Sci2 Sample Workflows

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

1 File
Load ...
Load and Clean ISI File

Read Directory Hierarchy

Save ...

View ...
View with ...

Merge Node and Edge Files
Split Graph to Node and Edge Files

Preferences

Converter Graph

Exit

2 Data Preparation
Database

ISI
Merge Identical ISI People
Suggest ISI People Merges
Merge Document Sources
Create Document Source Merging Table
Match References to Papers

Extract Authors
Extract Documents
Extract Keywords
Extract Document Sources

Extract Authors by Year
Extract References by Year
Extract Original Author Keywords by Year
Extract New ISI Keywords by Year

Extract Authors by Year for Burst Detection
Extract Documents by Year for Burst Detection
Extract Original Author Keywords by Year for Burst Detection
Extract New ISI Keywords by Year for Burst Detection
Extract References by Year for Burst Detection

Extract Longitudinal Summary

Extract Co-Author Network

Extract Author Citation Network
Extract Document Citation Network (Core Only)
Extract Document Citation Network (Core and References)
Extract Document Source Citation Network (Core Only)
Extract Document Source Citation Network (Core and References)

Extract Document Co-Citation Network (Core Only)
Extract Document Co-Citation Network (Core and References)
Extract Document Source Co-Citation Network (Core Only)
Extract Document Source Co-Citation Network (Core and References)
Extract Author Co-Citation Network

Extract Author Bibliographic Coupling Network
Extract Document Bibliographic Coupling Network
Extract Document Source Bibliographic Coupling

NSF
Merge Identical NSF People

Extract Investigators
Extract Awards
Extract Organizations

Extract Co-PI Network

General
Create Merging Tables
Merge Entities

Custom Table Query
Custom Graph Query

Extract Raw Tables from Database

Text Files
Remove ISI Duplicate Records
Remove Rows with Multitudinous Fields

Extract Directed Network
Extract Bipartite Network
Extract Paper Citation Network
Extract Author Paper Network

Extract Co-Occurrence Network
Extract Word Co-Occurrence Network
Extract Co-Author Network
Extract Reference Co-Occurrence (Bibliographic Coupling) Network

Extract Document Co-Citation Network

Detect Duplicate Networks
Update Network by Merging Nodes

3 Preprocessing
General
Extract Top N% Records
Extract Top N Records
Aggregate Data

Temporal
Slice Table by Time

Geospatial
Extract ZIP Code

Topical
Lowercase, Tokensize, Stem, and Stopword Text

Networks
Extract Top Nodes
Extract Nodes Above or Below Value
Delete Isolates
Extract Top Edges
Extract Edges Above or Below Value
Remove Self Loops
Trim by Degree
MST-Pathfinder Network Scaling
Fast Pathfinder Network Scaling

Snowball Sampling (N nodes)
Node Sampling
Edge Sampling

Symmetrize
Dichotomize
Multipartite Joining

Merge 2 Networks

4 Analysis
Temporal
Burst Detection

Geospatial
Geocoder
Yahoo Geocoder
Congressional District Geocoder

Topical
Burst Detection

Networks
Network Analysis Toolkit (NAT)
Unweighted & Undirected
Node Degree
Degree Distribution

K-Nearest Neighbor (Java)
Watts-Strogatz Clustering Coefficient
Watts Strogatz Clustering Coefficient over K

Diameter
Average Shortest Path
Shortest Path Distribution
Node Betweenness Centrality

Weak Component Clustering
Global Connected Components

Extract K-Core
Annotate K-Coreness

HITS

Blondel Community Detection

Weighted & Undirected
Clustering Coefficient
Nearest Neighbor Degree

Strength vs Degree
Degree & Strength
Average Weight vs End-point Degree
Strength Distribution
Weight Distribution
Randomize Weights

Node Betweenness Centrality

Blondel Community Detection

HITS

Unweighted & Directed
Node Indegree
Node Outdegree
Indegree Distribution
Outdegree Distribution

K-Nearest Neighbor
Single Node In-Out Degree Correlations

Dyad Reciprocity
Arc Reciprocity
Adjacency Transitivity

Weak Component Clustering
Strong Component Clustering

Extract K-Core
Annotate K-Coreness

Node Betweenness Centrality

HITS
PageRank

Weighted & Directed
HITS
Weighted PageRank

5 Modeling
Networks
Random Graph
Watts-Strogatz Small World
Barabási-Albert Scale-Free

TARL (Topics, Aging and Recursive Linking)

6 Visualization
General
GnuPlot
Image Viewer

Temporal
Horizontal Bar Graph

Geospatial
Geo Map (Circle Annotations)
Geo Map (Colored-Region Annotations)

Topical
RefMapper

Science Map via 554 Fields
Science Map via Journals

Networks
GUESS

Radial Tree/Graph (prefuse alpha)
Radial Tree/Graph with Annotation (prefuse beta)
Tree View (prefuse beta)
Tree Map (prefuse beta)
Force Directed with Annotation (prefuse beta)
Fruchterman-Reingold with Annotation (prefuse beta)

DrL (VxOrd)
Specified (prefuse beta)

Circular Hierarchy

Micro
Individual Level Studies
NSF awards for one scholar are analyzed to understand temporal patterns and co-investigator network.

Meso
Institution Level Studies
ISI publication data from four network science researchers are studied to understand temporal patterns and co-author networks.

Macro
Global Level Studies
USPTO patents mentioning “influenza” downloaded from the Scholarly Database is geolocated by country of patent holder. Number of patents and patent citations are shown.

