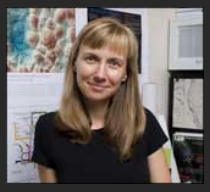
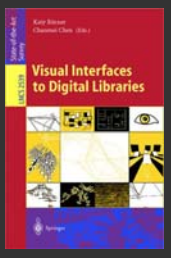
Science Maps: How to Analyze, Map, and Make Sense of Science

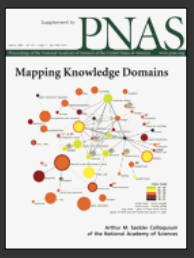


Dr. Katy Börner
Cyberinfrastructure for Network Science Center, Director
Information Visualization Laboratory, Director
School of Library and Information Science
Indiana University, Bloomington, IN
katy@indiana.edu

National Research Council, Ottawa, Canada
10:00am, July 7th, 2008

Science Maps in Action





Computational Scientometrics:
Studying Science by Scientific Means

- *Börner, Katy, Chen, Chaomei, and Boyack, Kevin. (2003).* ***Visualizing Knowledge Domains.*** *In Blaise Cronin (Ed.), Annual Review of Information Science & Technology, Medford, NJ: Information Today, Inc./American Society for Information Science and Technology, Volume 37, Chapter 5, pp. 179-255.* http://ivl.slis.indiana.edu/km/pub/2003-borner-arist.pdf
- *Shiffrin, Richard M. and Börner, Katy (Eds.) (2004).* ***Mapping Knowledge Domains.*** *Proceedings of the National Academy of Sciences of the United States of America, 101(Suppl_1).* http://www.pnas.org/content/vol101/suppl_1/
- *Börner, Katy, Sanyal, Soma and Vespignani, Alessandro (2007).* ***Network Science.*** *In Blaise Cronin (Ed.), Annual Review of Information Science & Technology, Information Today, Inc./American Society for Information Science and Technology, Medford, NJ, Volume 41, Chapter 12, pp. 537-607.* http://ivl.slis.indiana.edu/km/pub/2007-borner-arist.pdf

- ***Places & Spaces: Mapping Science*** *exhibit, see also http://scimaps.org.*

Mapping Science Exhibit – 10 Iterations in 10 years

The Power of Maps (2005)

Science Maps for Economic Decision Makers (2008)

The Power of Reference Systems (2006)

Science Maps for Science Policy Makers (2009)
Science Maps for Scholars (2010)
Science Maps as Visual Interfaces to Digital Libraries (2011)
Science Maps for Kids (2012)
Science Forecasts (2013)

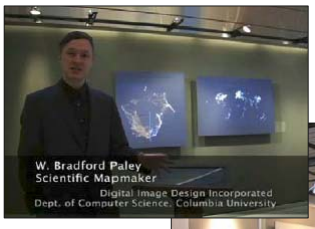
How to Lie with Science Maps (2014)

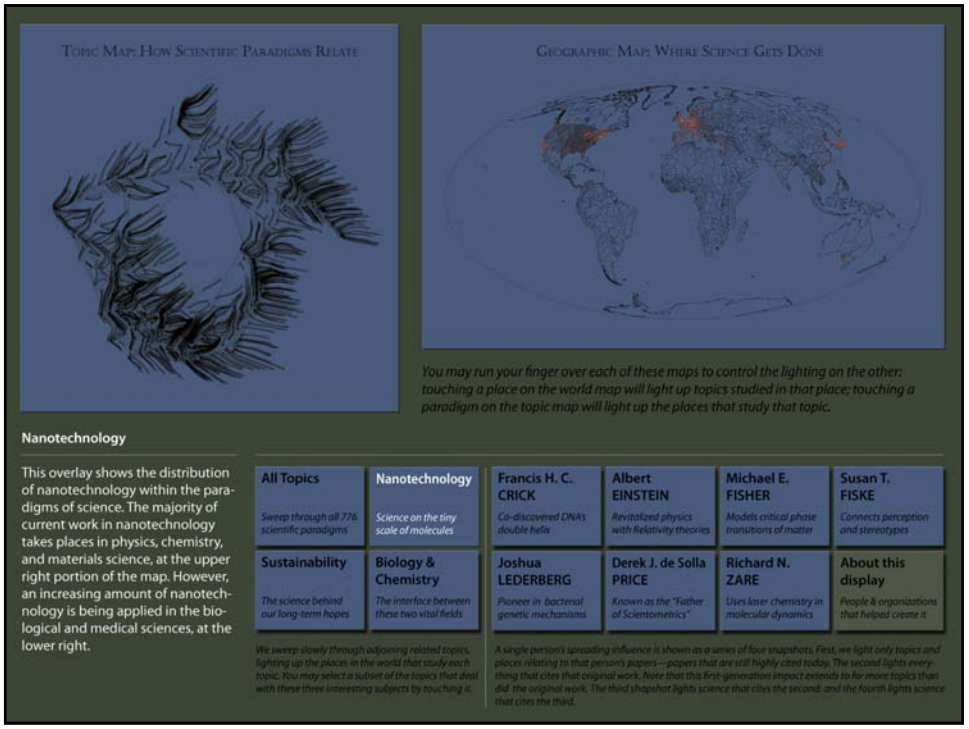
The Power of Forecasts (2007)

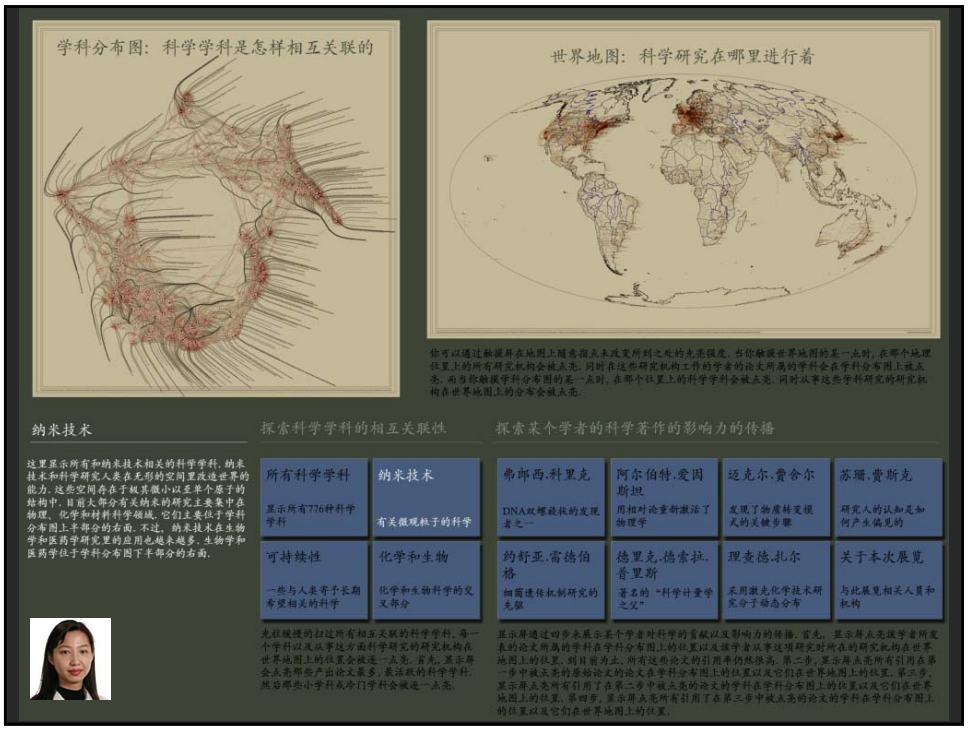
scimaps.org

Illuminated Diagram Display

W. Bradford Paley, Kevin W. Boyack, Richard Kalvans, and Katy Börner (2007) Mapping, Illuminating, and Interacting with Science. SIGGRAPH 2007, San Diego, CA.

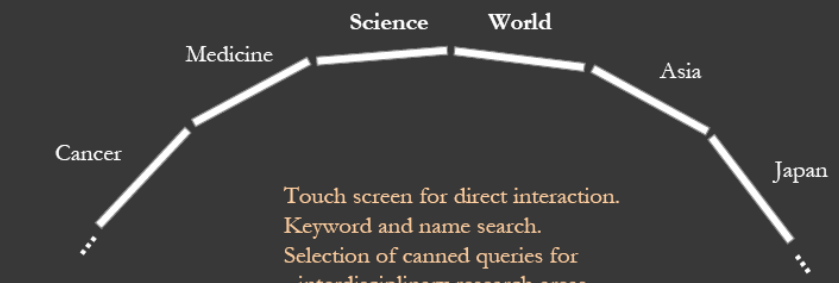



Topic Map: How Scientific Paradigms Relate
Geographic Map: Where Science Gets Done
You may run your finger over each of these maps to control the lighting on the other: touching a place on the world map will light up topics studied in that place; touching a paradigm on the topic map will light up the places that study that topic.
Nanotechnology
This overlay shows the distribution of nanotechnology within the paradigms of science. The majority of current work in nanotechnology takes places in physics, chemistry, and materials science, at the upper right portion of the map. However, an increasing amount of nanotechnology is being applied in the biological and medical sciences, at the lower right.
All Topics
Sweep through all 776 scientific paradigms
Nanotechnology
Science on the tiny scale of molecules
Sustainability
The science behind our long-term hopes
Biology & Chemistry
The interface between these two vital fields
Francis H. C. CRICK
Co-discovered DNA's double helix
Albert EINSTEIN
Revitalized physics with Relativity theories
Michael E. FISHER
Models critical phase transitions of matter
Susan T. FISKE
Connects perception and stereotypes
Joshua LEDERBERG
Pioneer in bacterial genetic mechanisms
Derek J. de Solla PRICE
Known as the "Father of Scientometrics"
Richard N. ZARE
Uses laser chemistry in molecular dynamics
About this display
People & organizations that helped create it
We sweep slowly through adjoining related topics, lighting up the places in the world that study each topic. You may select a subset of the topics that deal with these three interesting subjects by touching it.
A single person's spreading influence is shown as a series of four snapshots. First, we light only topics and places relating to that person's papers — papers that are still highly cited today. The second lights everything that cites that original work. Note that this first-generation impact extends to far more topics than did the original work. The third shapshot lights science that cites the second; and the fourth lights science that cites the third.

