut's properties:
 - Quadtree Max Level: 10
 - Theta: 1.2
- Bottom Tools:** Presets..., Reset, T (highlighted with a red box), A, A, Arial-BoldMT, 32, Color Swatch, Context menu icon.
- Graph View:** Dragging (Configure). Nodes: 6, Edges: 9, Directed Graph.
- Context Panel:** Nodes: 6, Edges: 9, Network Overview, Edge Overview, Dynamic, Statistics.
- Network Diagram:** A directed graph with nodes labeled "winston", "Celine", "Diana", "Carla", "John", and "Simon". "winston" is pink, "Celine" is green, "Diana" is pink, "Carla" is pink, "John" is green, and "Simon" is green. Arrows indicate directed edges between nodes.
- Right Sidebar:** Network Overview, Edge Overview, Dynamic, Statistics.

Show Labels

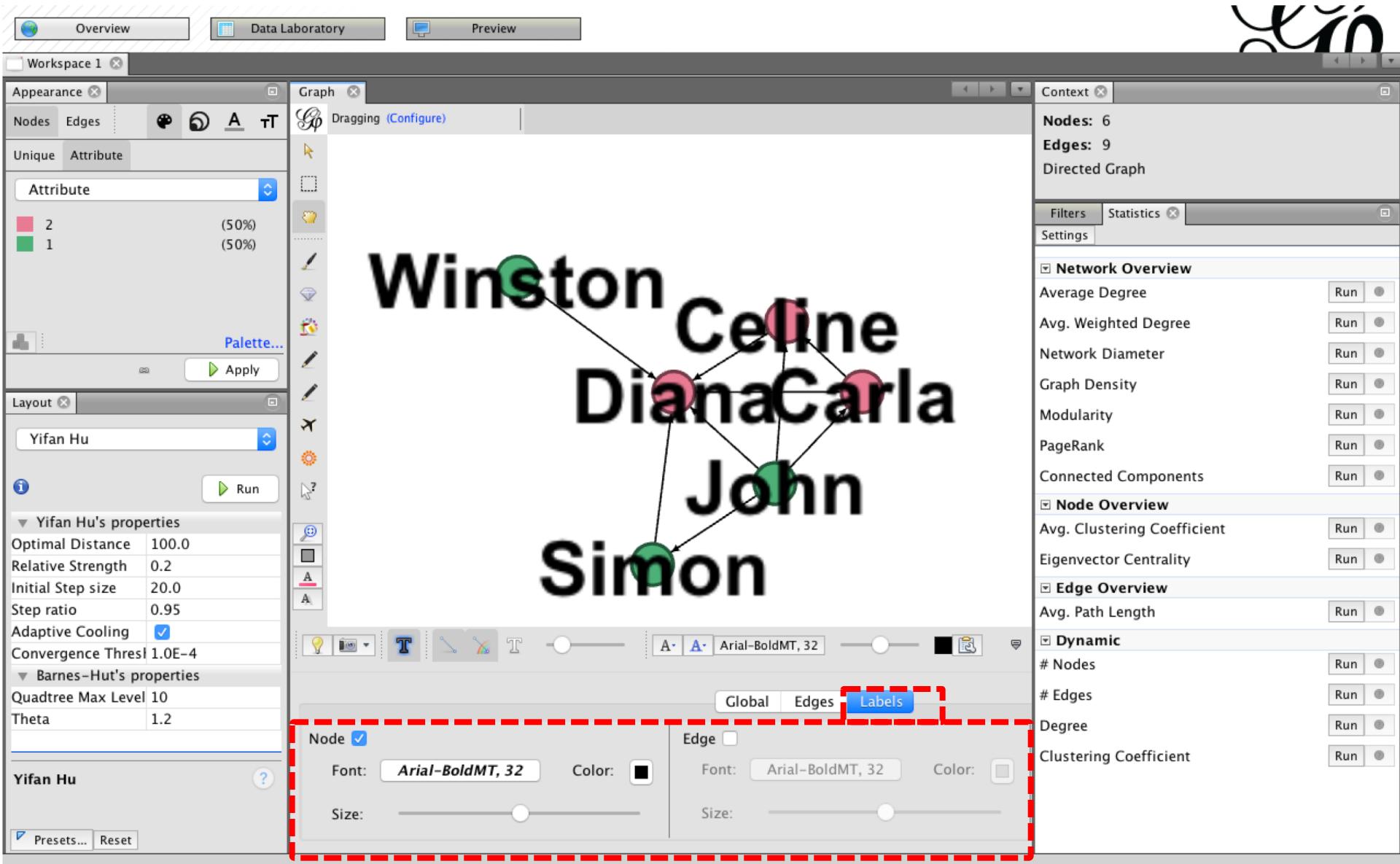


Global Edges Labels

The screenshot shows a network analysis software interface with the following components:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Panel (Appearance):**
 - Nodes Edges:** Nodes: 2 (50%), Edges: 1 (50%).
 - Attribute:** Shows two categories: 2 (50%) and 1 (50%).
 - Layout:** Set to "Yifan Hu".
 - Properties:**
 - Yifan Hu's properties:** Optimal Distance: 100.0, Relative Strength: 0.2, Initial Step size: 20.0, Step ratio: 0.95, Adaptive Cooling: checked, Convergence Thresh: 1.0E-4.
 - Barnes-Hut's properties:** Quadtree Max Level: 10, Theta: 1.2.
 - Presets... Reset**- Graph View:** Displays a directed graph with nodes labeled Winston, Celine, Diana, Carla, John, and Simon. Some nodes have green circles and some have pink circles.
- Bottom Panel (highlighted by a red dashed box):**
 - Controls:** Global, Edges, Labels (selected).
 - Background color:**
 - Zoom:** A slider.
 - Highlight selection:**
 - Autoselect neighbor:**
- Right Panel (Context):**
 - Nodes:** 6
 - Edges:** 9
 - Directed Graph**
 - Filters Statistics Settings**
 - Network Overview:** Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity, PageRank, Connected Components.
 - Node Overview:** Avg. Clustering Coefficient, Eigenvector Centrality.
 - Edge Overview:** Avg. Path Length.
 - Dynamic:** # Nodes, # Edges, Degree, Clustering Coefficient.
- Top Right Logo:** A stylized 'x' logo.

Labels



Labels Node Size

Overview Data Laboratory Preview

Workspace 1

Appearance

Nodes Edges Unique Attribute

Attribute

2 (50%)
1 (50%)

Palette... Apply

Layout Yifan Hu Run

Yifan Hu's properties

Optimal Distance 100.0
Relative Strength 0.2
Initial Step size 20.0
Step ratio 0.95
Adaptive Cooling
Convergence Thresh 1.0E-4

Barnes-Hut's properties

Quadtree Max Level 10
Theta 1.2

Yifan Hu Presets... Reset

Graph Dragging (Configure)

Context Nodes: 6
Edges: 9
Directed Graph

Filters Statistics 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

Dynamic

Nodes Run
Edges Run
Degree Run
Clustering Coefficient Run

Labels

Node Font: Arial-BoldMT, 32 Color: Size:

Edge Font: Arial-BoldMT, 32 Color: Size:

Labels Node Font Size

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute: 2 (50%) 1 (50%)

Palette... Apply

Layout Yifan Hu Run

Yifan Hu's properties:

- Optimal Distance: 100.0
- Relative Strength: 0.2
- Initial Step size: 20.0
- Step ratio: 0.95
- Adaptive Cooling:
- Convergence Thresl: 1.0E-4

Barnes-Hut's properties:

- Quadtree Max Level: 10
- Theta: 1.2

Yifan Hu Presets... Reset

Graph Dragging (Configure)

Nodes: 6
Edges: 9

Font

Family: Arial (selected)
Style: Bold (selected)
Size: 24

Preview: Aa Bb Yy Zz

Dynamic: # Nodes, # Edges, Degree, Clustering Coefficient

Global Edges Labels

Node:
Font: Arial-BoldMT, 24
Color: Size:

Edge:
Font: Arial-BoldMT, 32
Color: Size:

```
graph TD; Winston((Winston)) --> Diana((Diana)); Diana --> John((John)); John --> Celine((Celine)); Celine --> Carla((Carla)); Simon((Simon)) --> Diana;
```

Labels Node Size

Overview Data Laboratory Preview

Workspace 1

Appearance

Nodes Edges Unique Attribute

Attribute

2 (50%)
1 (50%)

Palette... Apply

Layout Yifan Hu Run

Yifan Hu's properties

Optimal Distance 100.0
Relative Strength 0.2
Initial Step size 20.0
Step ratio 0.95
Adaptive Cooling
Convergence Thresh 1.0E-4

Barnes-Hut's properties

Quadtree Max Level 10
Theta 1.2

Yifan Hu Presets... Reset

Graph Dragging (Configure)

Context Nodes: 6
Edges: 9
Directed Graph

Filters Statistics 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

Dynamic

Nodes Run
Edges Run
Degree Run
Clustering Coefficient Run

Labels

Node Edge

Font: Arial-BoldMT, 24 Color: █

Size:

Font: Arial-BoldMT, 32 Color: █

Size:

Labels Scaled

Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges Unique Attribute

Attribute: 2 (50%) 1 (50%)

Palette... Apply

Layout Yifan Hu Run

Yifan Hu's properties:

- Optimal Distance: 100.0
- Relative Strength: 0.2
- Initial Step size: 20.0
- Step ratio: 0.95
- Adaptive Cooling:
- Convergence Thresh: 1.0E-4

Barnes-Hut's properties:

- Quadtree Max Level: 10
- Theta: 1.2

Yifan Hu Presets... Reset

Graph Dragging (Configure)

Nodes: 6
Edges: 9
Directed Graph

Context

Filters Statistics Settings

Network Overview

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

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview

- Avg. Path Length

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Labels

Font: Arial-BoldMT, 24
Color: Black
Size: 24px

Font: Arial-BoldMT, 32
Color: Black
Size: 32px

AA Fixed
✓ % Scaled
AA Node size
Labels

Labels Color

Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges Unique Attribute

Attribute: 2 (50%) 1 (50%)

Palette...

Graph Dragging (Configure)

Layout Yifan Hu

Yifan Hu's properties

- Optimal Distance: 100.0
- Relative Strength: 0.2
- Initial Step size: 20.0
- Step ratio: 0.95
- Adaptive Cooling:
- Convergence Thresh: 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level: 10
- Theta: 1.2

Yifan Hu

Choose a Color

Hue: 2 Sat: 96 Bri: 99 Red: 252 Green: 17 Blue: 9 Hex: FC1109 Alpha: 128

Cancel OK

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Winston → Diana → Ce
Winston → Diana → Jo
Ce → Diana
Jo → Diana
Simon → Diana

Global Edges Labels

Show Edge default color: Scale Selection color
Use node color In: Both: Out:

Labels Color

Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges Unique Attribute

Attribute
2 (50%)
1 (50%)

Palette...

Graph Dragging (Configure)

Context Nodes: 6
Edges: 9
Directed Graph

Filters Statistics Settings

Network Overview
Average Degree

Avg. Weighted Degree

Network Diameter

Graph Density

Modularity

PageRank

Connected Components

Node Overview
Avg. Clustering Coefficient

Eigenvector Centrality

Edge Overview
Avg. Path Length

Dynamic
Nodes
Edges
Degree
Clustering Coefficient

Yifan Hu

Yifan Hu's properties
Optimal Distance 100.0
Relative Strength 0.2
Initial Step size 20.0
Step ratio 0.95
Adaptive Cooling
Convergence Thresh 1.0E-4

Barnes-Hut's properties
Quadtree Max Level 10
Theta 1.2

Yifan Hu

Diagram:

```
graph TD; Winston((Winston)) --> Diana((Diana)); Winston((Winston)) --> John((John)); Diana((Diana)) --> Celine((Celine)); Diana((Diana)) --> John((John)); Diana((Diana)) --> Simon((Simon)); Celine((Celine)) --> John((John)); John((John)) --> Simon((Simon)); Carla((Carla)) --> Celine((Celine)); Simon((Simon)) --> Diana((Diana))
```

Labels

Node Edge

Font: Arial-BoldMT, 24 Color: █ Size:

Font: Arial-BoldMT, 32 Color: █ Size:

Gephi Statistics: Average Degree

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute

2 (50%) 1 (50%)

Palett Apply

Layout Yifan Hu Run

Yifan Hu's properties

- Optimal Distance 100.0
- Relative Strength 0.2
- Initial Step size 20.0
- Step ratio 0.95
- Adaptive Cooling
- Convergence Thresh 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level 10
- Theta 1.2

Yifan Hu Presets... Reset

HTML Report

Degree Report

Results:

Average Degree: 3.000

Degree Distribution

Count

Value

Print Copy Save Close

Filters Statistics Settings

Nodes: 6
Edges: 9
Directed Graph

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
 Dynamic
Nodes Run
Edges Run
Degree Run
Clustering Coefficient Run

Gephi Statistics: Average Degree

Screenshot of the Gephi interface showing statistics for a network graph.

The top menu bar includes: Overview, Data Laboratory, Preview, and a workspace tab labeled "Workspace 1".

The left sidebar contains:

- Appearance: Nodes, Edges, Unique, Attribute.
- Attribute palette: 2 (50%) and 1 (50%).
- Layout: Yifan Hu.
- Properties for Yifan Hu's properties and Barnes-Hut's properties.
- Presets... and Reset buttons.

The central workspace displays two distribution plots:

- In-Degree Distribution:** A scatter plot showing Count (Y-axis, 0.00 to 2.00) versus Value (X-axis, 0 to 6). The data points are at (0, 2.00), (1, 2.00), (2, 1.00), and (5, 1.00).
- Out-Degree Distribution:** A scatter plot showing Count (Y-axis, 1.75 to 2.00) versus Value (X-axis, 0 to 6). The plot area is currently empty.

The bottom navigation bar includes: Print, Copy, Save, and Close.

The right sidebar displays network statistics:

- Nodes: 6, Edges: 9, Directed Graph.
- Filters: Network Overview (checked), Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity, PageRank, Connected Components.
- Statistics: Node Overview (checked), Avg. Clustering Coefficient, Eigenvector Centrality.
- Edge Overview (checked), Avg. Path Length.
- Dynamic: # Nodes, # Edges, Degree, Clustering Coefficient.

A red dashed box highlights the "Network Overview" section under the Filters category.

Gephi Statistics: Avg. Weighted Degree

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute

2 (50%) 1 (50%)

Palett Apply

Layout Yifan Hu Run

Yifan Hu's properties

- Optimal Distance 100.0
- Relative Strength 0.2
- Initial Step size 20.0
- Step ratio 0.95
- Adaptive Cooling
- Convergence Thresl 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level 10
- Theta 1.2

Yifan Hu

Presets... Reset

HTML Report

Weighted Degree Report

Results:

Average Weighted Degree: 1.500

Degree Distribution

Count

Value

Print Copy Save Close

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics Settings

Network Overview

- Average Degree 3 Run
- Avg. Weighted Degree 1.5 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

Dynamic

- # Nodes Run
- # Edges Run
- Degree Run
- Clustering Coefficient Run

Gephi Statistics: Network Diameter

The screenshot shows the Gephi software interface with various panels and a central graph area.

Top Navigation: Overview, Data Laboratory, Preview.

Left Sidebar: Workspace 1, Appearance (Nodes, Edges, Unique, Attribute), Layout (Yifan Hu), Presets..., Reset.

Central Graph Area: Graph (Dragging (Configure)), Context (Nodes: 6, Edges: 9, Directed Graph).

Graph Distance Settings Dialog:

- Distance:** The average graph-distance between all pairs of nodes. Connected nodes have graph distance 1. The diameter is the longest graph distance between any two nodes in the network. (i.e. How far apart are the two most distant nodes).
- Options:** Radio buttons for **Directed** (selected) and **Undirected**. Checkboxes for **Normalize Centralities in [0,1]**.
- Buttons:** Cancel, OK.

Bottom Labels Panel:

- Node:** Font: Arial-BoldMT, 24, Color: Red, Size: 100px.
- Edge:** Font: Arial-BoldMT, 32, Color: White, Size: 100px.

Statistics Panel (highlighted with a red dashed border):

- Network Overview:** Average Degree (Run), Avg. Weighted Degree (Run), Network Diameter (Run).
- Graph Properties:** Graph Density (Run), Modularity (Run), PageRank (Run), Connected Components (Run).
- Node Properties:** Node Overview (Run), Avg. Clustering Coefficient (Run), Eigenvector Centrality (Run).
- Edge Properties:** Edge Overview (Run), Avg. Path Length (Run).
- Dynamic Properties:** # Nodes (Run), # Edges (Run), Degree (Run), Clustering Coefficient (Run).