Output formats
- JPEG (*.jpg)
- PDF (*.pdf)
- PostScript (*.ps)

Sci2

A tool for science of science research & practice • http://sci2.cns.iu.edu

SCIENCE OF SCIENCE (SCI2) TOOL

Project Investigators: Katy Börner and Kevin W. Boyack (SciTech Strategies Inc.)
Programmers: Joseph R. Biberstine, Russell J. Duhon, Chin Hua Kong, Micah W. Linnemeier, Patrick A. Phillips, Thomas G. Smith, Chintan Tank
Users, Testers & Tutorial Writers: Scott Weingart, Hanning Guo, Katy Börner

Cyberinfrastructure for Network Science Center
School of Library and Information Science
Indiana University, Bloomington, IN
http://cns.iu.edu

Introduction

The Science of Science (Sci2) Tool is a modular toolset designed specifically for the study of science. It supports the temporal, geospatial, topical, and network analysis and visualization of datasets at the micro (individual), meso (local), and macro (global) levels.The web site at http://sci2.cns.iu.edu supports free registration, an online tutorial with workflow examples, and personalized support via the Ask an Expert feature.

Functionality

- Read datasets in many different formats including CSV, ISI, NSF
- Perform extensive data preprocessing: data cleaning, deduplication, filtering, network extraction
- Use advanced analysis algorithms
- Visualizations to interactively explore, understand, and communicate results. Many visualizations use an easy to read reference system, automatic legend design, and 'fine print' text on who created the visualization, when, and using what data source.
- Audit trail documentation to automatically record workflows
- New algorithm plugins can be easily installed by anyone

As of October 2011, more than 150 different preprocessing, analysis, modeling, and visualization algorithms are available, see listing on back.

System Architecture

The Sci2 Tool is built on the Cyberinfrastructure Shell (CIShell) (CIShell.org), an open source software framework for the easy integration and utilization of datasets, algorithms, tools, and computing resources. CIShell is based on the Equinox implementation of the OSGi R4 Specification (OSGi.org).

Four other tools:

- Network Workbench (http://nwb.cns.iu.edu)
- DynaNets (http://www.dynanets.org)
- TEXTrend (http://www.textrend.org)
- Epidemiology Tool (EpiC) (http://epic.cns.iu.edu)

are CIShell powered and plugins from these efforts/tools can be plug-and-played in the Sci2 Tool. Simply copy a *.jar file from the /plugin directory of one tool into the /plugin directory of another tool and the algorithm or tool becomes available in the menu system. As the functionality of OSGi/CIShell-based software frameworks improves and the number and diversity of dataset and algorithm plugins increases, the capabilities of custom tools will expand.

Documentation & Tutorials

The tool comes with extensive documentation. A comprehensive online user manual shows how to use the tool for science of science research and science policy and there exist 12 two-hour tutorials originally designed for the National Institutes of Health.

Scott Weingart, Hanning Guo, Katy Börner, Kevin W. Boyack, Micah W. Linnemeier, Russell J. Duhon, Patrick A. Phillips, Chintan Tank, Chin Hua Kong, Thomas Smith, and Joseph Biberstine (2011) Science of Science (Sci2) Tool User Manual. Cyberinfrastructure for Network Science Center, School of Library and Information Science, Indiana University, Bloomington.

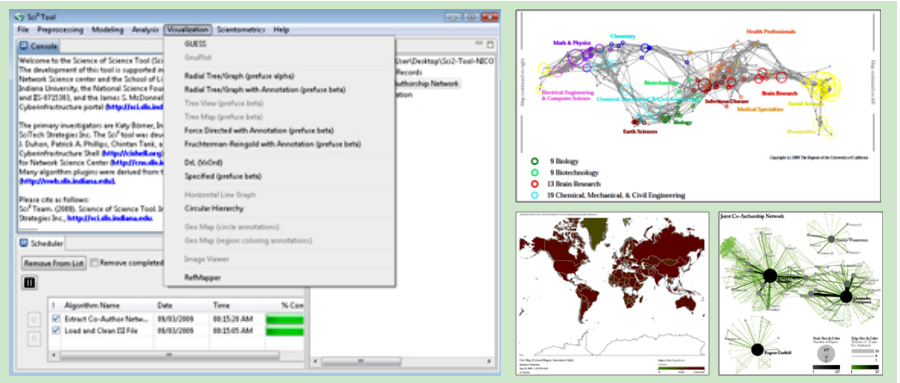
Katy Börner (2011) Sci2: A Tool of Science of Science Research and Practice. 13th International Society for Scientometrics and Informetrics (ISSI) Conference, Durban, South Africa.

Katy Börner and Chin Hua Kong (2011) Social Network Analysis Workshop CIShell Powered Tools: Network Workbench (NWB) & Science of Science (Sci2) Tool. Second Annual International Science of Team Science Conference, Chicago, IL.

Katy Börner and Angela Zoss (2010) Plug-and-Play Macroscopes Tutorial. International Conference on Social Computing, Behavioral Modeling and Prediction, Bethesda, MD.

Agency Adoption

The tool is actively used in peer-reviewed research and agencies including the National Science Foundation, the National Institutes of Health, and the US Department of Agriculture.



Please cite as

Sci2 Team. (2009). Science of Science (Sci2) Tool. Indiana University and SciTech Strategies, http://sci2.cns.iu.edu.

Acknowledgments

This work is supported in part by the Cyberinfrastructure for Network Science Center and the School of Library and Information Science at Indiana University, the National Science Foundation under Grant No. SBE-0738111 and IIS-0513650, and the James S. McDonnell Foundation.

INDIANA UNIVERSITY SCHOOL OF LIBRARY AND INFORMATION SCIENCE | cyberinfrastructure for NETWORK SCIENCE CENTER cns.iu.edu | James S. McDonnell Foundation | USDA | NSF | NATIONAL INSTITUTES OF HEALTH