



VIVO

enabling national
networking of scientists

Visualization in VIVO:

A case study in how VIVO data and technology can be used

August 24, 2011, 8:30 am – 12:00 pm

Facilitators

- Katy Börner, Cyberinfrastructure for Network Science Center, Indiana University
- Chintan Tank, Cyberinfrastructure for Network Science Center, Indiana University
- Chin Hua Kong, Cyberinfrastructure for Network Science Center, Indiana University

VIVO Team: **Cornell University:** Dean Krafft (Cornell PI), Manolo Bevia, Jim Blake, Nick Cappadona, Brian Caruso, Jon Corson-Rikert, Elly Cramer, Medha Devare, John Ferreira, Brian Lowe, Stella Mitchell, Holly Mistlebauer, Anup Sawant, Christopher Westling, Rebecca Younes. **University of Florida:** Mike Conlon (VIVO and UF PI), Cecilia Botero, Kerry Britt, Erin Brooks, Amy Buhler, Ellie Bushhousen, Chris Case, Valrie Davis, Nita Ferree, Chris Haines, Rae Jesano, Margeaux Johnson, Sara Kreinest, Yang Li, Paula Markes, Sara Russell Gonzalez, Alexander Rockwell, Nancy Schaefer, Michele R. Tennant, George Hack, Chris Barnes, Narayan Raum, Brenda Stevens, Alicia Turner, Stephen Williams. **Indiana University:** Katy Borner (IU PI), William Barnett, Shanshan Chen, Ying Ding, Russell Duhon, Jon Dunn, Micah Linnemeier, Nianli Ma, Robert McDonald, Barbara Ann O'Leary, Mark Price, Yuyin Sun, Alan Walsh, Brian Wheeler, Angela Zoss. **Ponce School of Medicine:** Richard Noel (Ponce PI), Ricardo Espada, Damaris Torres. **The Scripps Research Institute:** Gerald Joyce (Scripps PI), Greg Dunlap, Catherine Dunn, Brant Kelley, Paula King, Angela Murrell, Barbara Noble, Cary Thomas, Michaelen Trimarchi. **Washington University, St. Louis:** Rakesh Nagarajan (WUSTL PI), Kristi L. Holmes, Sunita B. Koul, Leslie D. McIntosh. **Weill Cornell Medical College:** Curtis Cole (Weill PI), Paul Albert, Victor Brodsky, Adam Cheriff, Oscar Cruz, Dan Dickinson, Chris Huang, Itay Klaz, Peter Michelini, Grace Migliorisi, John Ruffing, Jason Specland, Tru Tran, Jesse Turner, Vinay Varughese.

Intended Audience

Some of the people who might be interested in this workshop are:

- Anyone interested in the visualization capabilities of VIVO, and the visualization work of the Cyberinfrastructure for Network Science Center.
- **Software developers** interested in an overview of the VIVO environment from a technical perspective, and a more in-depth exploration of VIVO through the lens of visualization development.
- **Librarians and Science Administrators** interested in gaining a deeper understanding of how VIVO works, exploring some of what it is already capable of, and understanding what it could be used for in the future.
- **Companies** that plan to offer value-added services for VIVO.
- **Researchers** that would like to utilize VIVO data in their scientific work.

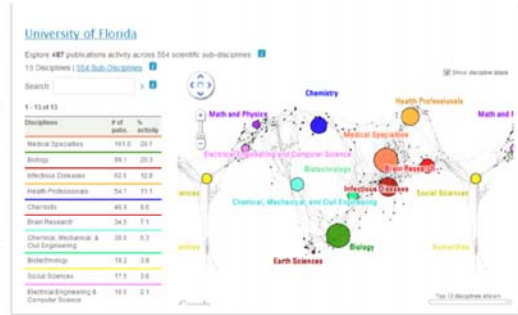
Content Overview

VIVO is an excellent system for creating and managing faculty and researcher profiles, but it is also capable of much more. VIVO's ability to obtain and interlink data from a variety of high quality sources, including institutional systems of record and online databases, coupled with VIVO's use of open semantic web technologies, makes VIVO an exciting and powerful data platform. This platform makes VIVO itself capable of many new features, and also makes it possible for outside companies and researchers to develop their own VIVO applications and perform their own analyses using VIVO data.

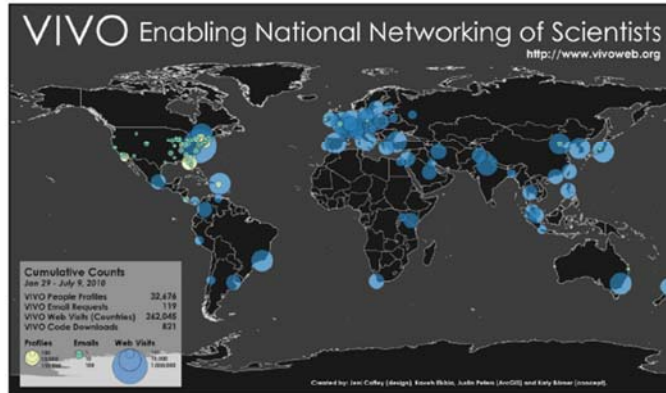
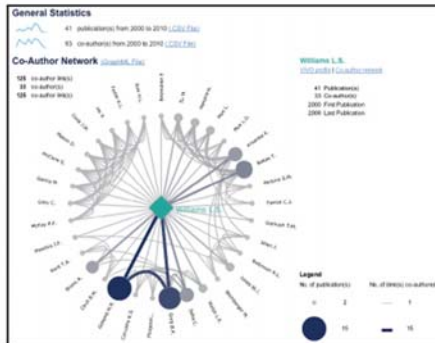
This hands-on workshop aims to explore the possibilities of VIVO technology and data by way of the Cyberinfrastructure for Network Science Center's VIVO visualization work. It starts with an overview of VIVO's architecture, and explores how the architecture makes it possible to expand and build on VIVO. We then describe the Cyberinfrastructure for Network Science Center's visualization work, including an overview of the visualizations created for VIVO thus far. Taking a closer look at the VIVO visualizations, we explore their individual motivations and features, and how we use VIVO to make these visualizations possible. We conclude with a hands-on component where participants are guided through the creation of a simple visualization using live data from VIVO instance. The workshop concludes with a general question-answer session.

Last but not least, we will showcase different data analyses and visualizations of VIVO data at the individual, institution, and national level such as:

- **Individual level.** Statistics and ego-centric scholarly networks on VIVO Profile pages.
- **Institutional level.** Analyses and visualizations of funding intake and publication output for departments and centers accessible via the VIVO Index page. Download of relevant data in tabular and network formats for further analysis using the Network Workbench tool.
- **National level.** Visualization of VIVO installations and their profile holdings together with web page access and general VIVO information requests. Plus, services that use VIVO URIs to access data across different VIVO instances.



The workshop concludes with a general question and answer session.



Workshop Attendees

Registered by Aug. 5, 2011



	A	B	C	D	E	F
1	First	Last Name	Participant Title	Participant Organization	Participant City	Participant Email
2	Carolyn	Eckhardt	Senior IT Analyst	Duke Health Technology Solutions (DHTS)	Durham	carolyn.eckhardt@duke.edu
3	Jeff	Erickson	IT Specialist	National Institute of Health	Bethesda	jeff.erickson@nih.gov
4	Holly	Falk-Krzesinski	Director, Research Team Support	Northwestern University	Chicago	h-falk@northwestern.edu
5	Tricia	Gallagher	Research Informatics Analyst, Lead	Emory University	Atlanta	tricia.gallagher@emory.edu
6	Jeffrey	Horon	SciVal Consultant	Elsevier, Inc.	New York	j.horon@elsevier.com
7	David	Jetter	Product Manager	InfoEd International	Albany	djetter@infoed.org
8	Layne	Johnson	Translational Science Information Scientist	University of Minnesota	Minneapolis	Layne@umn.edu
9	Craig	Knoblock	Research Professor	USC Computer Science Dept	Marina del Rey	knoblock@isi.edu
10	CARLOS	LIJERON	FACILITY MANAGER	GENE CENTER, HUNTER COLLEGE	NEW YORK	lijeron@genecenter.org
11	David	Lyons	IT Specialist	US EPA	Durham	lyons.david@epa.gov
12	John	Mark Ockerbloom	Digital library planner	University of Pennsylvania	Philadelphia	ockerblo@pobox.upenn.edu
13	Victoria	McGovern	Senior Program Officer	Burroughs Wellcome Fund	Research Triangle Park	vmcgovern@bwhfund.org
14	David	Palmer	Scholarly Communications Team Leader	The University of Hong Kong	Hong Kong	dtpalmer@hku.hk
15	Simon	Porter		University of Melbourne		simon.porter@unimelb.edu.au
16	Sean	Thomas	Program Manager, Scholarly Repository Services	Massachusetts Institute of Technology (MIT)	Cambridge	stthomas@mit.edu
17	Geert	Van Grootel	Senior researcher	Flemish government, Economy, Science & Innovation department	Brussels	geert.vangrootel@ewi.vlaanderen.be
18	Ann	Vega	Scientific Applications Manager	US EPA	Cincinnati	vega.ann@epa.gov
19	J. Michael	Warden	SciVal Consultant	Elsevier	Saline	m.warden@elsevier.com
20	Hal	Warren	Director, Publishing Innovation	American Psychological Association	washington	hal@apa.org

Workshop Schedule - Part I

Social Network Visualizations (Katy Borner)

- Visualization Types and Levels
- Exemplary User Needs
- Existing VIVO Visualizations

Analysis & Visualization of VIVO Data (Chin Hua Kong)

- Using Science of Science Tool (<http://sci2.cns.iu.edu>)
- Using Gephi (<http://gephi.org>)

10 min break

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Workshop Schedule - Part II

Visualization-in-depth (Chintan Tank & Chin Hua Kong)

- Map of Science
- Temporal Graph
- National Researcher Networking

VIVO Visualizations (Chintan Tank)

- Accessing VIVO data
- VIVO Architecture
- How we use VIVO data: The Visualization Pipeline

15 min break

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Workshop Schedule - Part III

Guided Tour (Chintan Tank)

- Create a new VIVO Visualization

Outlook (Katy Borner)

- Planned VIVO Visualizations
- National Level Visualizations

Q&A

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Social Network Visualizations

- Visualization Types and Levels
- Exemplary User Needs
- Proposed VIVO Visualizations

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Type of Analysis vs. Level of Analysis

	<i>Micro/Individual (1-100 records)</i>	<i>Meso/Local (101-10,000 records)</i>	<i>Macro/Global (10,000 < records)</i>
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of USA, all of science.
Temporal Analysis (When)	Funding portfolio of one individual	Mapping topic bursts in 20-years of PNAS	113 Years of physics Research
Geospatial Analysis (Where)	Career trajectory of one individual	Mapping a state's intellectual landscape	PNAS publications
Topical Analysis (What)	Base knowledge from which one grant draws.	Knowledge flows in Chemistry research	VxOrd/Topic maps of NIH funding
Network Analysis (With Whom?)	NSF Co-PI network of one individual	Co-author network	NSF's core competency

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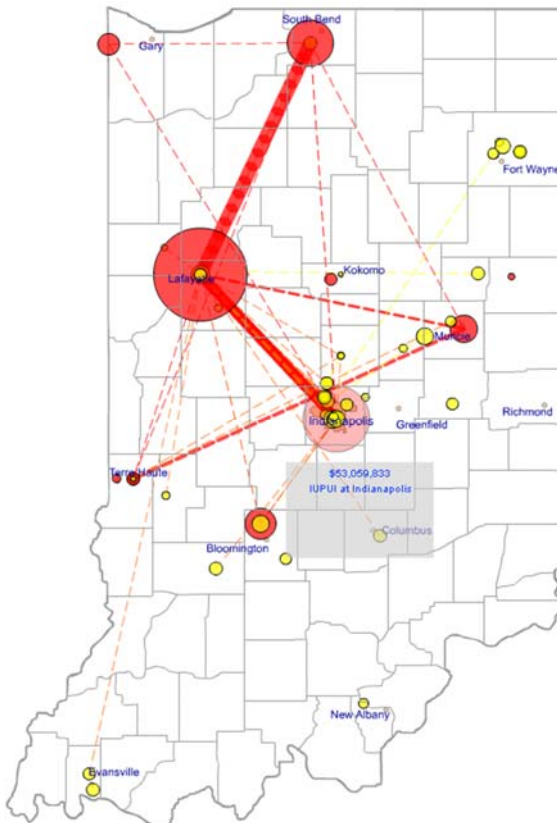
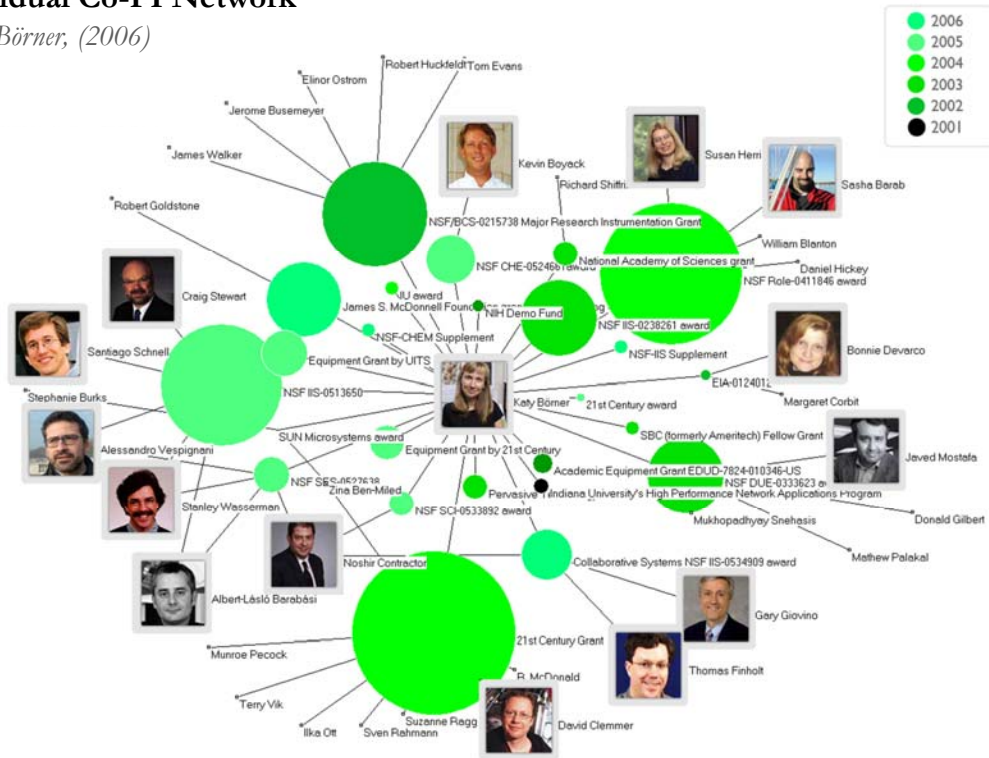
Type of Analysis vs. Scale of Level of Analysis