Page-Footer: 143

Gephi Statistics: Network Diameter

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute: 2 (50%) 1 (50%)

Palett Apply

Layout Yifan Hu Run

Yifan Hu's properties:

- Optimal Distance: 100.0
- Relative Strength: 0.2
- Initial Step size: 20.0
- Step ratio: 0.95
- Adaptive Cooling:
- Convergence Thresl: 1.0E-4

Barnes-Hut's properties:

- Quadtree Max Level: 10
- Theta: 1.2

Yifan Hu Presets... Reset

Graph Dragging (Configure)

HTML Report

Graph Distance Report

Parameters:

Network Interpretation: directed

Results:

Diameter: 1
Radius: 0
Average Path length: 1.0

Betweenness Centrality Distribution

Count

Print Copy Save Close

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics Settings

Network Overview

- Average Degree: 3 [Run]
- Avg. Weighted Degree: 1.5 [Run]
- Network Diameter: 1 [Run]
- Graph Density
- Modularity
- PageRank
- Connected Components

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview

- Avg. Path Length: 1 [Run]

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient



Gephi Statistics: Graph Density

The screenshot shows the Gephi software interface with a focus on a 'Graph Density Report' window.

Top Bar: Overview, Data Laboratory, Preview.

Left Sidebar: Workspace 1, Appearance (Nodes, Edges, Unique, Attribute), Attribute palette (2 pink, 1 green, 50% each), Layout (Yifan Hu), Properties (Optimal Distance: 100.0, Relative Strength: 0.2, etc.), Presets..., Reset.

Center: Graph panel (Dragging (Configure)), HTML Report window titled 'Graph Density Report' containing:

- Parameters:** Network Interpretation: directed
- Results:** Density: 0.300

Right Sidebar: Context (Nodes: 6, Edges: 9, Directed Graph), Filters, Statistics (Network Overview: Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity; Node Overview: Avg. Clustering Coefficient, Eigenvector Centrality; Edge Overview: Avg. Path Length; Dynamic: # Nodes, # Edges, Degree, Clustering Coefficient).

Gephi Statistics: Modularity

The screenshot shows the Gephi software interface with the following components:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Sidebar:** Appearance (Nodes, Edges, Unique, Attribute), Layout (Yifan Hu, Run), Properties (Optimal Distance, Relative Strength, Initial Step size, Step ratio, Adaptive Cooling, Convergence Thresh), Barnes-Hut's properties (Quadtree Max Level, Theta), and Yifan Hu section.
- Center Panel:** Graph (Dragging, Configure) and Context (Nodes: 6, Edges: 9, Directed Graph).
- Modularity Settings Dialog:** Titled "Modularity settings". It contains:
 - Randomize: Produce a better decomposition but increases computation time.
 - Use weights: Use edge weight.
 - Resolution: A slider set to 1.0.
- Bottom Panel:** Global, Edges, Labels tabs; Node and Edge configuration sections.
- Right Panel:** Statistics tab with various metrics listed:
 - Network Overview: Average Degree (Run), Avg. Weighted Degree (Run), Network Diameter (Run), Graph Density (Run, value 0.3).
 - Node Overview: Avg. Clustering Coefficient (Run), Eigenvector Centrality (Run).
 - Edge Overview: Avg. Path Length (Run, value 1).
 - Dynamic: # Nodes (Run), # Edges (Run), Degree (Run), Clustering Coefficient (Run).

Gephi Statistics: Modularity

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute

2 (50%)
1 (50%)

Dragging (Configure)

HTML Report

Modularity Report

Parameters:

Randomize: On
Use edge weights: On
Resolution: 1.0

Results:

Modularity: 0.000
Modularity with resolution: 0.000
Number of Communities: 1

Size Distribution

Yifan Hu

Layout

Yifan Hu's properties

- Optimal Distance 100.0
- Relative Strength 0.2
- Initial Step size 20.0
- Step ratio 0.95
- Adaptive Cooling
- Convergence Thresh 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level 10
- Theta 1.2

Yifan Hu

Presets... Reset

Filters Statistics

Settings

Network Overview

- Average Degree 3 Run
- Avg. Weighted Degree 1.5 Run
- Network Diameter 1 Run
- Graph Density 0.3 Run
- Modularity 0 Run
- PageRank Run
- Connected Components Run

Node Overview

- Avg. Clustering Coefficient Run
- Eigenvector Centrality Run

Edge Overview

- Avg. Path Length 1 Run

Dynamic

- # Nodes Run
- # Edges Run
- Degree Run
- Clustering Coefficient Run

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Gephi Statistics: Connected Components

The screenshot shows the Gephi interface with the following components:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Sidebar:** Workspace 1, Appearance (Nodes, Edges, Unique, Attribute), Layout (Yifan Hu), Presets..., Reset.
- Center:** Graph (Dragging, Configure) panel.
- Bottom Center:** Connected Components settings dialog:
 - Connected Components:** Determines the number of connected components in the network.
 - Radio Buttons:** Directed (Detects strongly & weakly connected components) and Undirected (Detects only weakly connected components).
 - Buttons:** Cancel, OK.
- Right Sidebar:** Context (Nodes: 6, Edges: 9, Directed Graph), Filters, Statistics (Network Overview, Node Overview, Edge Overview, Dynamic), and various statistics buttons like Run and ?.

Gephi Statistics: Connected Components

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

Attribute

2 (50%) 1 (50%)

Palett Apply

Layout Yifan Hu Run

Yifan Hu's properties

- Optimal Distance 100.0
- Relative Strength 0.2
- Initial Step size 20.0
- Step ratio 0.95
- Adaptive Cooling
- Convergence Thresh 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level 10
- Theta 1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

HTML Report

Connected Components Report

Parameters:
Network Interpretation: directed

Results:
Number of Weakly Connected Components: 1
Number of Strongly Connected Components: 6

Size Distribution

Count

Size

Print Copy Save Close

Filters Statistics Settings

Nodes: 6
Edges: 9
Directed Graph

Network Overview

- Average Degree 3 Run
- Avg. Weighted Degree 1.5 Run
- Network Diameter 1 Run
- Graph Density 0.3 Run
- Modularity 0 Run
- PageRank Run

Connected Components 1 Run

Node Overview

- Avg. Clustering Coefficient Run
- Eigenvector Centrality Run

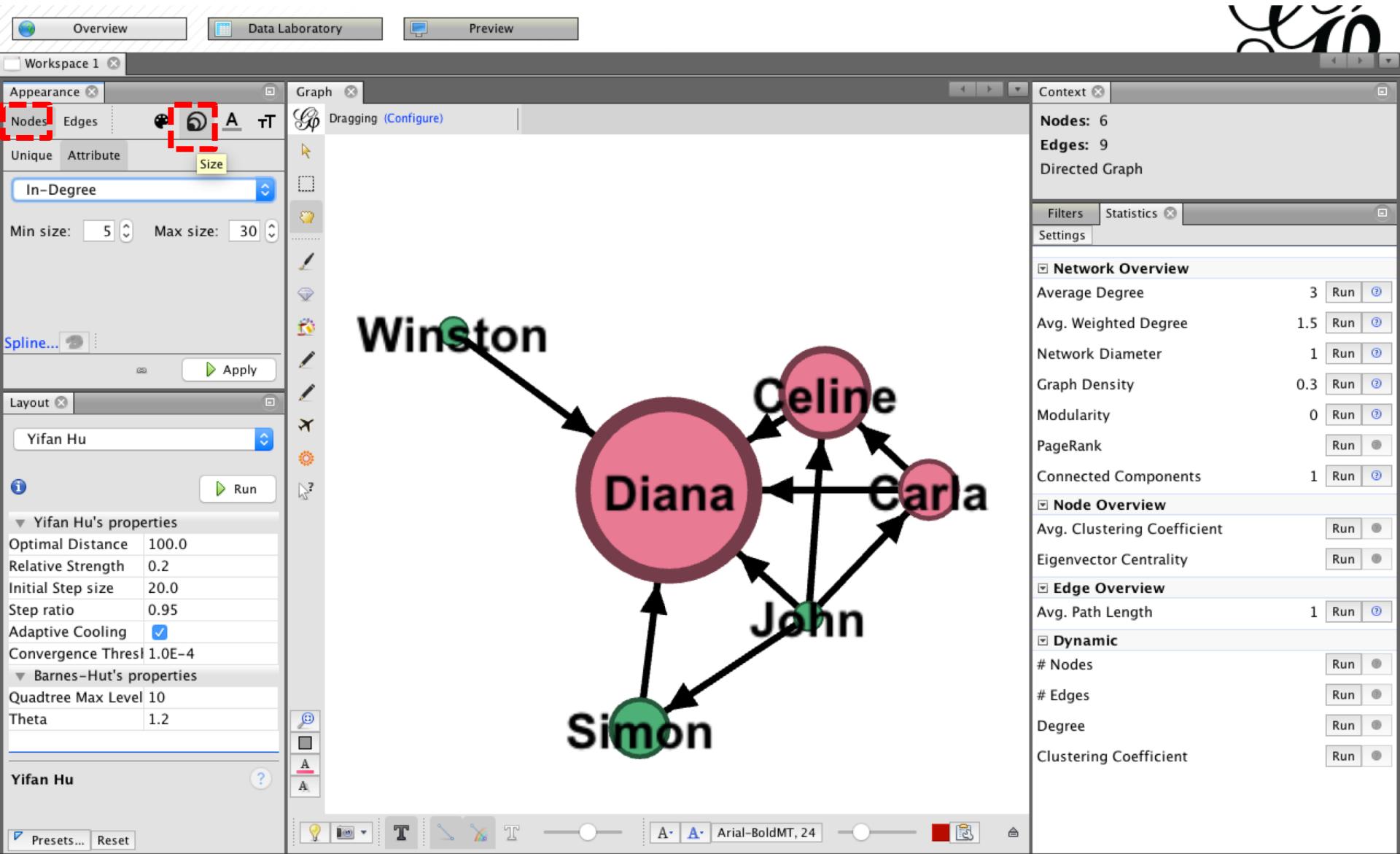
Edge Overview

- Avg. Path Length 1 Run

Dynamic

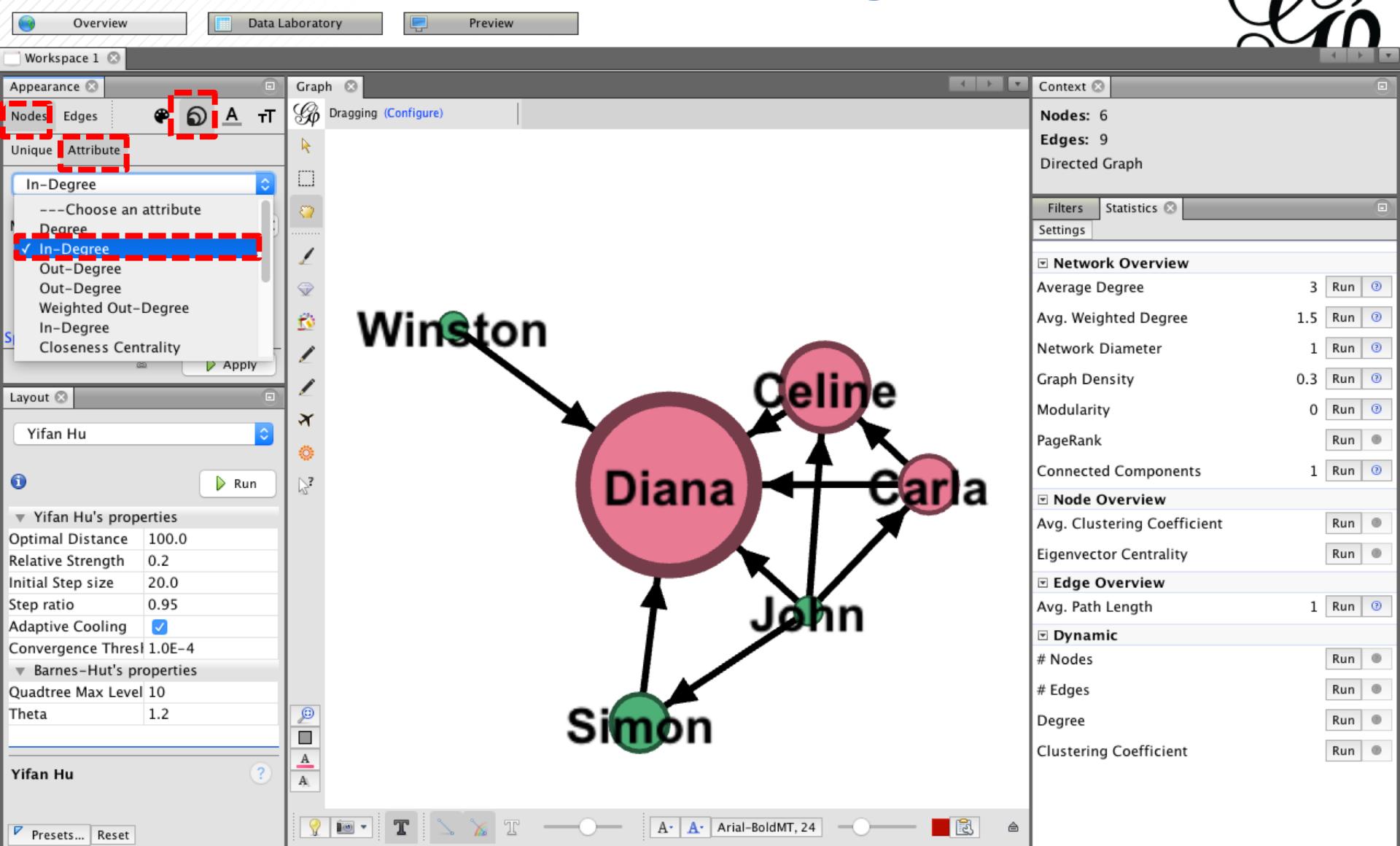
- # Nodes Run
- # Edges Run
- Degree Run
- Clustering Coefficient Run

Appearance Nodes Size



Appearance Nodes Size

Attribute / In-Degree



Appearance Nodes Size

Attribute / In-Degree / Min size / Max size / Apply

The screenshot shows a network analysis application with the following interface elements:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Panel (Appearance):**
 - Nodes:** Nodes and Edges tabs are selected. A red box highlights the Nodes tab.
 - In-Degree:** A dropdown menu showing "In-Degree".
 - Min size:** Set to 5. **Max size:** Set to 30.
 - Spline...** A button with an "Apply" button.
 - Layout:** Set to "Yifan Hu". A "Run" button is available.
 - Properties:**
 - Yifan Hu's properties:** Optimal Distance: 100.0, Relative Strength: 0.2, Initial Step size: 20.0, Step ratio: 0.95, Adaptive Cooling: checked, Convergence Thresh: 1.0E-4.
 - Barnes-Hut's properties:** Quadtree Max Level: 10, Theta: 1.2.
- Central Workspace (Graph):** Shows a directed graph with six nodes: Winston, Diana, Celine, Carla, John, and Simon. The nodes are represented as circles with varying sizes and colors (pink, purple, green). Directed edges connect the nodes as follows: Winston → Diana, Diana → Celine, Diana → Carla, Diana → John, John → Simon, and Simon → Diana. The node "Winston" is highlighted with a green circle.
- Right Panel (Context):**
 - Nodes:** 6, **Edges:** 9, **Directed Graph**.
 - Filters:** Buttons for "Network Overview", "Node Overview", "Edge Overview", "Dynamic", "# Nodes", "# Edges", "Degree", and "Clustering Coefficient".
 - Statistics:** Buttons for "Run" and "Edit" for each metric.
 - Metrics:**
 - Network Overview:** Average Degree: 3, Avg. Weighted Degree: 1.5, Network Diameter: 1, Graph Density: 0.3, Modularity: 0.
 - Node Overview:** PageRank, Connected Components: 1.
 - Edge Overview:** Avg. Path Length: 1.
 - Dynamic:** # Nodes, # Edges, Degree, Clustering Coefficient.

Appearance Edges

Attribute / Weight / Color

Overview Data Laboratory Preview

Workspace 1

Appearance Edges A TT

Nodes Edges Unique Attribute

Weight

Color: Default Invert Recent

Spline... Layout X Yifan Hu

Yifan Hu's properties

- Optimal Distance 100.0
- Relative Strength 0.2
- Initial Step size 20.0
- Step ratio 0.95
- Adaptive Cooling
- Convergence Thresl 1.0E-4

Barnes-Hut's properties

- Quadtree Max Level 10
- Theta 1.2

Yifan Hu Presets... Reset

Graph Dragging (Configure)

Context Nodes: 6 Edges: 9 Directed Graph

Filters Statistics Settings

Network Overview

- Average Degree 3
- Avg. Weighted Degree 1.5
- Network Diameter 1
- Graph Density 0.3
- Modularity 0
- PageRank
- Connected Components 1

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview

- Avg. Path Length 1

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Winston → Diana → Celine → Carla → John → Simon → Diana

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Appearance Edges

Attribute / Weight / Color / Apply

Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges A T

Unique Attribute

Weight

Color: 

Spline...