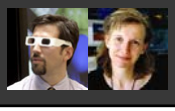

学科分布图：科学学科是怎样相互关联的
世界地图：科学研究在哪里进行着
你可以通过触摸屏在地图上随意指点来改变所列之处的光亮强度。当你触摸世界地图的某一点时，在那个地理位置上的所有研究机构会被点亮。同时在这些研究机构工作的学者的论文所属的学科会在学科分布图上被点亮。而当你触摸学科分布图的某一点时，在那个位置上的科学学科会被点亮。同时从事这些学科研究的研究机构在世界地图上的分布会被点亮。
纳米技术
这里显示所有和纳米技术相关的科学学科。纳米技术和科学研究人类在无形的空间里改造世界的能力。这些空间存在于极其微小以至单个原子的结构中。目前大部分有关纳米的研究主要集中在物理、化学和材料科学领域。它们主要位于学科分布图上半部分的右面。不过，纳米技术在生物学和医药学研究里的应用也越来越多。生物学和医药学位于学科分布图下半部分的右面。
探索科学学科的相互关联性
所有科学学科
显示所有776种科学学科
纳米技术
有关微观粒子的科学
可持续性
一些与人类有关长期希望相关的科学
化学和生物
化学和生物科学的交叉部分
无数规模的妇过所有相互关联的科学学科，每一个学科以及从事这方面科学研究的研究机构在世界地图上的位置会被逐一点亮。首先，显示屏会点亮那些产出论文最多，最活跃的科学学科。然后那些小学科或与门学科会被逐一点亮。
探索某个学者的科学著作的影响力的传播
弗郎西.科里克
DNA双螺旋状的发现者之一
阿尔伯特.爱因斯坦
用相对论重新激活了物理学
迈克尔.费舍尔
发现了物质转变模式的关键步骤
苏珊.费斯克
研究人的认知是如何产生偏见的
约舒亚.雷德伯格
细菌遗传机制研究的先驱
德里克.德索拉.普里斯
著名的"科学计量学之父"
理查德.扎尔
采用激光化学技术研究分子动态分布
关于本次展览
与此展览相关人员和机构
显示屏通过四步来展示某个学者对科学的贡献以及影响力的传播。首先，显示屏点亮该学者所发表的论文所属的学科在学科分布图上的位置以及该学者从事这项研究时所在的研究机构在世界地图上的位置。到目前为止，所有这些论文的引用率仍然很高。第二步，显示屏点亮所有引用在第一步中被点亮的原始论文的论文在学科分布图上的位置以及它们在世界地图上的位置。第三步，显示屏点亮所有引用了在第二步中被点亮的论文的学科在学科分布图上的位置以及它们在世界地图上的位置。第四步，显示屏点亮所有引用了在第三步中被点亮的论文的学科在学科分布图上的位置以及它们在世界地图上的位置。

Re-implementation of Illuminated Diagram Software
by Advanced Visualization Lab, Indiana University

Drives unlimited number of ID screens.



Touch screen for direct interaction.
Keyword and name search.
Selection of canned queries for
- interdisciplinary research areas
- famous people
- activity patterns, e.g., bursts, trends, etc.



"Science of Science" Opportunities

Advantages for Funding Agencies
- Supports monitoring of (long-term) money flow and research developments, evaluation of funding strategies for different programs, decisions on project durations, funding patterns.
- Staff resources can be used for scientific program development, to identify areas for future development, and the stimulation of new research areas.

Advantages for Researchers
- Easy access to research results, relevant funding programs and their success rates, potential collaborators, competitors, related projects/publications **(research push).**
- More time for research and teaching.

Advantages for Industry
- Fast and easy access to major results, experts, etc.
- Can influence the direction of research by entering information on needed technologies **(industry-pull)**.

Advantages for Publishers
- Unique interface to their data.
- Publicly funded development of databases and their interlinkage.

For Society
- Dramatically improved access to scientific knowledge and expertise.

Cyberinsfrastructures in Support of Computational Scientometrics

- **Scholarly Database at Indiana University** of 18 million scholarly records, https://sdb.slis.indiana.edu
- **OSGi/CIShell based Plug-and-Play CIs**
  - Information Visualization Cyberinfrastructure, http://iv.slis.indiana.edu
  - Network Workbench Tool and Community Wiki, http://nwb.slis.indiana.edu
  - Epidemics Cyberinfrastructure (EPIC), soon at http://epic.slis.indiana.edu

Designed and build in support of Knowledge Management

Scholarly Database at Indiana University

See also

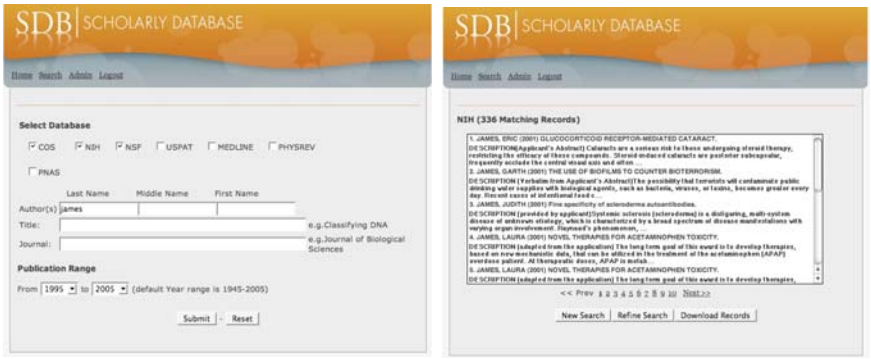
La Rowe, Gavin, Ambre, Sumeet Adinath, Burgoon, John W., Ke, Weimao & Börner, Katy. (2007). The Scholarly Database and Its Utility for Scientometrics Research. Torres-Salinas, D & Moed, H F (Eds.), Proceedings of the 11th International Conference on Scientometrics and Informetrics (ISSI 2007), Madrid, Spain, June 25-27, ISSI, pp. 457-462.

Contact Nianli Ma at nianma@indiana.edu

Scholarly Database: Web Interface

Search across publications, patents, grants.

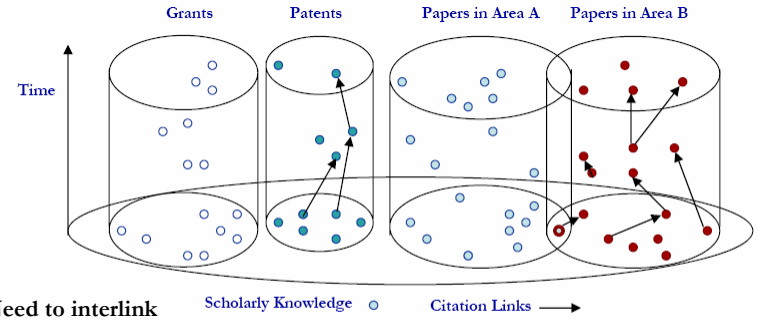
Download records and/or (evolving) co-author, paper-citation networks.



Register for free access at https://sdb.slis.indiana.edu.

Challenges

Interlink $ Input & Publication/Patent Citation Output



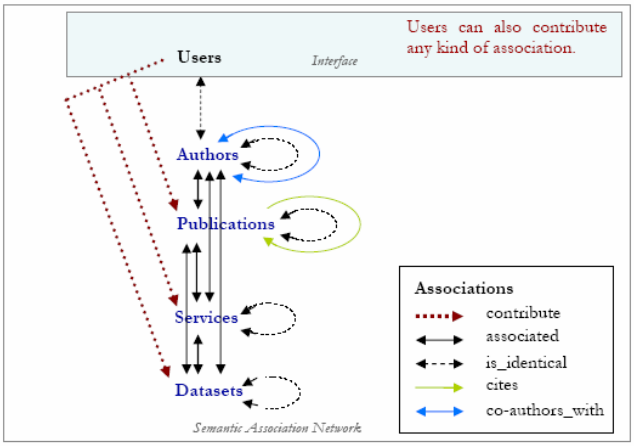
Need to interlink

- Grants and papers/patents.
- Grants/papers/patents and their PIs/authors/inventors, etc.

Use resulting networks to

- Count #papers, #citations, etc.
- Determine strength of co-PI/author/inventor relations, etc.

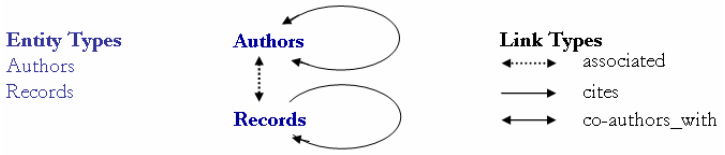
Semantic Association Networks



Katy Börner. (2006) Semantic Association Networks: Using Semantic Web Technology to Improve Scholarly Knowledge and Expertise Management. In Vladimir Geroimenko & Chaomei Chen (eds.) Visualizing the Semantic Web, Springer Verlag, 2nd Edition, chapter 11, pp. 183-198.

Improved Representation of Scholarly Knowledge

Entity and link types:



Attributes:

- Records often have a publication date, a publication type (e.g., journal paper, book, patents, grant, etc.), topics (e.g., keywords or classifications assigned by authors and/or publishers).
- Authors have an address with information on affiliation and geo-location.

Derived attributes:

- Because authors and records are associated, the geo-location(s) and affiliation(s) of an author can be attributed to the authors' papers.
- Similarly, the publication date, publication type and topic(s) can be associated with a paper's author(s).

Improved Representation of Scholarly Knowledge makes possible

Statistics:

- Number of papers, grants, co-authorships, citation (over time) per author.
- Bursts of activity (#citations, #$, #patents, #collaborators, etc.).
- Changes of topics and geo-locations for authors and their institutions over time.

Visualizations:

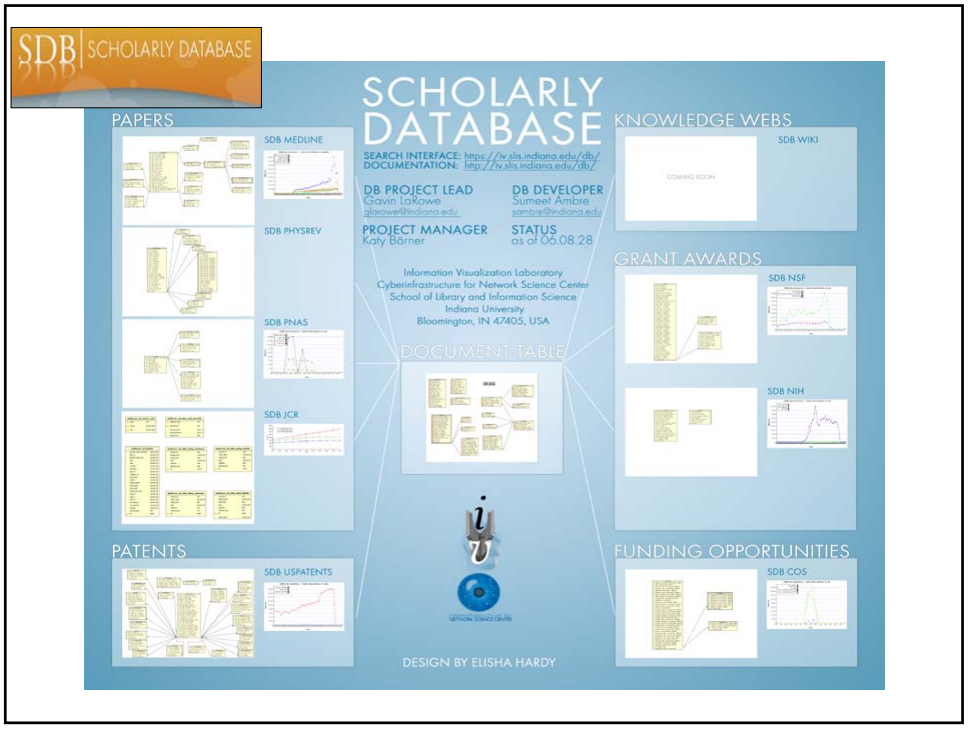
- Geospatial and topical distribution of funding input & research output.
- Structure and evolution of research topics.
- Evolving research areas (e.g., based on young yet highly cited papers).
- Diffusion of information, people, $s over geospatial and topic space.