	<i>Micro/Individual (1-100 records)</i>	<i>Meso/Local (101-10,000 records)</i>	<i>Macro/Global (10,000 < records)</i>
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of USA, all of science.
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Individual Co-PI Network

Ke & Börner, (2006)



Mapping Indiana's Intellectual Space

Identify

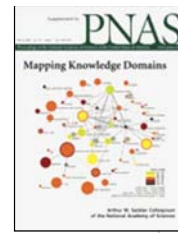
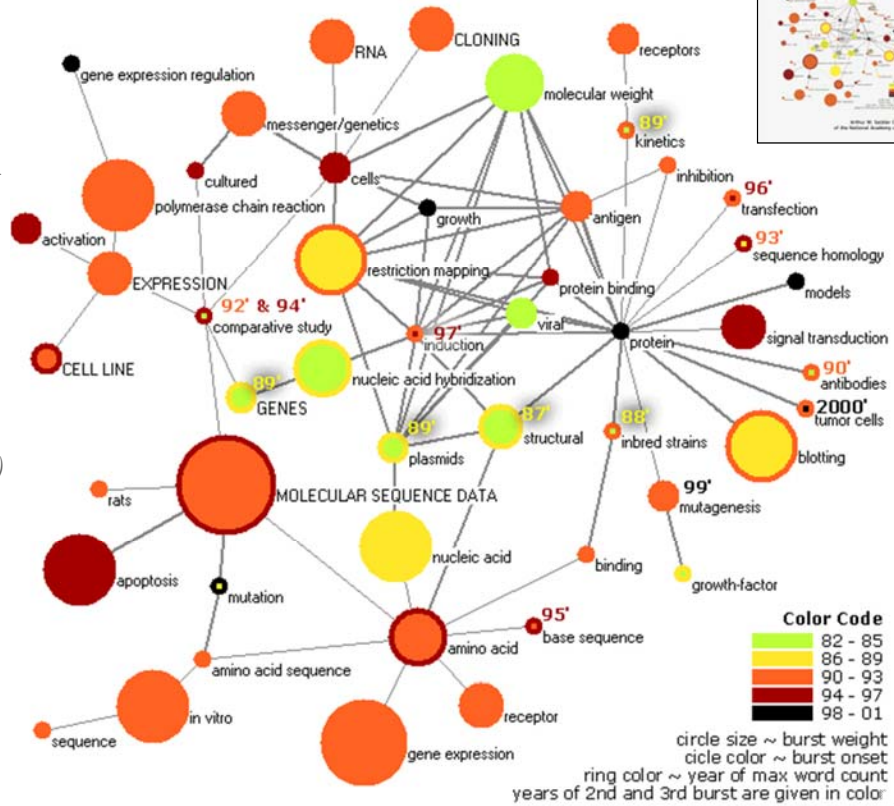
- Pockets of innovation
- Pathways from ideas to products
- Interplay of industry and academia



Mapping Topic Bursts

Co-word space of the top 50 highly frequent and bursty words used in the top 10% most highly cited PNAS publications in 1982-2001.

*Mane & Börner. (2004)
PNAS, 101(Suppl. 1):
5287-5290.*



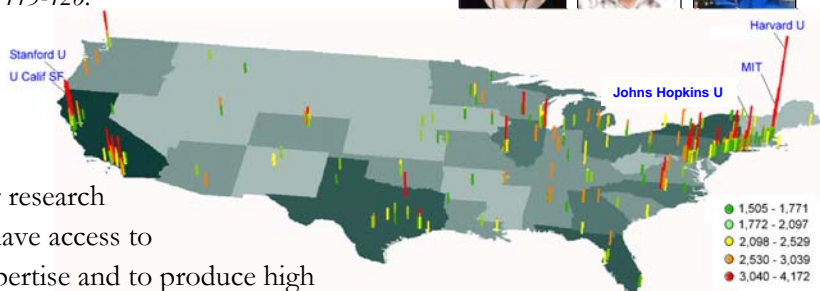
Spatio-Temporal Information Production and Consumption of Major U.S. Research Institutions

*Börner, Katy, Penumarthu, Shashikant, Meiss, Mark and Ke, Weimao. (2006)
Mapping the Diffusion of Scholarly Knowledge Among Major U.S. Research
Institutions. Scientometrics. 68(3), pp. 415-426.*



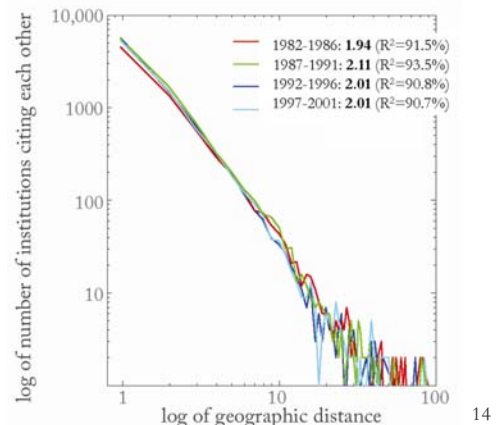
Research questions:

1. Does space still matter in the Internet age?
2. Does one still have to study and work at major research institutions in order to have access to high quality data and expertise and to produce high quality research?
3. Does the Internet lead to more global citation patterns, i.e., more citation links between papers produced at geographically distant research institutions?



Contributions:

- Answer to Qs 1 + 2 is YES.
- Answer to Qs 3 is NO.
- Novel approach to analyzing the dual role of institutions as information producers and consumers and to study and visualize the diffusion of information among them.



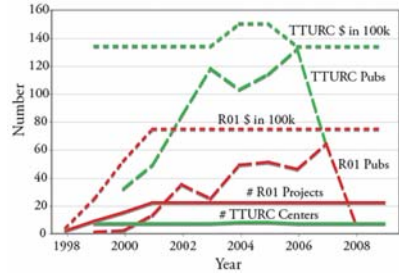
Mapping Transdisciplinary Tobacco Use Research Centers Publications

Compare R01 investigator based funding with TTURC Center awards in terms of number of publications and evolving co-author networks.

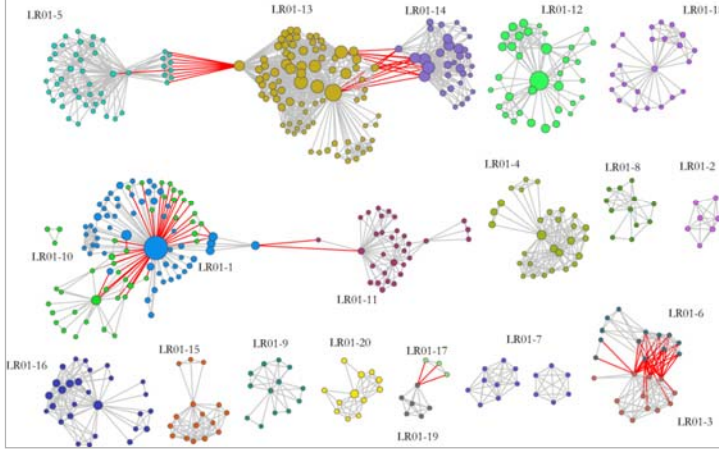
Zoss & Börner, *forthcoming*.

Supported by NIH/NCI Contract HHSN261200800812

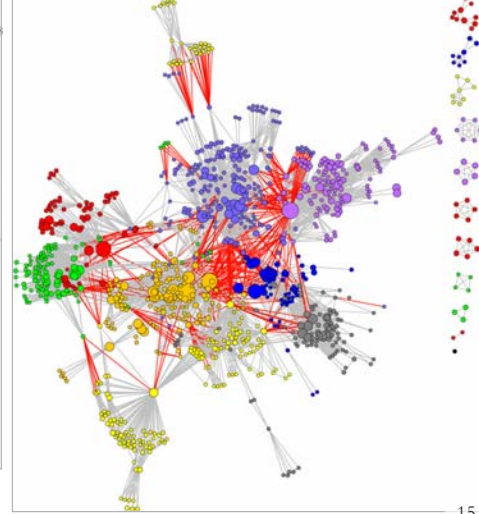
R01 & TTURC Project Information



Longitudinal R01 Co-Authorship Network



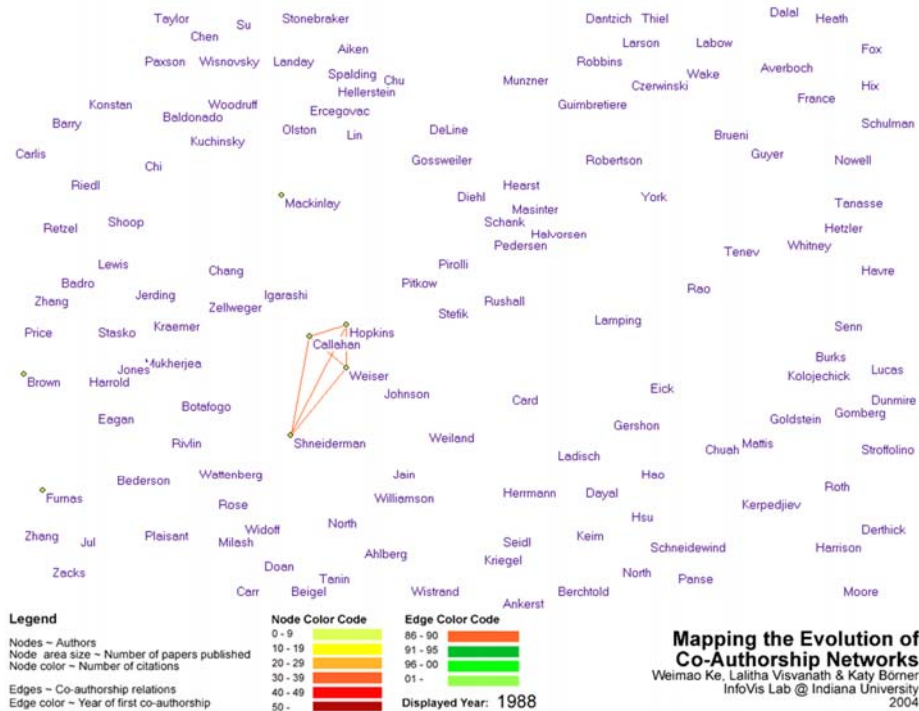
TTURC Co-Authorship Network



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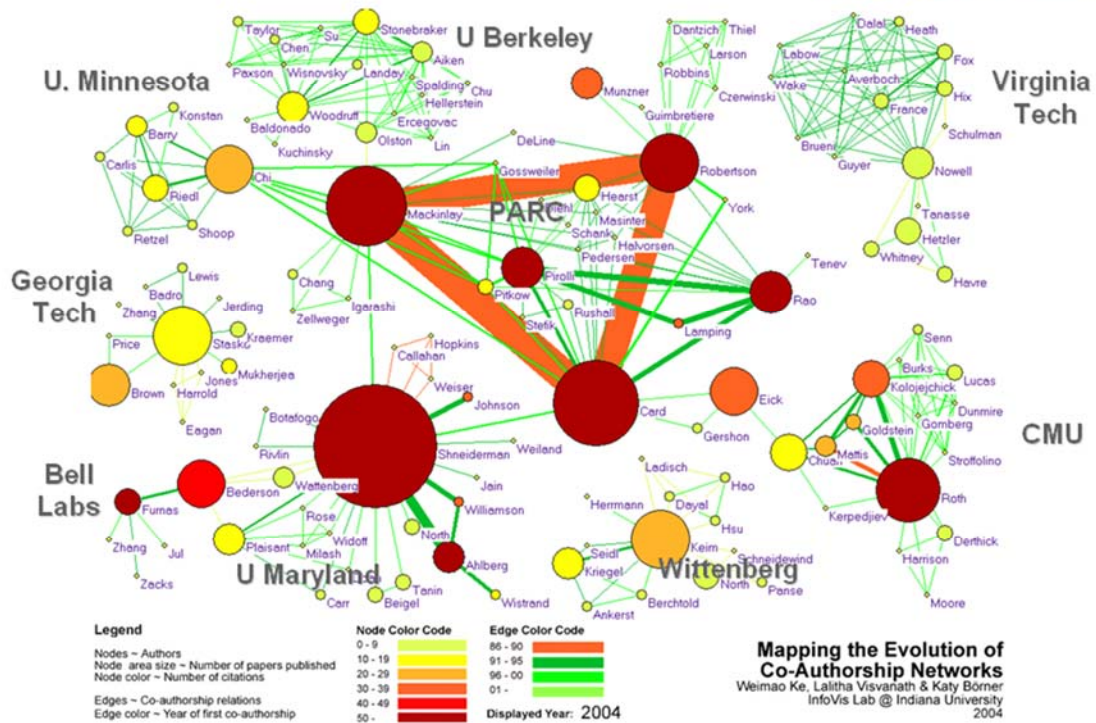
Mapping the Evolution of Co-Authorship Networks

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



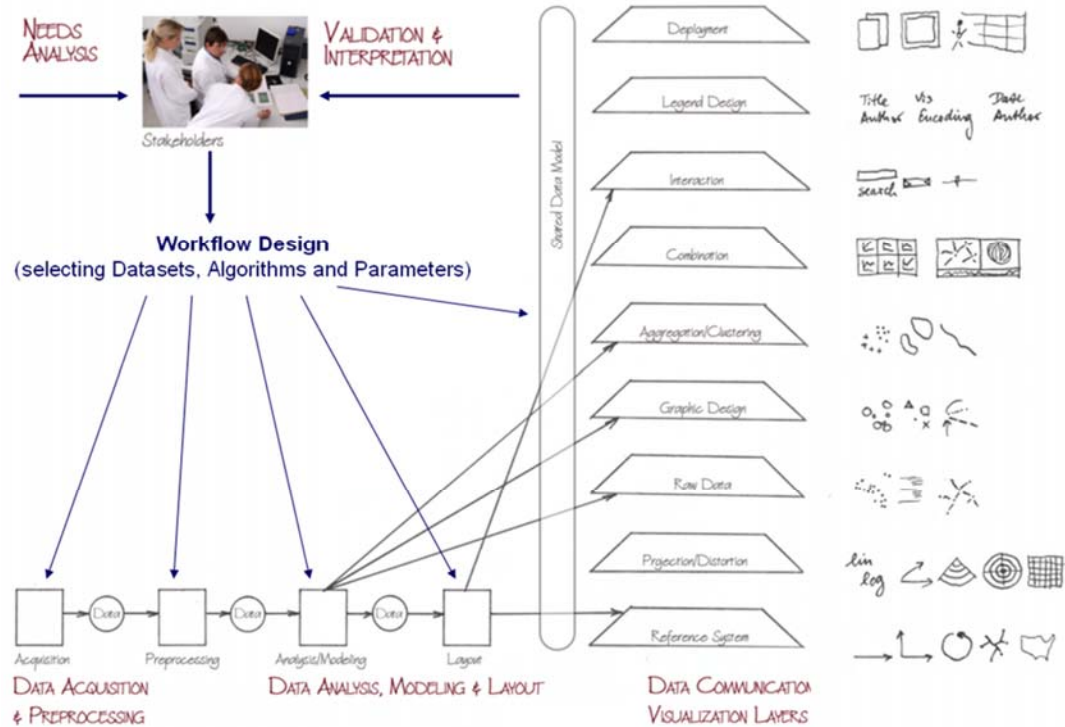
Mapping the Evolution of Co-Authorship Networks

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



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Needs-Driven Workflow Design using a modular data acquisition/analysis/modeling/ visualization pipeline as well as modular visualization layers.



