

NetworkWorkbench

A Workbench for Network Scientists

Network Workbench Tool For Large Scale Network Analysis, Modeling, and Visualization

Two-Hour Workshop

Katy Börner and the NWB Team @ IUB

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Network Workbench (<http://nwb.slis.indiana.edu>).

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NetworkWorkbench

A Workbench for Network Scientists

Project Details

Investigators: Katy Börner, Albert-Laszlo Barabasi, Santiago Schnell, Alessandro Vespignani & Stanley Wasserman, Eric Wernert



Software Team: Lead: Micah Linnemeier
Members: Patrick Phillips, Russell Duhon, Tim Kelley & Ann McCranie
Previous Developers: Weixia (Bonnie) Huang, Bruce Herr, Heng Zhang, Duygu Balcan, Bryan Hook, Ben Markines, Santo Fortunato, Felix Terkhorn, Ramya Sabineni, Vivek S. Thakre & Cesar Hidalgo



Goal: Develop a large-scale network analysis, modeling and visualization toolkit for physics, biomedical, and social science research.

Amount: \$1,120,926, NSF IIS-0513650 award

Duration: Sept. 2005 - Aug. 2009

Website: <http://nwb.slis.indiana.edu>

Network Workbench (<http://nwb.slis.indiana.edu>).

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NWB Advisory Board:

James Hendler (Semantic Web) <http://www.cs.umd.edu/~hendler/>

Jason Leigh (CI) <http://www.evl.uic.edu/spiff/>

Neo Martinez (Biology) <http://online.sfsu.edu/~webhead/>

Michael Macy, Cornell University (Sociology)
<http://www.soc.cornell.edu/faculty/macy.shtml>

Ulrik Brandes (Graph Theory) <http://www.inf.uni-konstanz.de/~brandes/>

Mark Gerstein, Yale University (Bioinformatics) <http://bioinfo.mbb.yale.edu/>

Stephen North (AT&T) <http://public.research.att.com/viewPage.cfm?PageID=81>

Tom Snijders, University of Groningen <http://stat.gamma.rug.nl/snijders/>

Noshir Contractor, Northwestern University <http://www.spcomm.uiuc.edu/nosh/>



1. Exemplary Network Science Research by NWB PIs
 - Computational Proteomics
 - Computational Economics
 - Computational Social Science
 - Computational Scientometrics
 - Computational Epidemics
2. NWB Tool Challenges and Opportunities
3. NWB Tool Overview
4. NWB Tool for Scientometrics Research
5. Discussion of Future Work

Computational Proteomics

What relationships exist between protein targets of all drugs and all disease-gene products in the human protein–protein interaction network?

Yildirim, Muhammed A., Kwan-Il Goh, Michael E. Cusick, Albert-László Barabási and Marc Vidal. (2007) Drug-target Network. *Nature Biotechnology* 25 no. 10: 1119-1126.

© 2007 Nature Publishing Group

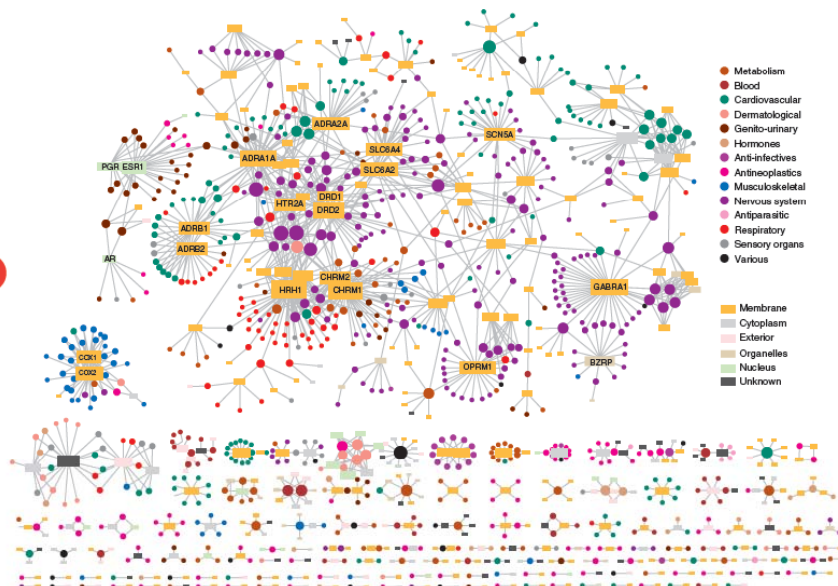


Figure 2 Drug-target network (DT network). The DT network is generated by using the known associations between FDA-approved drugs and their target proteins. Circles and rectangles correspond to drugs and target proteins, respectively. A link is placed between a drug node and a target node if the protein is a known target of that drug. The area of the drug (protein) node is proportional to the number of targets that the drug (the number of drugs targeting the protein). Color codes are given in the legend. Drug nodes (circles) are colored according to their Anatomical Therapeutic Classification, and the target proteins (rectangular boxes) are colored according to their cellular component obtained from the Gene Ontology database.



Network Workbench (<http://nwb.slis.indiar>)

Computational Economics

Does the type of product that a country exports matter for subsequent economic performance?

C. A. Hidalgo, B. Klinger, A.-L. Barabási, R. Hausmann (2007) The Product Space Conditions the Development of Nations. *Science* 317, 482 (2007).

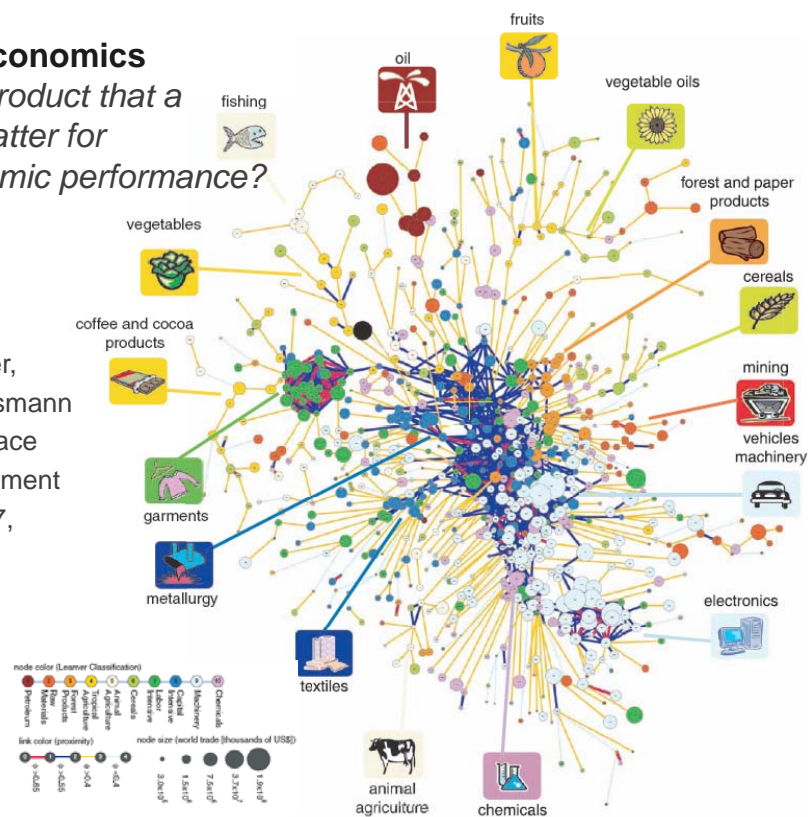


Fig. 1. The product space. (A) Hierarchically clustered proximity matrix representing the 775 SITC-4 product classes exported in the 1998–2000 period. (B) Network representation of the product space. Links are color coded with their proximity value. The sizes of the nodes are proportional to world trade, and their colors are chosen according to the classification introduced by Leamer.



Computational Social Science

Studying large scale social networks such as Wikipedia

Image: Bruce W. Herr and Todd M. Holloway

Power struggle

How do you keep track of the bubbling mass of information that is Wikipedia? This chaotic-looking mosaic is one attempt to show which topics are

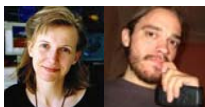


Vizzards 2007 Entry

Second Sight: An Emergent Mosaic of Wikipedian Activity, The NewScientist, May 19, 2007



locked until the mood cools (locked pages at the time of writing include entries on Sheffield Wednesday football club, Mikhail Gorbachev and pigs). The mosaic has been commended in a competition for images that visualise network dynamics, coinciding with this week's International Workshop and Conference on Network Science in Bloomington.



www.newscientist.com

19 May 2007 | NewScientist | 55

Computational Scientometrics

113 Years of Physical Review

Bruce W. Herr II and Russell Duhon (Data Mining & Visualization), Elisha F. Hardy (Graphic Design), Shashikant Penumarthi (Data Preparation) and Katy Börner (Concept)

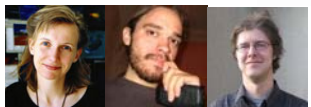
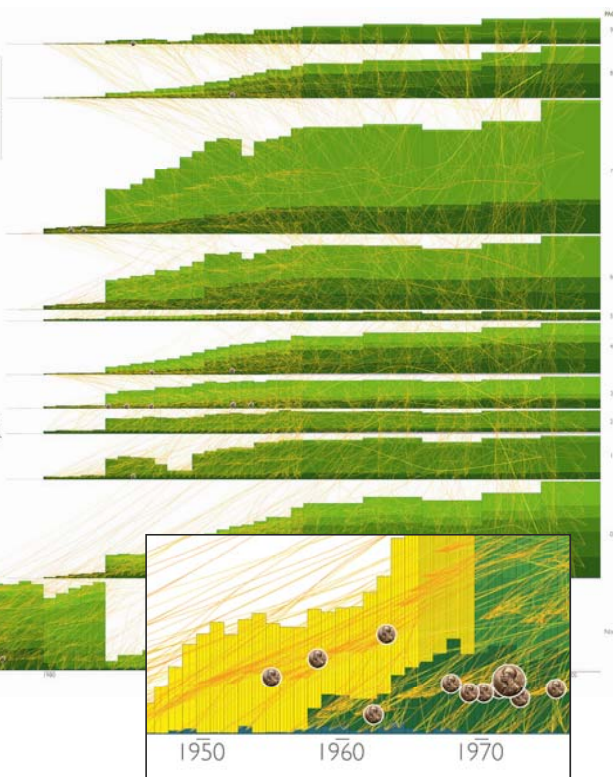
113 Years of Physical Review

The visualization depicts 1000 articles published in 100 volumes of Physical Review from 1915 to 2007. The 1000 articles selected from 10000 articles and their topics are listed in the Physical Review archive. The visualization is based on the Physical Review archive. The visualization is based on the Physical Review archive. The visualization is based on the Physical Review archive.

Nobel Prizes in Physical Review

- 2006 Roy J. Glauber (John L. Hall and Theodor W. Hänsch)
- 2004 David Gross, H. David Politzer and Frank Wilczek
- 2003 Raymond Davis Jr., Masatoshi Koshiba and Riccardo Giacconi
- 2001 Eric A. Cornell, Wolfgang Ketterle and Carl E. Wieman
- 1998 Robert S. Lyman
- 1997 Steven Chu and William D. Phillips
- 1996 David H. Lee, Douglas D. Osheroff, and Robert C. Richardson
- 1991 Martin L. Perl
- 1989 Baruch H. Zeev and Clifford G. Shull
- 1988 Jerome I. Friedman, Henry W. Kendall, and Richard E. Taylor

- | | | | | | | | | | | |
|-----------------|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------------|---|---|--|
| Physical Review | Physical Review Series I | Physical Review A | Physical Review B | Physical Review C | Physical Review D | Physical Review E | Physical Review Letters | Physical Review Special Topics: Accelerated Beams | Physical Review Special Topics: Statistical Physics | Physical Review Special Topics: Fluid Dynamics |
| Physical Review | Physical Review Series I | Physical Review A | Physical Review B | Physical Review C | Physical Review D | Physical Review E | Physical Review Letters | Physical Review Special Topics: Accelerated Beams | Physical Review Special Topics: Statistical Physics | Physical Review Special Topics: Fluid Dynamics |
| Physical Review | Physical Review Series I | Physical Review A | Physical Review B | Physical Review C | Physical Review D | Physical Review E | Physical Review Letters | Physical Review Special Topics: Accelerated Beams | Physical Review Special Topics: Statistical Physics | Physical Review Special Topics: Fluid Dynamics |



Computational Epidemics

Forecasting (and preventing the effects of) the next pandemic.