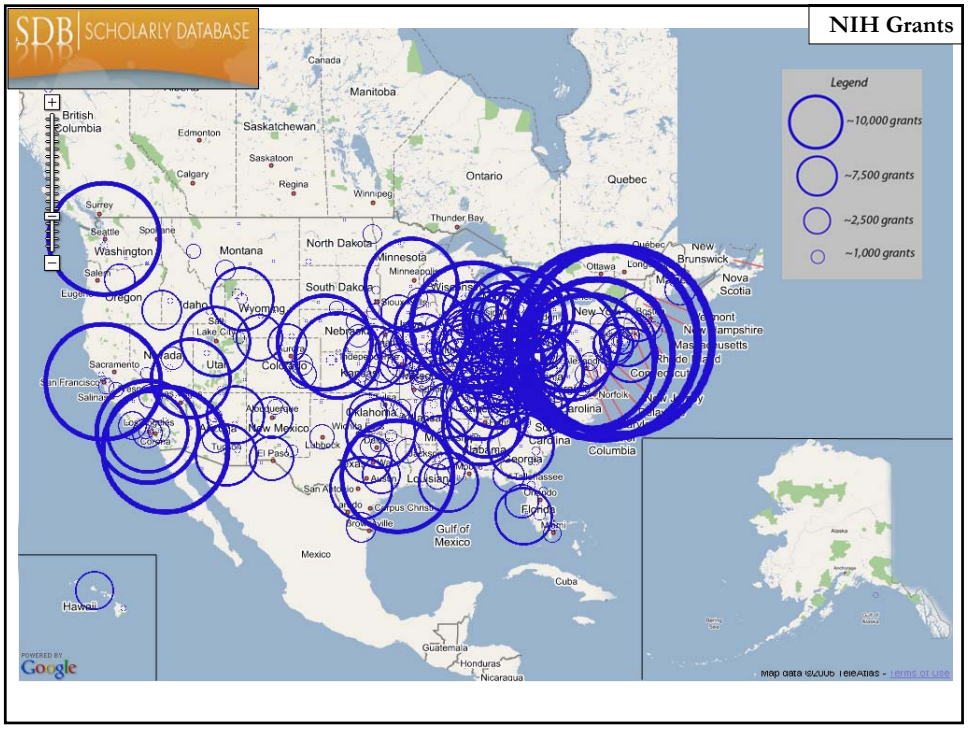
Scholarly Database: # Records & Years Covered

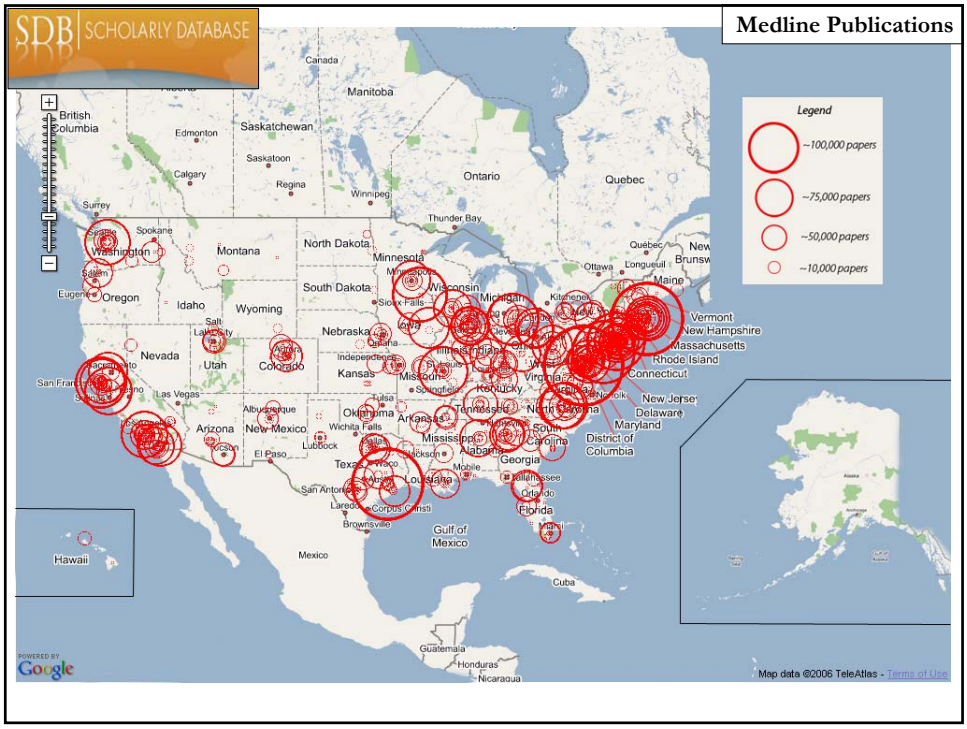
Datasets available via the Scholarly Database (* future feature)

Dataset	# Records	Years Covered	Updated	Restricted Access
Medline	13,149,741	1965-2005	Yes	
PhysRev	398,005	1893-2006		Yes
PNAS	16,167	1997-2002		Yes
JCR	59,078	1974, 1979, 1984, 1989 1994-2004		Yes
USPTO	3,179,930	1976-2004	Yes	
NSF	174,835	1985-2003	Yes*	
NIH	1,043,804	1972-2002	Yes*	
Total	**18,021,560**	**1893-2006**	**4**	**3**

Aim for comprehensive time, geospatial, and topic coverage.


SDB | SCHOLARLY DATABASE
SCHOLARLY DATABASE
PAPERS
SDB MEDLINE
SDB PHYSREV
SDB PNAS
SDB JCR
KNOWLEDGE WEBS
SDB WIKI
SEARCH INTERFACE: https://iv.slis.indiana.edu/db/
DOCUMENTATION: http://iv.slis.indiana.edu/db/
DB PROJECT LEAD
Gavin LaRowe
glarowe@indiana.edu
DB DEVELOPER
Sumeet Ambre
sambre@indiana.edu
PROJECT MANAGER
Katy Börner
STATUS
as of 06.08.28
Information Visualization Laboratory
Cyberinfrastructure for Network Science Center
School of Library and Information Science
Indiana University
Bloomington, IN 47405, USA
GRANT AWARDS
SDB NSF
SDB NIH
DOCUMENT TABLE
PATENTS
SDB USPATENTS
FUNDING OPPORTUNITIES
SDB COS
DESIGN BY ELISHA HARDY


SDB | SCHOLARLY DATABASE
NIH Grants
Legend
~10,000 grants
~7,500 grants
~2,500 grants
~1,000 grants
Canada
Manitoba
British Columbia
Edmonton
Saskatchewan
Saskatoon
Calgary
Regina
Winnipeg
Ontario
Quebec
Thunder Bay
Surrey
Seattle
Spokane
Washington
Montana
North Dakota
Minnesota
Minneapolis
Ottawa
New Brunswick
Nova Scotia
Salem
Oregon
South Dakota
Wyoming
Nebraska
Sacramento
Nevada
Utah
Colorado
San Francisco
Salinas
Albuquerque
New Mexico
Oklahoma
Lubbock
El Paso
Norfolk
Carolina
Columbia
Georgia
Florida
Miami
San Antonio
Corpus Christi
Brownsville
Gulf of Mexico
Mexico
Cuba
Hawaii
Guatemala
Honduras
Nicaragua
POWERED BY Google