Social Network Visualizations

- Visualization Types and Levels
- Exemplary User Needs
- Proposed VIVO Visualizations

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Exemplary User Needs

- **Individual level.** Researchers would like to enter data once and then use it to print cv's, annual summary reports, find team members & mentors, render web pages to "become effortlessly visible" in support of collaboration and research.
- **Institutional level.** Campus level officials need to pool (expertise) resources for major grant applications, understand research strengths and trends of different units as part of competitive landscape analysis, advertise their institution to recruit and retain students and faculty.
- **National level.** Funding agencies and others need to understand who is working on what topic(s), what research areas/expertise centers are emerging, or who is funding/supporting a certain topic/expert team.

Exemplary User Needs - Researchers

- **Authors**—need to select promising research topics, students, collaborators, and publication venues to increase their reputation. They benefit from a global view of competencies, reputation and connectivity of scholars; hot and cold research topics and bursts of activity, and funding available per research area.
- **Editors**—have to determine editorial board members, assign papers to reviewers, and ultimately accept or reject papers. Editors need to know the position of their journals in the evolving world of science. They need to advertise their journals appropriately and attract high-quality submissions to increase the journal's reputation leading to higher quality submissions.
- **Reviewers**—read, critique, and suggest changes to help improve the quality of papers and funding proposals. They need to identify related works that should be cited or complementary skills that authors might consider when selecting project collaborators.
- **Teachers**—teach classes, train doctoral students, and supervise postdoctoral researchers. They need to identify key works, experts, and examples relevant to a topic area and teach them in the context of global science.
- **Inventors**—create intellectual property and obtain patents, thus needing to navigate and make sense of research spaces as well as intellectual property spaces.
- **Investigators**—scholars acquire funding to support students, hire staff, purchase equipment, or attend conferences. Research interests and proposals have to be matched with existing federal and commercial funding opportunities, possible industry collaborators/sponsors.
- **Team Leads and Science Administrators**—need to evaluate performance and provide references for current or previous members; report the progress of different projects to funding agencies.

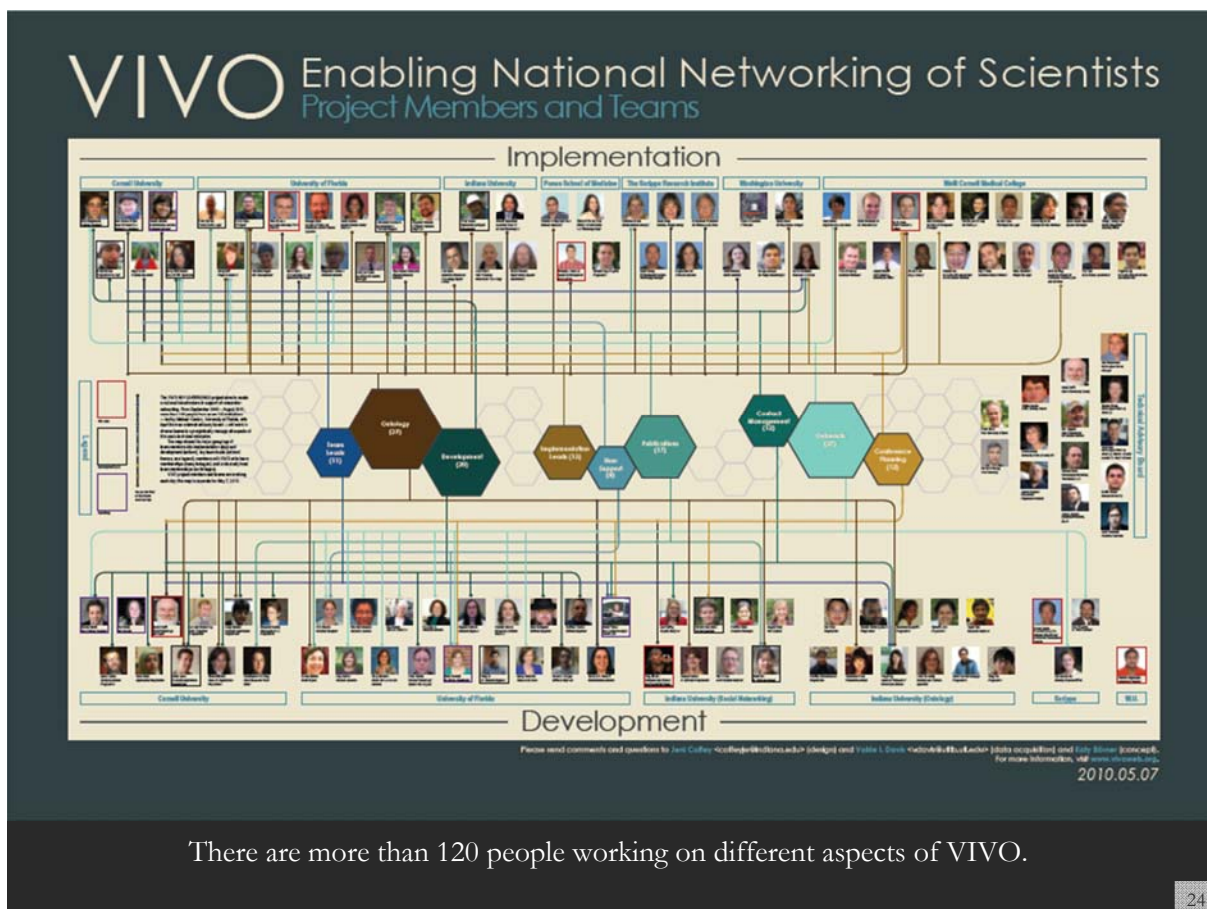
Social Network Visualizations

- Visualization Types and Levels
- Exemplary User Needs
- Proposed VIVO Visualizations

Existing VIVO Visualizations

- **Graphic Design Visualizations** that show VIVO team.
- **Individual level.** Sparkline statistics; ego-centric scholarly co-author and co-PI networks on VIVO Profile page, Temporal Comparison page.
- **Institutional level.** Analyses and visualizations of funding intake and publication output for departments and centers accessible via the Temporal Comparison page and Map of Science page. Download of relevant data in tabular and network formats for further analysis using MS Excel, the Science of Science Tool or Gephi.
- **International level.** Visualization of VIVO installations and their profile holdings together with web page access and general VIVO information requests.

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There are more than 120 people working on different aspects of VIVO.

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VIVO Enabling National Networking of Scientists

Project Members and Teams



Type of Analysis vs. Level of Analysis



	<i>Micro/Individual (1-100 records)</i>	<i>Meso/Local (101-10,000 records)</i>	<i>Macro/Global (10,000 < records)</i>
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<i>Temporal Analysis (When)</i>	Funding portfolio of one individual	Mapping topic bursts in 20-years of PNAS	113 Years of physics Research
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<i>Network Analysis (With Whom?)</i>	NSF Co-PI network of one individual	Co-author network	NSF's core competency

VIVO Enabling a National Network of Scientists

Home People Organizations Research Events

Davis, Vairie I | AST UNV LIBRA

Positions

- Michigan Science Library Outreach Librarian for Agricultural Sciences** (2007 - 2007)
- Michigan Science Library Staff Maintenance Supervisor** (2007 - 2007)
- AST UNV LIBRARIAN**

13 publications within the last 10 years (11 leads)

17 identifiers

152772289

Primary Web Page

Michigan Science Library profile

Affiliations

Publications **Research** **Background** **Contact** **Other**

Affiliation

professional title
Outreach Librarian for Agricultural Sciences

VIVO Enabling a National Network of Scientists

Home People Organizations Research Events

University of Florida

How do you want to compare?
by Publications

Who do you want to compare?
Search: [] X

Records 1 - 10 of 13

Entity Name	Publications	Entity Type
<input checked="" type="checkbox"/> Interdisciplinary Center for Bioremediation	18	UF Center, Agent, Center
<input checked="" type="checkbox"/> Continuing Education	24	UF Department, Agent, Non-Academic Department, Department
<input checked="" type="checkbox"/> Levin College of Law	17	Agent, UF College, College
<input checked="" type="checkbox"/> College of Agricultural and Life Sciences	14	Agent, UF College, College
<input type="checkbox"/> Whittier College of Agriculture and Horticulture	14	Agent, UF College, College
<input type="checkbox"/> Evelyn F. and William L. McKnight Brain Institute of the University of Florida	8	UF Center, Agent, Center

Comparing Publications of Organizations in University of Florida

Total Number of Publications

You have selected 4 of a maximum 10 organizations to compare. **Clear**

- College of Agricultural and Life Sciences: 14
- Levin College of Law: 17
- Continuing Education: 24
- Interdisciplinary Center for Bioremediation: 18

VIVO Enabling a National Network of Scientists

Home People Organizations Research Events

Search results for 'geriatrics'

Show only results of this type: **people activities organizations research**

AMERICAN GERIATRICS SOCIETY

- Geriatrics Education Curriculum, Residents (Geri) Program
- Evidence Based Decision Making in Geriatric Geriatrics Disability

AMERICAN GERIATRICS SOCIETY

- Harford Geriatrics Leadership Scholar
- Geriatric and Aging Research Institute on Aging (GRI)
- AGS ON GERIATRICS ACADEMIC PROGRAMS
- US OLTH RESOURCES AND SERVICES ADMIN
- Suflonin Study
- 2003 Scholar, Harford Institute of Geriatric Nursing Research, John A. Harford Institute for Geriatric Nursing, New York University
- Geriatric Rehabilitation and Prevention of Disability
- Supporting the Use of Short-Term
- Geriatric Medication Management and Medication Safety
- AMES ACAD OF NURSING
- The Epidemiology of Stress and the Menopausal Syndrome
- Supporting the Use of Short-Term

VIVO Enabling a National Network of Scientists

Home People Organizations Research Events

Welcome to VIVO

VIVO is a research-focused discovery tool that enables collaboration among scientists across all disciplines.

Browse or search information on people, departments, courses, grants, and publications.

Search VIVO

Log in

Search

Log in

Browse by

- Grants (11,814)
- People (48,721)
- Activities (11,818)
- Courses (1116)
- Events (379)
- Organizations (20,138)
- Research (11,283)
- Locations (376)

- Faculty Member (8882)
- Graduate Student (1)
- Librarian (67)
- Non-Academic (7536)
- Non-Faculty Academic (2)
- Alumn (8972)
- Professor Emeritus (802)

UF Clinical and Translational Science Institute
UNIVERSITY of FLORIDA

University of Florida

How do you want to compare?
by Grants

Who do you want to compare?
Search: [] X

Records 1 - 10 of 30

Entity Label	Grant Count	Entity Type
<input checked="" type="checkbox"/> Continuing Education	562	UF Department, Agent, Non-Academic Department, Department
<input checked="" type="checkbox"/> Florida Museum of Natural History	203	Museum, Agent
<input checked="" type="checkbox"/> College of Agricultural and Life Sciences	166	Agent, UF College, College
<input checked="" type="checkbox"/> College of Engineering	103	Agent, UF College, College
<input checked="" type="checkbox"/> Evelyn F. and William L. McKnight Brain Institute of the University of Florida	64	UF Center, Agent, Center
<input checked="" type="checkbox"/> International Center	54	UF Department, Agent, Non-Academic Department, Department
<input checked="" type="checkbox"/> Florida Sea Grant	44	UF Center, Agent, Center
<input type="checkbox"/> Whitney Laboratory for Marine Bioscience	42	UF Research Laboratory, Agent, Laboratory, Research Laboratory
<input type="checkbox"/> Water Institute	38	UF Center, Agent, Center
<input type="checkbox"/> College of Dentistry	35	Agent, UF College, College