Apply

Layout Yifan Hu Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresl	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Graph Dragging (Configure)

Context Nodes: 6 Edges: 9 Directed Graph

Filters Statistics Settings

Network Overview

Average Degree	3 <input type="checkbox"/> Run <input type="checkbox"/>
Avg. Weighted Degree	1.5 <input type="checkbox"/> Run <input type="checkbox"/>
Network Diameter	1 <input type="checkbox"/> Run <input type="checkbox"/>
Graph Density	0.3 <input type="checkbox"/> Run <input type="checkbox"/>
Modularity	0 <input type="checkbox"/> Run <input type="checkbox"/>
PageRank	<input type="checkbox"/> Run <input type="checkbox"/>
Connected Components	1 <input type="checkbox"/> Run <input type="checkbox"/>

Node Overview

Avg. Clustering Coefficient	<input type="checkbox"/> Run <input type="checkbox"/>
Eigenvector Centrality	<input type="checkbox"/> Run <input type="checkbox"/>

Edge Overview

Avg. Path Length	1 <input type="checkbox"/> Run <input type="checkbox"/>
------------------	---

Dynamic

# Nodes	<input type="checkbox"/> Run <input type="checkbox"/>
# Edges	<input type="checkbox"/> Run <input type="checkbox"/>
Degree	<input type="checkbox"/> Run <input type="checkbox"/>
Clustering Coefficient	<input type="checkbox"/> Run <input type="checkbox"/>

Winston → Diana → Celine → Carla → John → Simon → Diana

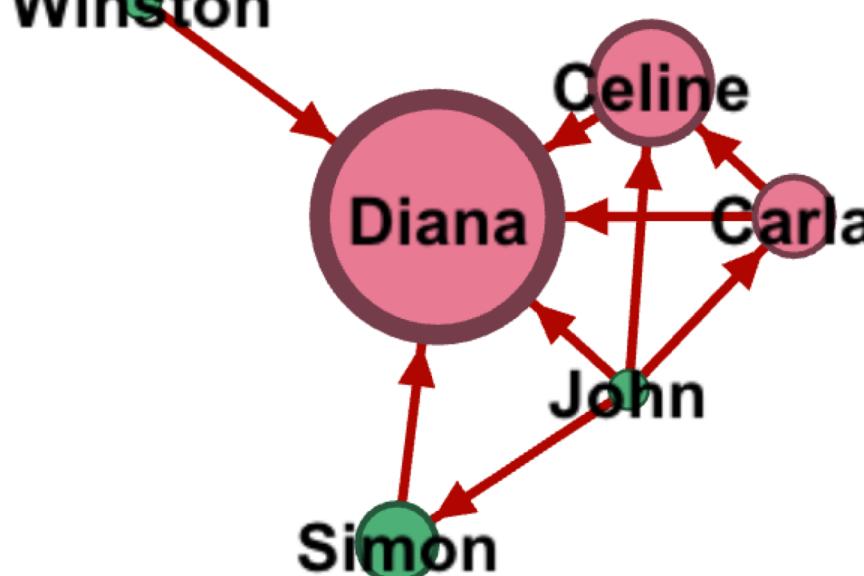


Diagram illustrating the appearance of edges in a network graph. The graph shows nodes Diana, Winston, Celine, Carla, John, and Simon connected by directed edges. The edges are colored red, indicating they have been styled using the 'Edges' tab in the Appearance panel. The nodes are pink circles with black outlines. The network is directed, as shown by the arrows on the edges.

Gephi Data Laboratory

Screenshot of the Gephi Data Laboratory interface showing a data table with network metrics for six nodes.

The Data Table view displays the following data:

Id	Label	Interval	Attribute	Degree		Weighted In-Degress		Weighted Out-Degress		Weighted Centrality		Eccentricity		Closeness Centrality		Harmonic Closeness		Betweenness Centrality		Modularity		Components		Strongly-Connected Components	
				In-Degree	Out-Degree	Weighted In-Degress	Weighted Out-Degress	Weighted Centrality	Eccentricity	Closeness Centrality	Harmonic Closeness	Betweenness Centrality	Modularity	Components	Strongly-Conn...										
1	John	1	0	4	4	0.0	4.0	4.0	1.0	1.0	1.0	0.0	0	0	4	0	0	0	0	4					
2	Carla	2	1	2	3	1.0	2.0	3.0	1.0	1.0	1.0	0.0	0	0	0	0	0	0	0	0	3				
3	Simon	1	1	1	2	1.0	1.0	2.0	1.0	1.0	1.0	0.0	0	0	0	0	0	0	0	0	2				
4	Celine	2	2	1	3	2.0	1.0	3.0	1.0	1.0	1.0	0.0	0	0	0	0	0	0	0	0	1				
5	Winston	1	0	1	1	0.0	1.0	1.0	1.0	1.0	1.0	0.0	0	0	0	0	0	0	0	0	5				
6	Diana	2	5	0	5	5.0	0.0	5.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0				

Below the table are various data manipulation tools:

- Add column
- Merge columns
- Delete column
- Clear column
- Copy data to other column
- Fill column with a value
- Duplicate column
- Create a boolean column from regex match
- Create column with list of regex matching groups

Gephi Preview

Overview Data Laboratory Preview

Workspace 1

Preview Settings Presets Default

Settings Manage renderers

Nodes

Border Width	1.0
Border Color	custom [0,0,0]
opacity	100.0

Node Labels

Show Labels	<input type="checkbox"/>
Font	Arial 12 Plain
Proportional size	<input checked="" type="checkbox"/>
Color	custom [0,0,0]
Shorten label	<input type="checkbox"/>
Max characters	30
Outline size	0.0
Outline color	custom [25,25,25]
Outline opacity	80.0
Box	<input type="checkbox"/>
Box color	parent
Box opacity	100.0

Edges

Show Edges	<input checked="" type="checkbox"/>
Thickness	1.0
Rescale weight	<input type="checkbox"/>
Color	mixed
Opacity	100.0
Curved	<input checked="" type="checkbox"/>

Preview ratio: 100%

Background Refresh Export: SVG/PDF/PNG

Background Reset zoom - +

The screenshot shows the Gephi software interface with the "Preview" tab selected. On the left, the "Preview Settings" panel displays various rendering options for nodes and edges. The "Nodes" section includes settings for border width, color, and outline. The "Edges" section includes settings for thickness, color, and curvature. The main preview area shows a network graph with six nodes and several edges. One edge is highlighted in green, indicating it is selected or being edited.



Gephi Preview: Show Labels

Screenshot of the Gephi software interface showing the Preview tab selected. The left panel displays the Preview Settings dialog with various rendering options. A red dashed box highlights the 'Node Labels' section under 'Nodes' settings, which includes options like 'Show Labels' (checked), 'Font' (Arial 8 Plain), and 'Proportional size' (checked). Another red dashed box highlights the 'Refresh' button at the bottom of the preview panel.

```
graph TD; Diana((Diana)) --- Celine((Celine)); Diana --- Carla((Carla)); Diana --- John((John)); Diana --- Simon((Simon)); Diana --- Winston((Winston)); Winston --- Diana;
```

Gephi Preview: Default Straight

Screenshot of the Gephi software interface showing the Preview tab. The main area displays a network graph with nodes labeled Winston, Celine, Diana, Carla, John, and Simon. The node Diana is the largest and pink, while others are smaller and green. Edges connect Winston to Diana, Celine to Diana, Diana to Carla, Diana to John, and Simon to John. The left sidebar shows the Preview Settings panel with a Presets dropdown set to "Default Straight". The "Settings" tab is selected, displaying options for Node Labels (Show Labels checked, Font Arial 8 Plain, Proportional size checked) and Edges (Show Edges checked, Thickness 1.0, Curved unchecked). The "Refresh" button at the bottom of the sidebar is highlighted with a red box.

Presets
Default Straight

Settings Manage renderers

Node Labels

- Show Labels
- Font Arial 8 Plain
- Proportional size
- Color custom [0,0,...]
- Shorten label
- Max characters 14
- Outline size 2.0
- Outline color custom [25...
- Outline opacity 80.0
- Box
- Box color parent
- Box opacity 100.0

Edges

- Show Edges
- Thickness 1.0
- Rescale weight
- Color mixed
- Opacity 100.0
- Curved
- Radius 0.0

Edge Arrows

- Size 3.0

Preview ratio: 100%

Refresh

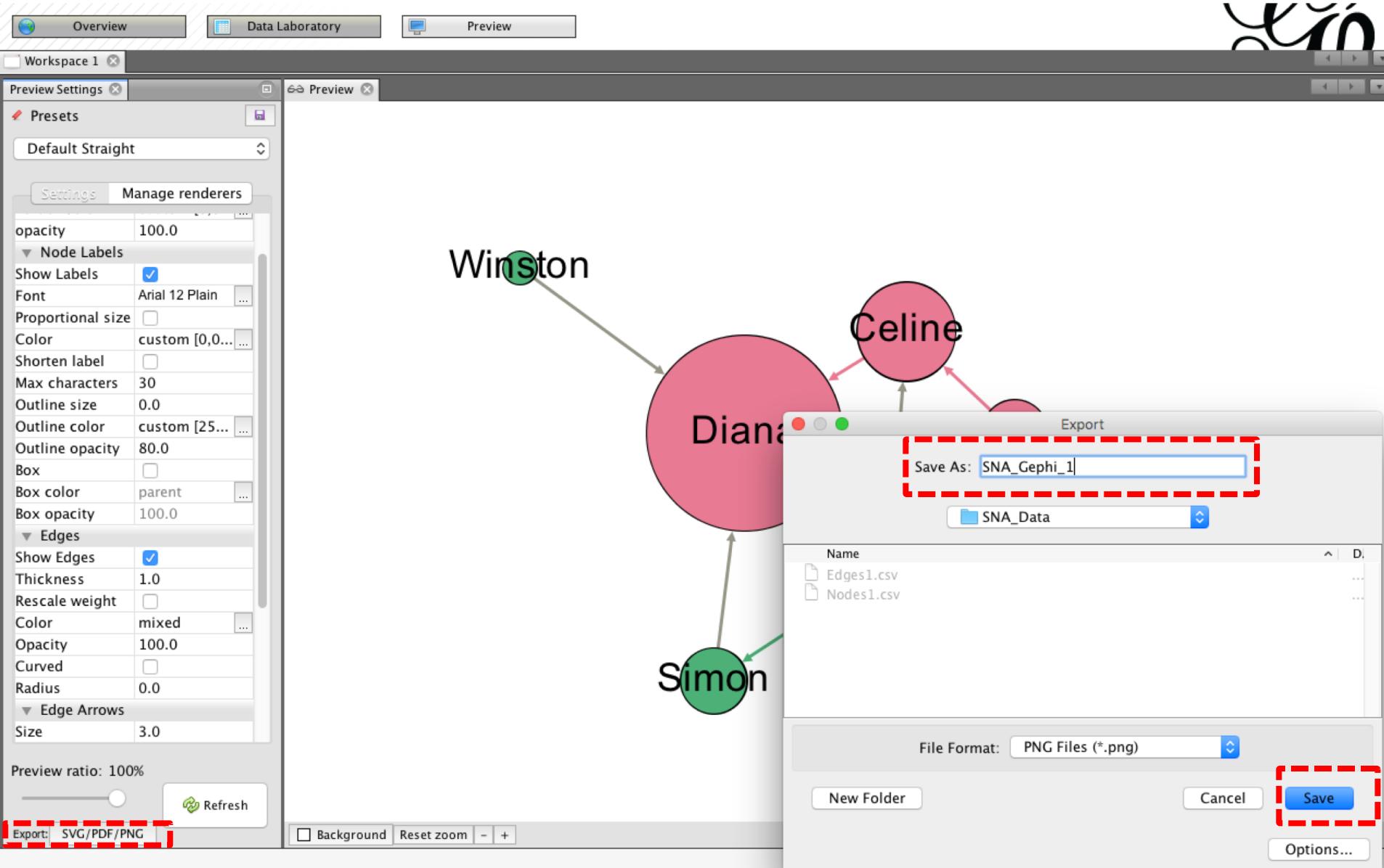
Background Reset zoom - +

Export: SVG/PDF/PNG

Gephi Preview: Default Straight

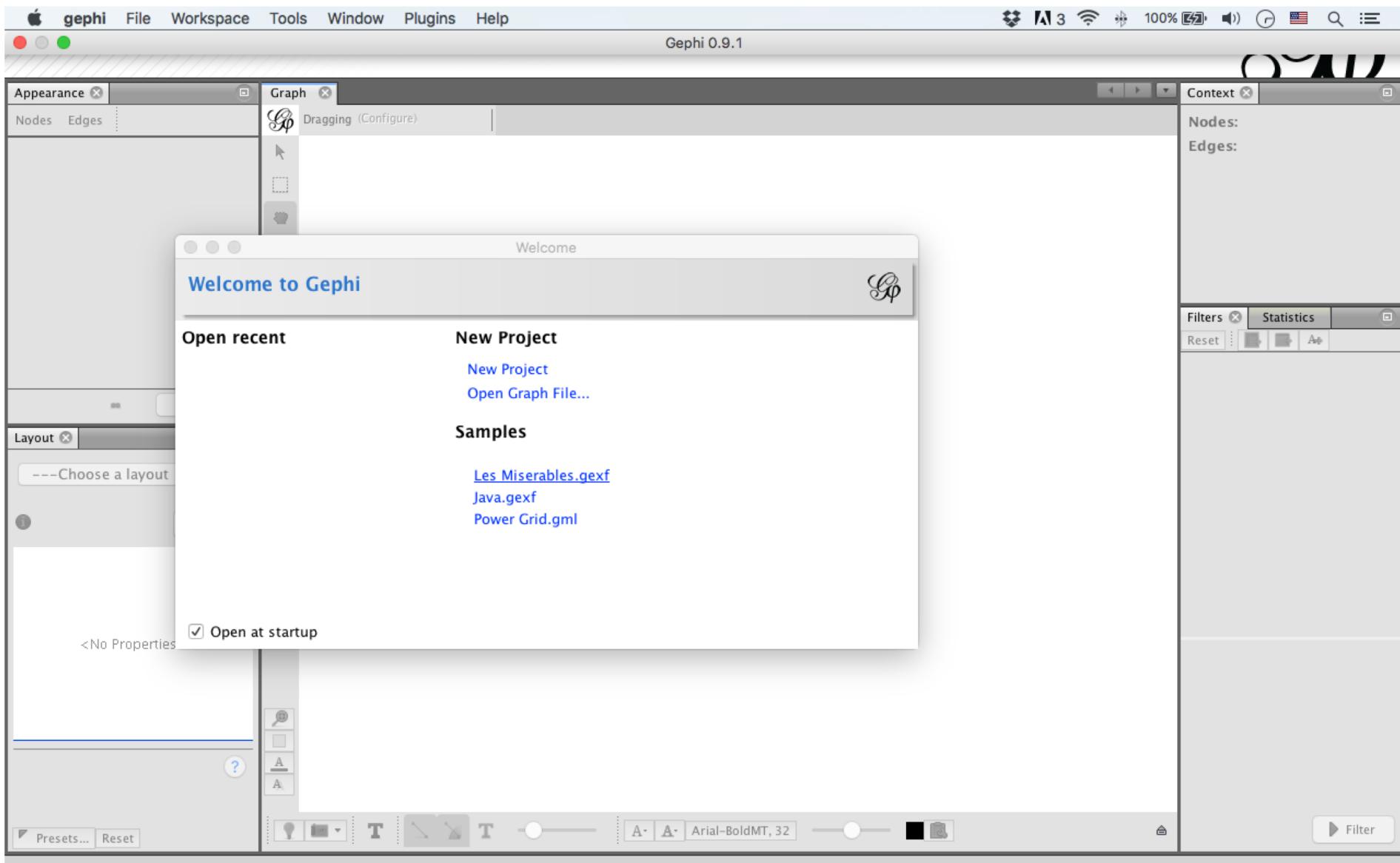
Screenshot of the Gephi software interface showing the Preview tab. The interface includes tabs for Overview, Data Laboratory, and Preview. A workspace titled "Workspace 1" is open. On the left, the "Preview Settings" panel is visible, with a red dashed box highlighting the "Presets" dropdown set to "Default Straight". The "Settings" tab is selected, showing configuration for Node Labels (e.g., Show Labels checked, Font Arial 12 Plain) and Edges (e.g., Show Edges checked, Thickness 1.0). A red dashed box also highlights the "Refresh" button at the bottom of the settings panel. The main preview area displays a network graph with nodes labeled Winston, Diana, Celine, Carla, John, and Simon. The edges are straight lines: Winston to Diana, Diana to Celine, Diana to Carla, Diana to John, John to Simon, and Simon to Diana.