SDB | SCHOLARLY DATABASE
Medline Publications
Legend
~100,000 papers
~75,000 papers
~50,000 papers
~10,000 papers
Canada
Manitoba
Saskatchewan
Ontario
Quebec
British Columbia
Edmonton
Saskatoon
Calgary
Regina
Winnipeg
Thunder Bay
Montana
North Dakota
Minnesota
South Dakota
Wisconsin
Michigan
Wyoming
Idaho
Oregon
Nebraska
Nevada
Utah
Colorado
Kansas
Missouri
Arizona
New Mexico
Oklahoma
Arkansas
Tennessee
Mississippi
Alabama
Georgia
Louisiana
Florida
Texas
Kentucky
Virginia
North Carolina
South Carolina
Maryland
Delaware
New Jersey
Connecticut
Rhode Island
Massachusetts
Vermont
New Hampshire
Maine
Hawaii
Gulf of Mexico
Mexico
Cuba
Guatemala
Honduras
Nicaragua
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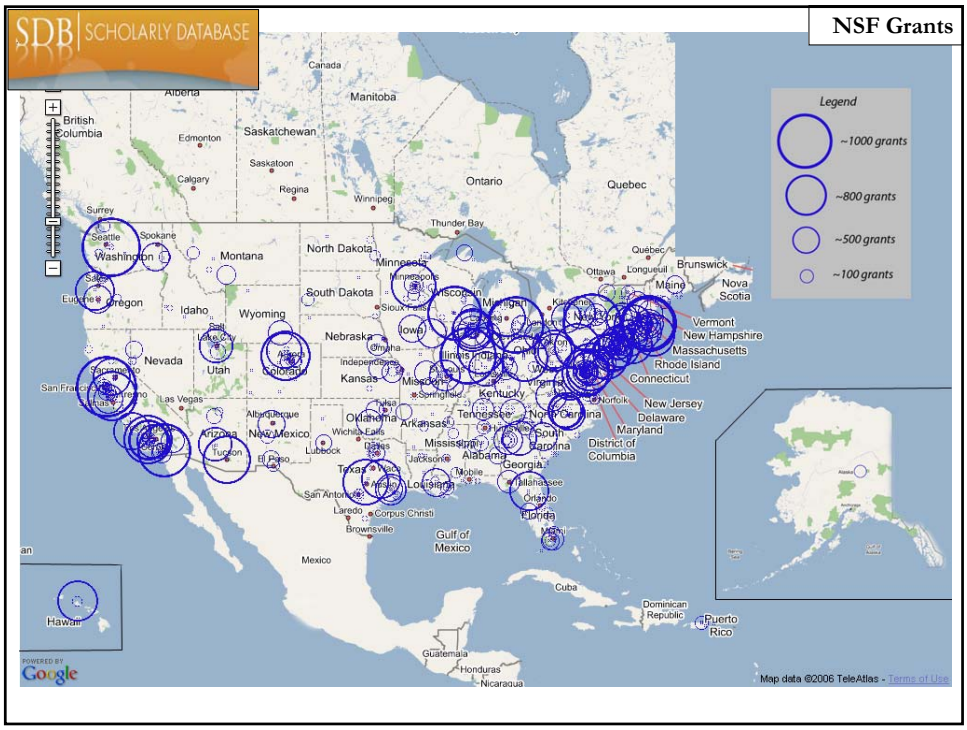
SDB | SCHOLARLY DATABASE
NSF Grants
Legend
~1000 grants
~800 grants
~500 grants
~100 grants
Canada
Manitoba
Saskatchewan
Ontario
Quebec
British Columbia
Edmonton
Saskatoon
Calgary
Regina
Winnipeg
Thunder Bay
Montana
North Dakota
Minnesota
South Dakota
Wisconsin
Michigan
Wyoming
Idaho
Oregon
Nebraska
Nevada
Utah
Colorado
Kansas
Missouri
Arizona
New Mexico
Oklahoma
Arkansas
Tennessee
Mississippi
Alabama
Georgia
Louisiana
Florida
Texas
Kentucky
Virginia
North Carolina
South Carolina
Maryland
Delaware
New Jersey
Connecticut
Rhode Island
Massachusetts
Vermont
New Hampshire
Maine
Brunswick
Nova Scotia
Hawaii
Gulf of Mexico
Mexico
Cuba
Dominican Republic
Puerto Rico
Guatemala
Honduras
Nicaragua
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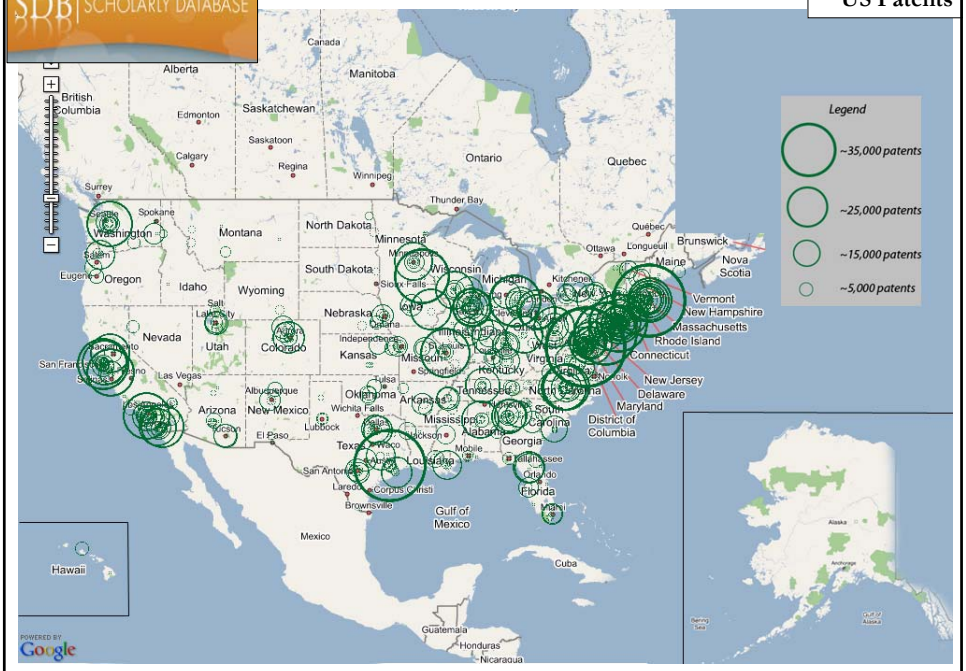
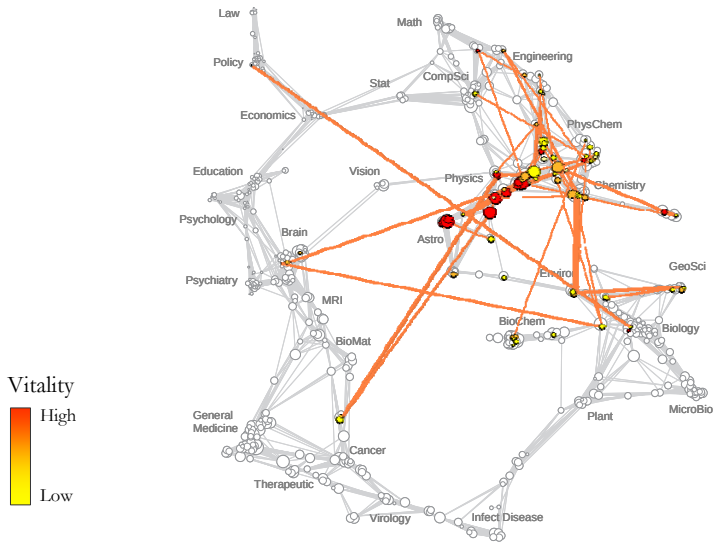
US Patents

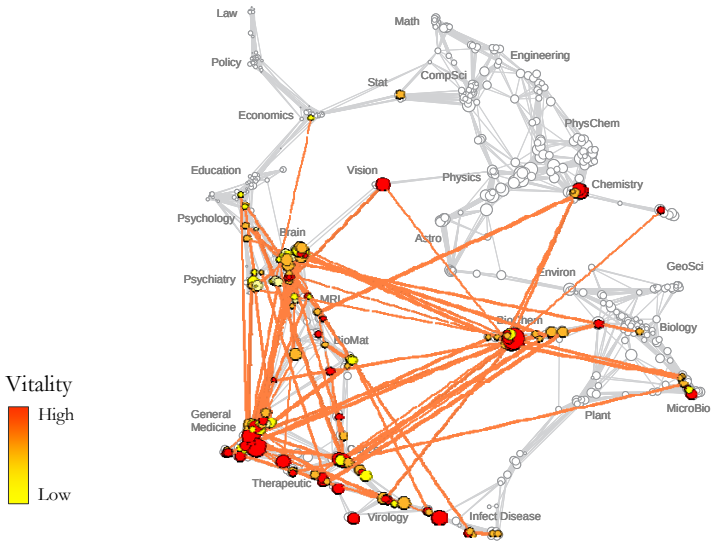


Funding overlay – DOE laboratories

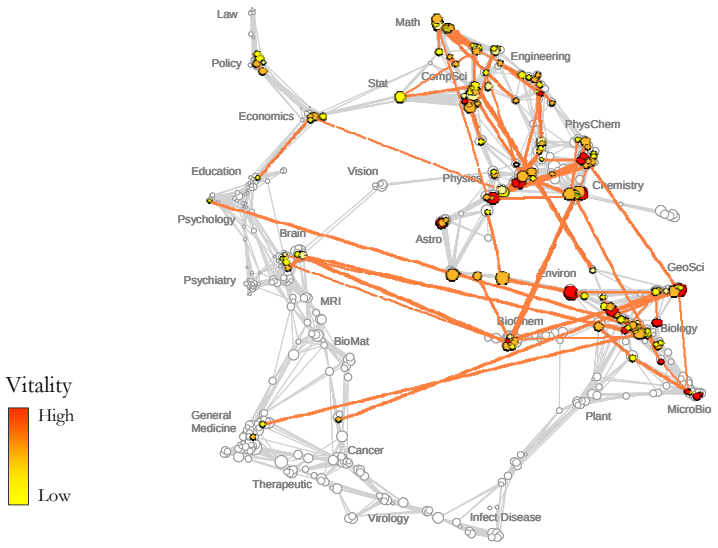


Katy Börner, Science Maps: How to Analyze, Map, and Make Sense of Science 22

Funding overlay – NIH funded research (extramural)

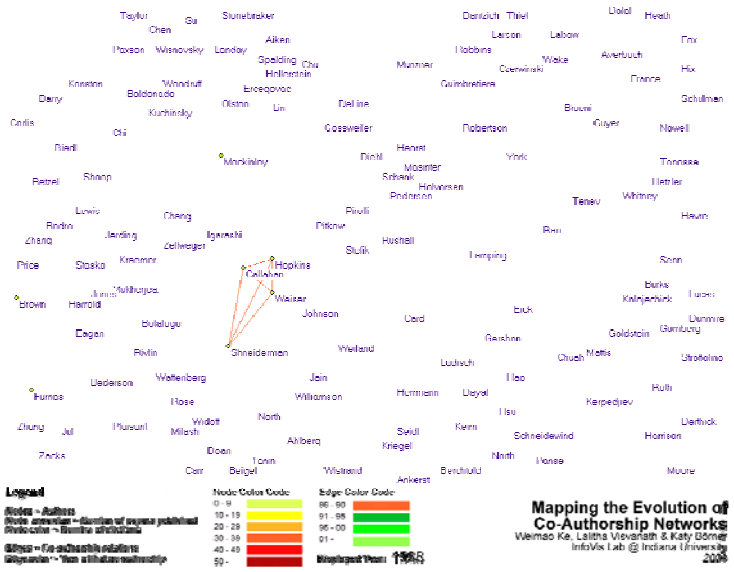


Funding overlay – NSF funded research



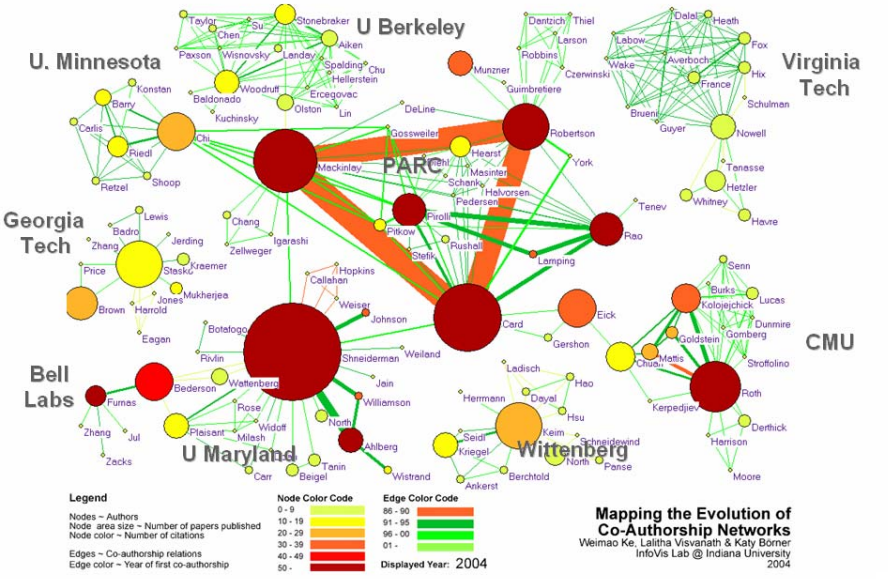
Mapping the Evolution of Co-Authorship Networks

Ke, Visvanath & Börner, (2004) Won 1st price at the IEEE InfoVis Contest.