Comparing Grants of Organizations in University of Florida

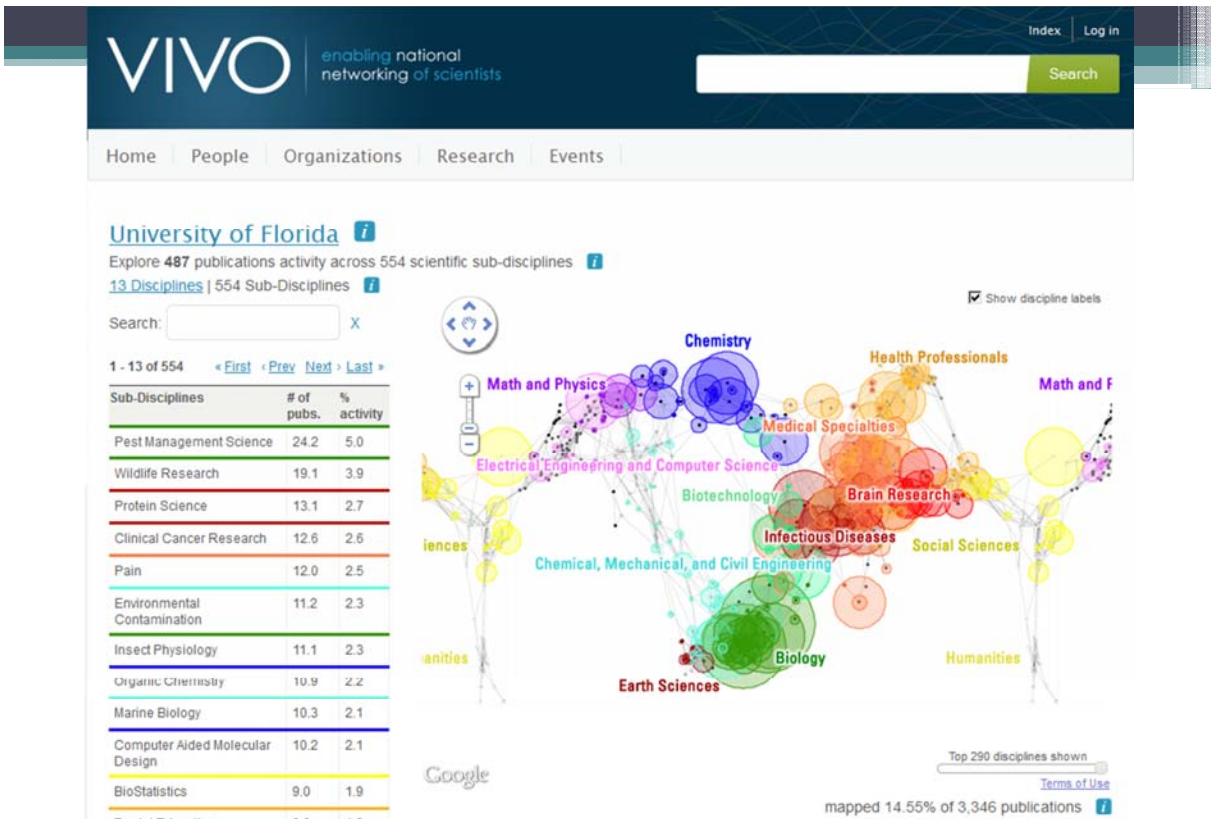
Total Number of Grants

You have selected 7 of a maximum 10 organizations to compare. **Clear**

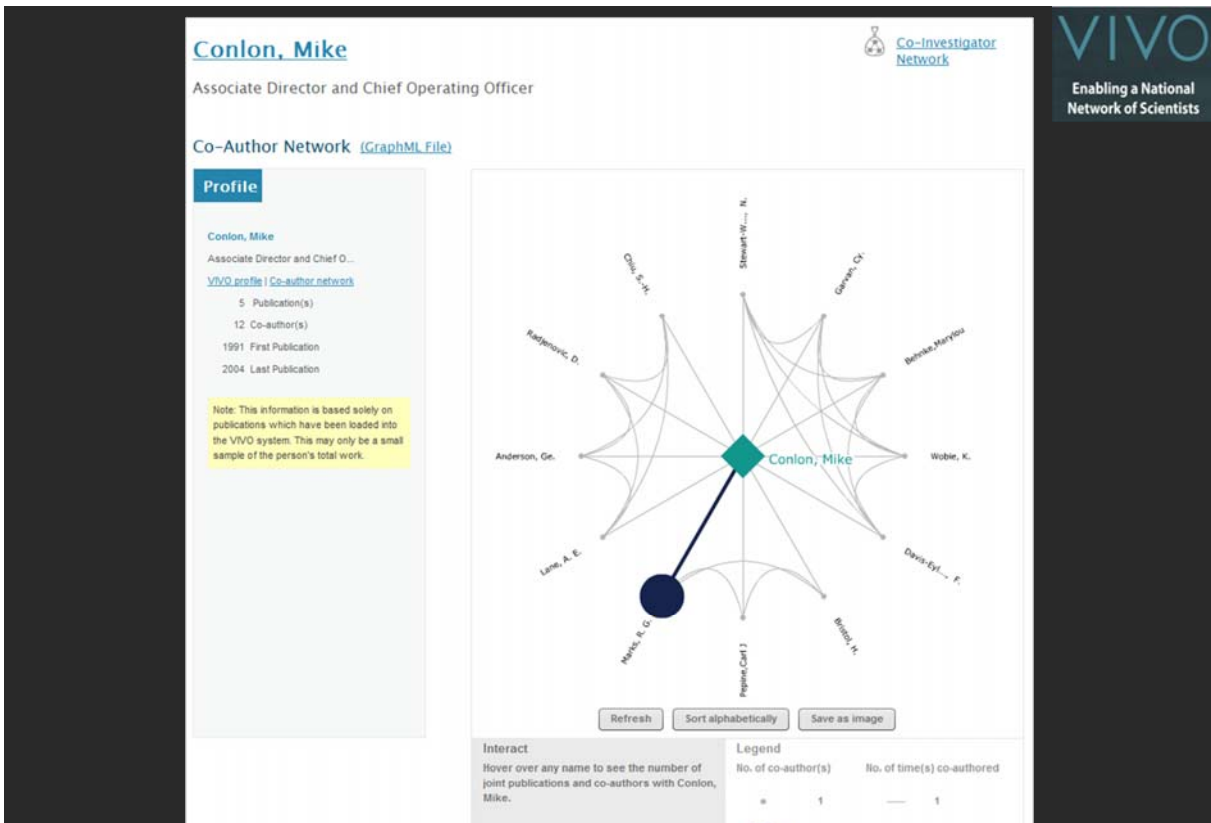
- Florida Sea Grant: 44
- International Center: 54
- Evelyn F. and William L. McKnight Brain Institute of the University of Florida: 64
- College of Engineering: 103
- College of Agricultural and Life Sciences: 166
- Florida Museum of Natural History: 203
- Continuing Education: 562

Save as CSV **Clear**

Temporal Analysis (When) Temporal visualizations of the number of papers/funding awarded at the institution, school, department, and people level



Topical Analysis (What) Science map overlays will show where a person, department, or university publishes most in the world of science. (in work)



Network Analysis (With Whom?) Who is co-authoring, co-investigating, co-inventing with whom? What teams are most productive in what projects?



<http://nrn.cns.iu.edu>

Geospatial Analysis (Where?) Where are what NRN instances and what data holdings do they have?

Hands-On (Chin Hua Kong)

- Analysis & Visualization of VIVO Data

Guided Tour (Chintan Tank)

- Create new VIVO visualization

Required tools and resources

- Make sure the following applications are installed on your computer
 - **Java** 1.5 or higher version. You can install the latest Java through <http://www.java.com>
 - The **Science of Science tool (Sci²)** can be downloaded at <http://sci2.cns.iu.edu>. The online tutorial is available at [here](#)
 - The **Gephi** tool can be downloaded at <http://gephi.org>. The user guide is available at [here](#)
- Download the workshop's **data package** from <http://wiki.cns.iu.edu/display/PRES/VIVO+Presentation>
- Make sure your computer has **Internet access**. The username is *VIVO2* and password is *vivoweb*.
- We also have the documents and software available for you on USB, if you need it.

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Analysis & Visualization of VIVO Data

- Using Science of Science Tool (<http://sci2.cns.iu.edu>)
- Using Gephi (<http://gephi.org>)

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Evolving the visualization technique

Zero code milestone!



Fast!



Can I create a
visualization
?!



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Utilizing VIVO data

- Administration
 - Providing abstract view of the organization
 - Cleaning the VIVO data
- Research
 - Free data for research
 - Analyze and visualize data for publication
- Development
 - Analyze and understand the data
 - Create Mockups
- Personal
 - Better understand of your network
 - Analyze your own interests

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Analysis & Visualization of VIVO Data

- Three-Step Visualization
- Sci²: Organization Hierarchy Visualization
- Gephi: Organization Hierarchy Visualization
- 1.5-Step Visualization

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Three-Step Visualization



- Three simplified steps to create a visualization

Playing with SPARQL queries



Cleaning and
Preprocessing the data



Visualizing the data

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Analysis & Visualization of VIVO Data

- Three-Step Visualization
- Sci²: Organization Hierarchy Visualization
- Gephi: Organization Hierarchy Visualization
- 1.5-Step Visualization

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Playing with SPARQL



- What is a SPARQL query?
 - An RDF query language
 - A key technology for semantic web where a query can consist triple patterns, conjunctions, disjunctions, and optional patterns .
 - [W3C definition](#)
 - [SPARQL Tutorial](#)
- Please visit the SPARQL query end-point of the University of Florida (UFL) at <http://sparql.vivo.ufl.edu/sparql.html> (You can find this link in the Readme.txt file located in the data package)

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Playing with SPARQL

- To retrieve 5 organization names in the UFL's VIVO system, copy and paste the query from the *FiveOrganizationLabelsSPARQL.txt* file into the text box at the [SPARQL endpoint](#). The following shows the content of the query.

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX core: <http://vivoweb.org/ontology/core#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