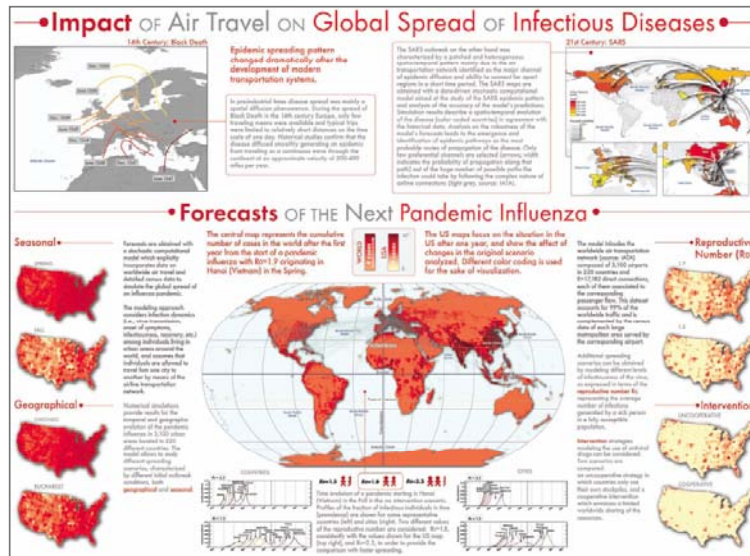
Epidemic Modeling in Complex realities, V. Colizza, A. Barrat, M. Barthelemy, A.Vespignani, Comptes Rendus Biologie, 330, 364-374 (2007).

Reaction-diffusion processes and metapopulation models in heterogeneous networks, V.Colizza, R. Pastor-Satorras, A.Vespignani, Nature Physics 3, 276-282 (2007).

Modeling the Worldwide Spread of Pandemic Influenza: Baseline Case and Containment Interventions, V. Colizza, A. Barrat, M. Barthelemy, A.-J. Valleron, A.Vespignani, PLoS-Medicine 4, e13, 95-110 (2007).



Network Workbench (<http://nwb.slis.indiana.edu>).



NetworkWorkbench

A Workbench for Network Sciences

2. NWB Challenges and Opportunities

- Data
 - Different data formats
 - Different data models
- Algorithms
 - Different research purposes (preprocessing, modeling, analysis, visualization, clustering)
 - Different implementations of the same algorithm
 - Different programming languages
 - Algorithm developers/users are not computer scientists
- Different tools (Pajek, UCINet, Guess, Cytoscape, R, ...)
- Different communities, practices, cultures

Network Workbench (<http://nwb.slis.indiana.edu>)

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Network Workbench (NWB) Tool

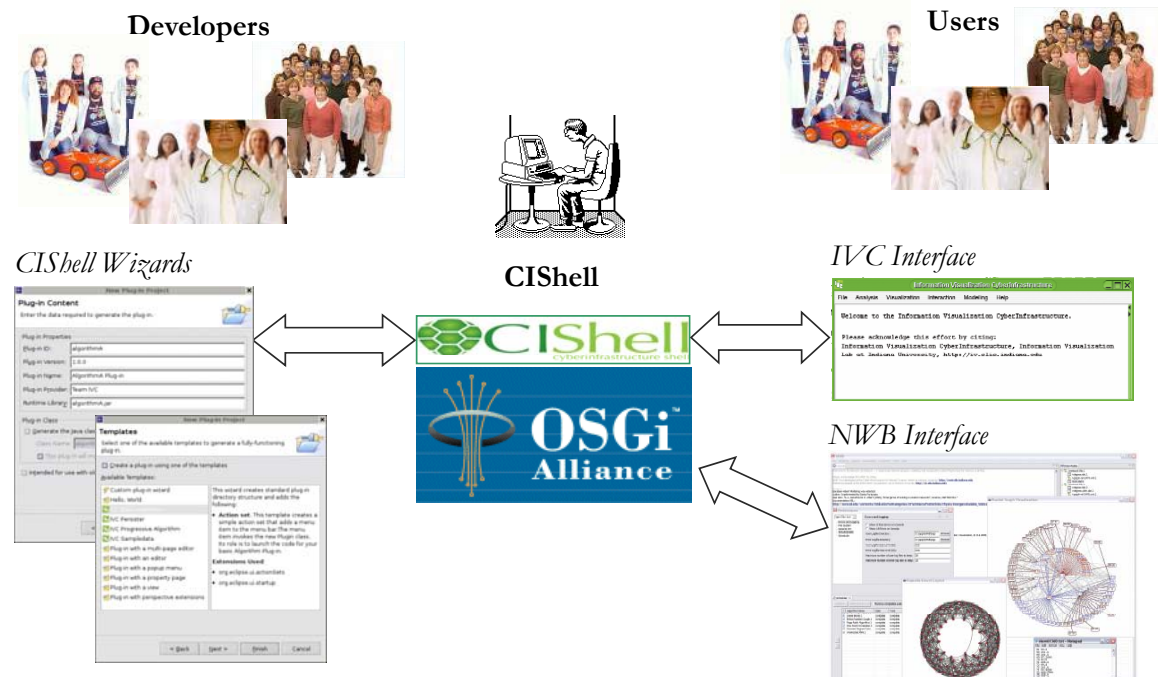
- A network analysis, modeling, and visualization toolkit for physics, biomedical, and social science research.
- Install and run on multiple Operating Systems.
- Supports many file formats.
- Easy integration of new algorithms thanks to CShell/OSGi.

Cyberinfrastructure Shell (CShell)

- An open source, software framework for the integration and utilization of datasets, algorithms, tools, and computing resources.
- Extends OSGi industry standard.



CShell – Serving Non-CS Algorithm Developers & Users





CIShell – Builds on OSGi Industry Standard

CIShell is built upon the Open Services Gateway Initiative (OSGi) Framework.

OSGi (<http://www.osgi.org>) is

- A standardized, component oriented, computing environment for networked services.
- Successfully used in the industry from high-end servers to embedded mobile devices since 8 years.
- Alliance members include IBM (Eclipse), Sun, Intel, Oracle, Motorola, NEC and many others.
- Widely adopted in open source realm, especially since Eclipse 3.0 that uses OSGi R4 for its plugin model.

Advantages of Using OSGi

- Any CIShell algorithm is a service that can be used in any OSGi-framework based system.
- Using OSGi, running CIShells/tools can be connected via RPC/RMI supporting peer-to-peer sharing of data, algorithms, and computing power.

Ideally, CIShell becomes a standard for creating OSGi Services for algorithms.

NWB Deliverables

Network Workbench (NWB) Tool

- A network analysis, modeling, and visualization toolkit for physics, biomedical, and social science research.
- Install and run on multiple Operating Systems.
- Supports many file formats.
- Easy integration of new algorithms thanks to CIShell/OSGi.

Cyberinfrastructure Shell (CIShell)

- An open source, software framework for the integration and utilization of datasets, algorithms, tools, and computing resources.
- Extends OSGi industry standard.

NWB Community Wiki

- A place for users of the NWB Tool, the Cyberinfrastructure Shell (CIShell), or any other CIShell-based program to request, obtain, contribute, and share algorithms and datasets.
- All algorithms and datasets that are available via the NWB Tool have been well documented in the Community Wiki.

Network Workbench (<http://nwb.slis.indiana.edu>).

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About the Network Workbench Community Wiki

The Network Workbench Community Wiki is the part of [Network Workbench \(NWB\)](#) project. It provides descriptions for algorithms and datasets that have been integrated in the [NWB Tool](#). It is also a place for users of the [NWB Tool](#), the [Cyberinfrastructure Shell](#), or any other CShell based program to get, upload, and request algorithms & datasets to be used in the tool. This site is a sounding board to be used by the community to work together and create a tool which will meet their needs and the needs of the scientific community at large.

Check out the lists of available [algorithms](#) and [datasets](#). Download the [NWB Tool](#) and play with it.

You are invited to add or edit your own dataset and algorithm descriptions (sign up [here](#)), or post wanted algorithms and datasets.

If you are interested in joining the NWB community, please sign up the [NWB mailing list](#), post your question there, or contact Weixia (Bonnie) Huang huangb@indiana.edu for more information.

Recent Changes (All) | [Edit SideBar](#) | Page last modified on June 23, 2008, at 05:40 PM | [Upload files](#) | [Edit Page](#) | [Page History](#)
Powered by [PmWiki](#)

<https://nwb.slis.indiana.edu/community/>

NetworkWorkbench
A Workbench for Network Scientists

Data Formats / Home Page

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Load Data [Edit](#)

Network Formats
[NWB \(.nwb\)](#)
[PaieK \(.net\)](#)
[GraphML \(.xml or .graphml\)](#)
[XGMML \(.xml\)](#)

Scientometric Formats
[ISI \(.isi\)](#)
[Scopus csv \(.scopus\)](#)
[NSF csv \(.nsf\)](#)
[Bibtex \(.bib\)](#)
[Endnote Export Format \(.enw\)](#)

Other Formats
[CSV \(.csv\)](#)
[Edgelist \(.edge\)](#)
[PaieK \(.mat\)](#)
[TreeML \(.xml\)](#)

Special Load Algorithms
[ISI Load and Clean](#)

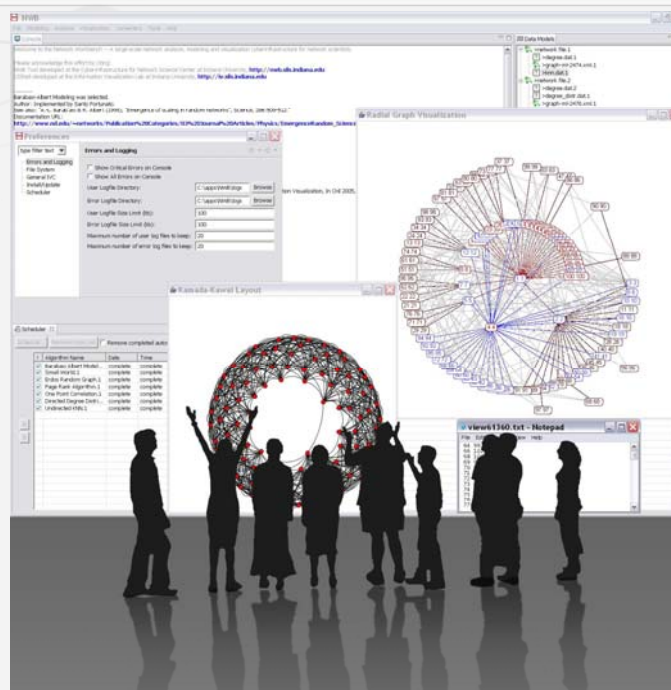
Databases
[SDB](#)

Streaming Data

<https://nwb.slis.indiana.edu/community/>

Major features in v1.0.0 beta 2 Release

- Installs and runs on Windows, Linux and Mac OS X.
- Provides over 80 modelling, analysis and visualization algorithms. Half of them are written in Fortran, others in Java.
- Supports large scale network modelling and analysis for certain workflows (over 100,000 nodes)
- Supports several visualization layouts with node/edge annotation.
- Provides several sample datasets with various formats.
- Supports multiple ways to introduce a network to the NWB tool.
- Supports automatic data conversion.
- Provides a Scheduler to monitor and control the progress of running algorithms.
- Integrates a 2D plotting tool – Gnuplot (requires pre-installation on Linux and Mac).
- Integrates GUESS graph exploration/visualization tool.