Mapping the Evolution of Co-Authorship Networks

Ke, Visvanath & Börner, (2004) Won 1st price at the IEEE InfoVis Contest.



26

OSGi/CIShell based Plug-and-Play CIs

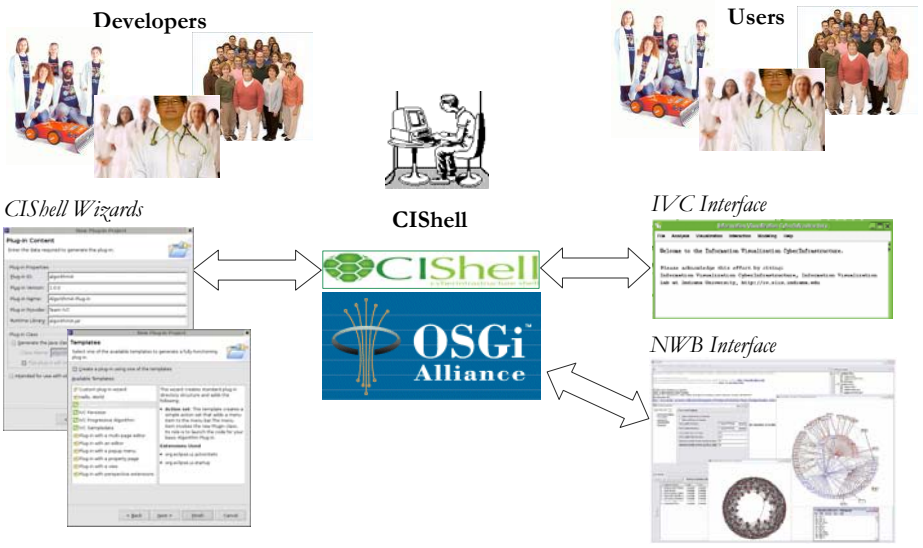
See also

Herr, Bruce W., Huang, Weixia, Penumarthy, Shashikant, Börner, Katy . (2007) Designing Highly Flexible and Usable Cyberinfrastructures for Convergence. In William S. Bainbridge and Mihail C. Roco (Eds.) Progress in Convergence – Technologies for Human Wellbeing. Annals of the New York Academy of Sciences, Boston, MA, volume 1093, pp. 161-179.

Building Market Places not Cathedrals

- 'Software glue' has to interlink datasets and algorithms written in different languages using different data formats.
- The smaller the glue or 'CI Shell', the more likely it can be maintained.

CIShell – Serving Non-CS Algorithm Developers & Users



CIShell – Build 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 7 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.

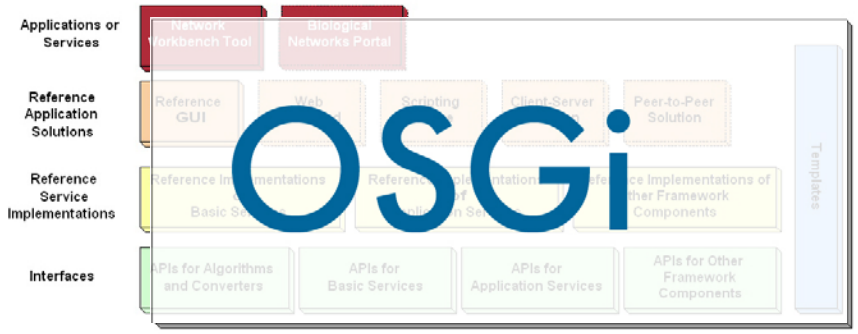
Advantages of Using OSGi

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

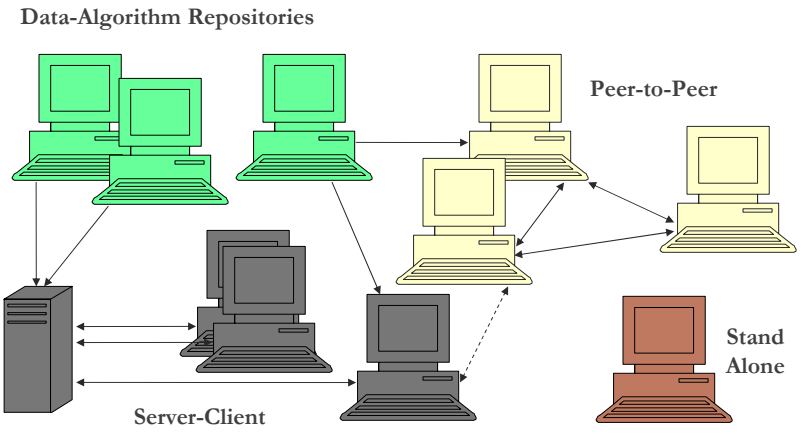
Ideally, CIShell becomes a standard for creating OSGi Services for algorithms.

CIShell – Technical Details

CIShell layer cake.

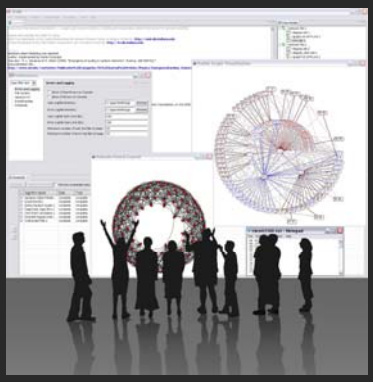


CIShell – Deployment



CIShell applications can be deployed as distributed data and algorithm repositories, stand alone applications, peer-to-peer architectures, and server-client architectures.

The Network Workbench Tool



Network Workbench (NWB)

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

Software Team: Lead: Weixia (Bonnie) Huang

Developers: Bruce Herr, Ben Markines, Santo Fortunato, Cesar Hidalgo, Ramya Sabbineni, Vivek S. Thakre, & Russell Duhon

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

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

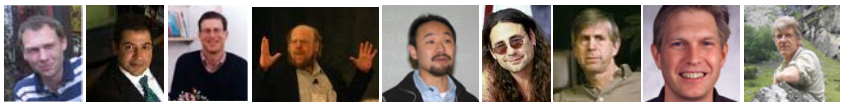
Duration: Sept. 2005 - Aug. 2008

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

Katy Börner, Science Maps: How to Analyze, Map, and Make Sense of Science 34

NWB Advisory Board

- Ulrik Brandes, University of Konstanz, Germany (Graph Theory)
- Noshier Contractor, Northwestern University (Communication Theory)
- Mark Gerstein, Yale University (Bioinformatics)
- James Hendler, Rensselaer Polytechnic Institute (Semantic Web)
- Jason Leigh, Electronic Visualization Laboratory, University of Illinois at Chicago (Visualization & CI)
- Neo Martinez, Pacific Ecoinformatics and Computational Ecology Lab (Biology)
- Michael Macy, Cornell University (Sociology)
- Stephen North, AT&T (Graph Visualization)
- Tom Snijders, University of Groningen (Social Network Analysis)



NWB CI Deliverables

Cyberglue:

- CIShell — Core programmer team lead by Bonnie Huang

Tools & Services:

- NWB Tool — Lead by Alex Vespignani with input from other PIs
- SciMaps Service — Lead by Katy Borner
- Bio Tool — Lead by Laszlo Barabasi & Santiago Schnell

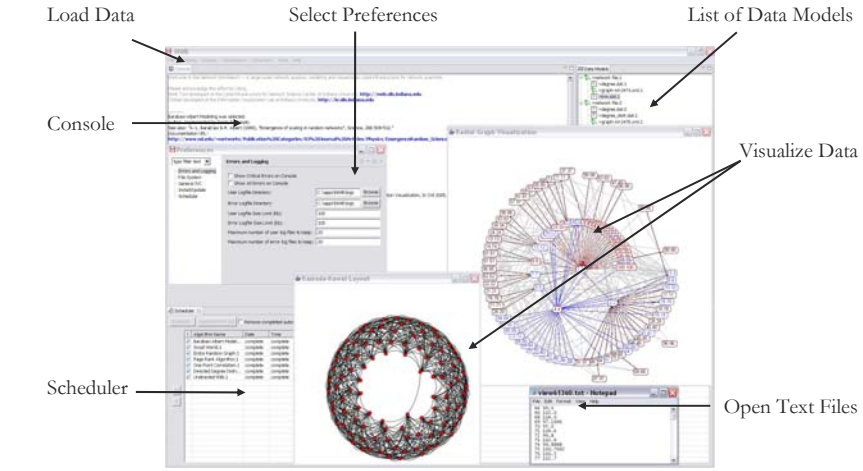
All three are prototypical instantiations of CIShell serving as reference implementations.

Documentation/Registry/Market Place:

- NWB Community Wiki — Lead by Katy Borner

NWB Tool: Interface Elements

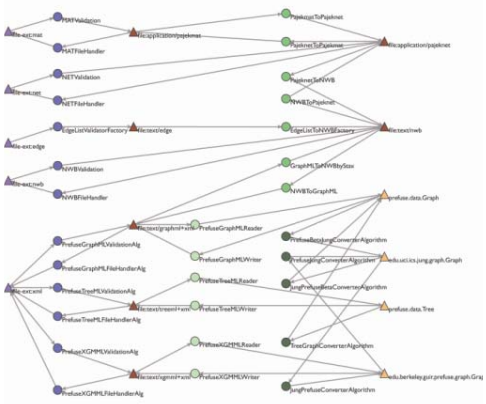
http://nwb.slis.indiana.edu



NWB Ecology of Data Formats and Converters

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

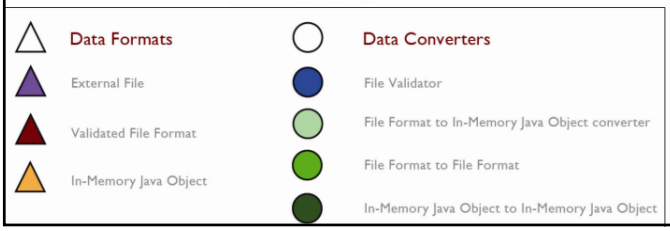
5
Supported data formats



5
Output formats for diverse visualization algorithms

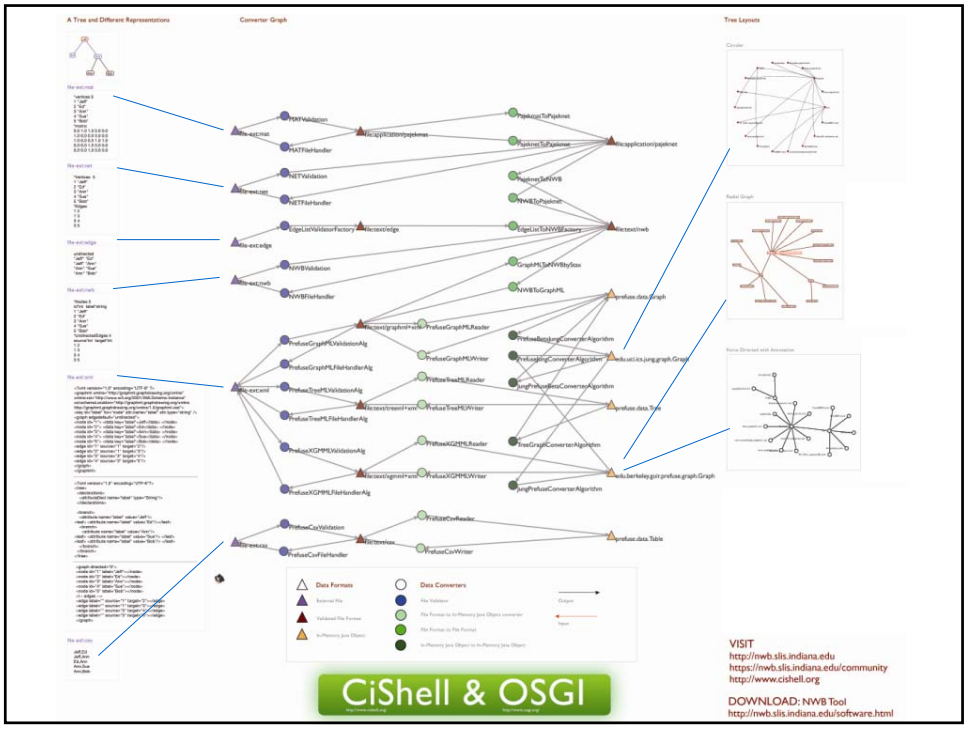
8
Intermediate data formats

Supported by
35
data converters.

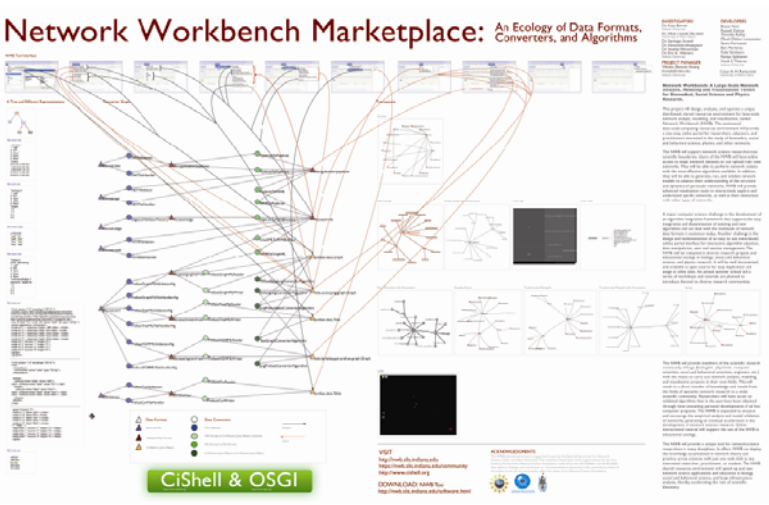


VISIT
http://nwb.slis.indiana.edu
https://nwb.slis.indiana.edu/community
http://www.cishell.org

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

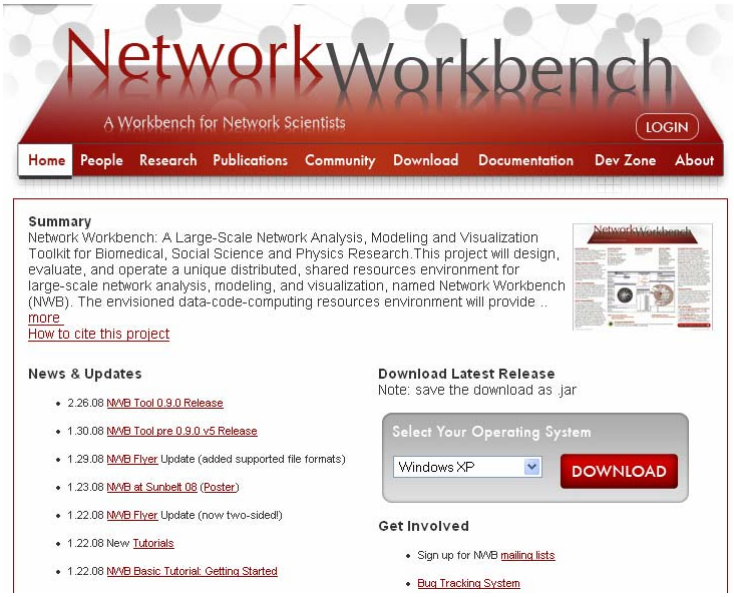


NWB
Community Wiki

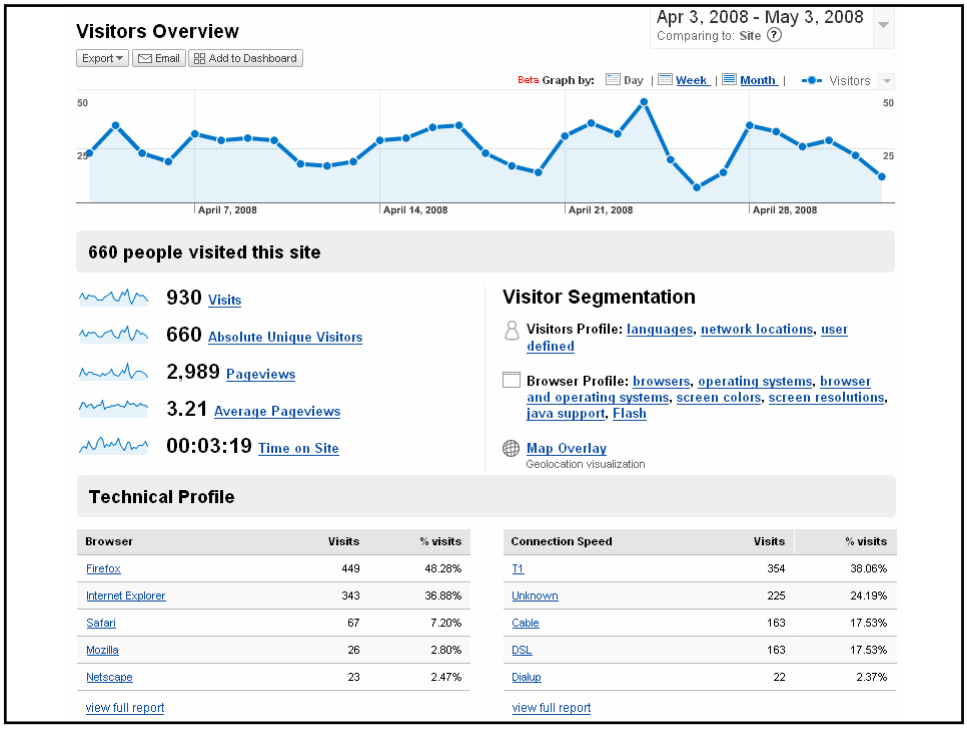


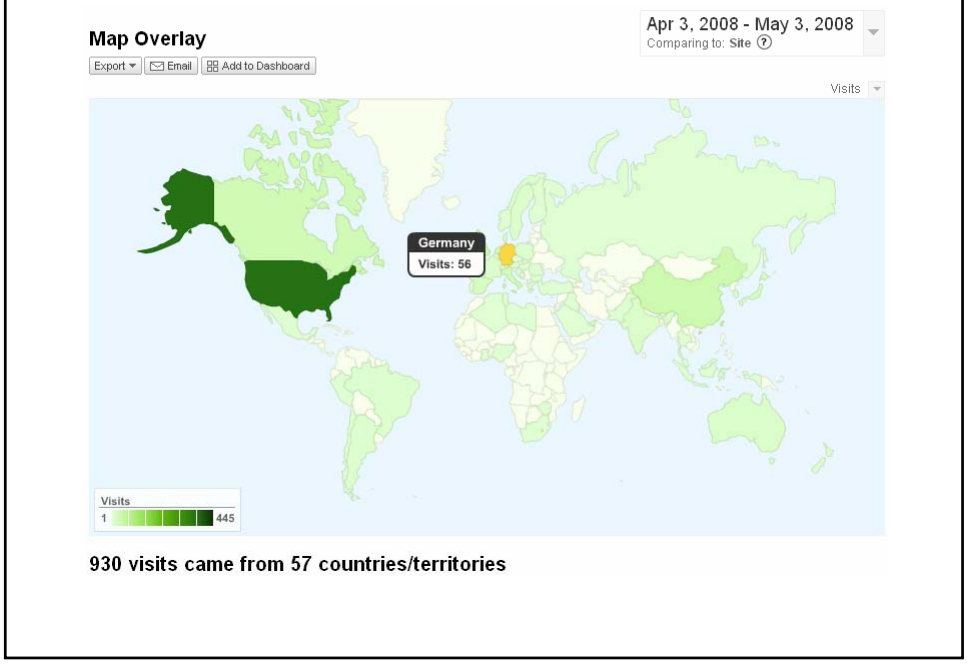
https://nwb.slis.indiana.edu/community/

Education – Learning Modules, NWB User and Developer Workshops



Download from http://nwb.slis.indiana.edu/


Visitors Overview
Apr 3, 2008 - May 3, 2008
Comparing to: Site
Export
Email
Add to Dashboard
Beta Graph by: Day | Week | Month | Visitors
50
25
April 7, 2008
April 14, 2008
April 21, 2008
April 28, 2008
660 people visited this site
930 Visits
660 Absolute Unique Visitors
2,989 Pageviews
3.21 Average Pageviews
00:03:19 Time on Site
Visitor Segmentation
Visitors Profile: languages, network locations, user defined
Browser Profile: browsers, operating systems, browser and operating systems, screen colors, screen resolutions, java support, Flash
Map Overlay
Geolocation visualization
Technical Profile
Browser | Visits | % visits
Firefox | 449 | 48.28%
Internet Explorer | 343 | 36.88%
Safari | 67 | 7.20%
Mozilla | 26 | 2.80%
Netscape | 23 | 2.47%
view full report
Connection Speed | Visits | % visits
T1 | 354 | 38.06%
Unknown | 225 | 24.19%
Cable | 163 | 17.53%
DSL | 163 | 17.53%
Dialup | 22 | 2.37%
view full report


Map Overlay
Apr 3, 2008 - May 3, 2008
Comparing to: Site
Export
Email
Add to Dashboard
Visits
Germany
Visits: 56
Visits
1
445
930 visits came from 57 countries/territories

Growing a Community of Network Science Researchers

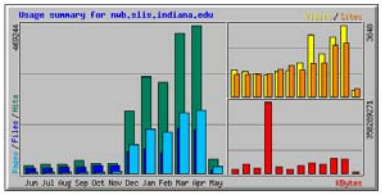
Users come from Social Science, Physics, Biology, Information Science, Telecommunications, Internet Research, Economics, Science Policy, etc.