SELECT (str(?orgLabel) as ?organizationLabel)
WHERE
{
  ?org rdf:type foaf:Organization .
  ?org rdfs:label ?orgLabel .
} LIMIT 5
```

43

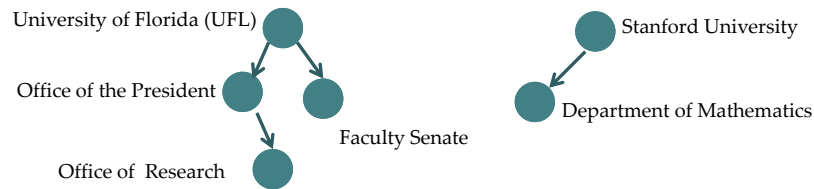
Playing with SPARQL

- You can save the results in five different formats
 - XML file
 - JSON file
 - Plaint text (in a table format)
 - **CSV file (Comma-delimited values)**
 - TSV file (Tab-delimited values)

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Playing with SPARQL

- Example of organization structure in UFL VIVO data



- Sample results from SPARQL

OrganizationLabel	subOrganizationLabel
UFL	Office of the President
Office of the President	Office of Research
UFL	Faculty Senate
Stanford University	Department of Mathematics

OrganizationToSubOrganization.csv

UFLOrganizationLabel
UFL
Office of the President
Faculty Senate
Office of Research

UFLOrganizations.csv

45

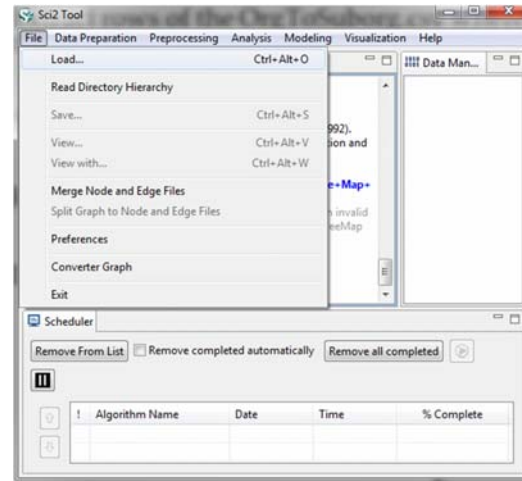
Playing with SPARQL

- Connect to the UFL's SPARQL endpoint at <http://sparql.vivo.ufl.edu/sparql.html>
- Retrieve all organizations to sub-organizations table by using the SPARQL query in the *OrganizationToSubOrganizationSPARQL.txt*
- Save and rename the output file as *OrganizationToSubOrganization.csv* (The pre-queried result is available in the data package)
- Use the SPARQL query in the *UFLOrganizationsSPARQL.txt* file (showed as below) to retrieve the sub-organizations (descendants) of the University of Florida (UFL)
- Save and rename the output file as *UFLOrganizations.csv* (The pre-queried result is available in the data package)

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Cleaning and Preprocessing

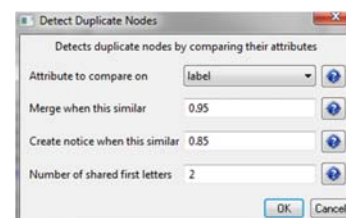
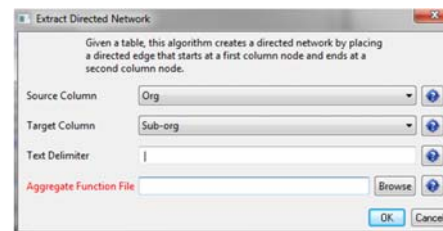
- Extract rows from the *OrganizationToSubOrganization.csv* where the organizationLabel appears in the UFLOrganizationLabel column of the *UFLOrganizations.csv*. You can do this by using Excel, Python, etc.
- Save the new file as *UFLOrganizationHierarchy.csv*. (The pre-processed result is available in the data package)
- Run Science of Science tool (Sci²)
- Select **File > Load** menu to load the *UFLOrgHierarchy.csv*



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Cleaning and Preprocessing

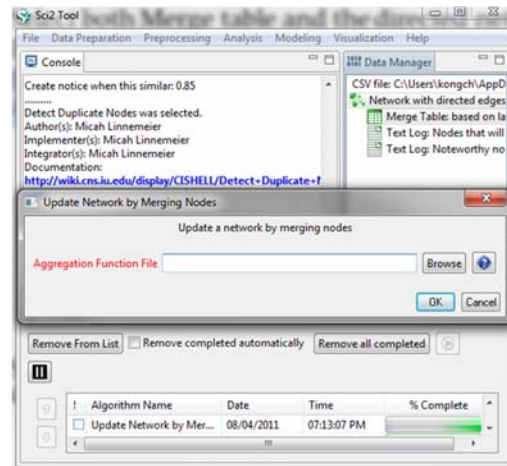
- Extract the directed network by selecting **Data Preparation > Extract directed Network**. A window will pop up.
- Fill in the following parameters and click OK. A directed network file will appear in the *Data Manager* panel.
- Select the **Data Preparation > Detect Duplicate Nodes** menu and execute with default parameters



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Cleaning and Preprocessing

- Select both Merge table and the directed network file in the *Data Manager* panel
- Execute the **Data Preparation > Update Network by Merging Nodes** menu to remove the duplicated nodes



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Cleaning and Preprocessing

- Node's indegree vs outdegree
 - Indegree: Number of edges pointing in
 - Outdegree: Number of edges pointing out
- Person A
Outdegree = 2
Indegree = 0

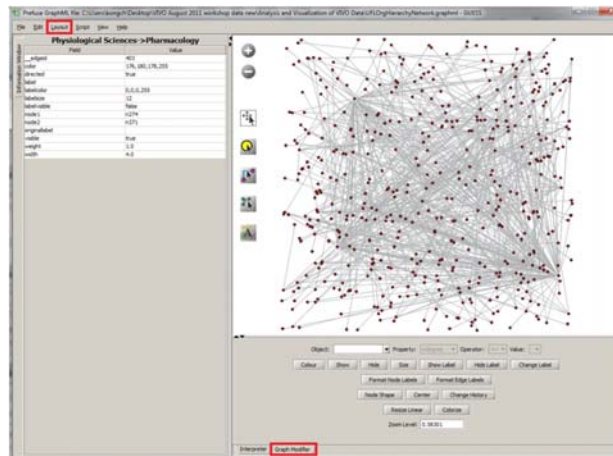
Grant 1
Outdegree = 0
Indegree = 1

Grant 2
Outdegree = 0
Indegree = 1
- Generate the in-degree attributes by using the "Updated Network" file and executing **Analysis > Networks > Unweighted and Directed > Node Indegree**
 - This will result a "Network with indegree attribute ..." file
 - Generate the out-degree attributes by using the "Network with indegree attribute ..." file and executing **Analysis > Networks > Unweighted and Directed > Node Outdegree**
 - This will result a "Network with outdegree attribute ..." file

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Visualizing: GUESS

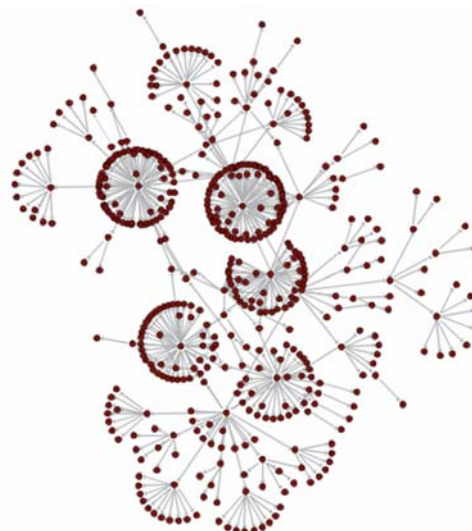
- Visualize the network by using the “Network with outdegree attribute ...” file and execute the **Visualization > Networks > GUESS**
- A GUESS window will pop up as showed in the following image. Please pay attention to the *Graph Modifier* tab and the *Layout* menu bar. We will use this functionality to modified the visualization.



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Visualizing: Layout

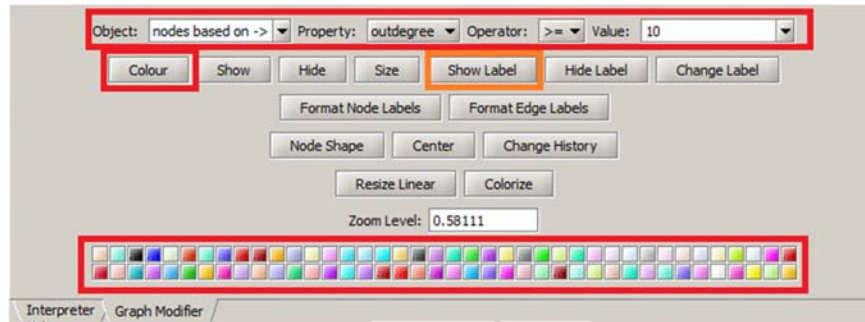
- Re-layout the nodes by executing **Layout > GEM / SPRING / Pin Back** or any combination of these layouts for your satisfaction.
- Here is the result by laying out with SPRING and then Pin Back.



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Visualizing: Color

- Now is time to bring information up front by using the functionality in the *Graph Modifier* tab.
- Color the node that have more than 10 sub-organizations. Using the following setting and click *Colour* button. Choose a color from the color box.

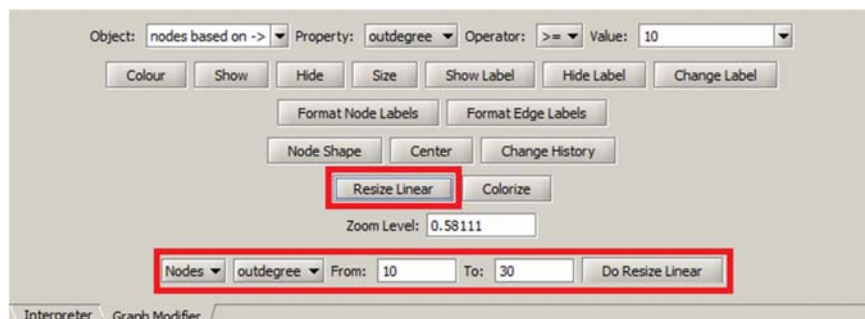


- You can also choose to show the labels

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Visualizing: Resize

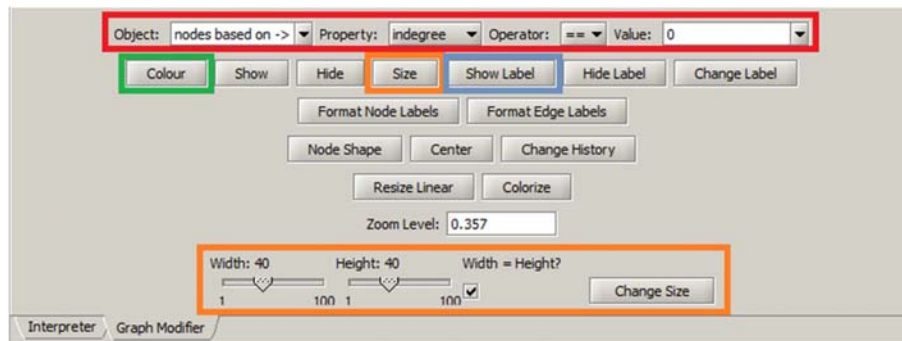
- Resize the nodes linearly based on the number of direct sub-organizations. To achieve this, click on the *Resize Linear* button and fill in the parameters as following.



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Visualizing - Highlight UFL

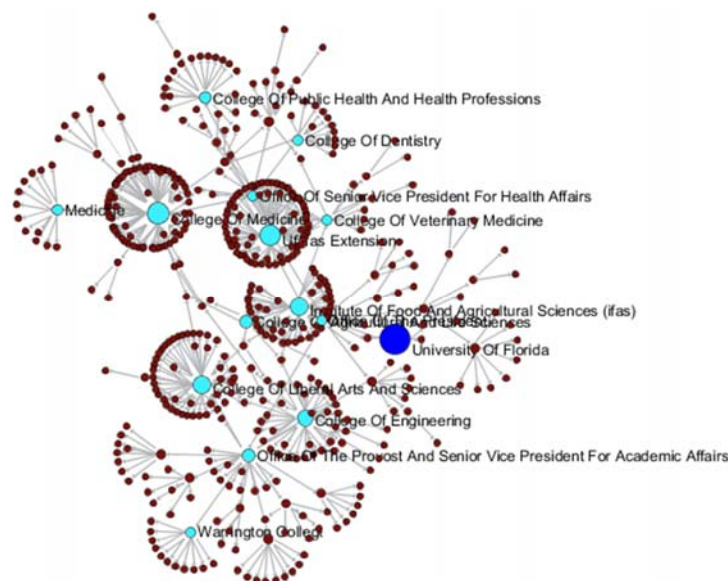
- Since UFL is the root of the hierarchy, it will not have a parent node. In other words, the indegree value of UFL is zero.
- Apply the condition to select the UFL node. Then resize and recolor the UFL node to increase its visibility. Finally, show the UFL node's label.



55

Visualizing: Result

- Here is the visualization result for the UFL organization hierarchy.



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Analysis & Visualization of VIVO Data

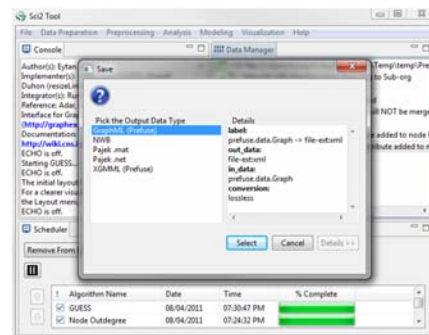
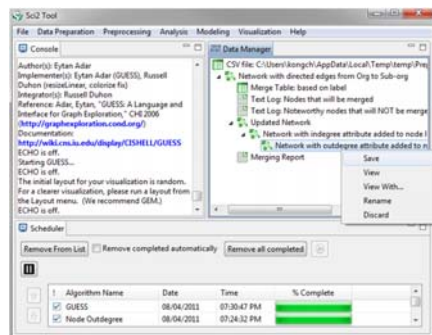
- Three-Step Visualization
- Sci²: Organization Hierarchy Visualization
- Gephi: Organization Hierarchy Visualization
- 1.5-Step Visualization

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Preprocessing



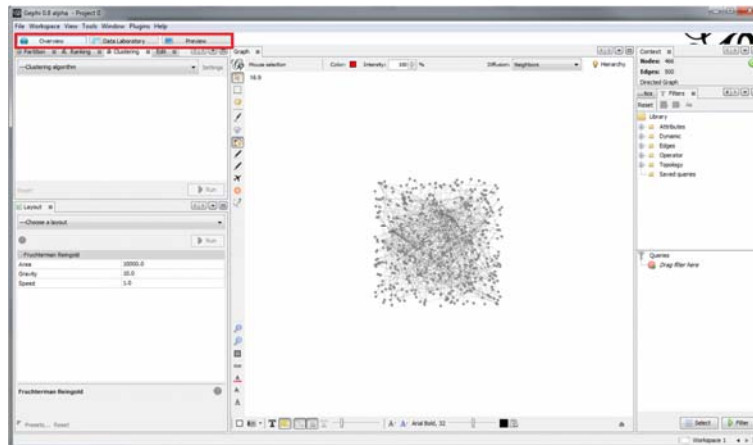
- Since this section also visualizing the organization hierarchy, we will avoid re-doing the Playing with SPARQL query; and Cleaning and Preprocessing Data steps.
- However, we have to export the “Network with outdegree attribute ...” file as graphml. To do this, right click on the “Network with outdegree attribute ...” file from the Data Manager and select Save.
- Choose GraphML as output type and save as *UFLHierarchyNetwork.xml*. Change the .xml extension to .graphml.



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Visualizing: Load Data

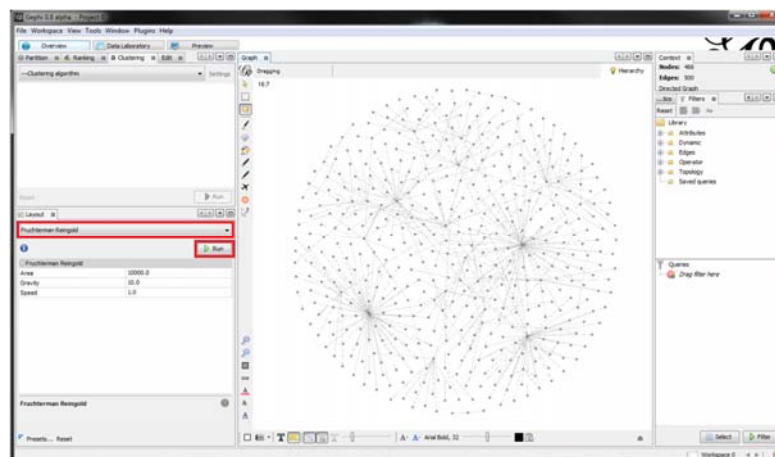
- Run the Gephi tool and load the *UFLHierarchyNetwork.graphml* through the **File > open** menu.
- There are three main tabs in Gephi: i) *Overview* tab for editing the visualization effect; ii) *Data Laboratory* tab for manipulating data; iii) *Preview* tab for polishing up the final image.



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Visualizing: Layout

- Choose a layout from the *Layout* tab and press run. You might need to stop the run once you are satisfied with the layout. Here is the result of Fruchterman Reingold layout.

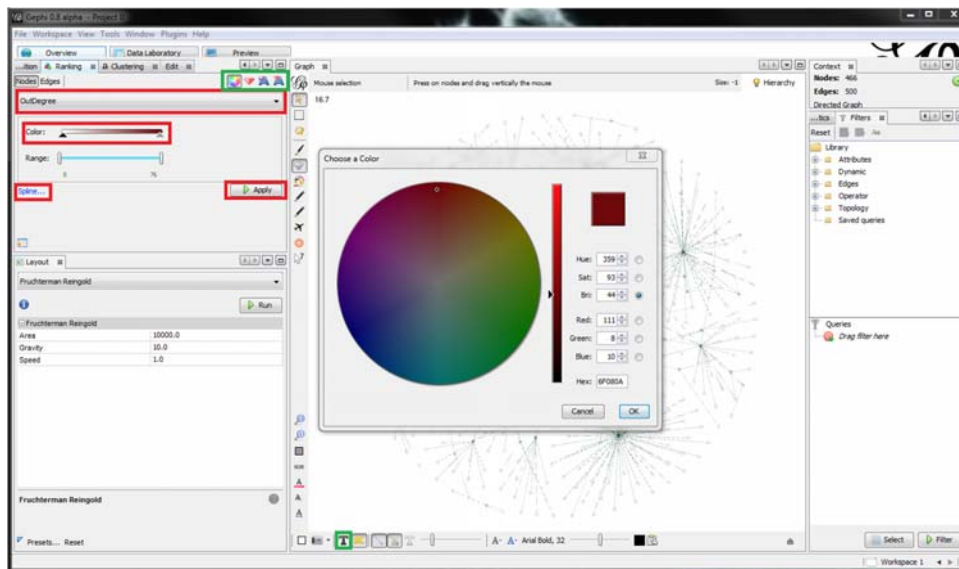


- You can pan and zoom in/out from the view by using the mouse right-click and scrolling.

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Visualizing: Color and Resize

- Select the *Ranking* sub-tab under the *Overview* tab.



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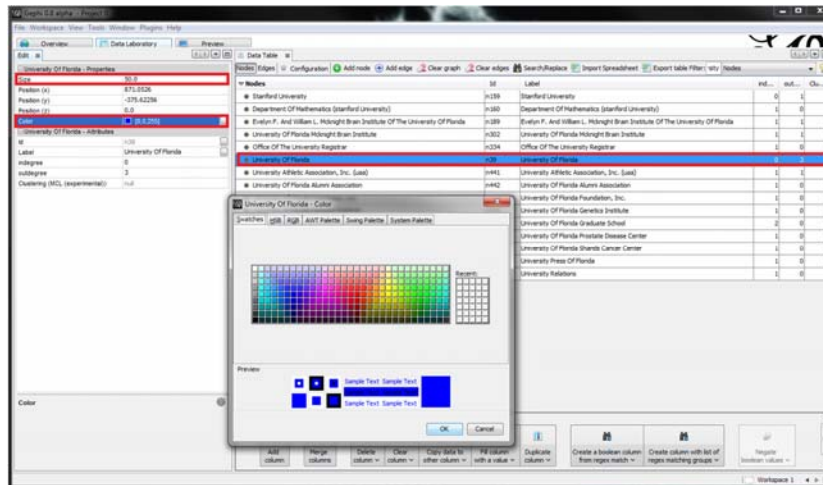
Visualizing: Color and Resize

- Choose the Nodes tab as the edited target.
- The squared green box is the target's property icons: circle (node color), diamond (node size), alphabet 'A' with circle (label color), alphabet 'A' with diamond (label size). To edit the node color, select the circle icon.
- Select OutDegree from the drop down box.
- Double click on the right slider of the color bar to bring up the color chooser.
- Adjust the color coding by using the Spline Editor.
- Click the Apply button to implement the changes.
- Repeat the above steps to edit the node size, label color and label size. Show the labels by clicking the black 'T' icon at the bottom of the *Graph* tab.

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Visualizing - Highlight UFL

- Now, highlight University of Florida (UFL) in the organization hierarchy.
- To do this, select the UFL node in the *Data Laboratory* tab. Adjust the size and color properties of the node to increase its visibility.



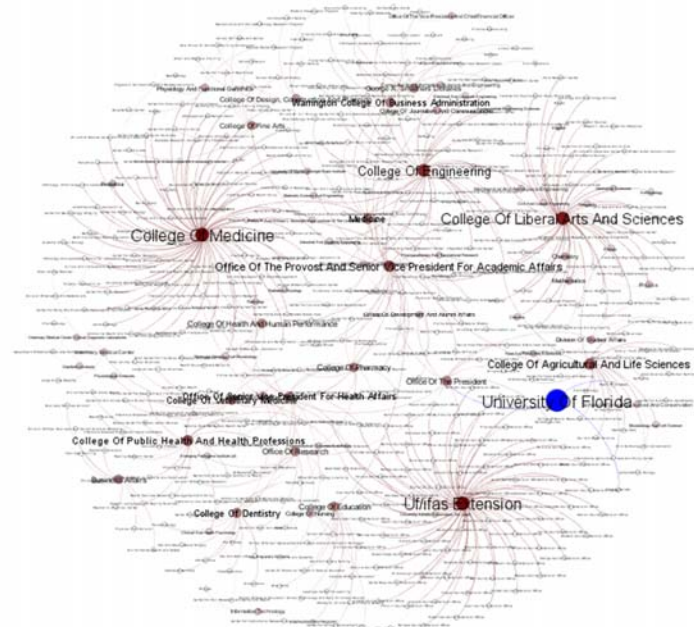
63

Visualizing: Preview and Polish

- Select the *Preview* tab and click on the Refresh button to show the result.
- Use the Presets drop down box to change the node and edge view.
- You also can enable / disable the nodes and edges, even edit the properties through the *Preview Settings* tab.
- Then press the Refresh button again to show the new result.
- Continue editing until you are satisfied with the look and feel.
- Gephi supports export formats as PDF, SVG, CSV, gdf, graphml, and gexf.

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Visualizing: Result



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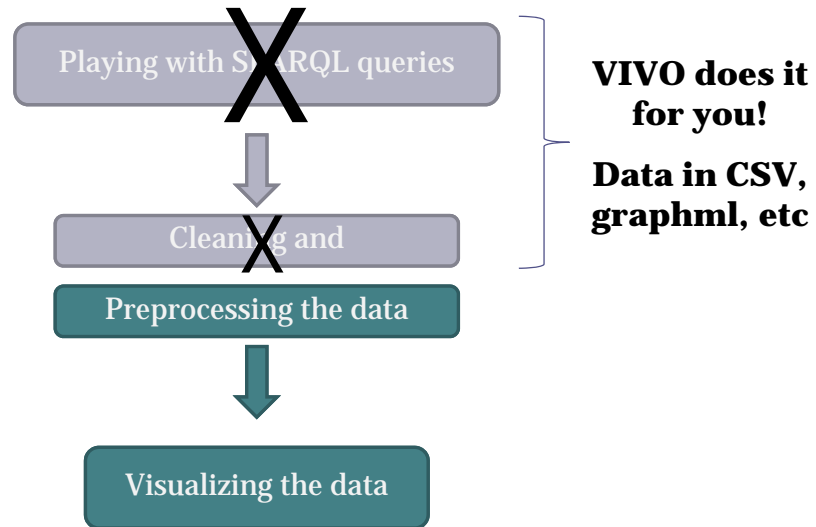
Analysis & Visualization of VIVO Data

- Three-Step Visualization
- Sci²: Organization Hierarchy Visualization
- Gephi: Organization Hierarchy Visualization
- 1.5-Step Visualization

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1.5-Step Visualization

- It is possible to reduce the three-steps visualization to 1.5 steps



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10 min break

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Visualization-in-depth

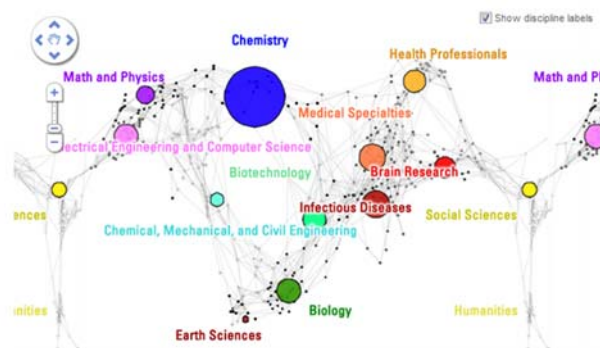
- Map of Science
- Temporal Graph
- National Researcher Networking (NRN)

69

Concept



- A visual inter-discipline interface for the VIVO publications analysis
- Activity of any organization, person, or university i.e. entity in a VIVO instance in the world of science