NWB Tool Overview

1. Download, install, and run.
2. Load, view, convert, save data.
3. Read and visualize a directory hierarchy.
4. Load a network, compute its basic properties, and explore it in GUESS.

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Goto <http://nwb.slis.indiana.edu>

NWB Tool 1.0.0 beta 2
(development release)
November 19th, 2008

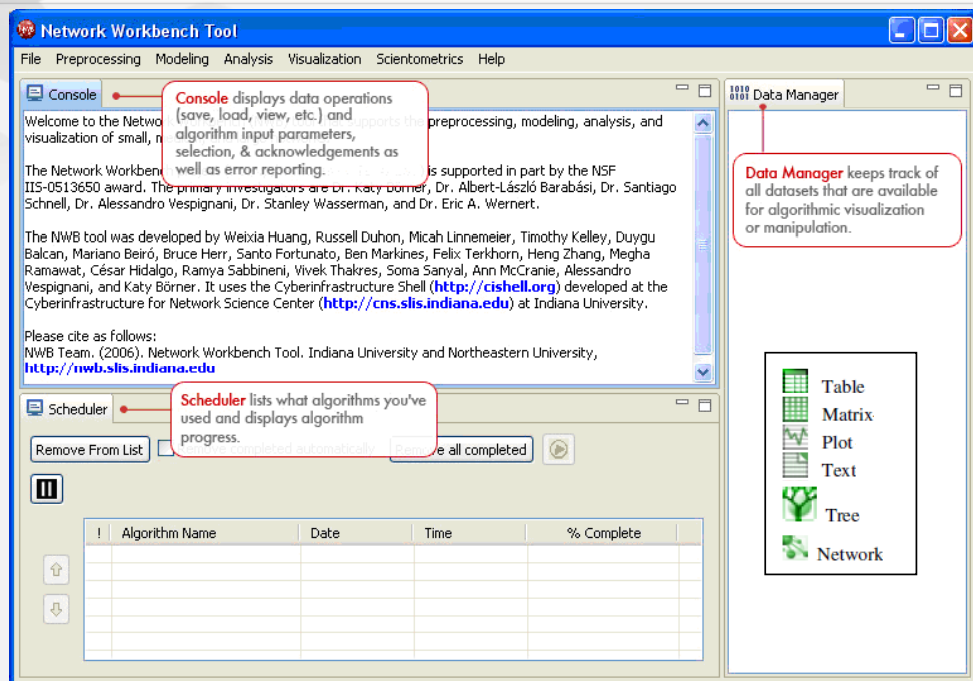
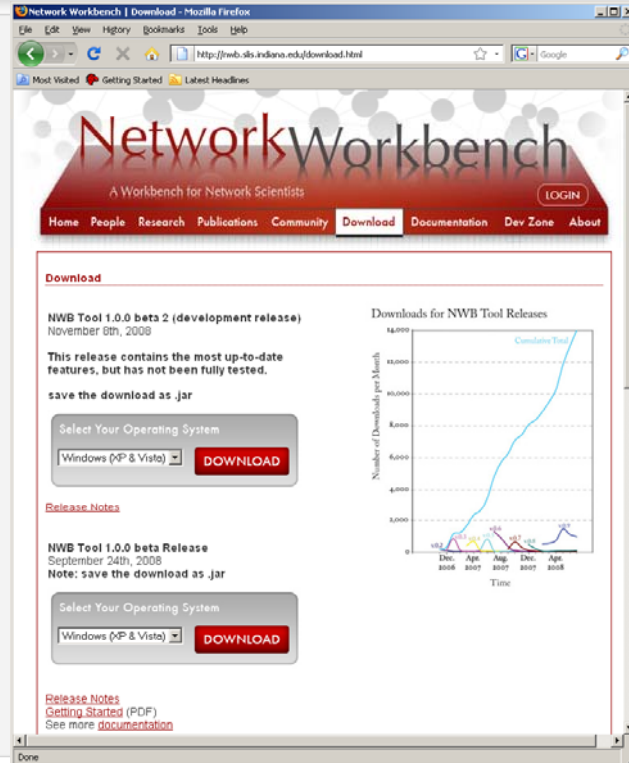
Select your operating system from the pull down menu.

Save as *.jar file.

Install and run.

Session log files are stored in
'*yournwbdirectory*/logs' directory.

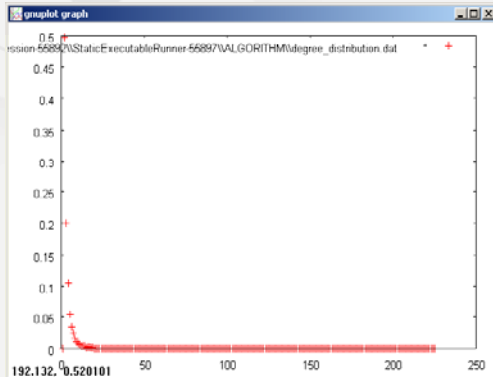
Network Workbench (<http://nwb.slis.indiana.edu>).



Network Workbench (<http://nwb.slis.indiana.edu>).

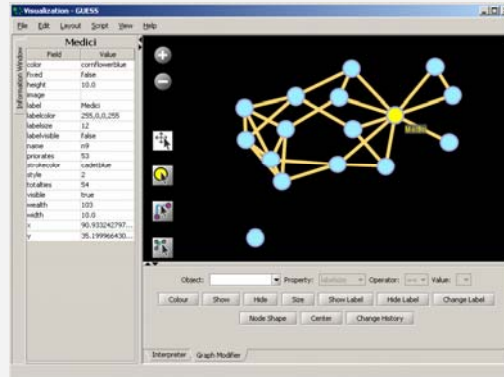
File	Preprocessing	Modeling	Visualization
Load... Load and Clean ISI File Read Directory Hierarchy Datasets	Extract Top Nodes Extract Nodes Above or Below Value Delete High Degree Nodes Delete Random Nodes Delete Isolates	Random Graph Watts-Strogatz Small World Barabási-Albert Scale-Free	GUESS
Save... View... View with...	Extract Top Edges Extract Edges Above or Below Value Remove Self Loops Trim by Degree Pathfinder Network Scaling	Can Chord Hypergrid PRU	GnuPlot
Merge Node and Edge Files Split Graph to Node and Edge Files	Snowball Sampling (n nodes) Node Sampling Edge Sampling	TARL Discrete Network Dynamics (DND)	DrL (VxOrd) Specified (prefuse beta)
Tests	Symmetrize Dichotomize Multipartite Joining Normalize Text Slice Table by Time		Circular (JUNG)
Preferences			Radial Tree/Graph (prefuse alpha) Radial Tree/Graph with Annotation (prefuse beta) Tree Map (prefuse beta) Tree View (prefuse beta) Balloon Graph (prefuse alpha)
Exit			Force Directed with Annotation (prefuse beta) Kamada-Kawai (JUNG) Fruchterman-Reingold (JUNG) Fruchterman-Reingold with Annotation (prefuse beta) Spring (JUNG) Small World (prefuse alpha)
			Parallel Coordinates (demo)
			LaNet

Analysis	Unweighted & Undirected	Unweighted & Directed
Network Analysis Toolkit (NAT)	Node Degree Degree Distribution	Node Indegree Node Outdegree Indegree Distribution Outdegree Distribution
Unweighted & Undirected	K-Nearest Neighbor Watts-Strogatz Clustering Coefficient	k-Nearest Neighbor Single Node In-Out Degree Correlations
Weighted & Undirected	Watts Strogatz Clustering Coefficient Over k	Page Rank
Unweighted & Directed	Diameter Average Shortest Path Shortest Path Distribution Node Betweenness Centrality	Dyad Reciprocity Arc Reciprocity Adjacency Transitivity
Search	Connected Components Weak Component Clustering	Weak Component Clustering Extract and Annotate Attractors
Textual	Extract K-Core Annotate K-Coreness	Extract K-Core Annotate K-Coreness
Search	Weighted & Undirected	
Can Chord k Random-Walk Random Breadth First	Average Clustering Coefficient Average Nearest Neighbor Degree Average Strength Degree and Strength Endpoint Degree Strength Distribution Weight Distribution	
Textual		
Burst Detection		



Gnuplot

portable command-line driven interactive data and function plotting utility
<http://www.gnuplot.info/>.



GUESS

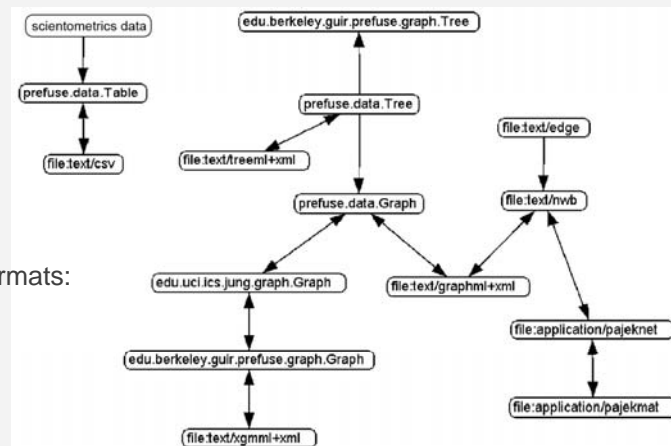
exploratory data analysis and visualization tool for graphs and networks.
<https://nwb.slis.indiana.edu/community/?n=VisualizeData.GUESS>.

In November 2008, the NWB tool supports loading the following input file formats:

- GraphML (*.xml or *.graphml)
- XGMML (*.xml)
- Pajek .NET (*.net) & Pajek .Matrix (*.mat)
- NWB (*.nwb)
- TreeML (*.xml)
- Edge list (*.edge)
- CSV (*.csv)
- ISI (*.isi)
- Scopus (*.scopus)
- NSF (*.nsf)
- Bibtex (*.bib)
- Endnote (*.enw)

and the following network file output formats:

- GraphML (*.xml or *.graphml)
- Pajek .MAT (*.mat)
- Pajek .NET (*.net)
- NWB (*.nwb)
- XGMML (*.xml)
- CSV (*.csv)

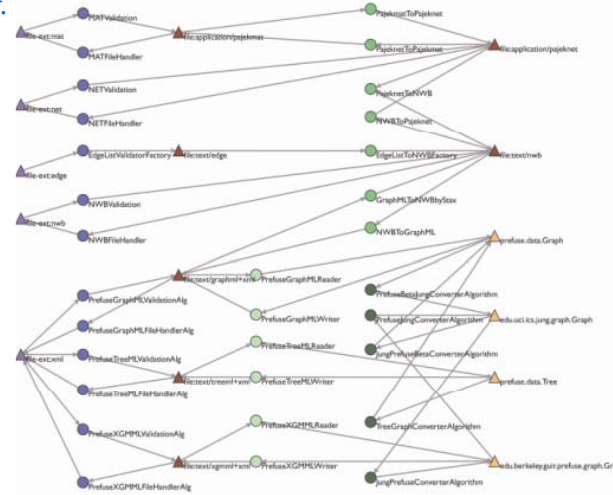


These formats are documented at
<https://nwb.slis.indiana.edu/community/?n=DataFormats.HomePage>.

NWB Ecology of Data Formats and Converters

Not shown are **15** sample datasets, **45** data preprocessing, analysis, modeling and visualization algorithms, **9** services.