It takes **9 months** to give birth to a human baby and **21 years** to raise it.
It takes **3-5 years** to build a CI and **???** years to build a vibrant, self-sustaining community.

Quickly identify and serve continuously changing needs of evolving community.

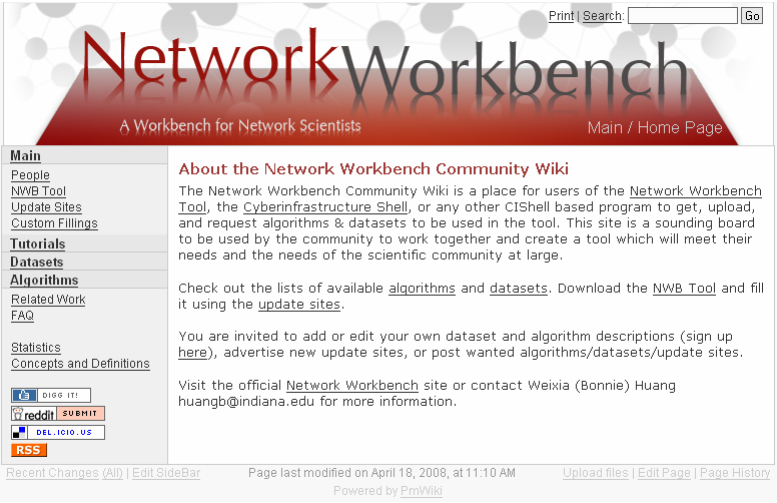
Usage Statistics for nwb.slis.indiana.edu

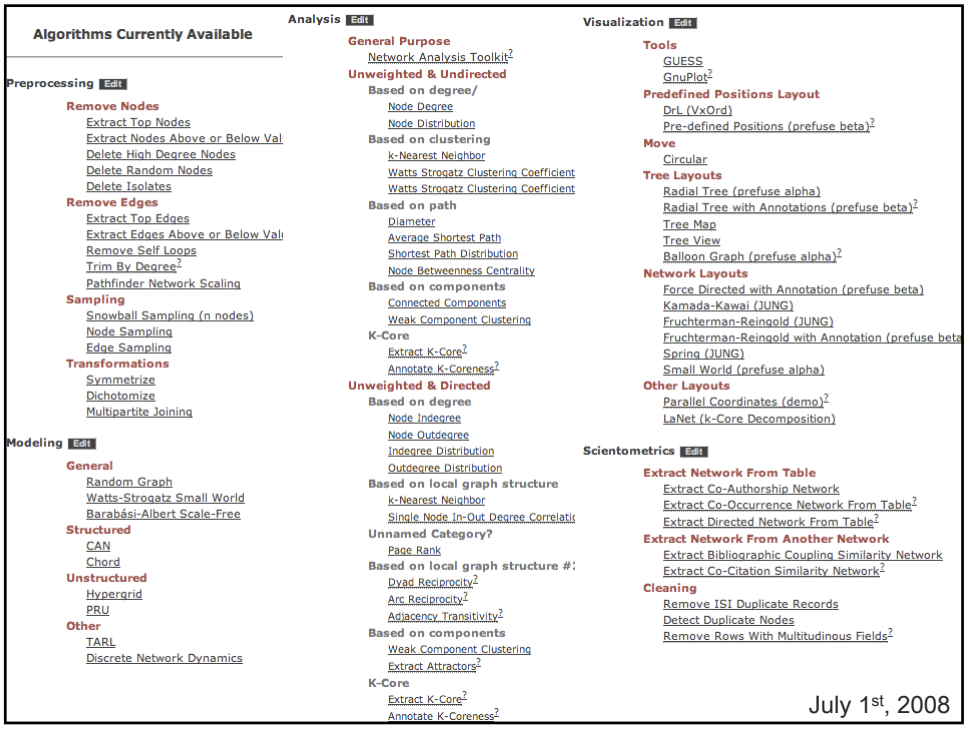
Summary Period: Last 12 Months
Generated 04-May-2008 05:05 EDT



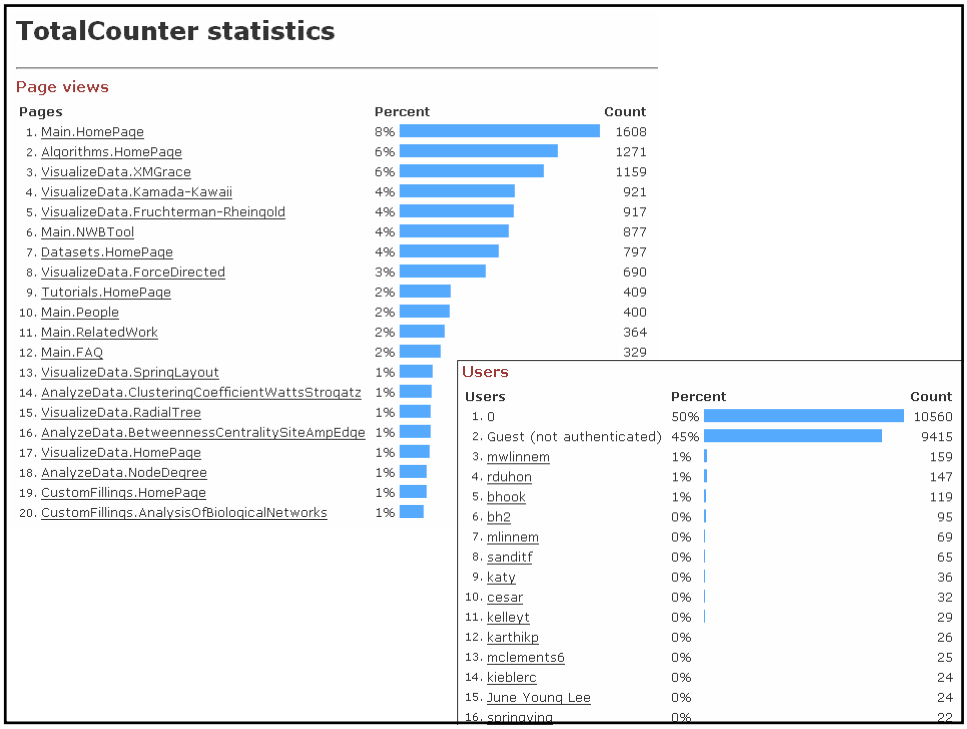
Top 30 of 33830 Total NWB Tool URLs Tracked – Last 30 days

	5	599	0.13%	20532984	28.71%	/nightly/0.9.0.200802261543NGT/installers/nwb-installer-0.9.0-win32.win32.jar
	6	518	0.11%	1656		/svn/nwb/tags/pre-v1.0.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.beta/src/edu/iu/nwb/visualization/prefuse/beta/
	7	398	0.08%	124934	0.17%	/Docs/NWB_Getting_Started.pdf
	8	377	0.08%	847		/svn/nwb/tags/v0.6.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.beta/src/edu/iu/nwb/visualization/prefuse/beta/comm
	9	341	0.07%	1467		/svn/nwb/tags/v0.6.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	10	337	0.07%	1629		/svn/nwb/tags/pre-v1.0.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/p
	11	336	0.07%	590		/svn/nwb/tags/v0.4.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.beta/src/edu/iu/nwb/visualization/prefuse/beta/comm
	12	332	0.07%	1416	0.00%	/doc.html
	13	327	0.07%	1763	0.00%	/download.html
	14	315	0.07%	1468		/svn/nwb/tags/v0.7.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	15	306	0.07%	1222		/svn/nwb/tags/v0.5.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	16	300	0.06%	1225		/svn/nwb/tags/v0.9.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	17	299	0.06%	1389		/svn/nwb/tags/v0.4.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	18	296	0.06%	159823	0.22%	/papers/arist02.pdf
	19	293	0.06%	1341		/svn/nwb/tags/v0.3.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	20	286	0.06%	934813	1.31%	/downloads/nwbflyer.pdf
	21	285	0.06%	1171		/svn/nwb/tags/v0.8.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefu
	22	284	0.06%	1057		/svn/nwb/trunk/plugins/visualization/edu.iu.nwb.visualization.prefuse.alpha.smallworld/src/edu/iu/nwb/visualization/prefuse/alp
	23	274	0.06%	614		/svn/nwb/tags/v0.9.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.beta/src/edu/iu/nwb/visualization/prefuse/beta/comm
	24	268	0.06%	181184	0.25%	/Docs/NWB_VisualizingTree.pdf
	25	253	0.05%	8592053	12.01%	/nightly/1.0.0.200804011946NGT/installers/nwb-installer-1.0.0-pre1-win32.win32.jar
	26	250	0.05%	58556	0.08%	/Docs/Thomson_Tutorial.pdf
	27	220	0.05%	89987	0.13%	/papers/2006-borner-arist.pdf
	28	217	0.05%	83388	0.12%	/papers/2007-colizza-epidmod.pdf
	29	209	0.04%	3602	0.01%	/people.html
	30	203	0.04%	509		/svn/nwb/tags/v0.8.0/plugins/visualization/edu.iu.nwb.visualization.prefuse.beta/src/edu/iu/nwb/visualization/prefuse/beta/comm