- 13 Disciplines and 554 Sub-Disciplines



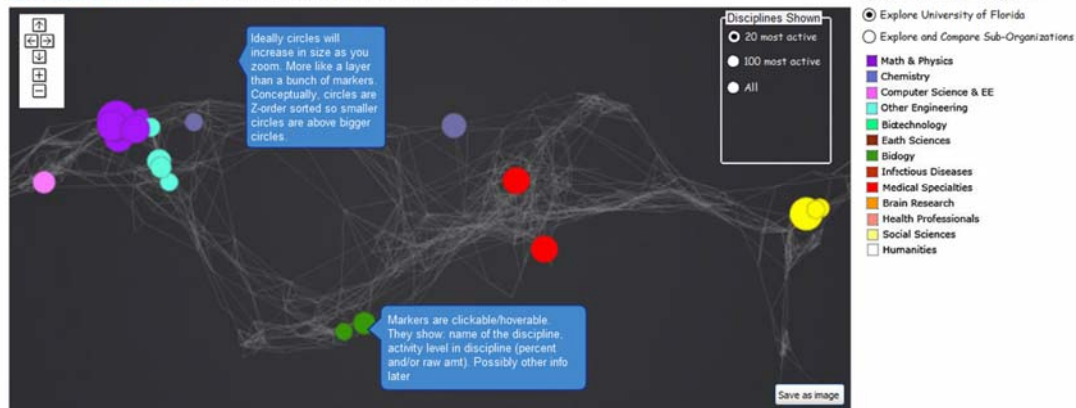
Google

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Mockups

University of Florida Publication Activity across 554 Scientific Disciplines



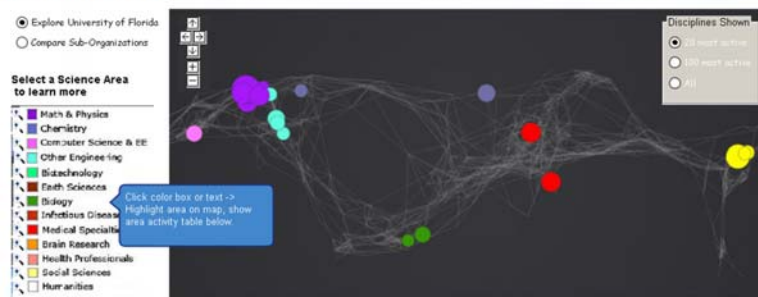
Most Active Scientific Areas	Most Active Discipline in Area	10 Most Active Disciplines (Overall)	% total activity
Math & Physics	Robotics Systems	1. Robotics Systems	5.5
Chemistry	Synthetic Materials	2. Morbi semper	3.2
Computer Science & EE	Foo Bar	3. Sed magna nisl	2.5
Other Engineering	Lorem Ipsum	4. Morbi pellentesque	1.9
Biotechnology	lobortis id	5. Etiam est leo	.5
Earth Sciences	Herf Durf	6. Y	.4
Biology	Sed ouctor rhoncus	7. Z	.4
Infectious Diseases		8. A	.3

Callout: Click -> Zoom to select discipline on map. Each discipline in these lists would have a button like

Lots of whitespace here. What else could we add?

Mockups

University of Florida Publication Activity across 554 Scientific Disciplines [94% matched \(45,032 of 47,655 publications\)](#)



18 Most Active Disciplines (Biology)	% of activity in Biology	18 Most Active Disciplines (Overall)	% total activity
1. Enzyme Microbiological Techniques	34%	1. Biomaterials	5.5
2. Ecology	29%	2. Forensic Science	3.2
3. Insects	10%	3. Gut	2.5
4. Comparative Animal Physiology	8%	4. Radiation Therapy	1.9
5. Entomology	5%	5. Mathematical Science (Russia)	.5
6. Myology		6. Nonlinear Analysis	.4
7. Sociobiology		7. DNA Repair	.4
8. Molecular Biological Evolution		8. Pure	.3
9. Insect Physiology	1%	9. Test Equipment	.2

Callout: Tint the header (or body) of this to be the science area color.

Save All as CSV | CSV has full ranking, additional info like raw activity values | Save All as CSV

Most Active Scientific Areas	Most Active Discipline in Area
1. Health Professionals	Biomaterials
2. Medical Specialties	Gut
3. Math & Physics	Nonlinear Analysis
4. Chemistry	Crystallography
5. Infectious Diseases	Poultry Science
6. Biotechnology	Enzyme Microbiological Techniques
7. Computer Science & EE	Test Equipment
8. Other Engineering Acoustics	
9. Earth Sciences	Genetics
10. Biology	Insects
11. Brain Research	Vision
12. Social Sciences	Tourism
13. Humanities	German Studies

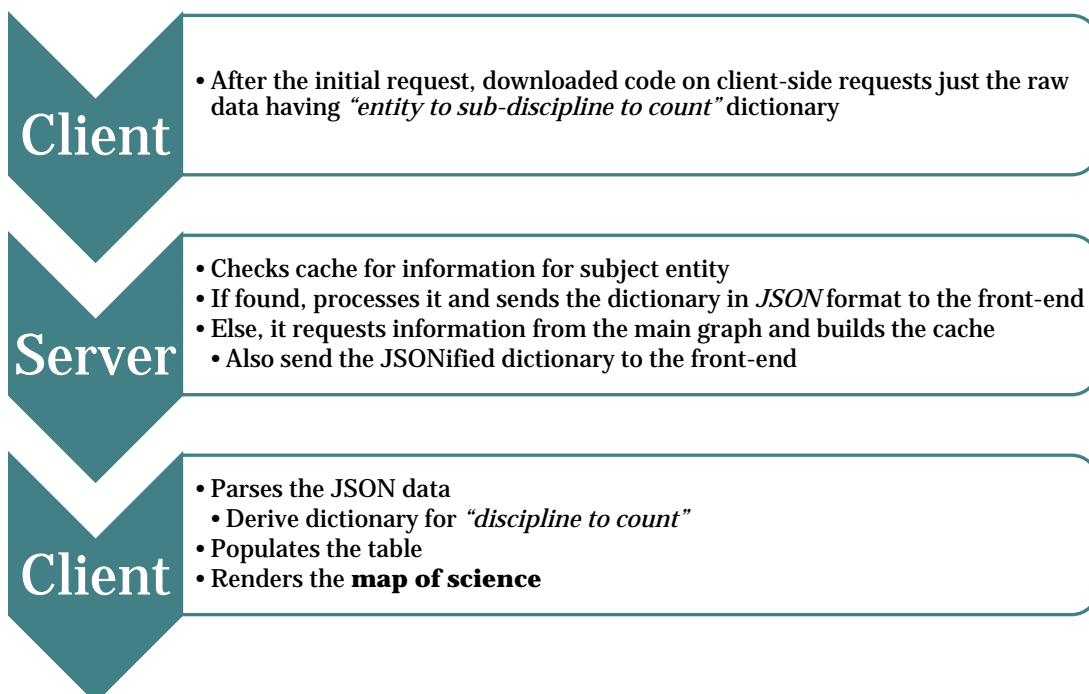
Save All as CSV

Features + Interactions

- Shows the publication activity of an entity in a VIVO instance, overlaid on the map of science
- Table lists all 13 disciplines and 554 sub-disciplines i.e. science field
 - Hover over a line so that corresponding field's location on map is outlined
 - Color of row based on corresponding *discipline's* color
 - Display impact of entity in terms of # of *pubs* in a particular science field
 - Sort, Search and Download data used to render the table, as CSV
- Size of node on the map indicates % of *activity* in that field
 - An entity has fixed *node area* to distribute across the displayed nodes
 - Toggle discipline label
 - Slider used to control how many fields to show on map
- How many publications were properly mapped?

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Data Access



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Code Libraries Used

- Google Maps API v3 – JavaScript mapping library¹
 - Provides a number of utilities for manipulating maps,
 - Adding content to the map through a variety of services, allowing creation of robust maps applications
- DataTables - JavaScript tabulating library² for jQuery
 - Client-side library for nicely tabulating data with pagination
 - Multi-column sorting with data type detection
 - Instant filtering of rows
- jQuery - fast and concise JavaScript library³
 - simplifies HTML document traversing, event handling, animating, and AJAX interactions
 - provides uniform behavior on all major browsers

[1] - <http://code.google.com/apis/maps/documentation/javascript/>

[2] - <http://www.datatables.net/>

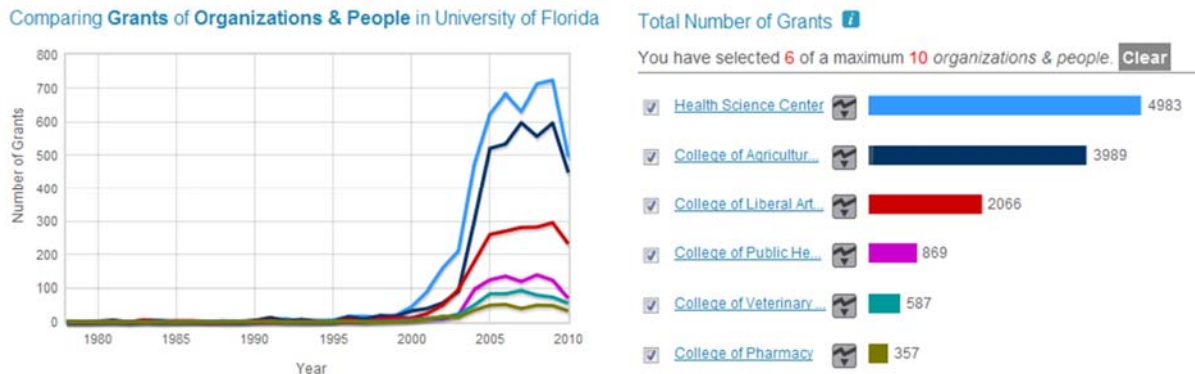
[3] - <http://jquery.com/>

Visualization-in-depth

- Map of Science
- Temporal Graph
- National Researcher Networking (NRN)

Concept

- Compare research activity in terms of publications and grants amongst peers
- Identify most fruitful blocks of time
- Create report for policy decision makers



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Features + Interactions

- Display line graph of publication and grant activity across years
 - Switch between *grant* and *publication* parameter
 - Preserve selections between parameters
- List all sub-entities (organization and people)
 - Drill-down to get the activity comparison of all sub-entities for a particular sub-entity i.e. sub-sub-entities
 - E.g. Compare activity for all the sub-entities for *College of Medicine*
 - Similarly drill-up from a sub-entity
- Search for entity in the table on name, count and type
 - Pagination
- Download data used to render the table, as CSV

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Code Libraries Used

- Flot – JavaScript plotting library¹ for jQuery
 - Produces graphical plots of arbitrary datasets on-the-fly client-side.
 - Works in modern browsers including IE and on iOS platforms.
- DataTables - JavaScript tabulating library² for jQuery
 - Client-side library for nicely tabulating data with pagination
 - Multi-column sorting with data type detection
 - Instant filtering of rows
- jQuery - fast and concise JavaScript library³
 - simplifies HTML document traversing, event handling, animating, and AJAX interactions
 - provides uniform behavior on all major browsers.

[1] - <http://code.google.com/p/flot/>

[2] - <http://www.datatables.net/>

[3] - <http://jquery.com/>

Visualization-in-depth

- Temporal Graph
- Map of Science
- National Researcher Networking (NRN)

Concept

- Provide a overview of the adoption of National Researcher Network systems across the U.S. and also internationally
- Show the evolution of the NRN systems through time since Jan, 2010
- Support of scientific discoveries, technological breakthroughs, and the communication of research results to diverse stakeholders
- Encourage future adoption and usage of NRN systems

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National Researcher Networking (NRN)



<http://nrn.cns.iu.edu>

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Features + Interactions

- Display the institution's resources on the map
 - The resources are People, Publications, Patents, Funding, Courses
 - Turn on / off resources through the check boxes
 - Markers are area-size-coded by count

- Show the evolution of national researcher networks
 - Play – Playback month by month since January 2010
 - Pause – Pause the playback
 - Stop – Clear the playback and show latest resources status

- Browsing resources through the NRN sites
 - Navigate to the resource's site by clicking on the resource's marker
 - Hide the map for a full screen view of the resource's site

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Code Libraries Used

- Science of Science tool (Sci²)
 - An desktop tool for scientific analysis
 - Contains Yahoo! Geocoding plugin for retrieving geo-location information of the institutions

- Google Map API V3
 - A Javascript Maps Applications for both the Desktop and Mobile Devices
 - A free service, available for any web site that is free to consumers

- jQuery - fast and concise JavaScript library³
 - simplifies HTML document traversing, event handling, animating, and AJAX interactions
 - provides uniform behavior on all major browsers.

[1] - <http://sci2.cns.iu.edu>

[2] - <http://code.google.com/apis/maps/documentation/javascript/>

[3] - <http://jquery.com/>

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VIVO Visualization

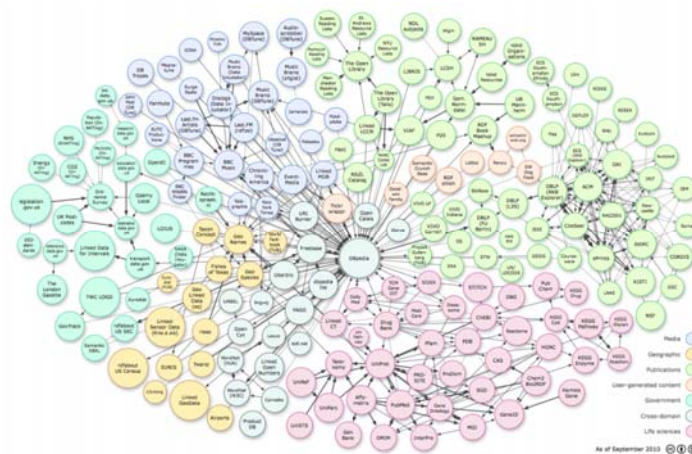
- Accessing VIVO Data
- Architecture
- Pipeline Explanation

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Accessing VIVO Data



- Read “The Semantic Web: An Introduction”
<http://infomesh.net/2001/swintro>



author: Chris Bizer

taken from: http://linkeddatabook.com/editions/1.0/images/lod-cloud_2010.png

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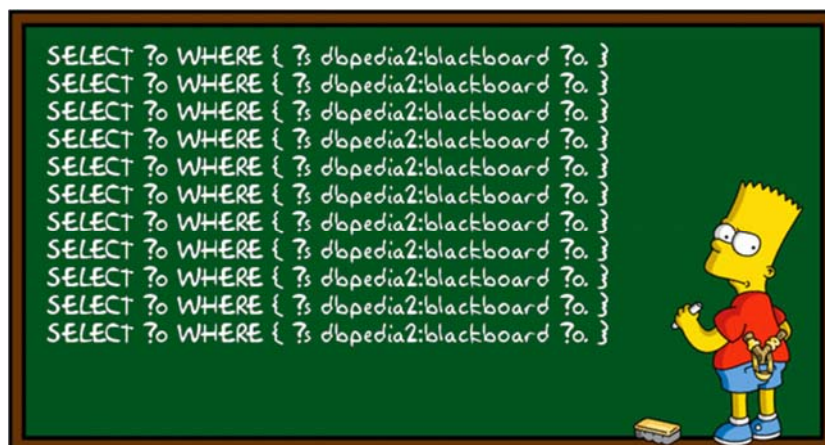
Linked Open Data (via RDF or N3)

- Accessible to anyone on the Web.
- It can be a bit tedious to work with large amounts of data quickly/easily.
- N3 example:
 - <http://vivo.iu.edu/individual/person25557/person25557.n3>
- RDF example:
 - <http://vivo.iu.edu/individual/person25557/person25557.rdf>

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SPARQL Endpoints

- Working with data is easier/faster (using SPARQL queries).
- But may not be accessible to everyone.



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VIVO Visualization

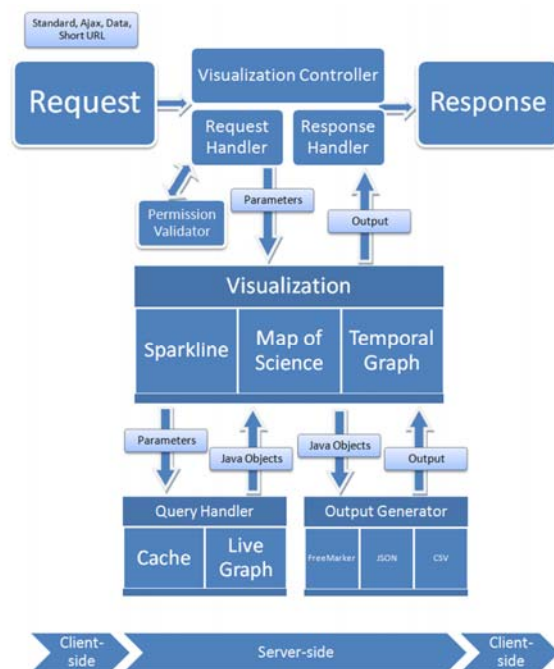
- Accessing VIVO Data
- Architecture
- Pipeline Explanation

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VIVO Visualization Architecture



1. User requests the visualization
2. Request is received by the VIVO application
3. Specific controller gets control
4. Controller delegates the control of flow to the handler of the requested visualization, if permission validated
5. The handler passes request information to the Query Handler
6. Query Handler queries the semantic web data store (cached or live)
7. Results of the query are converted into Java objects
8. Java objects are used to generate response in the requested format
9. Request handler renders the generated response



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VIVO Visualization

- Accessing VIVO Data
- Architecture
- Pipeline Explanation

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Map of Science Visualization Pipeline

- Breakdown of serving the *map of science* visualization request received at, <http://vivo.iu.edu/vis/map-of-science/IndianaUniversity>

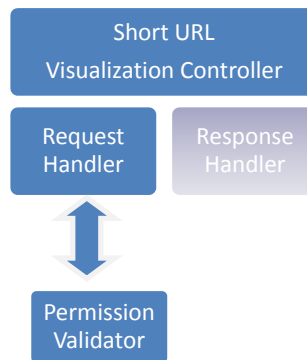
Request

- Short URL Request
- It has following parameters,
 - **/vis** – Short URL prefix
 - **/map-of-science** – Visualization type
 - **/IndianaUniversity** – URI of subject of the visualization
- Long form looks like