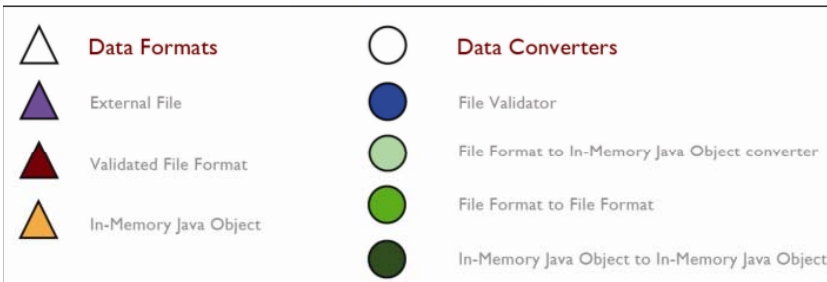
13
Supported
data
formats



6
Output formats
for diverse visualization
algorithms

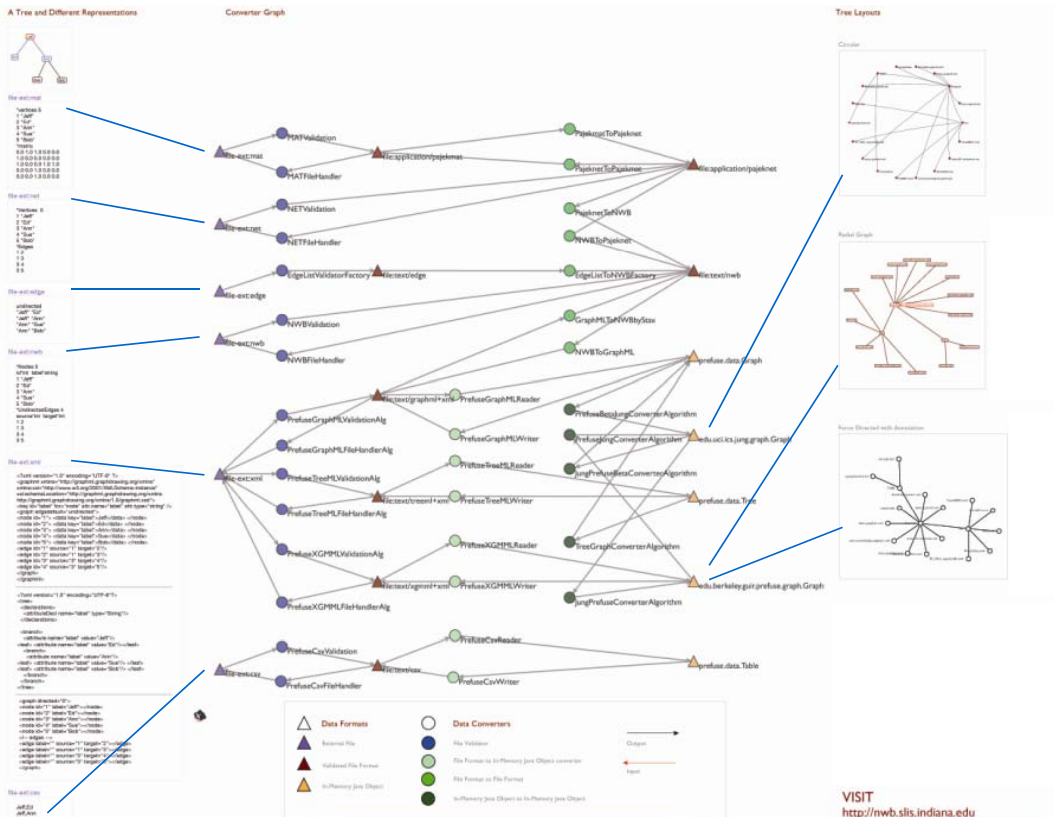
8
Intermediate
data formats

Supported by
35
data converters.



VISIT
<http://nwb.slis.indiana.edu>
<https://nwb.slis.indiana.edu/community>
<http://www.cishell.org>

DOWNLOAD: NWB Tool
<http://nwb.slis.indiana.edu/software.html>



CiShell & OSGI

VISIT
<http://nwb.slis.indiana.edu>
<https://nwb.slis.indiana.edu/community>
<http://www.cishell.org>

DOWNLOAD: NWB Tool
<http://nwb.slis.indiana.edu/software.html>

The ‘**yournwbdirectory**’ directory also contains

/sampledata/scientometrics/properties // Used to extract networks and merge data

- *bibtexCoAuthorship.properties*
- *endnoteCoAuthorship.properties*
- *isiCoAuthorship.properties*
- *isiCoCitation.properties*
- *isiPaperCitation.properties*
- *mergeBibtexAuthors.properties*
- *mergeEndnoteAuthors.properties*
- *mergeIsciAuthors.properties*
- *mergeNsfPIs.properties*
- *mergeScopusAuthors.properties*
- *nsfCoPI.properties*
- *scopusCoAuthorship.properties*

/sampledata/scripts/GUESS // Used to do color/size/shape code networks

- *co-author-nw.py*
- *co-PI-nw.py*
- *paper-citation-nw.py*
- *reference-co-occurrence-nw.py*

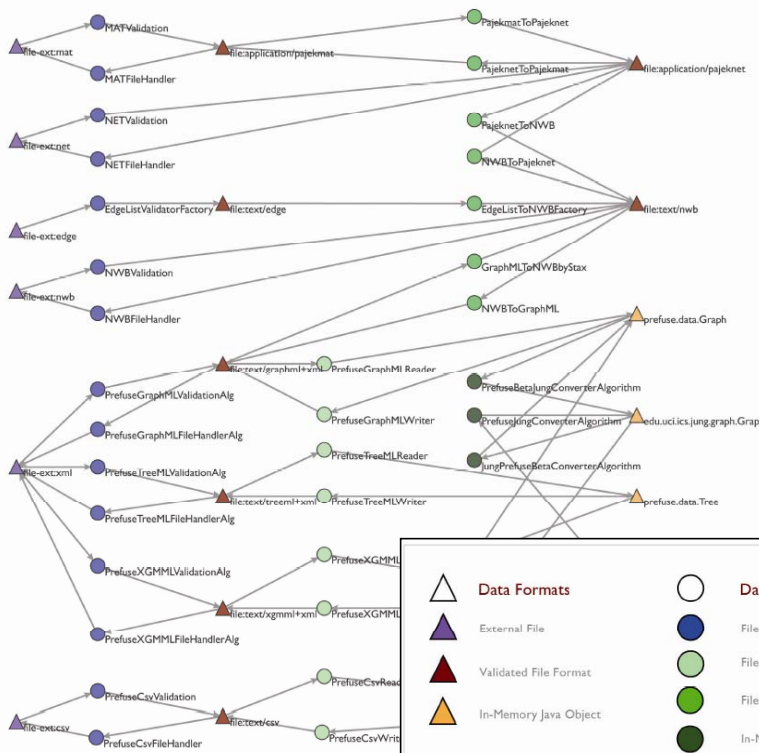
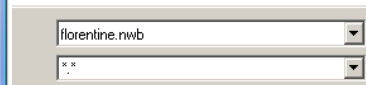
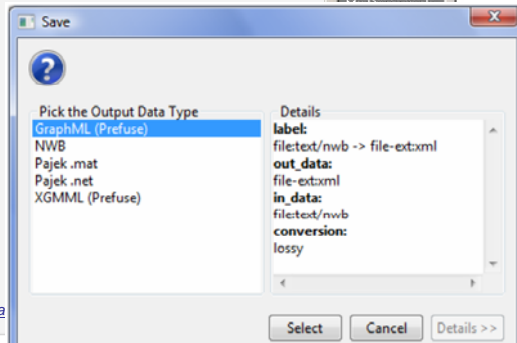
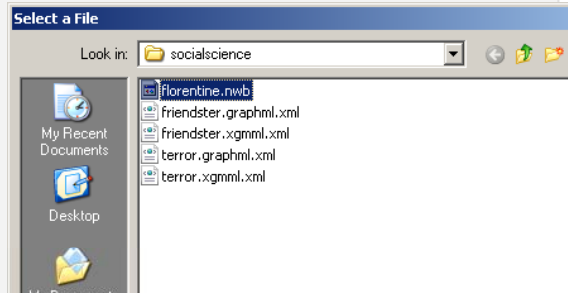
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Use 'File > Load File' to load *florentine.nwb* in sample datasets in
'*yournwbdirectory*/sampledata/socialscience'.

The loaded file will appear in
the Data Manager window.

Right click loaded file to save,
view, rename, or discard.



There is no central
data format.

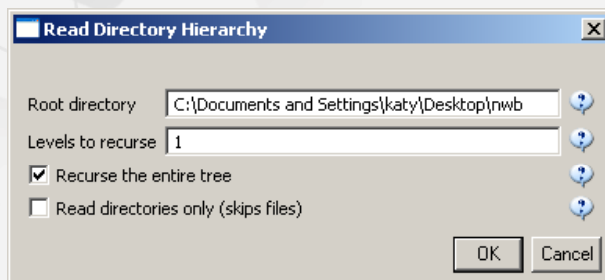
Instead, data formats
used in different
communities and
required by the
different algorithms
are supported.

NWB Tool Overview

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3. **Read and visualize a directory hierarchy.**
4. Load a network, compute its basic properties, and explore it in GUESS.

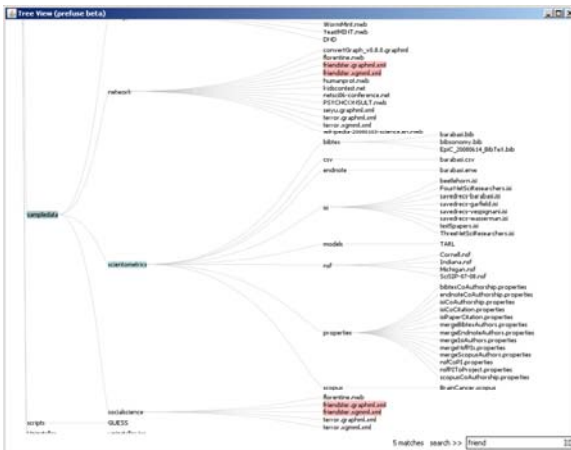
Reading and Visualizing a Directory Hierarchy

Use *'File > Read Directory Hierarchy'* with parameters



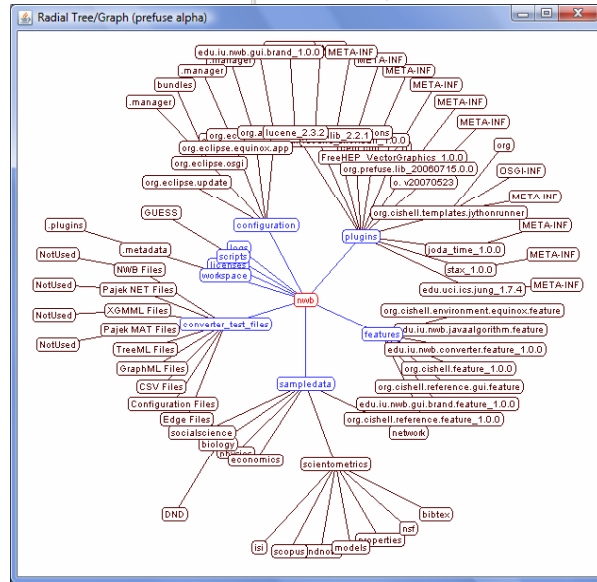
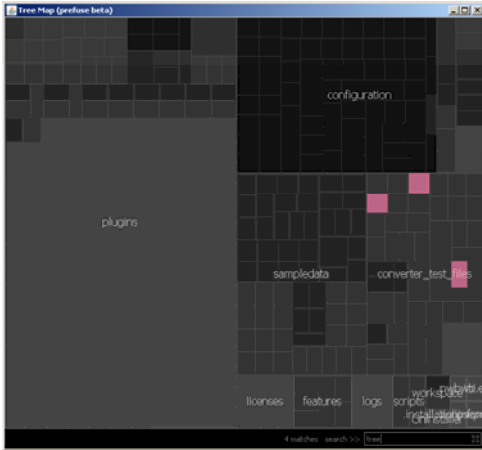
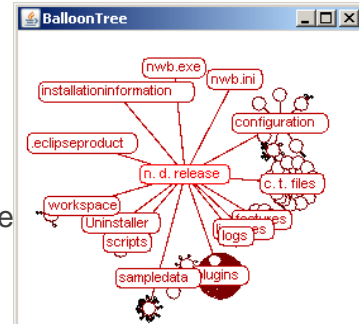
Visualize resulting *'Directory Tree - Prefuse (Beta) Graph'* using

- *'Visualization > Tree View (prefuse beta)'*
- *'Visualization > Tree Map (prefuse beta)'*
- *'Visualization > Balloon Graph (prefuse alpha)'*
- *'Visualization > Radial Tree/Graph (prefuse alpha)'*



Different views of the /nwb directory hierarchy.