Gephi Preview: Export SVG/PDF/PNG



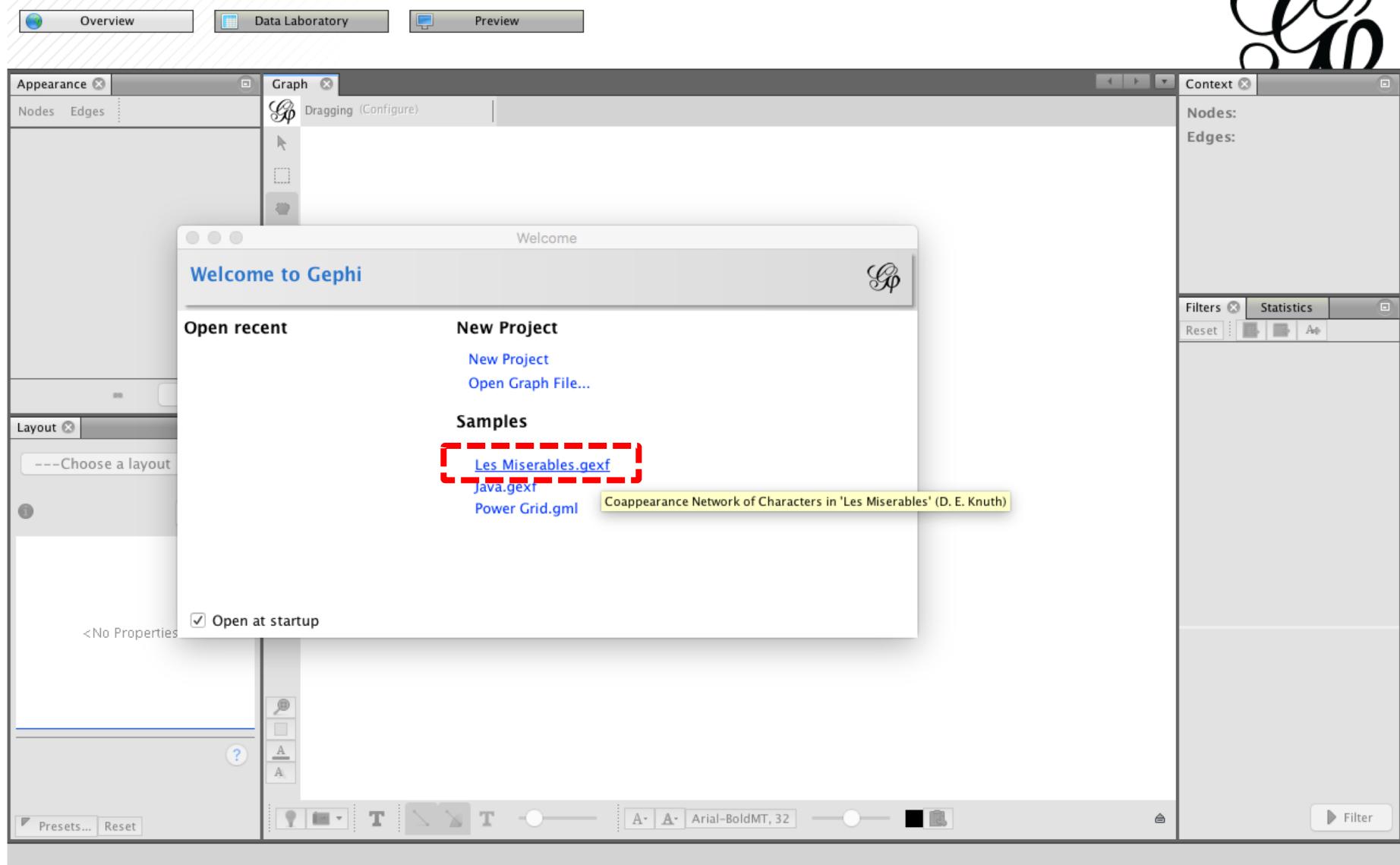
Open Gephi Samples

Gephi Samples

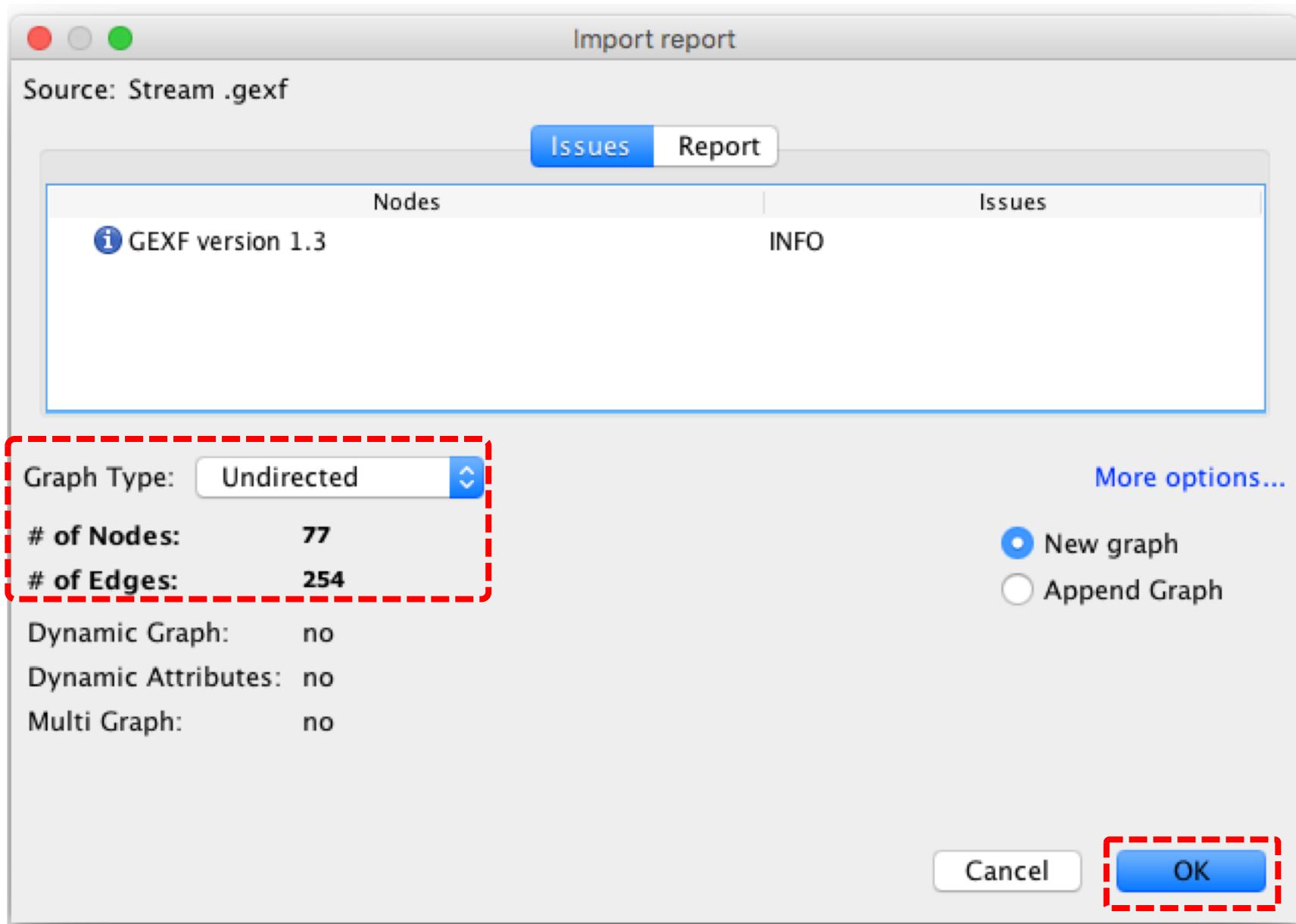


Gephi Samples

Les Miserables.gexf



Gephi Import Report



Gephi Overview

The screenshot shows the Gephi interface with a network graph centered on a red node. The interface includes:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Panel (Appearance):** Nodes, Edges, Unique, Attribute, color palette (#c0c0c0), Apply button.
- Left Panel (Layout):** Choose a layout (e.g., ForceAtlas2, Circular, Radial), Run button.
- Central Graph Area:** Network visualization with a red central node connected to various clusters of green, blue, purple, and yellow nodes.
- Right Panel (Context):** Nodes: 77, Edges: 254, Undirected Graph.
- Right Panel (Filters):** Library (Attributes, Dynamic, Edges, Operator, Topology, Saved queries).
- Bottom Panel:** Presets..., Reset, font toolbar (Arial-BoldMT, 32), color palette.

Gephi Layout

Screenshot of the Gephi software interface showing a network graph and various layout options.

The main window displays a network graph with a central red node connected to several green, blue, and purple nodes, which in turn connect to smaller clusters of nodes. The nodes are semi-transparent circles of varying sizes, representing their degree or importance in the network.

Toolbar:

- Overview, Data Laboratory, Preview
- Workspace 1
- Appearance (Nodes, Edges, Unique, Attribute, color #c0c0c0)
- Graph (Dragging, Configure) icon
- Context (Nodes: 77, Edges: 254, Undirected Graph)
- Filters (Library: Attributes, Dynamic, Edges, Operator, Topology, Saved queries), Statistics
- Layout (Choose a layout: Contraction, Expansion, Force Atlas, ForceAtlas 2, Fruchterman Reingold, Label Adjust, Noverlap, OpenOrd, Apply button)
- Presets..., Reset
- Text tools (T), Selection tool (S), Edge tool (E), Node tool (N), Zoom controls, Font (Arial-BoldMT, 32), Size, Color
- Filter button

Queries: Drag filter here

Gephi Layout: Force Atlas

Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges Unique Attribute #c0c0c0

Graph Dragging (Configure)

Context Nodes: 77 Edges: 254 Undirected Graph

Filters Reset Library Attributes Dynamic Edges Operator Topology Saved queries

Queries Drag filter here

Layout Force Atlas Run

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 sensitivity	0.2
Gravity	30.0

Force Atlas Presets... Reset

Arial-BoldMT, 32 Filter

The screenshot shows the Gephi interface with a network graph centered on a large red node. The graph consists of various colored nodes (green, blue, purple) connected by edges. On the left, the 'Layout' panel is open, specifically showing the 'Force Atlas' settings, which are highlighted with a red box. The 'Force Atlas' section contains the following parameters:

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 sensitivity	0.2
Gravity	30.0

The right side of the interface includes a 'Context' panel showing network statistics (Nodes: 77, Edges: 254, Undirected Graph), a 'Filters' panel with a 'Library' section containing categories like 'Attributes', 'Dynamic', 'Edges', 'Operator', 'Topology', and 'Saved queries', and a 'Queries' panel with a placeholder 'Drag filter here'. The bottom of the interface features a toolbar with various icons for selection, zoom, and text tools, along with font and color settings.

Gephi Layout: Contraction

Screenshot of the Gephi software interface showing the Contraction layout.

The main window displays a network graph with a large red central node and several clusters of smaller nodes in blue, green, purple, and yellow. The graph is labeled "Dragging (Configure)".

Toolbar (Top): Overview, Data Laboratory, Preview.

Appearance Panel (Left): Nodes, Edges, Unique, Attribute, Color #c0c0c0, Apply button.

Layout Panel (Left): Contraction (selected), Run button (highlighted with a red box).

Graph Panel (Center): Dragging (Configure).

Context Panel (Right): Nodes: 77, Edges: 254, Undirected Graph, Statistics, Library (Attributes, Dynamic, Edges, Operator, Topology, Saved queries), Queries (Drag filter here).

Bottom Panel: Presets..., Reset, Tools (Lightbulb, Selection, Zoom, Text, Arrow, Size, Filter).

Gephi Layout: Expansion

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

#c0c0c0

Layout X

Expansion

Run

properties

Scale factor 0.8

Expansion

Presets... Reset

Apply

Graph Dragging (Configure)

Nodes: 77
Edges: 254
Undirected Graph

Filters Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

Drag filter here

Filter

The screenshot shows the Gephi software interface with the following details:

- Top Bar:** Overview, Data Laboratory, Preview.
- Left Sidebar:** Appearance, Graph, Context.
- Appearance Panel:** Nodes, Edges, Unique, Attribute, color palette (#c0c0c0).
- Graph Panel:** Graph Dragging (Configure) button.
- Context Panel:** Nodes: 77, Edges: 254, Undirected Graph.
- Filters Panel:** Filters, Statistics, Reset.
- Library Panel:** Library section with categories: Attributes, Dynamic, Edges, Operator, Topology, Saved queries.
- Queries Panel:** Queries section with a placeholder "Drag filter here".
- Layout Panel (highlighted with a red dashed border):**
 - Expansion:** A dropdown menu currently set to "Expansion".
 - Run:** A button with a play icon.
 - properties:** A section containing "Scale factor" with a value of "0.8".
 - Expansion:** A large section at the bottom labeled "Expansion".
 - Buttons:** Presets..., Reset.
- Bottom Tools:** A toolbar with various icons for selection, zoom, and styling.
- Network Graph:** A central graph visualization showing a complex network of nodes (colored in red, blue, green, purple, yellow) and edges.

Gephi Layout: ForceAtlas 2

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

#c0c0c0

Apply

Layout

ForceAtlas 2

Stop

Threads number 3

Tolerance (speed) 1.0

Approximate Repu

Approximation 1.2

Tuning

Scaling 10.0

Stronger Gravity

Gravity 1.0

ForceAtlas 2

Presets... Reset

Drag filter here

Filter

Graph Dragging (Configure)

Nodes: 77
Edges: 254
Undirected Graph

Filters Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

ForceAtlas 2

The screenshot displays the Gephi interface with a network graph consisting of several clusters of nodes. The nodes are colored in various shades of green, cyan, purple, blue, and yellow, representing different communities or clusters. The 'Layout' panel on the left is active, showing the 'ForceAtlas 2' settings. A red box highlights the 'Stop' button in the 'Performance' section of the layout settings. The 'Graph' panel at the top center shows the current state of the layout process. The right side of the interface contains the 'Context' panel with node and edge counts, and the 'Library' panel listing various data types. The bottom right corner features a progress bar labeled 'ForceAtlas 2'.

Gephi Layout: Fruchterman Reingold

Screenshot of the Gephi software interface showing the Fruchterman Reingold layout algorithm applied to a network graph.

The main window displays a complex network graph with nodes of various sizes and colors (red, blue, green, purple) connected by edges of different colors (blue, green, red, purple, orange). A large red central node is surrounded by several smaller clusters of nodes.

The left sidebar contains the "Layout" panel, which is highlighted with a red dashed border. It shows the selected layout type, "Fruchterman Reingold", and its parameters:

- Area: 10000.0
- Gravity: 10.0
- Speed: 1.0

The "Stop" button in the Fruchterman Reingold section is also highlighted with a red box.

The top navigation bar includes tabs for Overview, Data Laboratory, Preview, and a workspace tab labeled "Workspace 1".

The right sidebar provides summary statistics: Nodes: 77, Edges: 254, and Undirected Graph. It also includes sections for Library, Queries, and a Context panel showing detailed node and edge counts.

The bottom status bar shows the layout name "Fruchterman Reingold" and a filter icon.