```
http://vivo.iu.edu/visualization
?vis=map-of-science
&uri=http://vivo.iu.edu/individual/IndianaUniversity
```

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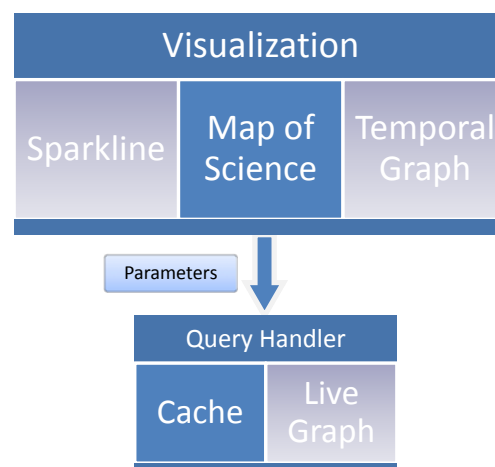
Map of Science Visualization Pipeline



- */vis* – Short URL Visualization Controller assumes the control of flow
- Parse URL to get visualization type – Map Of Science
- Gets permission requirements for Map of Science visualization
- Validates it against the requesting user’s privileges

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Map of Science Visualization Pipeline



- After validation captured parameters are passed to the Map of Science Visualization
- Check cache for all models pertaining to “IndianaUniversity” entity
- If not present create models and store in cache

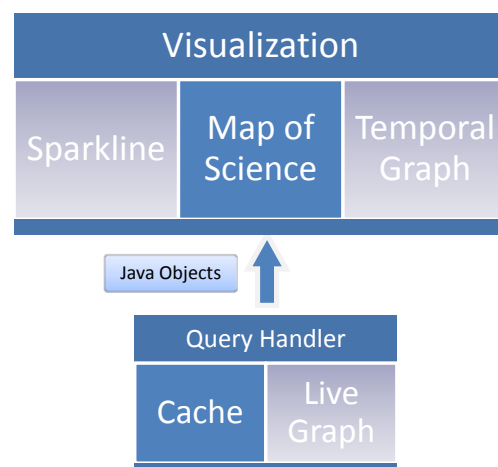
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Map of Science Visualization Pipeline

- Models used are,
 - ORGANIZATION_MODEL_WITH_TYPES
 - no input uri
 - all sub-organizations recursively
 - ORGANIZATION_TO_PUBLICATIONS_FOR_SUBORGANIZATIONS
 - specific for an input uri
 - all publications for entity-associated people
 - ORGANIZATION_ASSOCIATED_PEOPLE_MODEL_WITH_TYPES
 - specific for an input uri
 - e.g. President of University
 - PEOPLE_TO_PUBLICATIONS
 - no input uri
 - all people associated with publication

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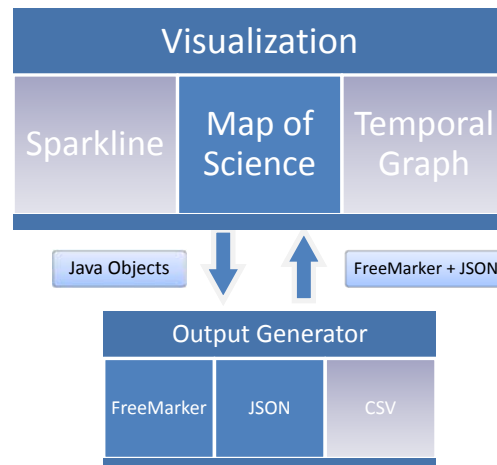
Map of Science Visualization Pipeline



- SPARQL query fired against the previous mentioned cache
- Using the query results create the java objects
 - Entity (for subject entity)
 - SubEntity (for child entities)
 - Activity (for publication info)

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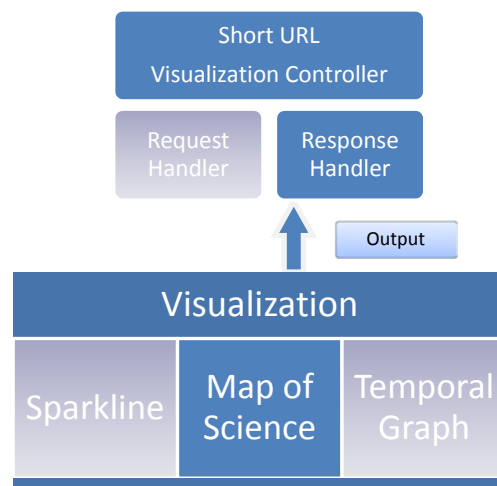
Map of Science Visualization Pipeline



- Java objects used to generate output
- FreeMarker object
 - HTML markup including CSS, JavaScript
- JSON
 - Used by JavaScript to render tables, map etc

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Map of Science Visualization Pipeline



- Output from visualization (FreeMarker + JSON) sent to Response Handler
- Makes sure output formatted properly
 - E.g. For FreeMarker – compile HTML markup

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Map of Science Visualization Pipeline

Response

Indiana University

Explore 24 publications activity across 554 scientific sub-disciplines

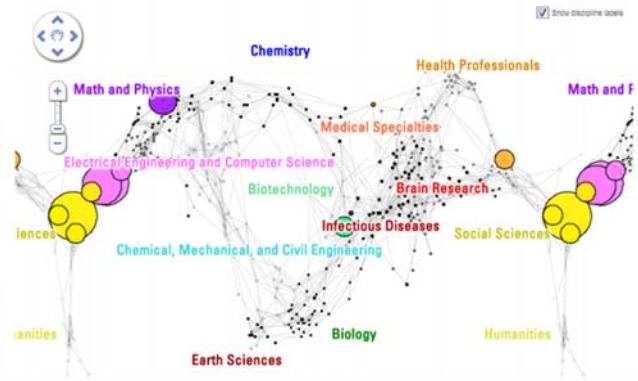
13 Disciplines | 554 Sub-Disciplines

Search: X

1 - 13 of 554 [First](#) [Prev](#) [Next](#) [Last](#)

Sub-Disciplines	# of pubs.	% activity
Human Resource Management	6.0	25.0
Search Engines; Web Crawling	5.0	20.8
Library Science; Information Retrieval	4.0	16.7
Chaos Fractals & Complexity	2.0	8.3
Bioinformatics	1.0	4.2
Decision Support Systems	1.0	4.2
Engineering Education	1.0	4.2
Environmental Policy	1.0	4.2
Gerontology	1.0	4.2
Machine Learning	1.0	4.2
Acoustics	0.0	0.0
Addictive Behavior	0.0	0.0
Aeronautics & Astronautics	0.0	0.0

Save All as CSV



Google

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mapped 1.58% of 1,517 publications

15 min break

Playing with SPARQL

- Get titles of all publications in the system for a person