Note the size of the /plugin directory.



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Select *florentine.nwb* in Data Manager.

- Run 'Analysis > Network Analysis Toolkit (NAT)' to get basic properties.

```
This graph claims to be undirected.

Nodes: 16
Isolated nodes: 1
Node attributes present: label, wealth, totalties, priorates

Edges: 27
No self loops were discovered.
No parallel edges were discovered.
Edge attributes:
Nonnumeric attributes:
      marriag... T
      busines... F

Did not detect any numeric attributes
This network does not seem to be a valued network.

Average degree: 3.375
This graph is not weakly connected.
There are 2 weakly connected components. (1 isolates)
The largest connected component consists of 15 nodes.
Did not calculate strong connectedness because this graph was not directed.
```

- **Optional: Run 'Analysis -> Unweighted & Undirected -> Node Betweenness Centrality' with default parameters.**
- Select network and run '*Visualization > GUESS*' to open GUESS with file loaded.
- Apply 'Layout -> GEM'.

The screenshot shows the Network Workbench Tool interface. The console window displays the output of the Network Analysis Toolkit (NAT) analysis for the 'Medici-Acciaiuoli' network. The GUESS window shows a network graph with nodes and edges, and a table of node attributes.

Console Output:

```

.....
GUESS was selected.
Author(s): Eytan Adar
Implementer(s): Eytan Adar (GUESS), Russell Duhon (resizeLinear, colorize fix)
Integrator(s): Russell Duhon
Reference: Adar, Eytan, "GUESS: A Language and Interface for Graph Exploration," CHI 2006 (http://graphexploration.cond.org/)
Documentation: https://nwb.slis.indiana.edu/community/?m=VisualizeData.GUESS
ECHO is off.
Starting GUESS...
ECHO is off.
The initial layout for your visualization is random. For a clearer visualization, please run a layout from the Layout menu. (We recommend GEM.)
ECHO is off.
GUESS log file for this session can be found in
C:\DOCUMENTS~1\katty\LOCAL~1\TEMP\1137611-session-20892\37a0c1c2ecurabilekunner-20904\4L6UK11HM\guesslog.txt
.....
GUESS was selected.
Author(s): Eytan Adar
Implementer(s): Eytan Adar
Integrator(s): Russell Duhon
Reference: Adar, Eytan, "
Documentation: https://nwb.slis.indiana.edu/community/?m=VisualizeData.GUESS
ECHO is off.
Starting GUESS...
ECHO is off.
The initial layout for your v
ECHO is off.
GUESS log file for this sess
C:\DOCUMENT~1\katty\LOCAL~1\TEMP\1137611-session-20892\37a0c1c2ecurabilekunner-20904\4L6UK11HM\guesslog.txt
.....

```

GUESS Information Window:

Field	Value
_edgeid	0
business	F
color	dandelion
directed	false
label	
labelcolor	0,0,0,255
labelsize	12
labelvisible	false
marriage	T
node1	n0
node2	n1
visible	true
weight	1.0
width	2.0

Graph Properties:

Object: Property: Operator: Value:

Buttons: Colour, Show, Hide, Size, Show Label, Hide Label, Change Label, Node Shape, Center, Change History

Visualization - GUESS

File Edit Layout Script View Help

Medici

Field	Value
color	cornflowerblue
fixed	false
height	10.0
image	
label	Medici
labelcolor	255,0,0,255
labelsize	12
labelvisible	false
name	n9
priorates	53
sitebetweenness	105.167
strokecolor	cadetblue
style	2
totalties	54
visible	true
wealth	103
width	10.0
x	46.803955078...
y	83.871322631...

Pan:
“grab” the background by holding left-click and moving your mouse.

Zoom:
Using scroll wheel, press the “+” and “-” buttons in the upper-left hand corner, or right-click and move the mouse left or right. Center graph by selecting ‘View -> Center’.

Select to select/navigate single nodes. Hold down ‘Shift’ to select multiple.

Right click to modify Color, etc.

Visualization - GUESS

File Edit Layout Script View Help

Ridolfi

Field	Value
color	cornflower...
fixed	false
height	10.0
image	
label	Ridolfi
labelcolor	255,0,0,255
labelsize	12
labelvisible	false
name	n13
priorates	38
sitebetwee...	30.0833
strokecolor	cadetblue
style	2
totalties	4
visible	true
wealth	27
width	10.0
x	87.629302...
y	88.654205...

Graph Modifier:
Select “all nodes” in the Object drop-down menu and click ‘Show Label’ button.

Select “nodes based on ->”, then select “wealth” from the Property drop-down menu, “>=” from the Operator drop-down menu, and finally type “50” into the Value box. Then a color/size/shape code.

Visualization - GUESS

File Edit Layout Script View Help

Information Window

Field	Value
color	255,174,1...
fixed	false
height	19.442478...
image	
label	Pazzi
labelcolor	255,0,0,255
labelsize	12
labelvisible	false
name	n10
priorates	0
sitebetwee...	15.0
strokecolor	cadetblue
style	2
totalties	7
visible	true
wealth	48
width	19.442478...
x	43.387603...
y	120.93868...

```

>>>
>>> colorize(wealth, white, red)
>>> resizeLinear(sitebetweenness,5,50)
>>> resizeLinear(sitebetweenness,5,25)
>>>
  
```

Interpreter Graph Modifier

Interpreter:
Uses Jython a combination of Java and Python.

Try
colorize(wealth,
white, red)

resizeLinear(sitebet
weenness, 5, 25)

Network Workbench (<http://nwb.slis.indiana.edu>).

NetworkWorkbench
A Workbench for Network Scientists

NWB Tool for Scientometrics Research

1. Loading NSF datasets with currently active NSF funding for Indiana U, Cornell U, and Michigan U, extracting, and comparing Co-PI networks.
2. Loading ISI files of major network science researchers, extracting, analyzing and visualizing paper-citation networks and co-author networks.
3. Loading text files and detecting Bursts.

Network Workbench (<http://nwb.slis.indiana.edu>).

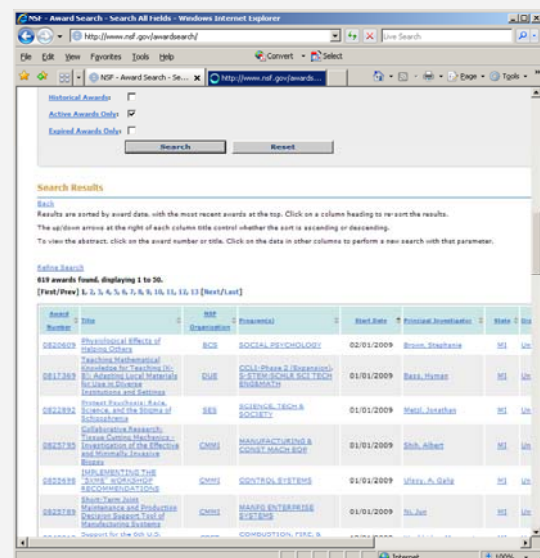
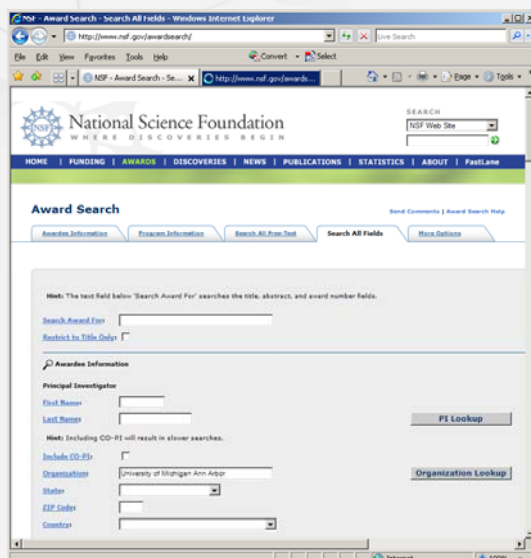
44

NWB Tool for Scientometrics Research

1. Loading NSF datasets with currently active NSF funding for Indiana U, Cornell U, and Michigan U, extracting, and comparing Co-PI networks.
2. Loading ISI files of major network science researchers, extracting, analyzing and visualizing paper-citation networks and co-author networks.
3. Loading text files and detecting Bursts.

Analyzing NSF Data

Download NSF awards data from <http://www.nsf.gov/awardsearch/>



Active NSF Awards on 11/07/2008:

- **Indiana University** 257
(there is also Indiana University at South Bend Indiana University Foundation, Indiana University Northwest, Indiana University-Purdue University at Fort Wayne, Indiana University-Purdue University at Indianapolis, Indiana University-Purdue University School of Medicine)
- **Cornell University** 501
(there is also Cornell University – State, Joan and Sanford I. Weill Medical College of Cornell University)
- **University of Michigan Ann Arbor** 619
(there is also University of Michigan Central Office, University of Michigan Dearborn, University of Michigan Flint, University of Michigan Medical School)

Save files as csv but rename into .nsf.

Or simply use the files saved in

`"*yournwbdirectory*/sampledata/scientometrics/nsf/".`

Extracting Co-PI Networks

Load NSF data, selecting the loaded dataset in the Data Manager window, run 'Scientometrics > Extract Co-Occurrence Network' using parameters:

Two derived files will appear in the Data Manager window: the co-PI network and a merge table. In the network, nodes represent investigators and edges denote their co-PI relationships. The merge table can be used to further clean PI names.

Running the 'Analysis > Network Analysis Toolkit (NAT)' reveals that the number of nodes and edges but also of isolate nodes that can be removed running 'Preprocessing > Delete Isolates'.

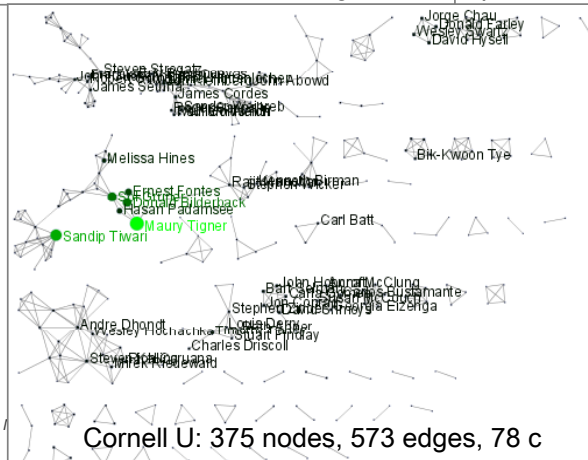
Select 'Visualization > GUESS' to visualize. Run 'co-PI-nw.py' script.