Gephi Layout: OpenOrd

Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

#c0c0c0

Layout X

OpenOrd

Run

Stages

Liquid (%)	25
Expansion (%)	25
Cooldown (%)	25
Crunch (%)	10
Simmer (%)	15

OpenOrd

Edge Cut: 0.8
Num Threads: 3
Num Iterations: 750

Presets... Reset

Graph Dragging (Configure)

Nodes: 77
Edges: 254
Undirected Graph

Filters Statistics

Reset

Library

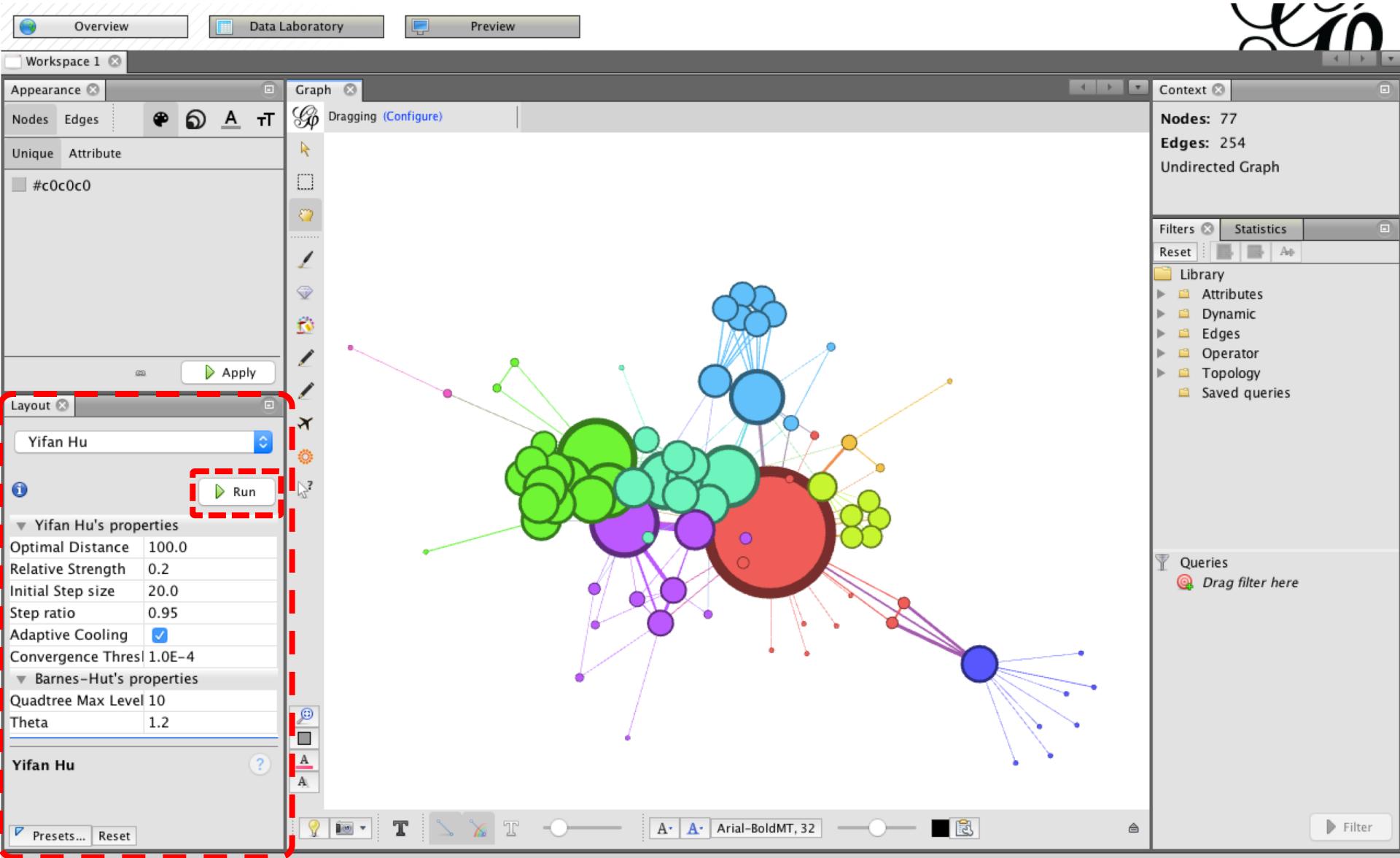
- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries Drag filter here

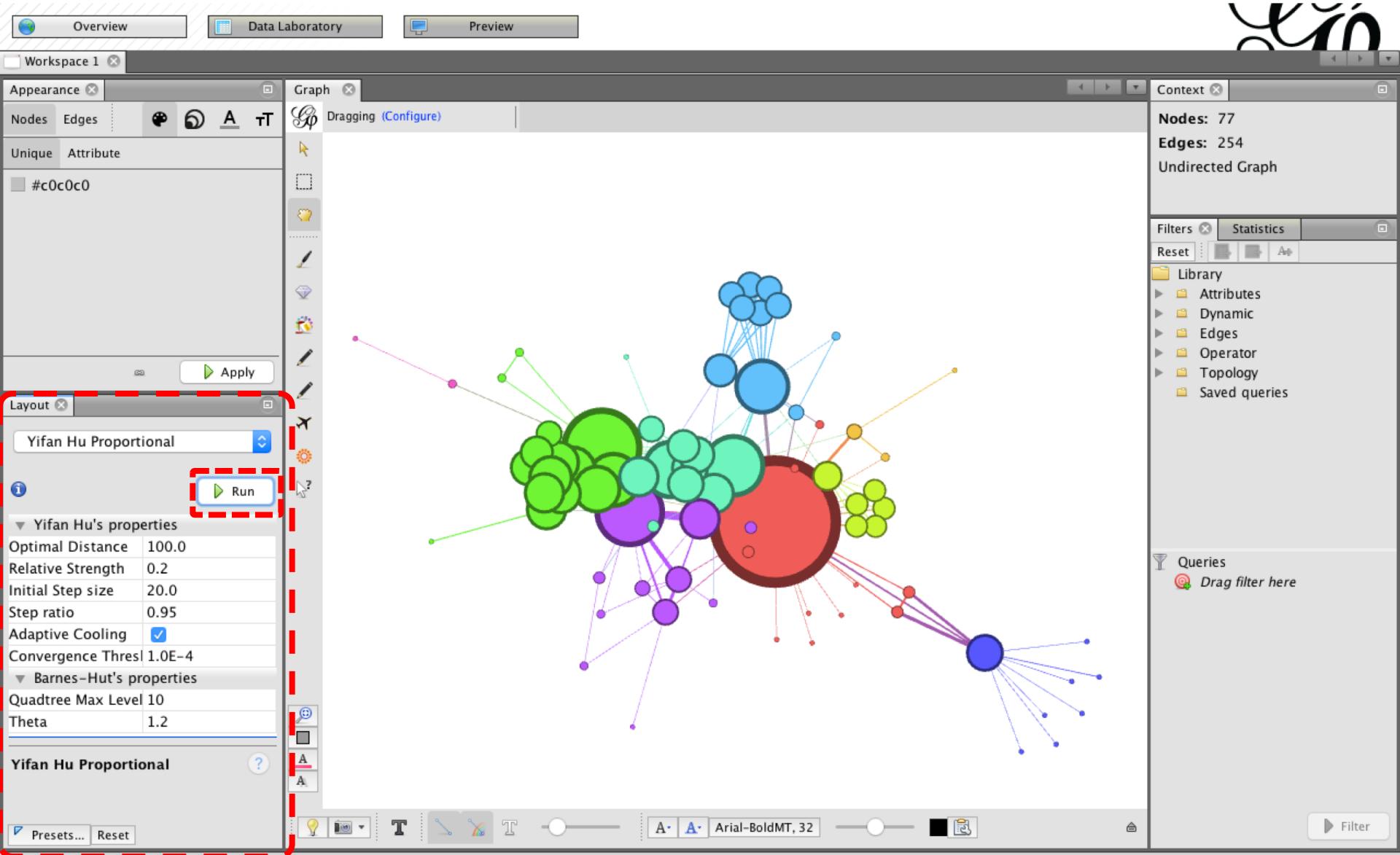
Filter

The screenshot displays the Gephi interface with a network graph centered. The graph consists of numerous nodes of varying sizes and colors (red, green, blue, purple) connected by a complex web of edges in various colors (red, green, blue, purple). The 'Layout' panel on the left is highlighted with a red dashed border, focusing on the 'OpenOrd' configuration. Within this panel, the 'Run' button is also highlighted with a red box. The 'Graph' tab is active at the top. The right side of the interface shows summary statistics: Nodes: 77, Edges: 254, Undirected Graph. Below the stats are sections for 'Filters', 'Statistics', and 'Library'. The 'Library' section includes categories like Attributes, Dynamic, Edges, Operator, Topology, and Saved queries. The bottom right corner features a 'Filter' button.

Gephi Layout: Yifan Hu



Gephi Layout: Yifan Hu Proportional



Gephi Data Laboratory: Nodes

Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes **Edges** Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Id

ID	Label	Interval	Modularity Class
0	Myriel		0
1	Napoleon		0
10	Labarre		1
11	Valjean		1
12	Marguerite		1
13	MmeDeR		1
14	Isabeau		1
15	Gervais		1
16	Tholomyes		2
17	Listolier		2
18	Fameuil		2
19	Blacheville		2
2	MlleBaptistine		1
20	Favourite		2
21	Dahlia		2
22	Zephine		2
23	Fantine		2
24	MmeThenardier		7
25	Thenardier		7
26	Cosette		6
27	Javert		7
28	Fauchelevent		4
29	Bamatabois		3
3	MmeMagloire		1
30	Perpetue		2
31	Simplice		2
32	Scaufflaire		1
33	Woman1		1
34	Judge		3
35	Champmathieu		3

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Data Laboratory: Edges

Screenshot of the Gephi Data Laboratory interface showing the Edges tab selected. The interface includes a navigation bar with Overview, Data Laboratory (selected), and Preview tabs. Below is a workspace titled "Workspace 1" containing a "Data Table" window.

The Data Table window displays a list of edges with the following columns: Source, Target, Type, Id, Label, Interval, and Weight. The "Edges" tab is highlighted with a red box. The "Source" column lists various node IDs from 1 to 21. The "Target" column lists node IDs 0 through 29. All edges are categorized as "Undirected". The "Type" column shows "Undirected" for all entries. The "Id" column contains numerical values corresponding to the edge index. The "Label" column is empty. The "Interval" column is also empty. The "Weight" column contains numerical values ranging from 1.0 to 10.0. A "Filter:" input field and a "Source" dropdown are visible at the top of the table.

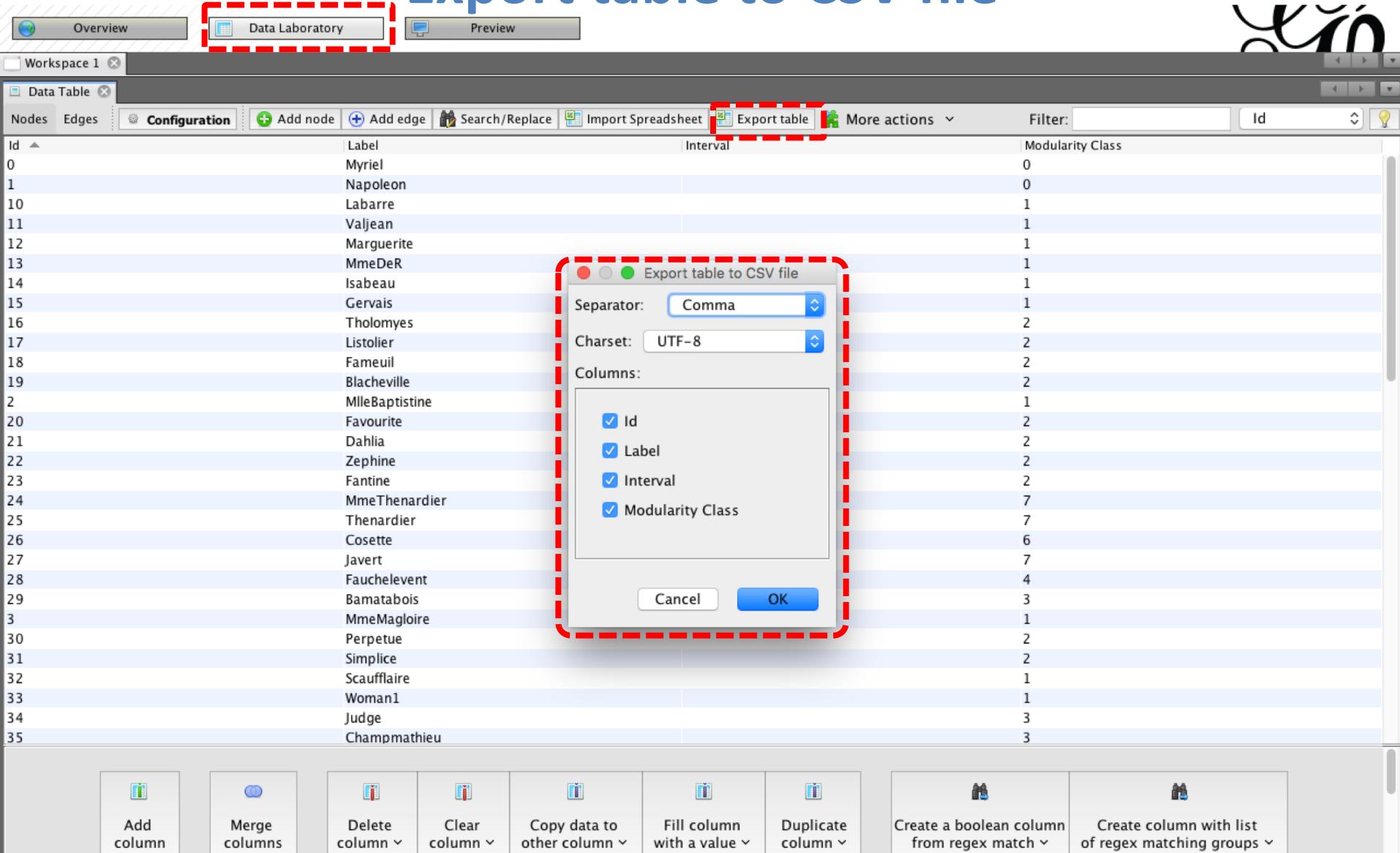
Source	Target	Type	Id	Label	Interval	Weight
1	0	Undirected	0			1.0
2	0	Undirected	1			8.0
3	0	Undirected	2			10.0
3	2	Undirected	3			6.0
4	0	Undirected	4			1.0
5	0	Undirected	5			1.0
6	0	Undirected	6			1.0
7	0	Undirected	7			1.0
8	0	Undirected	8			2.0
9	0	Undirected	9			1.0
11	0	Undirected	13			5.0
11	2	Undirected	12			3.0
11	3	Undirected	11			3.0
11	10	Undirected	10			1.0
12	11	Undirected	14			1.0
13	11	Undirected	15			1.0
14	11	Undirected	16			1.0
15	11	Undirected	17			1.0
17	16	Undirected	18			4.0
18	16	Undirected	19			4.0
18	17	Undirected	20			4.0
19	16	Undirected	21			4.0
19	17	Undirected	22			4.0
19	18	Undirected	23			4.0
20	16	Undirected	24			3.0
20	17	Undirected	25			3.0
20	18	Undirected	26			3.0
20	19	Undirected	27			4.0
21	16	Undirected	28			3.0
21	17	Undirected	29			3.0

Below the table are several toolbar icons:

- Add column
- Merge columns
- Delete column ▾
- Clear column ▾
- Copy data to other column ▾
- Fill column with a value ▾
- Duplicate column ▾
- Create a boolean column from regex match ▾
- Create column with list of regex matching groups ▾

Gephi Data Laboratory:

--- Export table to CSV file



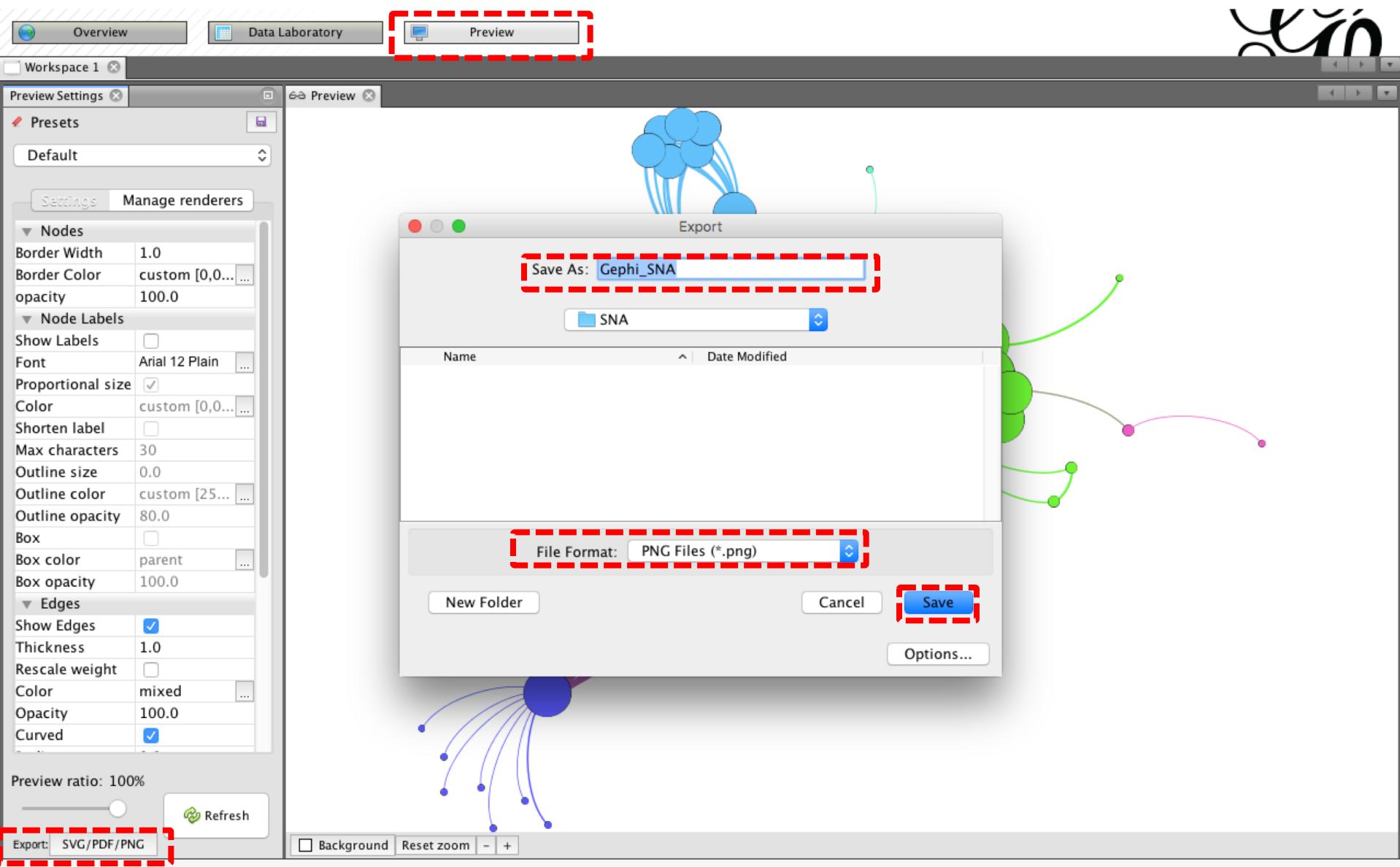
Gephi Preview

Screenshot of the Gephi software interface showing a network graph preview.