```

PREFIX rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs:   <http://www.w3.org/2000/01/rdf-schema#>
PREFIX bibo:   <http://purl.org/ontology/bibo/>
PREFIX foaf:   <http://xmlns.com/foaf/0.1/>
PREFIX core:   <http://vivoweb.org/ontology/core#>

SELECT  (str(?publication) as ?publicationURILit)
        (str(?publicationTitle) as ?publicationTitleLit)

WHERE {

<http://vivo.ufl.edu/individual/n25562>
    core:authorInAuthorship ?authorshipNode .

?authorshipNode core:linkedInformationResource ?publication .
?publication rdf:type bibo:AcademicArticle .
?publication rdfs:label ?publicationTitle .

}

```

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Playing with SPARQL

- What are the results?

publicationURI	publicationTitleLabel
http://vivo.ufl.edu/individual/n282	Seismic evidence for small-scale...
http://vivo.ufl.edu/individual/n1597	Small scale lateral shear velocity...
http://vivo.ufl.edu/individual/n7858	Coexisting shear- and compressi...
...

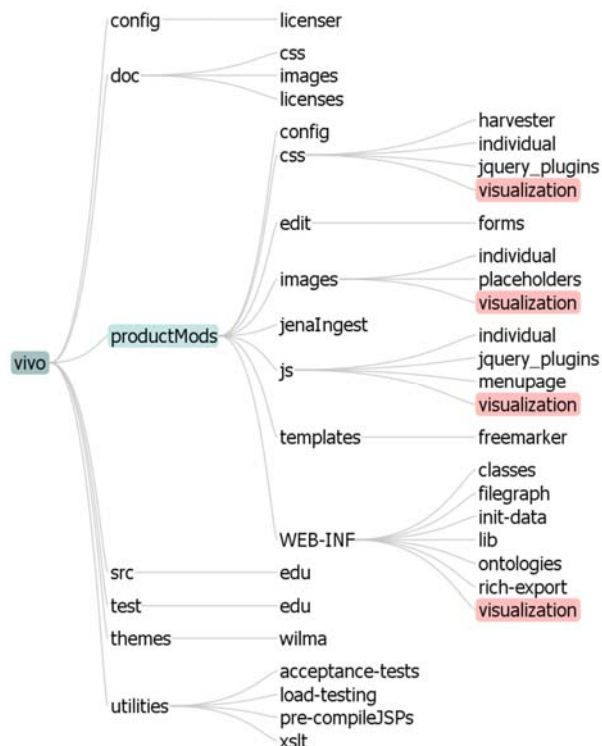
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Code Structure

- For visualization development
 - Front-End Module
 - \$VIVO_ROOT/productMods (\$FRONT_END)
 - \$FRONT_END/templates - FreeMarker templates
 - \$FRONT_END/css - Stylesheets
 - \$FRONT_END/js - JavaScripts
 - \$FRONT_END/images - Images
 - Back-End Module
 - \$VIVO_ROOT/src (\$BACK_END)
 - \$BACK_END/./webapp/controller/visualization - Controller
 - \$BACK_END/./webapp/visualization - Specific visualizations

Code Structure

- Front-End Module

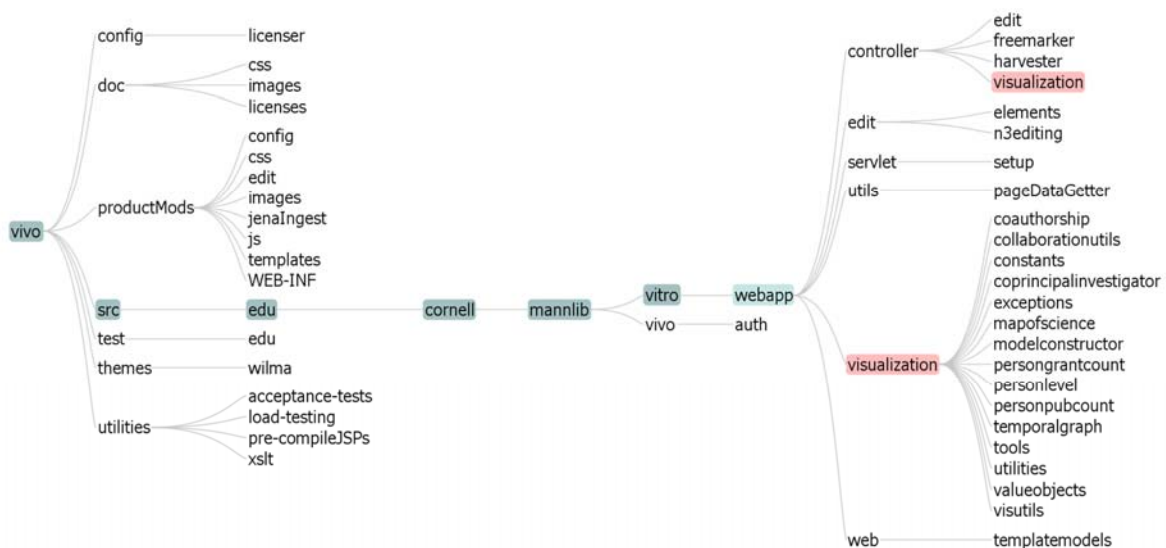


Front-End Module

- Create folders for “Word Cloud” in `templates`, `css`, `js` folders
 - Copy `js`, `css` libraries in to newly created `wordcloud` folder
- Put code from the standalone page into a newly created `ftl` file
 - Change parts of code specific to integration with the back-end like inclusion of scripts, import of json data
- Difference between the standalone html page and FreeMarker file
 - Inclusion of external scripts (stylesheets & JavaScripts)
 - Access to back-end provided variables
- How does the magic happen?

Code Structure

- Back-End Module



Outlook (Katy Borner)

- Create new VIVO visualization
- Planned VIVO Visualizations
 - Empower Others to Visualize VIVO Data
 - Map of Science Comparison Visualization
 - Make VIVO Visualizations Useful for Other NRN, e.g., as Open Social gadgets
- (Inter)National VIVO Visualizations

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Empower Others to Visualize VIVO Data:
Provide VIVO data ready for analysis, e.g.,

- 1. Organizational hierarchy:** from root node (e.g., UFL) to persons.
- 2. Bimodal network of people-organizations:**
Organization Name / Person Name(s) separated by "/"
WORKFLOW: Extract bimodal network, calculate indegree/outdegree, vis in GUESS with diff colors for diff node types and nodes area coded by degree, label high degree nodes.
- 3. Bimodal network of people-funding awards for any organization node (e.g., SLIS or all of IU):**
Funding Award Title / \$ amount / Person Name(s) separated by "/"
WORKFLOW: Extract bimodal network, calculate indegree/outdegree, vis in GUESS with diff colors for diff node types and nodes area coded by total award amount for funding or degree, label high degree/\$ nodes.

Empower Others to Visualize VIVO Data: Provide VIVO data ready for analysis, e.g.,

4. **Bimodal network of people-publications for any organization node (e.g., SLIS or all of IU):**

Paper Title | times cited | Person Name(s) separated by “|”

WORKFLOW: Extract bimodal network, calculate indegree/outdegree, vis in GUESS with diff colors for diff node types and nodes area coded by times cited for papers or degree, label high degree/#citations nodes.

5. **Bimodal network of people-courses for any organization node (e.g., SLIS or all of IU):**

Course title | Person Name(s) separated by “|”

WORKFLOW: Extract bimodal network, calculate indegree/outdegree, vis in GUESS with diff colors for diff node types and nodes area coded by degree, label high degree nodes.

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Empower Others to Visualize VIVO Data



8.2 Network Analysis and Other Tools

Tools ▾

Added by Sean Lind, last edited by Ted Polley on Jul 25, 2011 (view change)

Table 8.1 provides an overview of existing tools used in scientometrics research, see also (Fekete and Börner-chairs 2004). The tools are sorted by the date of their creation. Domain refers to the field in which they were originally developed such as social science (SocSci), scientometrics (Scientom), biology (Bio), geography (Geo), and computer science (CS). Coverage aims to capture the general functionality and types of algorithms available, e.g., Analysis and Visualization (A+V), see also description column.

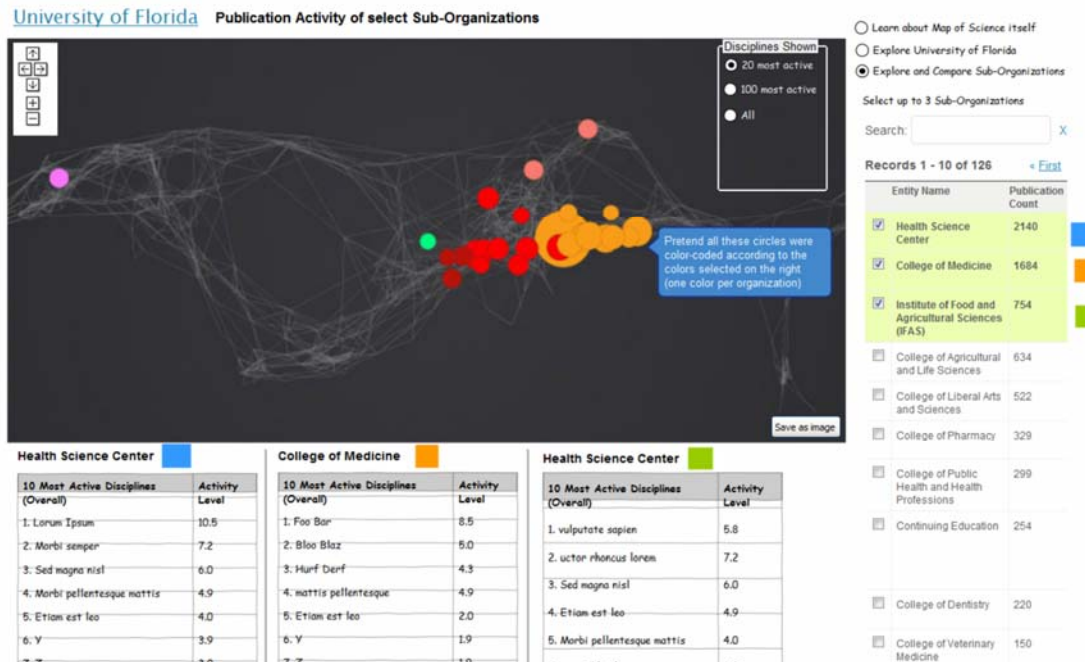
Table 8.1 Network analysis and visualization tools commonly used in scientometrics research.

Tool	Year	Domain	Coverage	Description	UI	Open Source	Operating System	References
S&T Dynamics Toolbox	1985	Scientom.	Scientom.	Tools from Loet Leydesdorff for organization analysis, and visualization of scholarly data.	Command-line	No	Windows	(Leydesdorff 2008)
In Flow	1987	SocSci	A + V	Social network analysis software for organizations with support for what-if analysis.	Graphical	No	Windows	(Krebs 2008)
Pajek	1996	SocSci*	A + V	A network analysis and visualization program with many analysis algorithms, particularly for social network analysis.	Graphical	No	Windows	(Batagelj and Mrnar 1998)

<http://sci2.wiki.cns.iu.edu/display/SCI2TUTORIAL/8.2+Network+Analysis+and+Other+Tools> has a table with 22 network layout algorithms.

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Map of Science Comparison Visualization



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Making VIVO Visualizations Useful for Other NRN, e.g., as Open Social gadgets

OpenSocial (<http://opensocial.org>) defines a common API for social applications across multiple websites. With standard JavaScript and HTML, developers can create apps that access a social network's friends or update feeds.

We plan to make VIVO visualization available as Open Social Gadget for use in VIVO, Harvard Profiles, SciVerse.

- Thanks to Duke U, VIVO will soon have an Open Social Container
- Thanks to USE, Harvard Profiles has an Open Social Container.
- Elsevier's SciVerse has a Open Social Container.

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From Local to (Inter)National

See also National Search



<http://nrn.cns.iu.edu>

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VIVO Documentation, Code, and Data

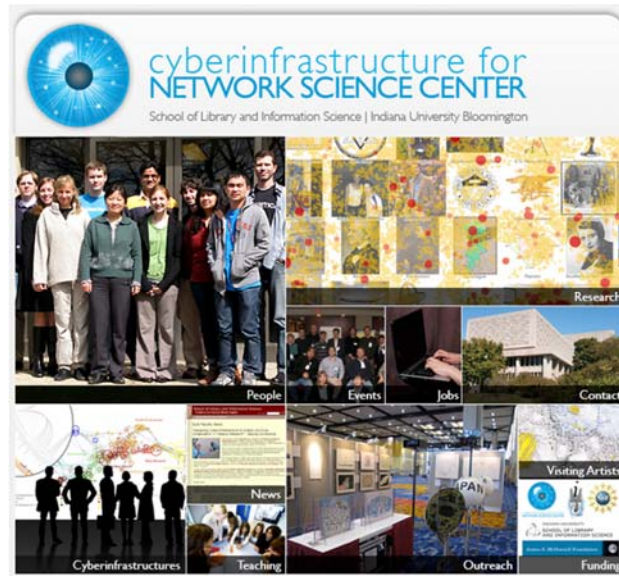
Documentation and Code:

- VIVO Web Site: <http://vivoweb.org>
- VIVO Support: <http://vivoweb.org/support>
- VIVO Ontology: <http://vivoweb.org/download#ontology>
- Sourceforge for source code: <http://sourceforge.net/projects/vivo>

Workshop materials and slides

- <http://wiki.cns.iu.edu/display/PRES/VIVO+Presentation>

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All papers, maps, tools, talks, press are linked from <http://cns.iu.edu>

CNS Facebook: <http://www.facebook.com/cnscenter>

Mapping Science Exhibit Facebook:

<http://www.facebook.com/mappingscience>