Indiana U: 223 nodes, 312 edges, 52 components



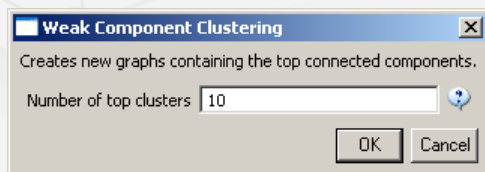
U of Michigan: 497 nodes, 672 edges, 117 c



Cornell U: 375 nodes, 573 edges, 78 c

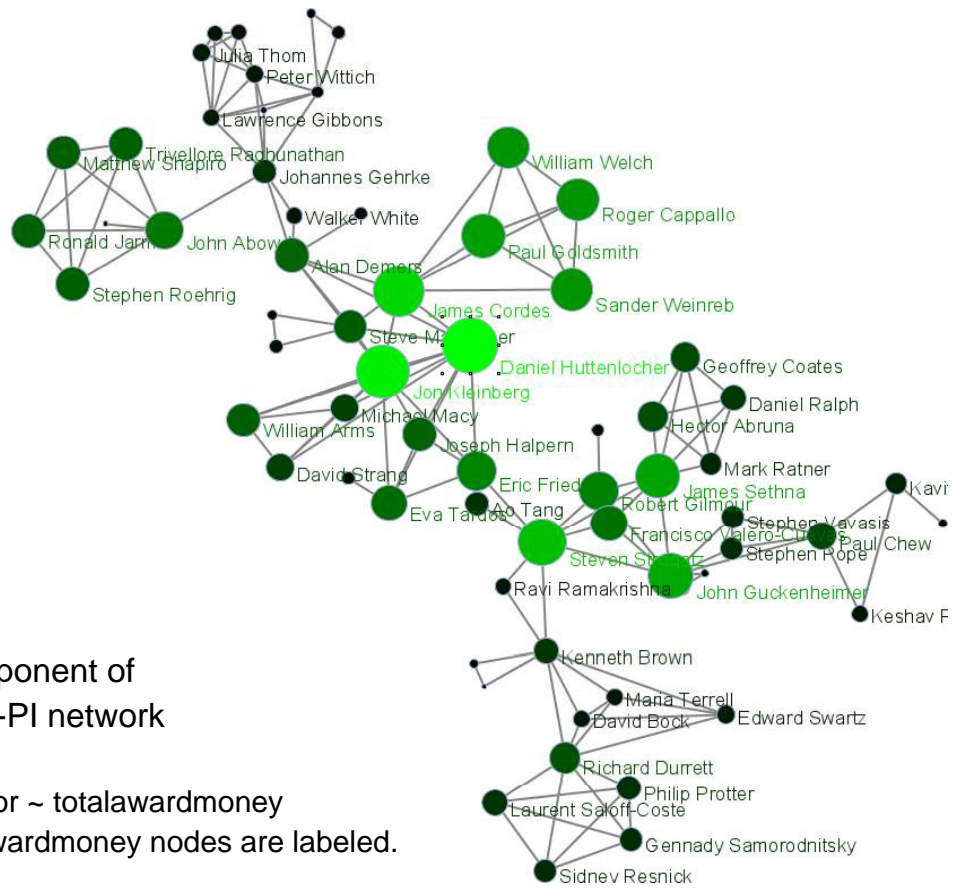


Select network after removing isolates and run 'Analysis > Unweighted and Undirected > Weak Component Clustering' with parameter



Indiana's largest component has 19 nodes, Cornell's has 67 nodes, Michigan's has 55 nodes.

Visualize Cornell network in GUESS using same .py script and save via 'File > Export Image' as jpg.



Largest component of
Cornell U co-PI network

Node size/color ~ totalawardmoney
Top-50 totalawardmoney nodes are labeled.

NetworkWorkbench

A Workbench for Network Scientists

Top-10 investigators by total award money

```
for i in range(0, 10):
    print str(nodesbytotalawardmoney[i].label) + ": " + str(nodesbytotalawardmoney[i].totalawardmoney)
```

Indiana University

Curtis Lively: 7,436,828
Frank Lester: 6,402,330
Maynard Thompson: 6,402,330
Michael Lynch: 6,361,796
Craig Stewart: 6,216,352
William Snow: 5,434,796
Douglas V. Houweling: 5,068,122
James Williams: 5,068,122
Miriam Zolan: 5,000,627
Carla Caceres: 5,000,627

Cornell University

Maury Tigner: 107,216,976
Sandip Tiwari: 72,094,578
Sol Gruner: 48,469,991
Donald Bilderback: 47,360,053
Ernest Fontes: 29,380,053
Hasan Padamsee: 18,292,000
Melissa Hines: 13,099,545
Daniel Huttenlocher: 7,614,326
Timothy Fahey: 7,223,112
Jon Kleinberg: 7,165,507

Michigan University

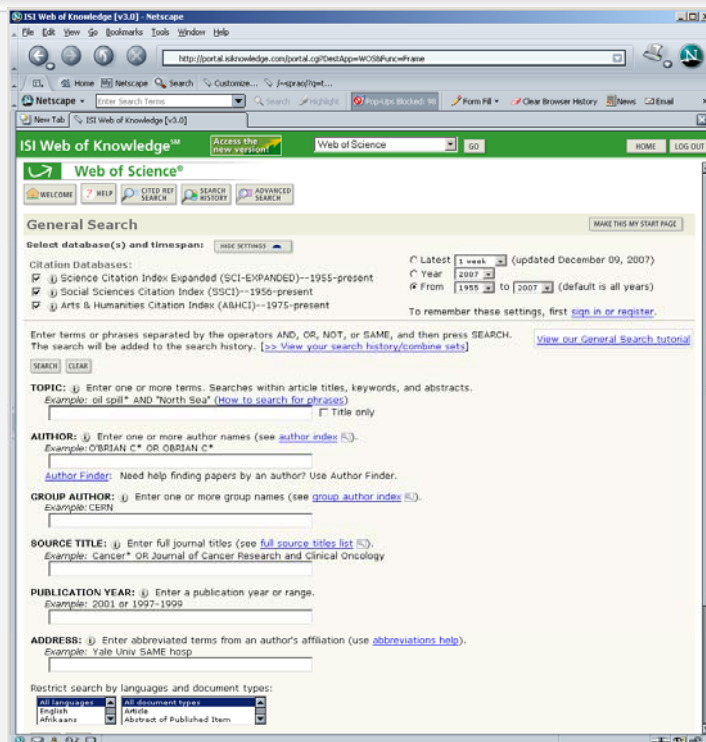
Khalil Najafi: 32,541,158
Kensall Wise: 32,164,404
Jacquelynn Eccles: 25,890,711
Georg Raithel: 23,832,421
Roseanne Sension: 23,812,921
Theodore Norris: 23,350,921
Paul Berman: 23,350,921
Roberto Merlin: 23,350,921
Robert Schoeni: 21,991,140
Wei-Jun Jean Yeung: 21,991,140

NWB Tool for Scientometrics Research

1. Loading NSF datasets with currently active NSF funding for Indiana U, Cornell U, and Michigan U, extracting, and comparing Co-PI networks.
2. Loading ISI files of major network science researchers, extracting, analyzing and visualizing paper-citation networks and co-author networks.
3. Loading text files and detecting Bursts.

Data Acquisition from Web of Science

- Download all papers by
- Eugene Garfield
 - Stanley Wasserman
 - Alessandro Vespignani
 - Albert-László Barabási
- from
- Science Citation Index Expanded (SCI-EXPANDED)--1955-present
 - Social Sciences Citation Index (SSCI)--1956-present
 - Arts & Humanities Citation Index (A&HCI)--1975-present



Eugene Garfield

1,525 papers

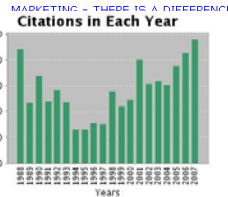
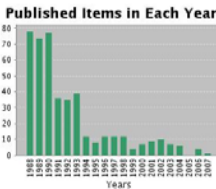
papers/citations for last 20 years

Network Workbench (<http://nwb.slis.indiana.edu>).

1,525 results found (Set #14)
Records 1 -- 10 | Show 10 per page

Use the checkboxes to select records for output. See the sidebar for options.

- 1. **GARFIELD E**
[CITATION ANALYSIS AS A TOOL IN JOURNAL EVALUATION - JOURNALS CAN BE RANKED BY FREQUENCY AND IMPACT OF CITATIONS FOR SCIENCE POLICY STUDIES](#)
SCIENCE 178 (406D): 471+ 1972
Times Cited: 622
[IU@Link](#)
- 2. **GARFIELD E**
[CITATION INDEXES FOR SCIENCE - NEW DIMENSION IN DOCUMENTATION THROUGH ASSOCIATION OF IDEAS](#)
SCIENCE 122 (3159): 108-111 1955
Times Cited: 295
[IU@Link](#)
- 3. **Garfield E**
[How can impact factors be improved?](#)
BRITISH MEDICAL JOURNAL 313 (7054): 411-413 AUG 17 1996
Times Cited: 156
[IU@Link](#) [VIEW FULL TEXT](#)
- 4. **GARFIELD E**
[NEW YEAR, NEW BUILDING](#)
CURRENT CONTENTS (1): 5-8 1980
Times Cited: 156
[IU@Link](#)
- 5. **GARFIELD E**
[INTRODUCING CITATION CLASSICS - HUMAN SIDE OF SCIENTIFIC REPORTS](#)
CURRENT CONTENTS (1): 5-7 1977
Times Cited: 140
[IU@Link](#)



Results found: 1,525
Sum of the Times Cited: 5,282 [View](#)
[View without self-citations](#)
Average Citations per Item: 3.46
h-index: 31

Can download 500 records max.
Exclude Current Contents articles

Refine your results

[Subject Categories](#) | [Source Titles](#) | [Document Types](#) | [Authors](#) | [Publication Years](#) [more choices](#)

Top Source Titles:

- CURRENT CONTENTS (1066)
- SCIENTIST (145)
- CURRENT CONTENTS/LIFE SCIENCES (89)
- JOURNAL OF CHEMICAL DOCUMENTATION (12)
- JOURNAL OF INFORMATION SCIENCE (12)
- NATURE (12)
- JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE (11)
- ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY (10)
- SCIENCE (9)
- SCIENTOMETRICS (9)
- CURRENT COMMENTS (7)
- ANNALS OF INTERNAL MEDICINE (5)
- BRITISH MEDICAL JOURNAL (5)
- CURRENT SCIENCE (5)

- For more options, use [Analyze Results](#).

[VIEW RECORDS](#) [EXCLUDE RECORDS](#)

Include only articles. Download 99 articles.

Refine your results

[Subject Categories](#) | [Source Titles](#) | [Document Types](#) | [Authors](#) | [Publication Years](#)

Top Document Types:

- EDITORIAL MATERIAL (239)
- ARTICLE (99)
- LETTER (76)
- MEETING ABSTRACT (17)
- ITEM ABOUT AN INDIVIDUAL (7)
- DISCUSSION (4)
- BIOGRAPHICAL-ITEM (3)
- BOOK REVIEW (3)
- NOTE (3)
- REPRINT (3)
- REVIEW (3)
- CORRECTION (1)
- CORRECTION, ADDITION (1)

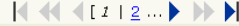
- For more options, use [Analyze Results](#).

99 results found

Records 1 -- 10

Show 10 per page

Go to Page: 1 of 10



Use the checkboxes to select records for output. See the sidebar for options.

- 1. **GARFIELD E**
[CITATION ANALYSIS AS A TOOL IN JOURNAL EVALUATION - JOURNALS CAN BE RANKED BY FREQUENCY AND IMPACT OF CITATIONS FOR SCIENCE POLICY STUDIES](#)
SCIENCE 178 (4060): 471+ 1972
Times Cited: **672**
[IU@Link](#)
- 2. **GARFIELD E**
[CITATION INDEXES FOR SCIENCE - NEW DIMENSION IN DOCUMENTATION THROUGH ASSOCIATION OF IDEAS](#)
SCIENCE 122 (3159): 108-111 1955
Times Cited: **295**
[IU@Link](#)
- 3. **Garfield E**
[How can impact factors be improved?](#)
BRITISH MEDICAL JOURNAL 313 (7054): 411-413 AUG 17 1996
Times Cited: **156**
[IU@Link](#) [VIEW FULL TEXT](#)
- 4. **GARFIELD E**
[CITATION INDEXING FOR STUDYING SCIENCE](#)
NATURE 227 (5259): 669& 1970
Times Cited: **134**
[IU@Link](#)
- 5. **GARFIELD E**
[SCIENCE CITATION INDEX-NEW DIMENSION IN INDEXING - UNIQUE APPROACH UNDERLIES VERSATILE BIBLIOGRAPHIC SYSTEMS FOR COMMUNICATING + EVALUATING INFORMATION](#)
SCIENCE 144 (361): 649& 1964
Times Cited: **109**
[IU@Link](#)

Stanley Wasserman

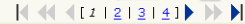
35 papers

35 results found (Set #7) (Why 35?)