The interface includes:

- Top navigation bar with tabs: Overview, Data Laboratory, and Preview (highlighted with a red dashed box).
- Left sidebar with "Preview Settings" tab open, showing "Presets" and "Default".
- Settings panel on the left:
 - Nodes**: Border Width (1.0), Border Color (custom [0,0,...]), opacity (100.0).
 - Node Labels**: Show Labels (unchecked), Font (Arial 12 Plain), Proportional size (checked), Color (custom [0,0,...]), Shorten label (unchecked), Max characters (30), Outline size (0.0), Outline color (custom [25..., ...]), Outline opacity (80.0), Box (unchecked), Box color (parent), Box opacity (100.0).
 - Edges**: Show Edges (checked), Thickness (1.0), Rescale weight (unchecked), Color (mixed), Opacity (100.0), Curved (checked).
- Preview area showing a complex network graph with nodes of various sizes and colors (red, blue, green, purple, yellow) and edges of different colors and thicknesses.
- Bottom right corner features the Gephi logo.
- Bottom left corner shows "Preview ratio: 100%" with a slider and "Refresh" button (highlighted with a red dashed box).
- Bottom navigation bar with "Export: SVG/PDF/PNG" and zoom controls (- +).

Gephi Preview: Export SVG/PDF/PNG



Gephi Overview: Text Labels

Screenshot of the Gephi software interface showing a network graph of characters from Les Misérables. The graph consists of nodes representing characters and edges representing relationships. Nodes are colored by cluster, with the central node 'Valjean' being red. The interface includes various panels for managing nodes, edges, and appearance.

Appearance Panel:

- Nodes: Edges
- Unique Attribute
- Color: #c0c0c0
- Apply button

Layout Panel:

- Yifan Hu Proportional
- Run button
- Properties:
 - Optimal Distance: 100.0
 - Relative Strength: 0.2
 - Initial Step size: 20.0
 - Step ratio: 0.95
 - Adaptive Cooling: checked
 - Convergence Thresh: 1.0E-4
- Barnes-Hut's properties:
 - Quadtree Max Level: 10
 - Theta: 1.2

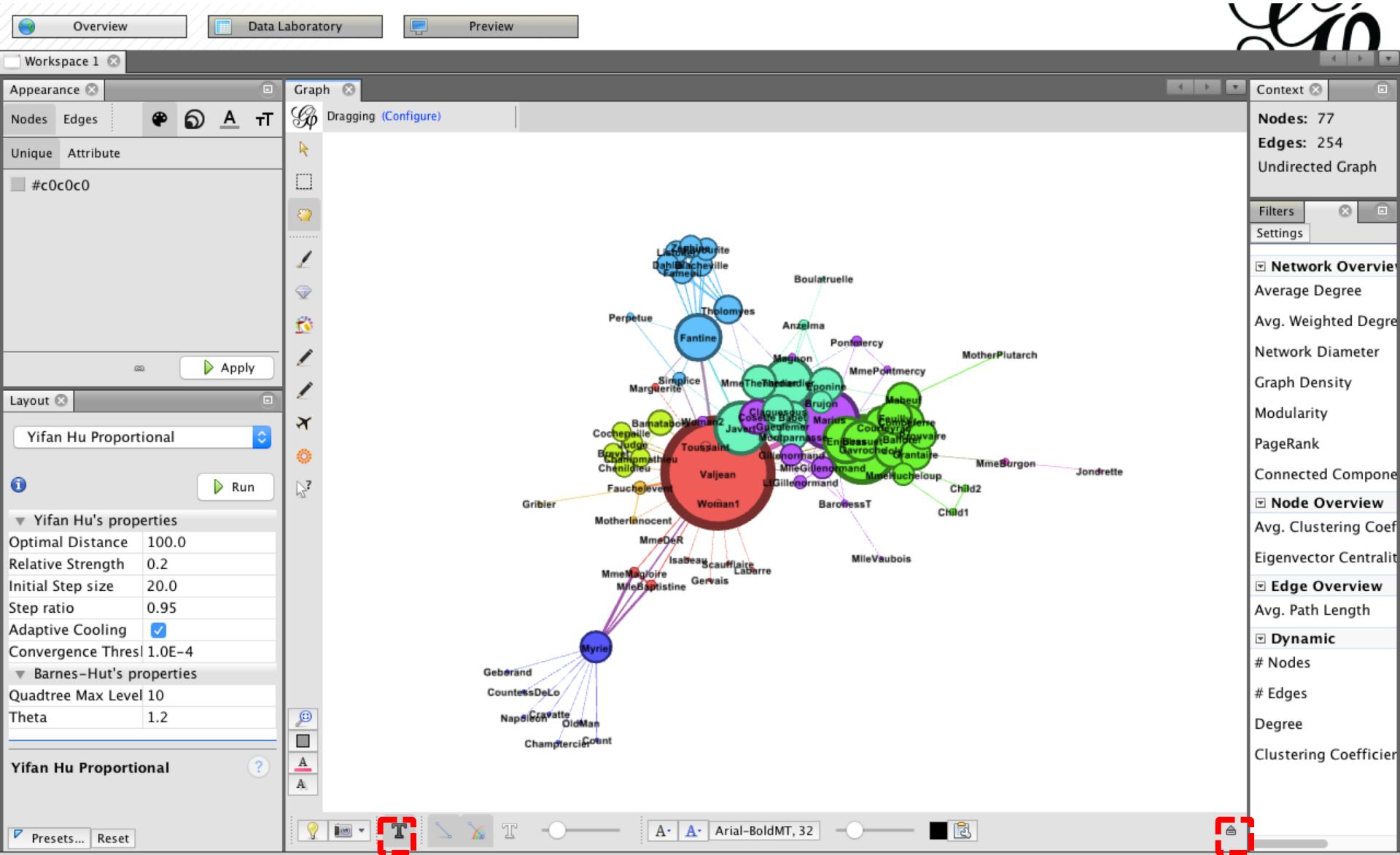
Graph Panel:

- Dragging (Configure) button
- Tool icons: Selection, Zoom, Hand, Pen, Diamond, Pencil, Color, Layout, Run, Help.
- Text input field: #c0c0c0
- Font: Arial-BoldMT, 32
- Color: Black
- Size: Scaled
- Color: Text
- Labels tab (selected)
- Global, Edges tabs
- Presets... Reset buttons

Context Panel:

- Nodes: 77
- Edges: 254
- Undirected Graph
- Filters, Settings buttons
- Network Overview:
 - Average Degree
 - Avg. Weighted Degree
 - Network Diameter
 - Graph Density
 - Modularity
 - PageRank
 - Connected Components
- Node Overview:
 - Avg. Clustering Coef
 - Eigenvector Centralit
- Edge Overview:
 - Avg. Path Length
- Dynamic:
 - # Nodes
 - # Edges
 - Degree
 - Clustering Coefficie

Gephi Overview: Text Labels



Comparison of Social Network Analysis (SNA) Tools

General Comparison of SNA Tools

Software	NETWORKX	IGRAPH	GEPHI	PAJEK
TYPE	LIBRARY	LIBRARY	STAND ALONE	STAND ALONE
PLATFORM	PYTHON	PYTHON\R\C LIBRARY	WINDOWS	WINDOWS
COMPUTATIONAL TIME	FAST	FAST	FAST	MEDIUM
NO. OF NODES	1 MILLION	1 MILLION	0.15 MILLION	1 MILLION

Naheed Akhtar (2014)

Network Types Supported by SNA Tools

Graph type	Networkx	IGraph	Gephi	Pajek
1-Mode network	Yes	Yes	Yes	Yes
2-Mode network Graph	Yes	Yes	Yes	Yes
Multirelational network Graph	No	No	No	Yes
Temporarily network Graph	Yes	No	No	Yes

Naheed Akhtar (2014)

Graph Layout Supported by SNA Tools

Layout	Networkx	IGraph	Pajek	Gephi
Circular layout	Yes	Yes	Yes	Yes
Random layout	Yes	Yes	Yes	No
Spectral layout	Yes	No	No	No
Spring layout	Yes	Yes	Yes	Yes
Graphviz layout	Yes	No	No	No
Kamada kawai	No	Yes	Yes	No
Fruchterman reingold	No	Yes	Yes	No
Force Atlas layout	No	No	Yes	No

Naheed Akhtar (2014)

Execution Time for SNA Features

SNA Features	Networkx	IGraph	Gephi	Pajek
Load time	54.67 sec.	3.707 sec	29 sec	3 sec
Degree centrality	58.57 sec	6.199 sec	4 sec	2 sec
Graph degree	60.87 sec	6.22 sec	4 sec	2 sec
Page rank	120.78 sec	9.81 sec	10 sec	No
Hits	57.23 sec	15.43	8 sec	No
Cliques	66.98 sec	9.35 sec	Na	No
Density	58.94 sec	3.302 sec	4 sec	No
Modularity	81 .4 sec	9 sec	30 sec	6 sec
Network diameter	35 sec	3.51 sec	120 sec	No
Core	65.84 sec	6.532 sec	No	1 sec
Cohesion	No	8.943 sec	No	No
Clustering coefficient	3303.99 sec	1800 sec	1200 sec	108 sec
Hub	76.57	5.831 sec	3 sec	No
Authority	Array is to big	6.783 sec	3 sec	No

Naheed Akhtar (2014)

Comparative analysis of Social Networking Analysis tools

Software	Pajek	Gephi	Social Network Visualizer	Netlytic	Graphviz
Version	1.26	0.7 alpha	1.56 Beta	Tier 1,2,3	2.38.0
Type	Stand-alone software	Stand-alone software	Stand-alone software	Stand-alone software	Stand-alone software
Platform	Windows	Java	Windows	Windows	Windows
License	Free	GNU GPL	Free	Tier 1,2 (Free) Tier 3 (CS)	Free
Expectable Computing Time	Fast(C)	Medium(JAVA)	Fast(C)	Medium(JAVA)	Fast(C)
Tractable number of nodes	500000 nodes	150000 nodes	100000 nodes	300000 nodes	1400000 nodes
Time to load 10^5 nodes and 10^6 edges	24 seconds	40 seconds	46 seconds	50 seconds	34 seconds
File formats					
GML	No	Yes	Yes	Yes	No
Pajek(.net)	No	Important Only	No	No	No
GraphML	Export only	Yes	Yes	Yes	No
DL	Yes	Yes	Yes	Yes	No
GEXF	No	Yes	Yes	Yes	No
Graph types					
Two-mode graphs	Yes	No	No	No	Yes
Multi-relational graphs	Yes	No	No	Yes	Yes
Temporality	Yes	No	No	Yes	Yes
Visualization layouts					
FruchtermanReingold	Yes	Yes	Yes	Yes	No
Kamada Kawai	Yes	Yes	No	No	Yes
Other spring layouts	No	Yes	Yes	No	Yes
Indicators					
Degree centrality	Yes	Yes	Yes	Yes	Yes
Betweenness centrality	Yes	Yes	Yes	Yes	Yes
Closeness centrality	Yes	Yes	Yes	Yes	Yes
Dyad census	No	No	No	No	No
Triad census	Yes	No	No	No	No
HITS	No	Yes	Yes	No	No
Page Rank	No	Yes	Yes	Yes	No
Clustering Algorithms					
Edge Betweenness	No	No	No	Yes	No
Walktrap	No	No	No	Yes	No
Spinglass	No	No	No	Yes	No
Dendogram Display	Yes	Yes	Yes	Yes	Yes

Comparative analysis of Social Networking Analysis tools

Software	Pajek	Gephi
Version	1.26	0.7 alpha
Type	Stand-alone software	Stand-alone software
Platform	Windows	Java
License	Free	GNU GPL
Expectable Computing Time	Fast(C)	Medium(JAVA)
Tractable number of nodes	500000 nodes	150000 nodes
Time to load 10^5 nodes and 10^6 edges	24 seconds	40 seconds

File formats

GML	No	Yes
Pajek(.net)	No	Important Only
GraphML	Export only	Yes
DL	Yes	Yes
GEXF	No	Yes

Graph types

Two-mode graphs	Yes	No
Multi-relational graphs	Yes	No
Temporality	Yes	No

Comparative analysis of Social Networking Analysis tools

Software	Pajek	Gephi
Visualization layouts		
FruchtermanReingold	Yes	Yes
Kamada Kawai	Yes	Yes
Other spring layouts	No	Yes
Indicators		
Degree centrality	Yes	Yes
Betweenness centrality	Yes	Yes
Closeness centrality	Yes	Yes
Dyad census	No	No
Triad census	Yes	No
HITS	No	Yes
Page Rank	No	Yes
Clustering Algorithms		
Edge Betweenness	No	No
Walktrap	No	No
Spinglass	No	No
Dendogram Display	Yes	Yes

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

Tools	Pajek	Gephi	igraph
Version	4.1	0.9.1	1.0.1
Website	vlado.fmf.uni-lj.si/pub/networks/pajek/	gephi.org	igraph.org
Type	Software	Software	Library
Platform	Windows	Windows, Mac OS X, Linux	R, Python, C/C++
License	Free and Commercial	Open source and free	Open source and free
Number of nodes	1 Billion	0.6 Million	>1 Million
Computing Time	Medium	Fast	Fast

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

Network Type	Pajek	Gephi	igraph
1-mode network	Yes	Yes	Yes
2-mode network	Yes	Yes	Yes
Multi-relational network	Yes	No	No
Temporal (dynamic) network	Yes	No	No

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

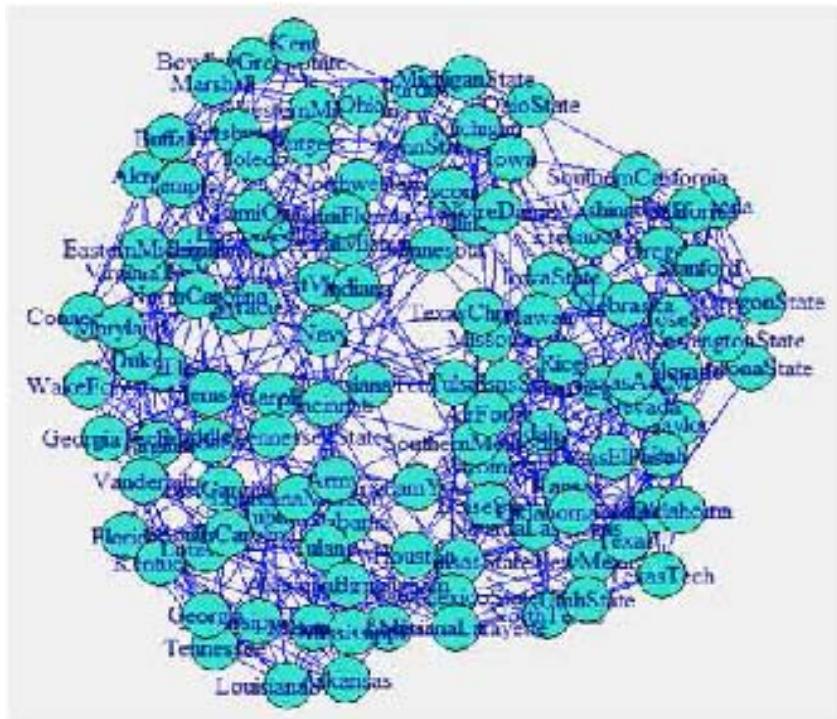
File Format	Pajek	Gephi	igraph
.net	Yes	Yes	No
.gml	No	Yes	Yes
.graphml	No	Yes	Yes
.txt	No	No	Yes
.csv	No	Yes	Yes
.pajek	Yes	Import only	Yes
.dl	No	Yes	Import only
.graphdb	No	No	Yes
.dot	No	Yes	Export only

A Survey of Tools for Community Detection and Mining in Social Networks

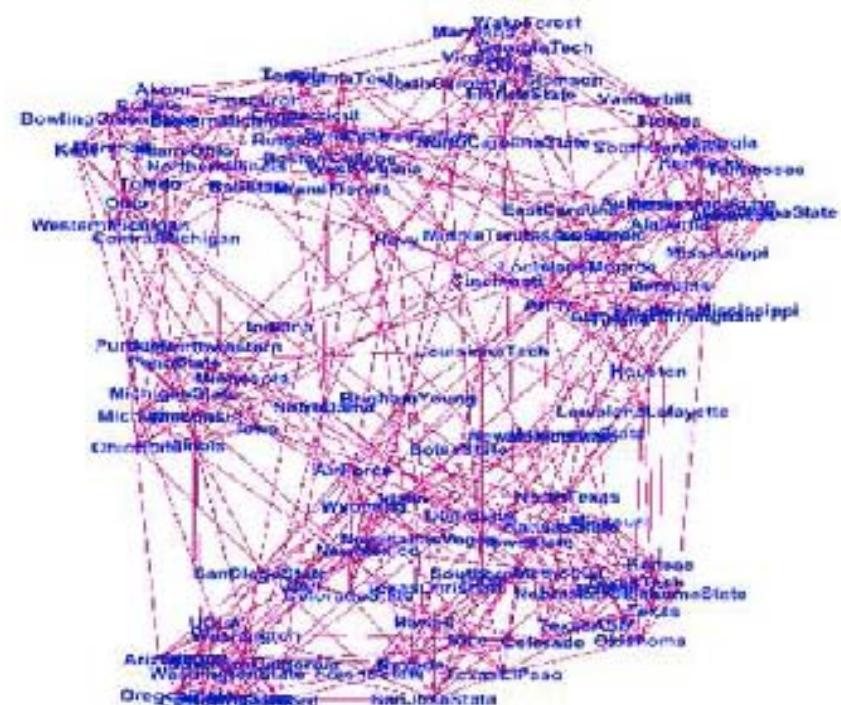
(Maivizhi et al., 2016)

Visualization Layout	Pajek	Gephi	igraph
Kamada-kawai	Yes	No	Yes
Fruchterman-Reingold	Yes	Yes	Yes
Other spring layout	Yes	No	Yes
Circular layout	Yes	No	Yes
Random layout	Yes	Yes	Yes
Force atlas layout	Yes	Yes	Yes
Spectral layout	No	No	No
Tree layout	No	No	Yes

Visualization using igraph and Gephi



Visualization of American College Football using **igraph** with **kamada-kawai** layout.