July 1st, 2008



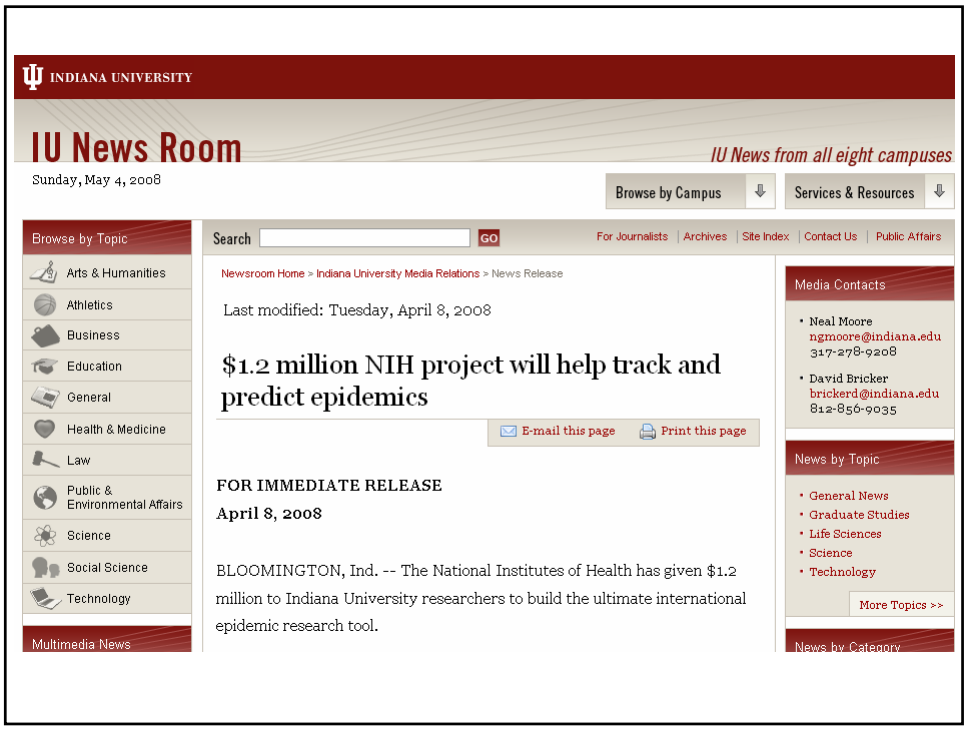
TotalCounter statistics

Page views

	Pages	Percent	Count
1.	Main.HomePage	8%	1608
2.	Algorithms.HomePage	6%	1271
3.	VisualizeData.XMGrace	6%	1159
4.	VisualizeData.Kamada-Kawaii	4%	921
5.	VisualizeData.Fruchterman-Rheingold	4%	917
6.	Main.NWBTool	4%	877
7.	Datasets.HomePage	4%	797
8.	VisualizeData.ForceDirected	3%	690
9.	Tutorials.HomePage	2%	409
10.	Main.People	2%	400
11.	Main.RelatedWork	2%	364
12.	Main.FAQ	2%	329
13.	VisualizeData.SpringLayout	1%	
14.	AnalyzeData.ClusteringCoefficientWattsStrogatz	1%	
15.	VisualizeData.RadialTree	1%	
16.	AnalyzeData.BetweennessCentralitySiteAmpEdge	1%	
17.	VisualizeData.HomePage	1%	
18.	AnalyzeData.NodeDegree	1%	
19.	CustomFillings.HomePage	1%	
20.	CustomFillings.AnalysisOfBiologicalNetworks	1%	

Users

	Users	Percent	Count
1.	0	50%	10560
2.	Guest (not authenticated)	45%	9415
3.	mwlinnem	1%	159
4.	rduhon	1%	147
5.	bhook	1%	119
6.	bh2	0%	95
7.	mlinnem	0%	69
8.	sanditf	0%	65
9.	katy	0%	36
10.	cesar	0%	32
11.	kelleyt	0%	29
12.	karthikp	0%	26
13.	mclements6	0%	25
14.	kieblerc	0%	24
15.	June Young Lee	0%	24
16.	springying	0%	22



INDIANA UNIVERSITY

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IU News from all eight campuses

Sunday, May 4, 2008

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- Health & Medicine
- Law
- Public & Environmental Affairs
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- Social Science
- Technology

Multimedia News

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Newsroom Home > Indiana University Media Relations > News Release

Last modified: Tuesday, April 8, 2008

$1.2 million NIH project will help track and predict epidemics

E-mail this page | Print this page

FOR IMMEDIATE RELEASE
April 8, 2008

BLOOMINGTON, Ind. -- The National Institutes of Health has given $1.2 million to Indiana University researchers to build the ultimate international epidemic research tool.

Media Contacts

- Neal Moore
  ngmoore@indiana.edu
  317-278-9208
- David Bricker
  brickerd@indiana.edu
  812-856-9035

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- Life Sciences
- Science
- Technology

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News by Category

Network Workbench in Action:
Embracing the Diversity of Network Science

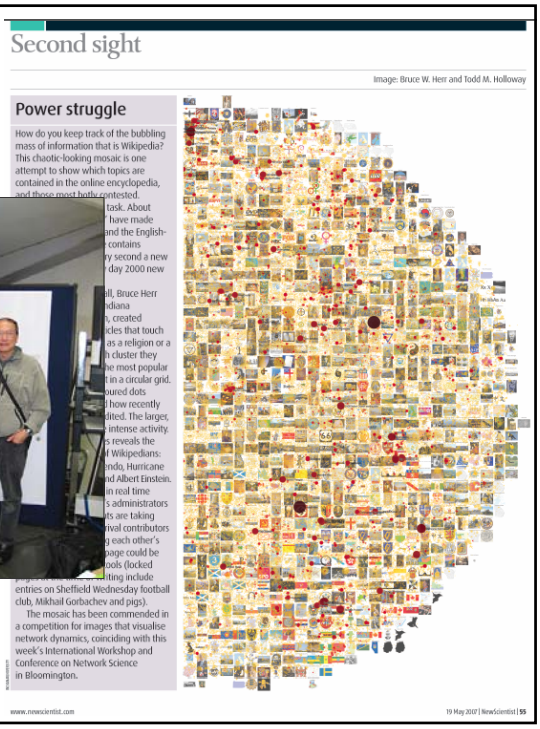
See also

Börner, Katy, Sanyal, Soma & Vespignani, Alessandro. (2007). Network Science. In Cronin, Blaise (Eds.), Annual Review of Information Science & Technology (Vol. 41, pp. 537-607), chapter 12, Medford, NJ: Information Today, Inc./American Society for Information Science and Technology.

Computational Social Science
Studying large scale social networks such as Wikipedia

Vizzards 2007 Entr

Second Sight: An En
Mosaic of Wikipedia
The NewScientist, M



Second sight

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 contained in the online encyclopedia, and those most hotly contested.

task. About
have made
and the English-
contains
ry second a new
day 2000 new

ll, Bruce Herr
diana
, created
icles that touch
as a religion or a
cluster they
e most popular
in a circular grid.
oured dots
how recently
dited. The larger,
intense activity.
s reveals the
Wikipedians:
ndo, Hurricane
d Albert Einstein.
in real time:
s administrators
ts are taking
ival contributors
each other's
page could be
ools (locked
ting 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 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).

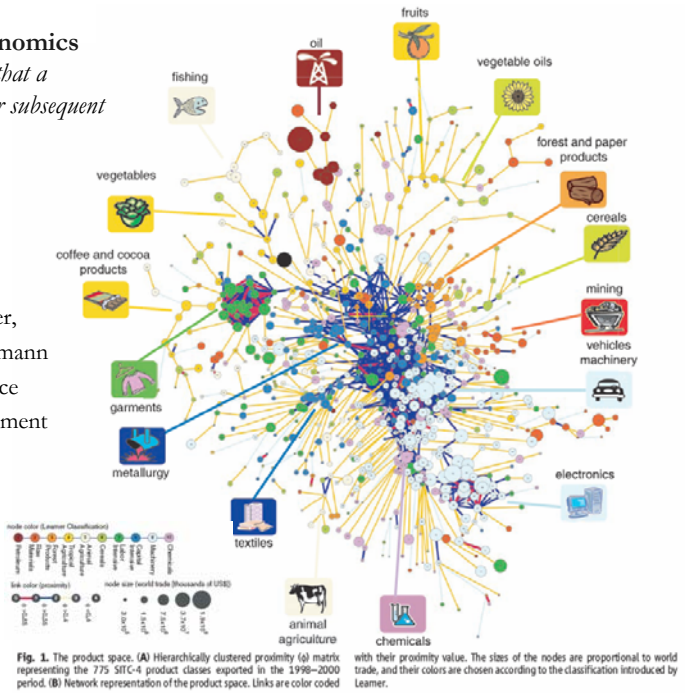
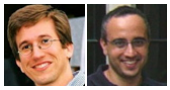
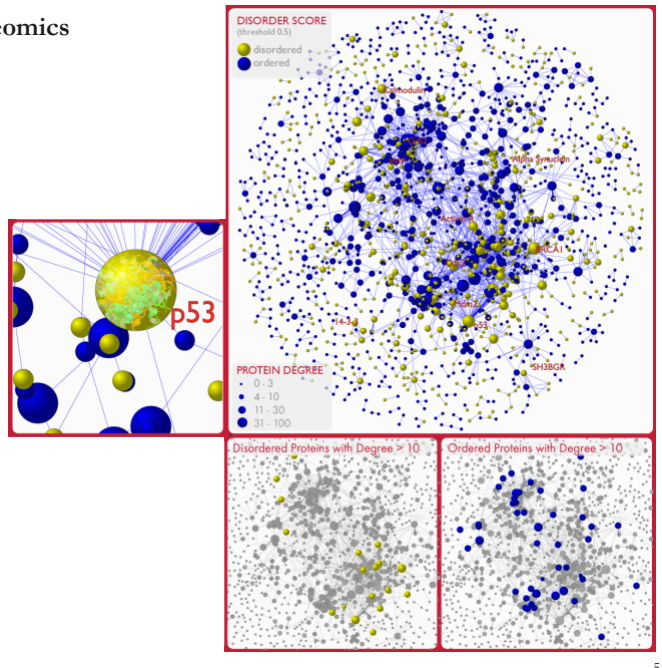


Fig. 1. The product space. **(A)** Hierarchically clustered proximity (φ) matrix representing the 775 SITC-4 product classes exported in the 1998–2000 period. **(B)** Network representation of the product space. Links are color coded with their proximity value. The sizes of the nodes are proportional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

Computational Proteomics

S. Schnell, S. Fortunato, and S. Roy (2007). Is the intrinsic disorder of proteins the cause of the scale-free architecture of protein-protein interaction networks? *Proteomics* 7, 961-964.





54

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).

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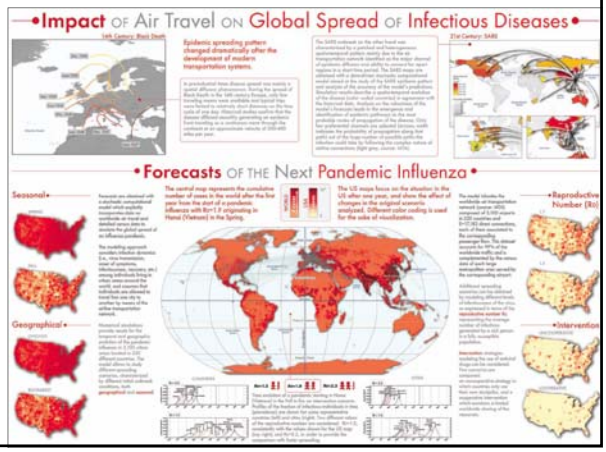

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