Records 1 -- 10

Show 10 per page

Go to Page: 1 of 4

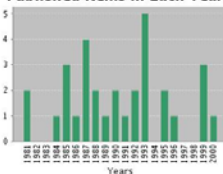


Use the checkboxes to select records for output. See the sidebar for options.

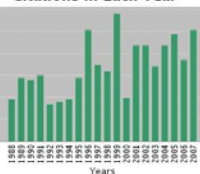
- 1. GALASKIEWICZ J, WASSERMAN S
[MIMETIC PROCESSES WITHIN AN INTERORGANIZATIONAL FIELD - AN EMPIRICAL-TEST](#)
ADMINISTRATIVE SCIENCE QUARTERLY 34 (3): 454-479 SEP 1989
Times Cited: **122**
[IU@Link](#)
- 2. Wasserman S, Pattison P
[Logit models and logistic regressions for social networks .1. An introduction to Markov graphs and p](#)
PSYCHOMETRIKA 61 (3): 401-425 SEP 1996
Times Cited: **29**
[IU@Link](#)
- 3. FIENBERG SE, MEYER MM, WASSERMAN SS
[STATISTICAL-ANALYSIS OF MULTIPLE SOCIOMETRIC RELATIONS](#)
JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION 80 (389): 51-67 1985
Times Cited: **47**
[IU@Link](#)
- 4. WASSERMAN S
[ANALYZING SOCIAL NETWORKS AS STOCHASTIC-PROCESSES](#)
JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION 75 (370): 280-294 1980
Times Cited: **38**
[IU@Link](#)
- 5. IACOBUCCI D, WASSERMAN S
[A GENERAL FRAMEWORK FOR THE STATISTICAL-ANALYSIS OF SEQUENTIAL DYADIC INTERACTION DATA](#)
PSYCHOLOGICAL BULLETIN 103 (3): 379-390 MAY 1988
Times Cited: **34**
[IU@Link](#)

papers/citations for last 20 years

Published Items in Each Year



Citations in Each Year



Results found: 35
Sum of the Times Cited (Σ): 744 [View](#)
Average Citations per Item (Σ): 21.83 [View what self-citations](#)
h-index (h): **17**

Alessandro Vespignani

101 papers

papers/citations for last 20 years

Network Workbench (<http://nwb.slis.indiana.edu>).

101 results found (Set #11) (Why 101?)
Records 1 -- 10 | Show 10 per page

Use the checkboxes to select records for output. See the sidebar for options.

1. Pastor-Satorras R, Vespignani A
[Epidemic spreading in scale-free networks](#)
PHYSICAL REVIEW LETTERS 86 (14): 3200-3203 APR 2 2001
Times Cited: 451
[IU Link](#)
2. Pastor-Satorras R, Vazquez A, Vespignani A
[Dynamical and correlation properties of the Internet](#)
PHYSICAL REVIEW LETTERS 87 (25): Art. No. 258701 DEC 17 2001
Times Cited: 224
[IU Link](#)
3. Barrat A, Barthelemy M, Pastor-Satorras R, et al.
[The architecture of complex weighted networks](#)
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 101 (11): 3747-3752 MAR 16 2004
Times Cited: 130
[IU Link](#)
4. Pastor-Satorras R, Vespignani A
[Epidemic dynamics and endemic states in complex networks](#)
PHYSICAL REVIEW E 63 (6): Art. No. 066117 Part 2 JUN 2001
Times Cited: 164
[IU Link](#)
5. Vazquez A, Pastor-Satorras R, Vespignani A
[Large-scale topological and dynamical properties of the Internet](#)
PHYSICAL REVIEW E 65 (6): Art. No. 066130 Part 2 JUN 2002
Times Cited: 123
[IU Link](#)
6. Vespignani A, Zappelli D
[How self-organized criticality works: A unified mean-field picture](#)
PHYSICAL REVIEW E 57 (6): 6345-6362 JUN 1998
Times Cited: 111
[IU Link](#)

Published Items in Each Year

Citations in Each Year

Results found: 101
Sum of the Times Cited: 3,811 [View](#)
Average Citations per Item: 37.73
h-index: 33

Albert-László Barabási

126 papers

papers/citations for last 20 years

Network Workbench (<http://nwb.slis.indiana.edu>).

126 results found (Set #9) (Why 126?)
Records 1 -- 10 | Show 10 per page

Use the checkboxes to select records for output. See the sidebar for options.

1. Barabasi AL, Albert R
[Emergence of scaling in random networks](#)
SCIENCE 286 (5439): 509-512 OCT 15 1999
Times Cited: 2218
[IU Link](#)
2. Albert R, Barabasi AL
[Statistical mechanics of complex networks](#)
REVIEWS OF MODERN PHYSICS 74 (1): 47-97 JAN 2002
Times Cited: 2060
[IU Link](#)
3. Jeong H, Tombor B, Albert R, et al.
[The large-scale organization of metabolic networks](#)
NATURE 407 (6804): 651-654 OCT 5 2000
Times Cited: 939
[IU Link](#)
4. Albert R, Jeong H, Barabasi AL
[Error and attack tolerance of complex networks](#)
NATURE 406 (6794): 378-382 JUL 27 2000
Times Cited: 775
[IU Link](#)
5. Jeong H, Mason SP, Barabasi AL, et al.
[Lethality and centrality in protein networks](#)
NATURE 411 (6833): 41-42 MAY 3 2001
Times Cited: 745
[IU Link](#)
6. Albert R, Jeong H, Barabasi AL
[Internet - Diameter of the World-Wide Web](#)
NATURE 401 (6749): 130-131 SEP 9 1999
Times Cited: 670
[IU Link](#)

Published Items in Each Year

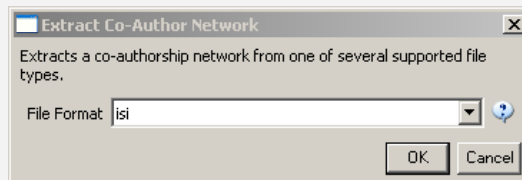
Citations in Each Year

Results found: 126
Sum of the Times Cited: 13,494 [View](#)
Average Citations per Item: 107.02
h-index: 47

	Age	Total # Cites	Total # Papers	H-Index
Eugene Garfield	82	1,525	672	31
Stanley Wasserman		122	35	17
Alessandro Vespignani	42	451	101	33
Albert-László Barabási	40	2,218	126	47 (Dec 2007)
	41	16,920	159	52 (Nov 2008)

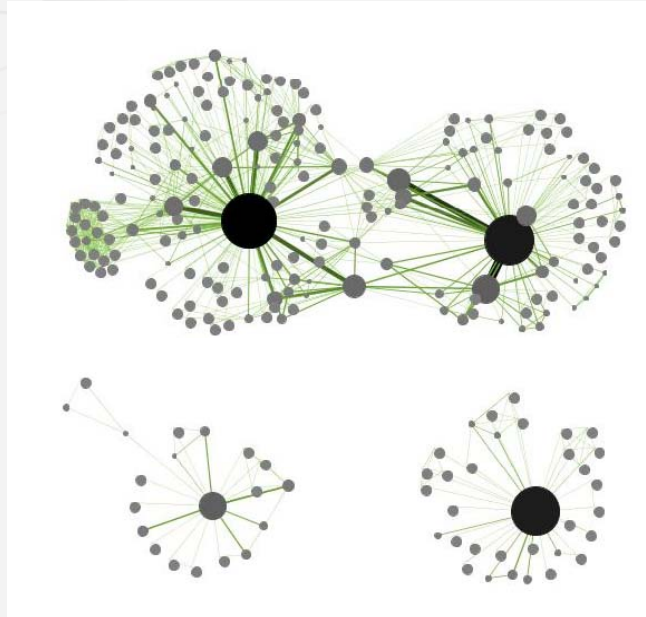
Load **yournwbdirectory*/sampledata/scientometrics/isi/FourNetSciResearchers.isi* using *'File > Load and Clean ISI File'*.

To extract the co-author network, select the *'361 Unique ISI Records'* table and run *'Scientometrics > Extract Co-Author Network'* using isi file format:

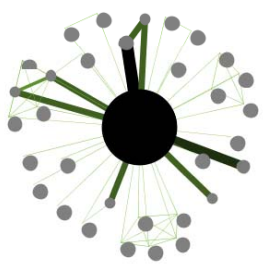


The result is an undirected network of co-authors in the Data Manager. It has 248 nodes and 891 edges.

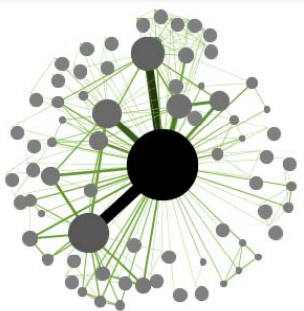
To view the complete network, select the network and run *'Visualization > GUESS > GEM'*. Run *Script > Run Script...* . And select *Script folder > GUESS > co-author-nw.py* .



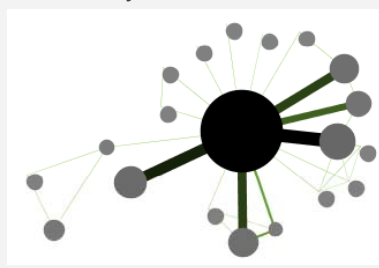
Eugene Garfield



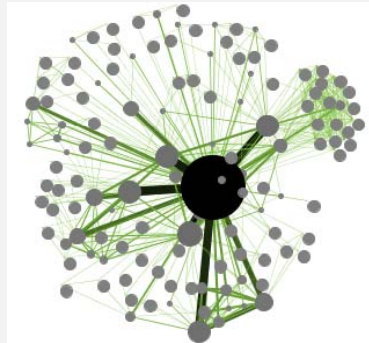
Alessandro Vespignani



Stanley Wasserman



Albert-László Barabási

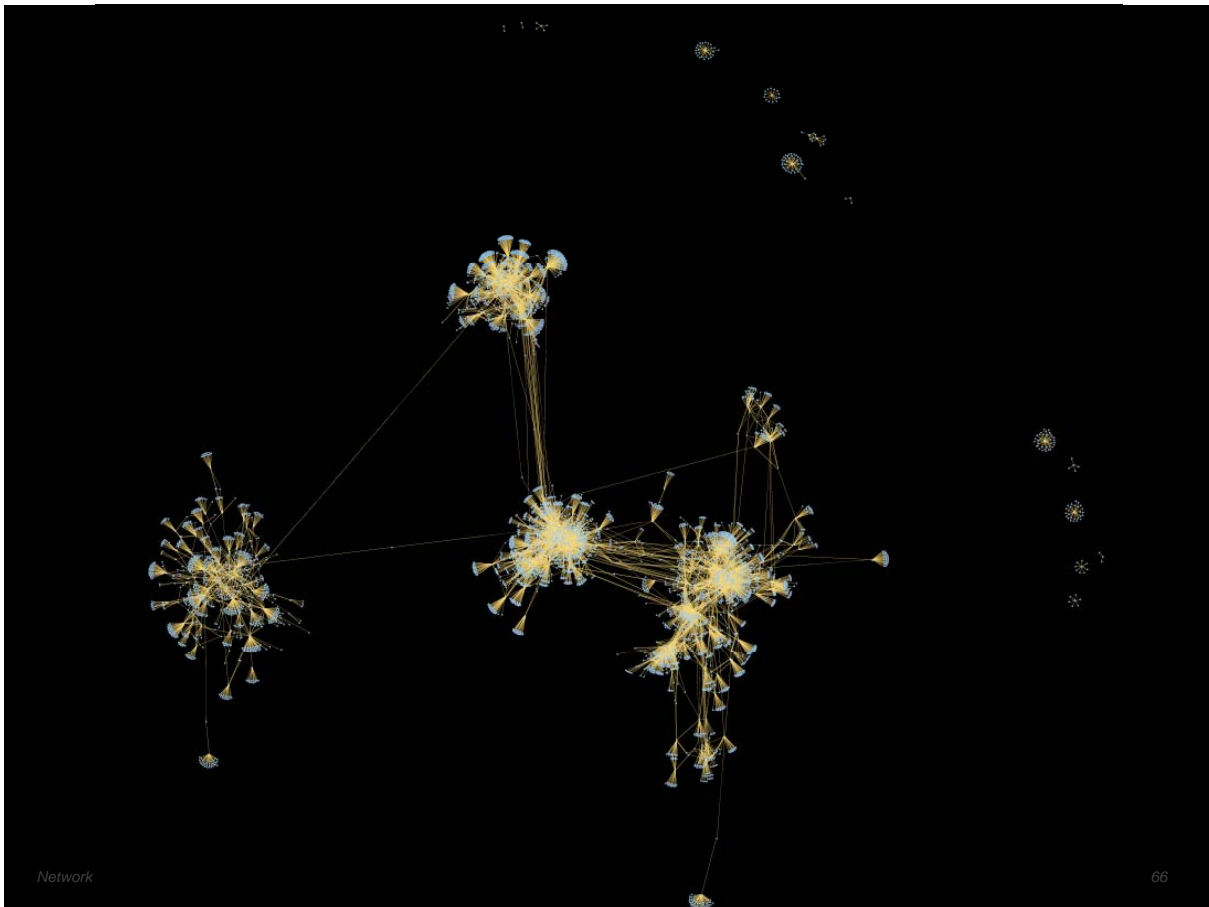


Load *'*yournwbdirectory*/sampledata/scientometrics/isi/FourNetSciResearchers.isi'* using *'File > Load and Clean ISI File'*.