Visualization of American College Football using **Gephi** with **force-directed** layout.

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

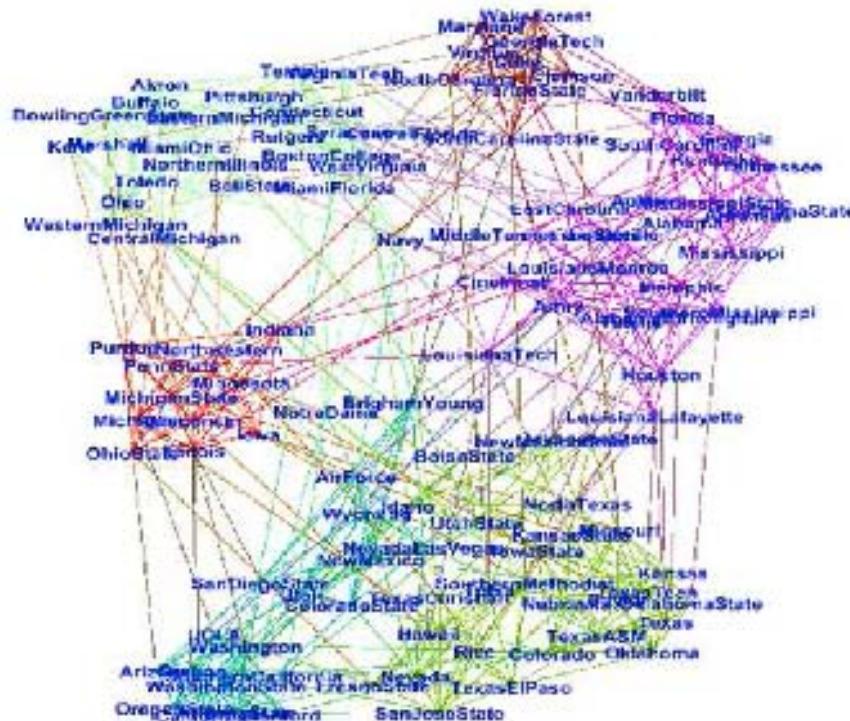
Network Metrics	Pajek	Gephi	igraph
Degree Centrality	Yes	Yes	Yes
Betweenness Centrality	Yes	Yes	Yes
Closeness Centrality	Yes	Yes	Yes
Network Diameter	Yes	Yes	Yes
Dyad Census	No	No	Yes
Triad Census	Yes	No	Yes
HITS	No	No	Yes
Page Rank	No	Yes	Yes

A Survey of Tools for Community Detection and Mining in Social Networks

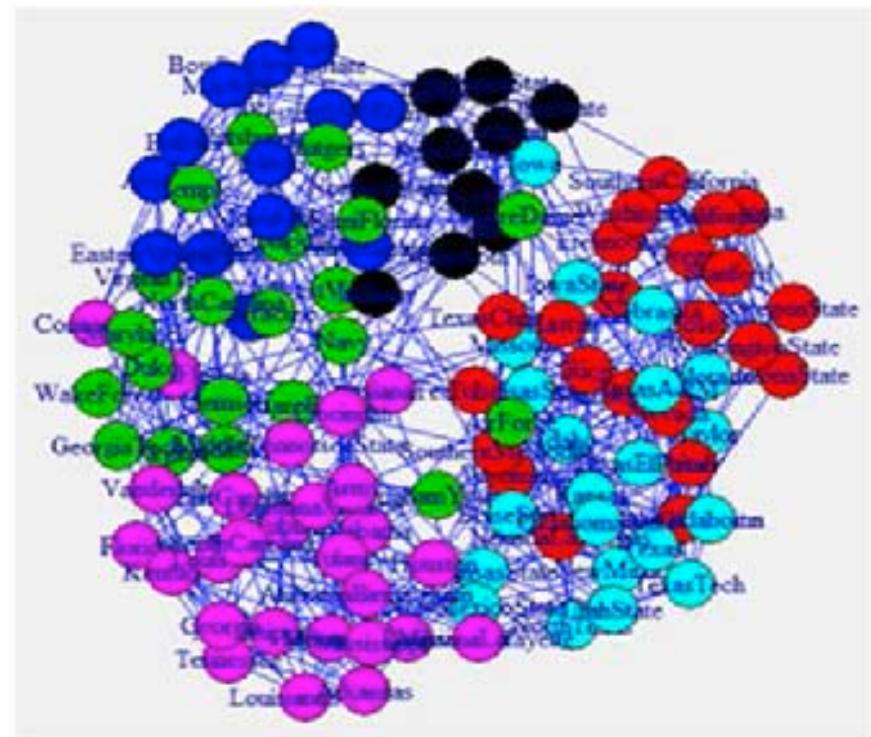
(Maivizhi et al., 2016)

Community Algorithms	Pajek	Gephi	igraph
Louvain Method	Yes	Yes	Yes
Edge Betweenness	No	No	Yes
Greedy Method	No	No	Yes
Modularity Method	No	No	No
Clique Percolation Method	No	No	No
Label Propagation	No	No	Yes
Eigen Vector	No	No	Yes
Random Walk	No	No	Yes
Statistical Method	No	No	Yes

Community Detection using Gephi and igraph



Community detection using Gephi with Louvain method.



Community detection using igraph with Fast Greedy Algorithm.

Application of SNA

Social Network Analysis

of

Research Collaboration

in

Information Reuse and Integration

Example of SNA Data Source



dblp
computer science bibliography

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IRI 2010: Las Vegas, NV, USA

- □ ⤵ ⤷ **Proceedings of the IEEE International Conference on Information Reuse and Integration, IRI 2010, 4-6 August 2010, Las Vegas, Nevada, USA.**
IEEE Systems, Man, and Cybernetics Society 2010
- ⤵ ⤷ Reda Alhajj, James B. D. Joshi, Mei-Ling Shyu: **Message from Program Co-Chairs.** 1
- ⤵ ⤷ Stuart Harvey Rubin, Shu-Ching Chen: **Forward.** 1
- ⤵ ⤷ Lotfi A. Zadeh: **Precision of meaning - toward computation with natural language.** 1-4
- ⤵ ⤷ Reda Alhajj, Shu-Ching Chen, Gongzhu Hu, James B. D. Joshi, Gordon K. Lee, Stuart Harvey Rubin, Mei-Ling Shyu, Lotfi A. Zadeh: **Panel title: Critical need for funding of basic and applied research in large-scale computing.** 1

Automation, Integration and Reuse across Various Apps

- ⤵ ⤷ László István Etesi, André Csillaghy, Lin-Ching Chang: **A message-based interoperability framework with application to astrophysics.** 1-6
- ⤵ ⤷ Awny Alnusair, Tian Zhao, Eric Bodden: **Effective API navigation and reuse.** 7-12
- ⤵ ⤷ Manabu Ohta, Ryohei Inoue, Atsuhiro Takasu: **Empirical evaluation of active sampling for CRF-based analysis of pages.** 13-18
- ⤵ ⤷ Qunzhi Zhou, Viktor K. Prasanna: **Workflow management of simulation based computation processes in transportation domain.** 19-24

Research Question

- RQ1: What are the scientific **collaboration patterns** in the IRI research community?
- RQ2: Who are the **prominent researchers** in the IRI community?

Methodology

- Developed a simple **web focused crawler** program to download literature information about all IRI papers published between **2003** and **2010** from **IEEE Xplore** and **DBLP**.
 - **767** paper
 - **1599** distinct author
- Developed a program to convert the list of coauthors into the **format of a network file** which can be readable by social network analysis software.
- **UCINet** and **Pajek** were used in this study for the social network analysis.

Top10 prolific authors (IRI 2003-2010)

1. Stuart Harvey Rubin
2. Taghi M. Khoshgoftaar
3. Shu-Ching Chen
4. Mei-Ling Shyu
5. Mohamed E. Fayad
6. Reda Alhajj
7. Du Zhang
8. Wen-Lian Hsu
9. Jason Van Hulse
10. Min-Yuh Day

Data Analysis and Discussion

- **Closeness Centrality**
 - Collaborated widely
- **Betweenness Centrality**
 - Collaborated diversely
- **Degree Centrality**
 - Collaborated frequently
- **Visualization of Social Network Analysis**
 - Insight into the structural characteristics of research collaboration networks

Top 20 authors with the highest **closeness** scores

Rank	ID	Closeness	Author
1	3	0.024675	Shu-Ching Chen
2	1	0.022830	Stuart Harvey Rubin
3	4	0.022207	Mei-Ling Shyu
4	6	0.020013	Reda Alhajj
5	61	0.019700	Na Zhao
6	260	0.018936	Min Chen
7	151	0.018230	Gordon K. Lee
8	19	0.017962	Chengcui Zhang
9	1043	0.017962	Isai Michel Lombera
10	1027	0.017962	Michael Armella
11	443	0.017448	James B. Law
12	157	0.017082	Keqi Zhang
13	253	0.016731	Shahid Hamid
14	1038	0.016618	Walter Z. Tang
15	959	0.016285	Chengjun Zhan
16	957	0.016285	Lin Luo
17	956	0.016285	Guo Chen
18	955	0.016285	Xin Huang
19	943	0.016285	Sneh Gulati
20	960	0.016071	Sheng-Tun Li

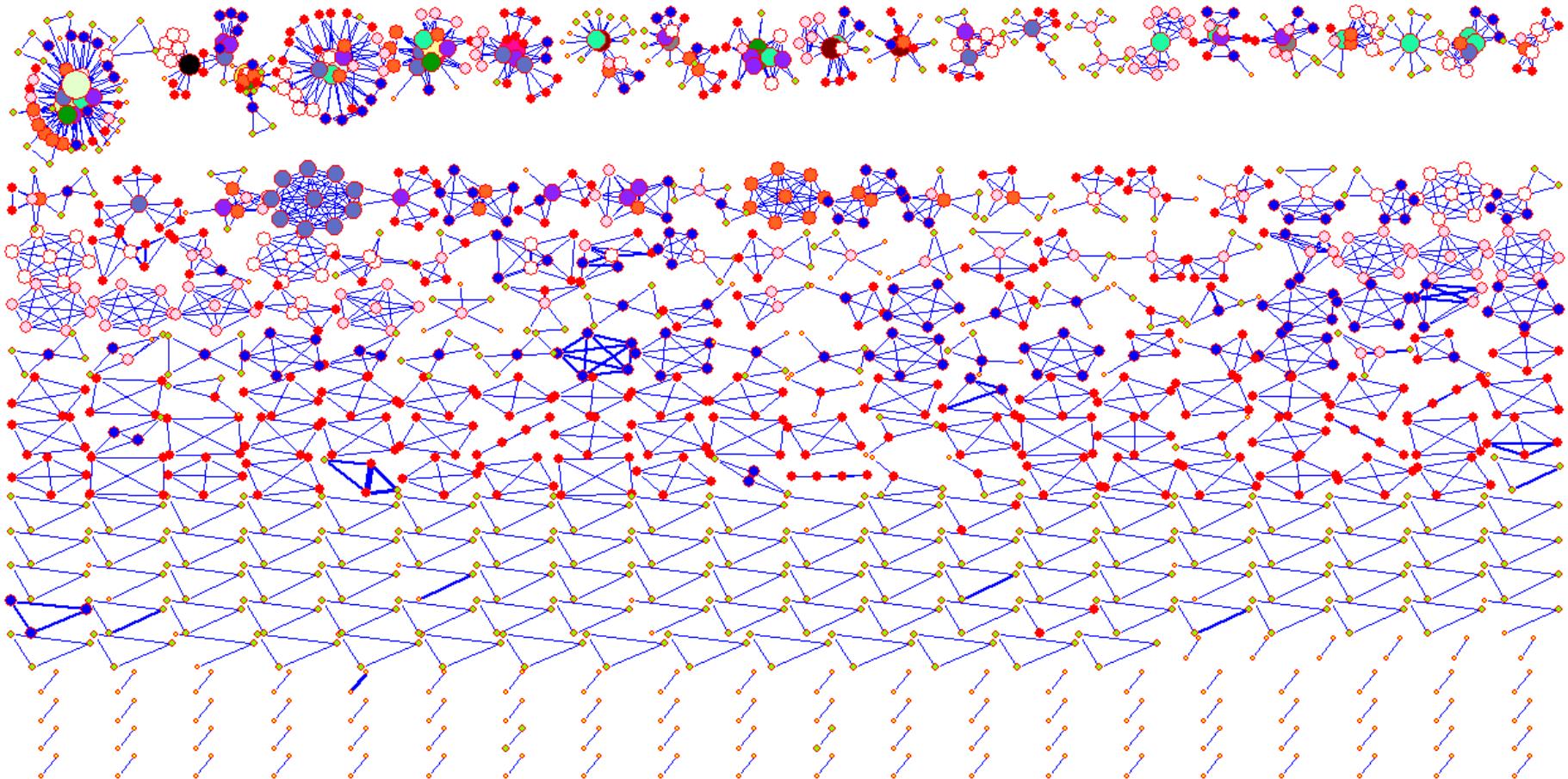
Top 20 authors with the highest **betweenness** scores

Rank	ID	Betweenness	Author
1	1	0.000752	Stuart Harvey Rubin
2	3	0.000741	Shu-Ching Chen
3	2	0.000406	Taghi M. Khoshgoftaar
4	66	0.000385	Xingquan Zhu
5	4	0.000376	Mei-Ling Shyu
6	6	0.000296	Reda Alhajj
7	65	0.000256	Xindong Wu
8	19	0.000194	Chengcui Zhang
9	39	0.000185	Wei Dai
10	15	0.000107	Narayan C. Debnath
11	31	0.000094	Qianhui Althea Liang
12	151	0.000094	Gordon K. Lee
13	7	0.000085	Du Zhang
14	30	0.000072	Baowen Xu
15	41	0.000067	Hongji Yang
16	270	0.000060	Zhiwei Xu
17	5	0.000043	Mohamed E. Fayad
18	110	0.000042	Abhijit S. Pandya
19	106	0.000042	Sam Hsu
20	8	0.000042	Wen-Lian Hsu

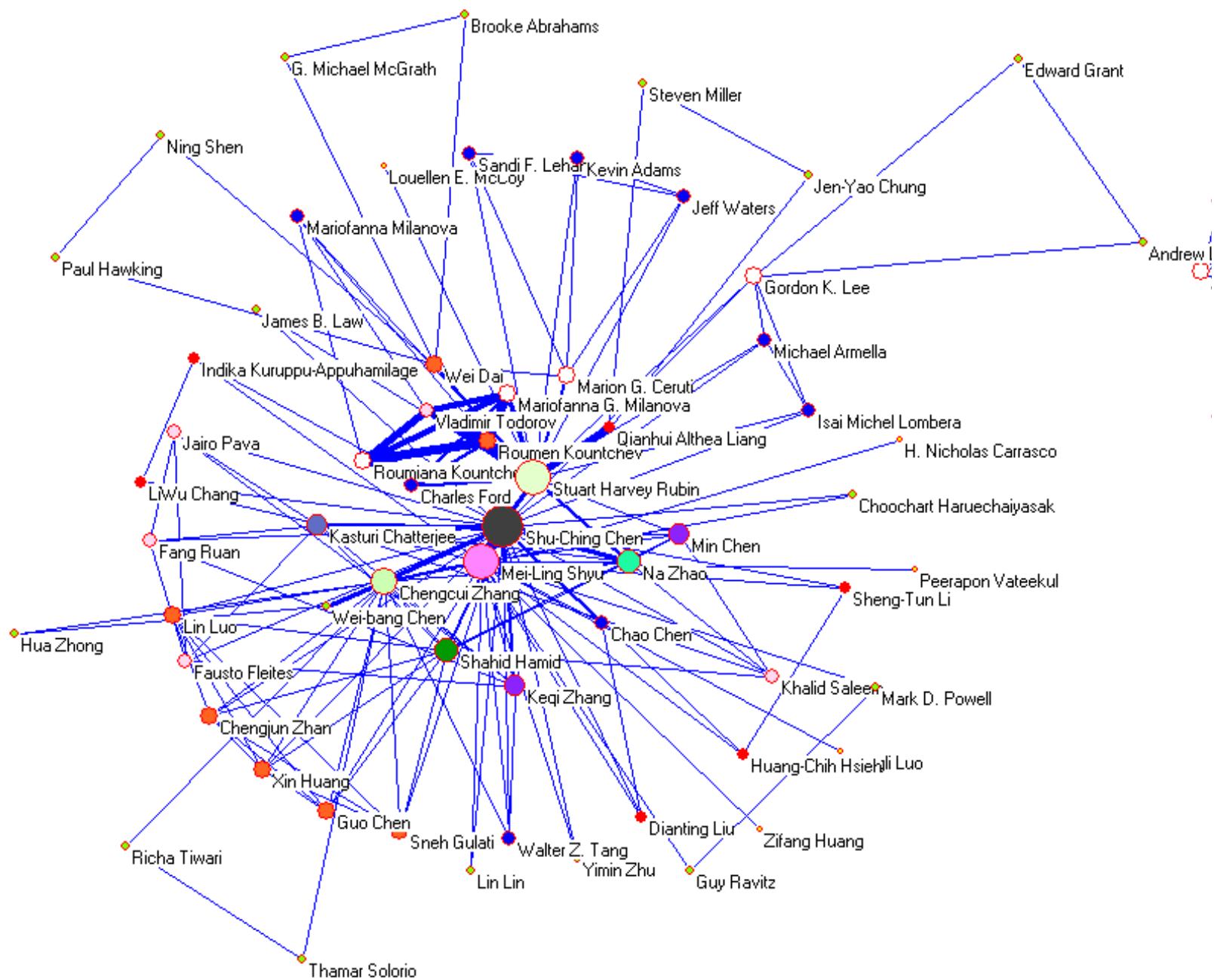
Top 20 authors with the highest degree scores

Rank	ID	Degree	Author
1	3	0.035044	Shu-Ching Chen
2	1	0.034418	Stuart Harvey Rubin
3	2	0.030663	Taghi M. Khoshgoftaar
4	6	0.028786	Reda Alhajj
5	8	0.028786	Wen-Lian Hsu
6	10	0.024406	Min-Yuh Day
7	4	0.022528	Mei-Ling Shyu
8	17	0.021277	Richard Tzong-Han Tsai
9	14	0.017522	Eduardo Santana de Almeida
10	16	0.017522	Roumen Kountchev
11	40	0.016896	Hong-Jie Dai
12	15	0.015645	Narayan C. Debnath
13	9	0.015019	Jason Van Hulse
14	25	0.013767	Roumiana Kountcheva
15	28	0.013141	Silvio Romero de Lemos Meira
16	24	0.013141	Vladimir Todorov
17	23	0.013141	Mariofanna G. Milanova
18	5	0.013141	Mohamed E. Fayad
19	19	0.012516	Chengcui Zhang
20	18	0.011890	Waleed W. Smari

Visualization of IRI (IEEE IRI 2003-2010) co-authorship network (global view)

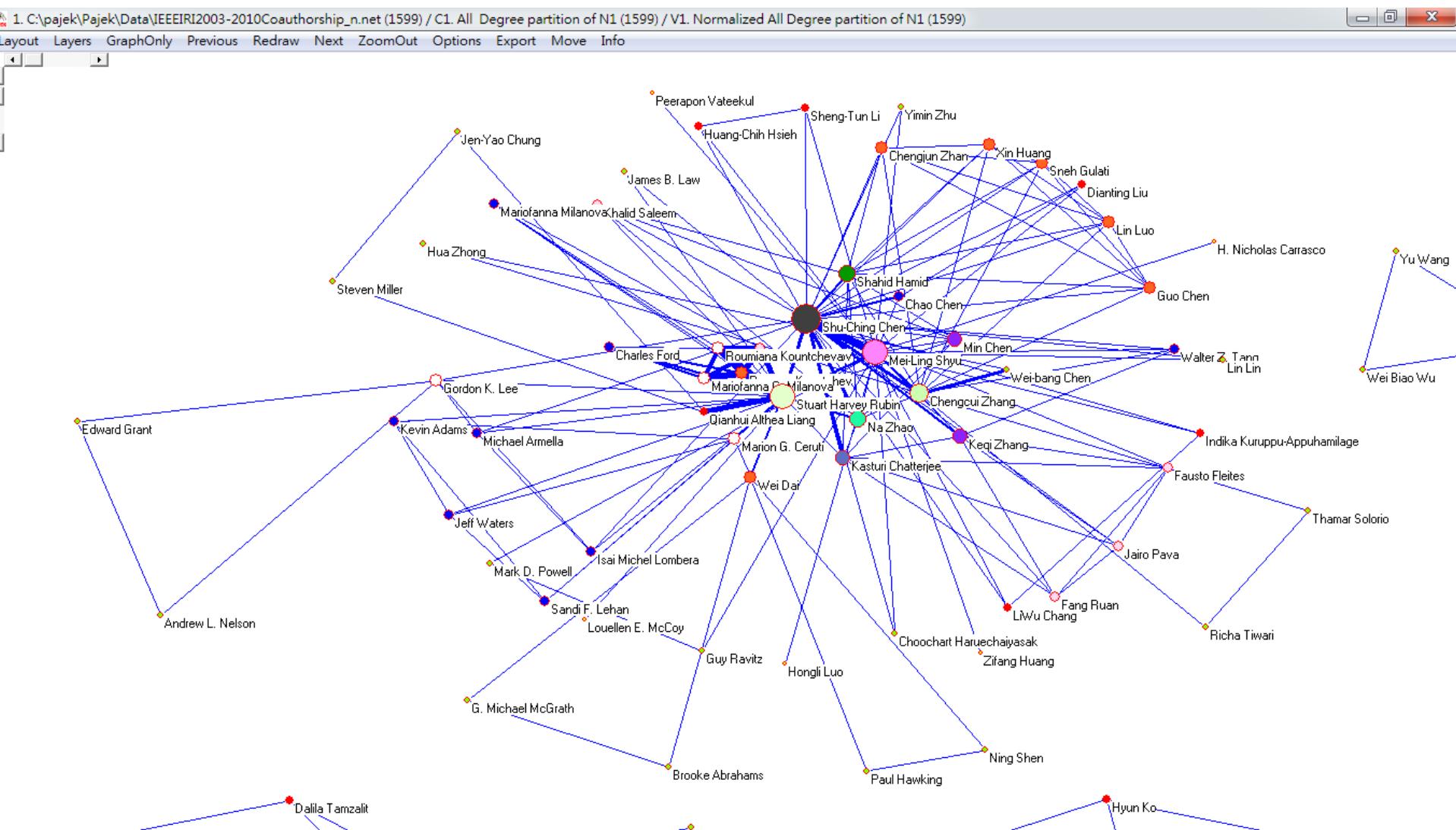


Source: Min-Yuh Day, Sheng-Pao Shih, Weide Chang (2011),
"Social Network Analysis of Research Collaboration in Information Reuse and Integration"

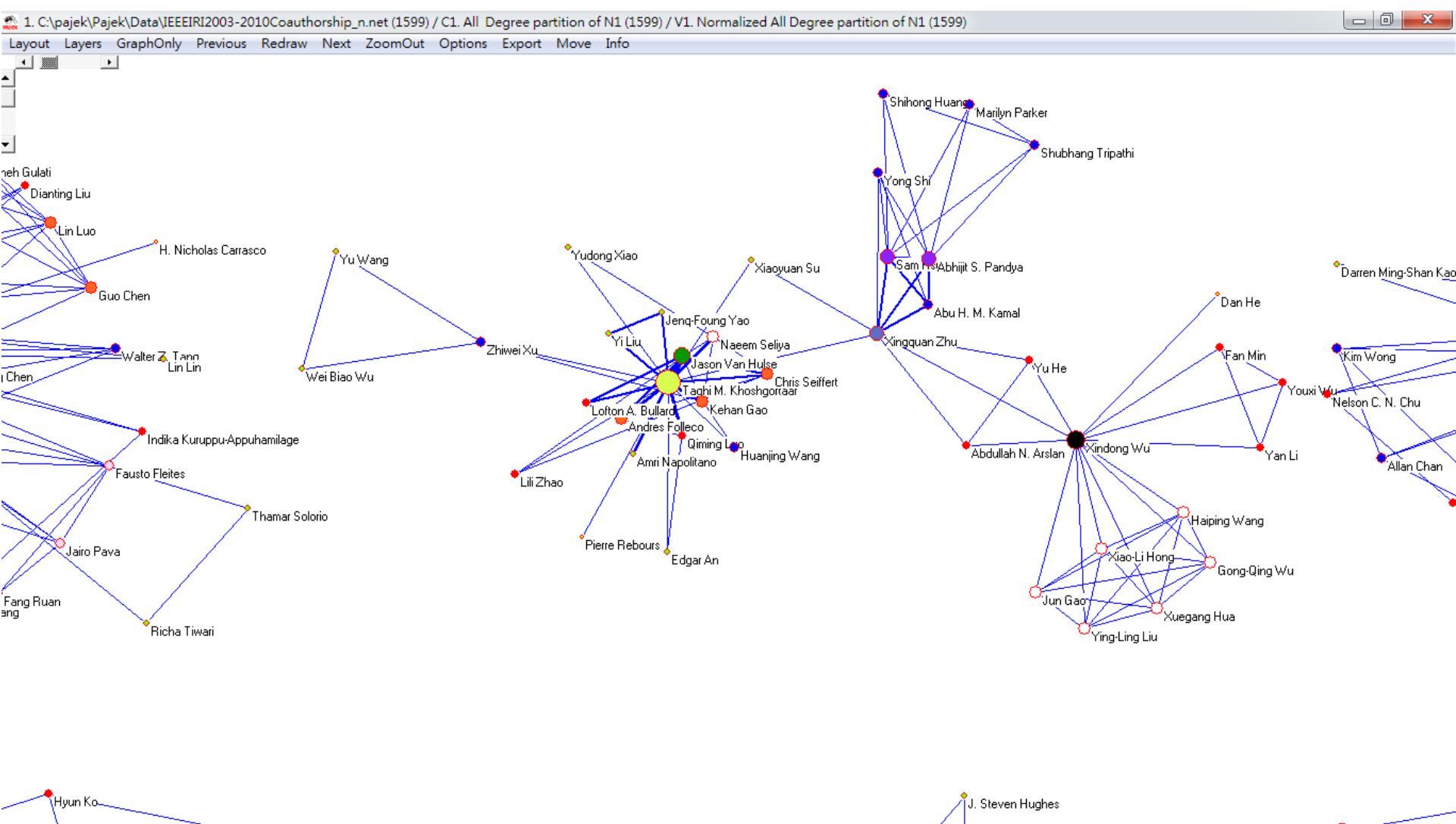


Source: Min-Yuh Day, Sheng-Pao Shih, Weide Chang (2011),
"Social Network Analysis of Research Collaboration in Information Reuse and Integration"

Visualization of Social Network Analysis

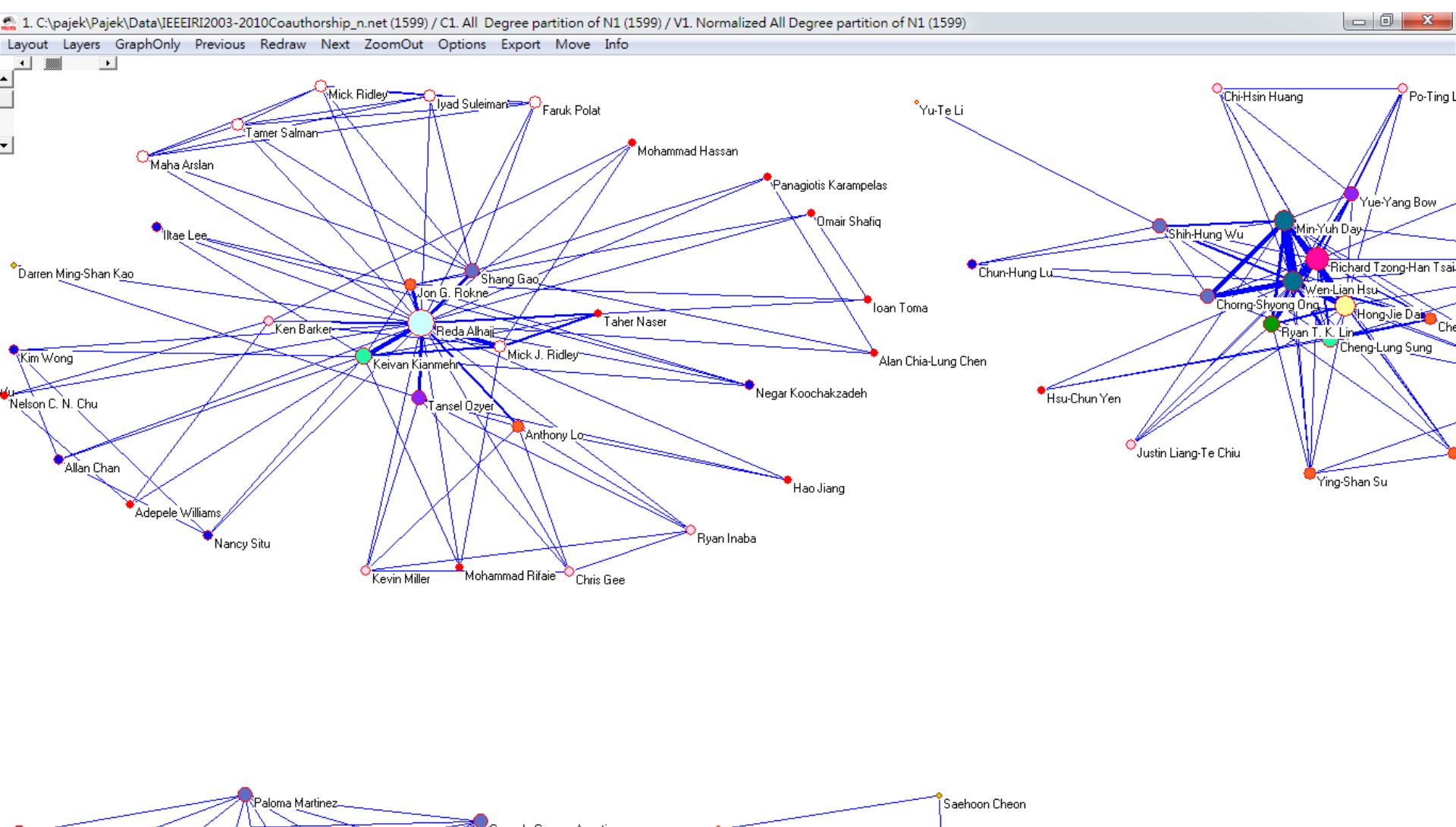


Visualization of Social Network Analysis



Source: Min-Yuh Day, Sheng-Pao Shih, Weide Chang (2011),
"Social Network Analysis of Research Collaboration in Information Reuse and Integration"

Visualization of Social Network Analysis



Source: Min-Yuh Day, Sheng-Pao Shih, Weide Chang (2011),
 "Social Network Analysis of Research Collaboration in Information Reuse and Integration"

Summary

- Social Computing and Social Network Analysis (SNA)
- Social Network Analysis with Gephi
- Applications of SNA

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