To extract the paper-citation network, select the *'361 Unique ISI Records'* table and run *'Scientometrics > Extract Directed Network'* using the parameters:

The result is a directed network of paper citations in the Data Manager. It has 5,335 nodes and 9,595 edges.

To view the complete network, select the network and run *'Visualization > GUESS'*. Run *'Script > Run Script ...'* and select *'yournwbdirectory*/script/GUESS/paper-citation-nw.py'*.



NWB Tool for Scientometrics Research

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2. Loading ISI files of major network science researchers, extracting, analyzing and visualizing paper-citation networks and co-author networks.
3. Loading text files and detecting Bursts.

SCHOLARLY DATABASE
Cyberinfrastructure for Network Science Center, SLIS, Indiana University, Bloomington

IU User
IU Users must login using the Central Authentication Service (CAS), the standard IU authentication system. Please click the button below to proceed to the IU login page.
[Go to IU Login](#)

Non-IU User
Email:
Password:
[Login](#)

Not Registered Yet?
[Register as an IU User](#)
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In the News
WikiField, Infn. 2008. [Group Theory](#). Nature, 455, 9: 720-723.

Please Cite As
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<http://slis.slis.indiana.edu/~katy/paper/07-issi-sdb.pdf>

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INDIANA UNIVERSITY
SCHOOL OF LIBRARY AND INFORMATION SCIENCE
James S. McDonnell Foundation

Goto: <http://sdb.slis.indiana.edu>

Email: nwb@indiana.edu


Password: nwb

Scholarly Database :: Search - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sdb.slis.indiana.edu/search/

Do you want Firefox to remember this password? Remember Never for This Site Not Now



SCHOLARLY DATABASE

Cyberinfrastructure for Network Science Center, SLIS, Indiana University, Bloomington

Search Edit Profile About Logout

Search

Creators:

Title:

Abstract:

All Text:

First Year:

Last Year:

Medline (1898 - 2008)

NIH (1961 - 2002)

NSF (1985 - 2004)

USPTO (1976 - 2007)

If multiple terms are entered in a field, they are automatically combined using 'OR'. So, 'breast cancer' matches any record with 'breast' or 'cancer' in that field.

You can put AND between terms to combine with 'AND'. Thus 'breast AND cancer' would only match records that contain both terms.

Double quotation can be used to match compound terms, e.g., "breast cancer" retrieves records with the phrase "breast cancer", and not records where 'breast' and 'cancer' are both present, but not the exact phrase.

The importance of a particular term in a query can be increased by putting a ^ and a number after the term. For instance, 'breast cancer^10' would increase the importance of matching the term 'cancer' by ten compared to matching the term 'breast'.

<http://sdb.slis.indiana.edu>

Network Wo Done


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Scholarly Database :: Results - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sdb.slis.indiana.edu/search/results?q=(sustainability) AND yea

Most Visited Getting Started Latest Headlines



SCHOLARLY DATABASE

Cyberinfrastructure for Network Science Center, SLIS, Indiana University, Bloomington

Search Edit Profile About Logout

Your search returned 2,790 results in 0.458 seconds.

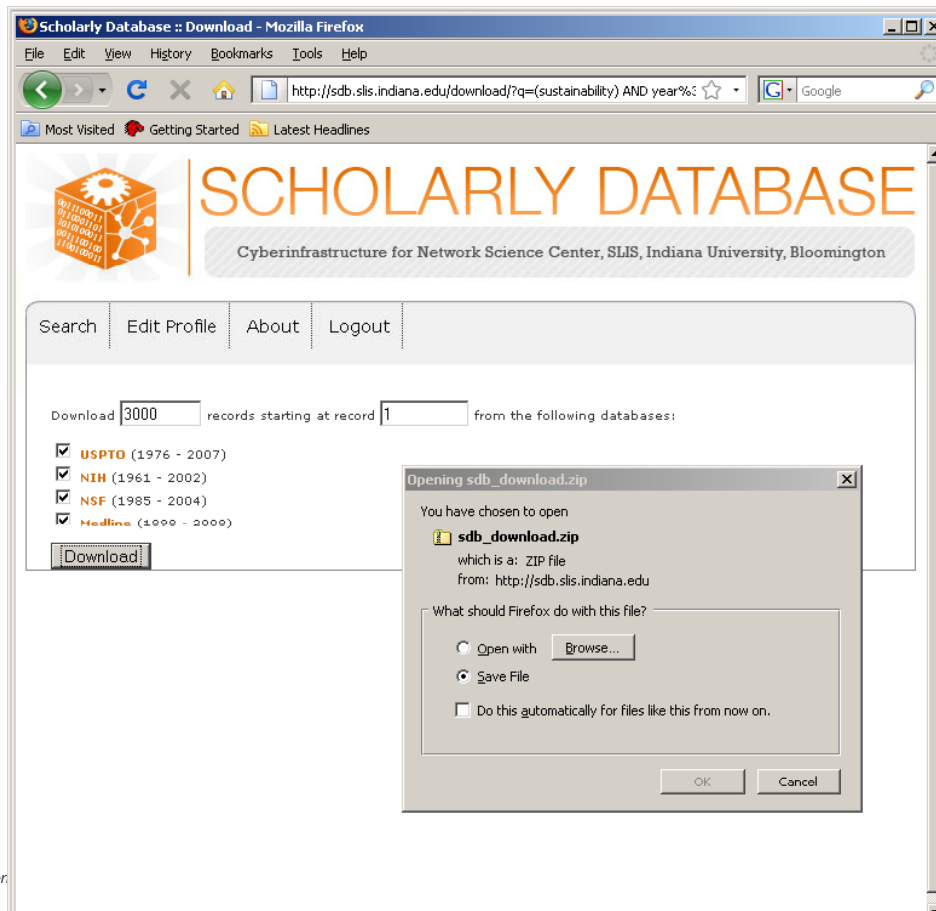
Total results per database: NIH: 70, Medline: 2,408, USPTO: 16, NSF: 296.

Results 1 through 20.

Next>>

Source	Authors/Creators	Year	Title	Score (out of 4.99)
Medline	Dandona et al.	2001	Financial sustainability.	4.99
Medline	Gölitz	2007	Chemistry, journals, and sustainability.	4.38
Medline	Dadabhoy and Gölitz	2008	Sustainability: chemistry is key.	4.38
Medline	Rowe	2007	Sustainability. Education for a sustainable future.	3.77
Medline		2002	Materials for sustainability.	3.15
Medline	Astle et al.	2005	Enhancing the SAFE strategy through collaboration, participation, accountability and sustainability.	3.15
Medline	Stanton	2008	MiniSymposium. Sustainability: public health's role in the 21st century.	3.15
Medline	Carpenter and Hoppszallern	2008	Greening up. Hospitals getting savvy on sustainability.	3.15

Done



Network Workben

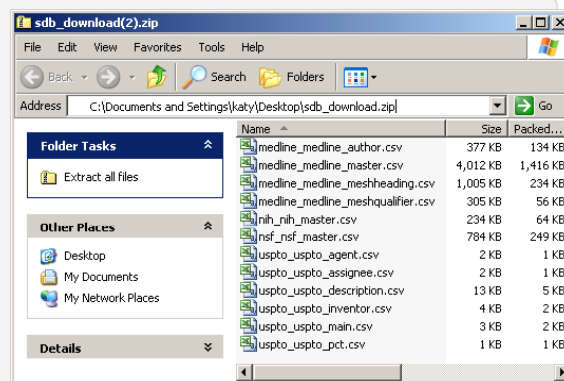
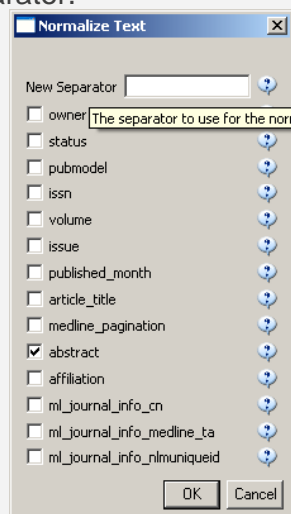
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NetworkWorkbench Open and Preprocess SDB zip file

A Workbench for Network Scientists

Load medline_medline_master.csv to NWB.

Run 'Preprocessing > Normalize Text' with a space as New Separator.



Network Workbench (<http://nwb.slis.indiana.edu>).

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Run 'Analysis > Textual > Burst Detection' with parameters:
and space as a separator.

Sort result by burst weight

Word	Length	Weight	Strength	Start	End
care	1	Infinity	Infinity	1988	1988
water	1	29.8883	29.8883	2002	2002
countri	10	27.03612	27.03612	1990	1999
protect	1	26.88557	26.88557	2002	2002
farm	1	23.32114	23.32114	2005	2005
villag	2	23.273	40.65081	2008	
crop	2	22.33649	30.42535	2008	
educ	2	22.14556	26.98588	1995	1996
blood	5	22.12166	22.12166	1996	2000

Network Workbench (<http://nwb.slis.indiana.edu>).

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- Improving GUESS usability.
- Creating wizard for integrating compiled algorithms.
- Algorithms can communicate with other algorithms at run-time using streams.
- Develop components to connect and query SDB.
- Customize Menu – Users can re-organize the algorithms for their needs.

The screenshot shows the IU News Room website. At the top, it says "INDIANA UNIVERSITY" and "IU News Room". The date is "Sunday, May 4, 2008". There are navigation menus for "Browse by Campus" and "Services & Resources". A search bar is present with a "GO" button. The main content area features a news article titled "\$1.2 million NIH project will help track and predict epidemics", last modified on Tuesday, April 8, 2008. The article is marked as "FOR IMMEDIATE RELEASE" and dated "April 8, 2008". The text of the article begins: "BLOOMINGTON, Ind. -- The National Institutes of Health has given \$1.2 million to Indiana University researchers to build the ultimate international epidemic research tool." To the right of the article, there are sections for "Media Contacts" listing Neal Moore and David Bricker, and "News by Topic" with links to General News, Graduate Studies, Life Sciences, Science, and Technology. A "More Topics >>" link is also visible. The page number "75" is in the bottom right corner.

Publications

- <http://nwb.slis.indiana.edu/pub.html>

Community Wiki, Tutorials, FAQ

- <https://nwb.slis.indiana.edu/community>
- <http://nwb.slis.indiana.edu/doc.html>
- GUESS Manual <http://guess.wikispot.org/manual>

Software

- <http://cishell.org>
- <http://nwb.slis.indiana.edu/download.html>

Developer Resources

- <http://cns-trac.slis.indiana.edu/trac/nwb>



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