Temporal Analysis using Sci2

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Please download Sci2 at http://sci2.cns.iu.edu
See documentation at http://wiki.cns.iu.edu/display/SCI2TUTORIAL

Cyberinfrastructure for Network Science Center
School of Library and Information Science
Indiana University Bloomington
LI001 Wells Library
Monday October 15, 2012 – 6:00pm-7:00pm

Overview

- Introduction to Temporal Analysis
  - Burst Detection
  - Slice Time by Table
  - Temporal Bar Graph
- Burst Detection Workflow
- Evolving Co-Authorship Network Workflow

Introduction to Temporal Analysis

- Science evolves over time
- Temporal analysis seeks to study this evolution by examining patterns, trends, seasonality, outliers, and bursts of activity
- Time series data can be thought of as either discrete or continuous
- Many scholarly datasets can be understood as a discrete time series with events or observations (publications etc.) that happen at regularly spaced intervals (journal publication cycles etc.)

Introduction to Temporal Analysis

- Demonstrate and discuss the utility of Kleinberg's burst detection algorithm as implemented in Sci2
- Design evolving network visualizations using Sci2

Temporal Analysis: Burst Detection

- Sci2 uses an implementation of Kleinberg's burst detection algorithm (Kleinberg 2002) to study bursts in usage of words in scholarly data
- Algorithm **does not** calculate the frequency of individual words
- Algorithm uses probabilistic model to determine the rate at which use of a word increases or decreases, identifying bursts in usage of a word

Kleinberg, J. (2002). Bursty and Hierarchical Structure in Streams. Proceedings from the Eighth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, Edmonton, Canada: ACM.

Temporal Analysis: Slice Table by Time

- Divides a table into new tables based on date/time column
- The column for date should have a single value for each row of data
- The output of this algorithm is separate tables so longitudinal analysis will require working with separate files, networks can be extracted from each of these tables to show evolution of a network over time
- The Slice Table by Time algorithm uses the Joda Time library extensively

Temporal Analysis: Temporal Bar Graph

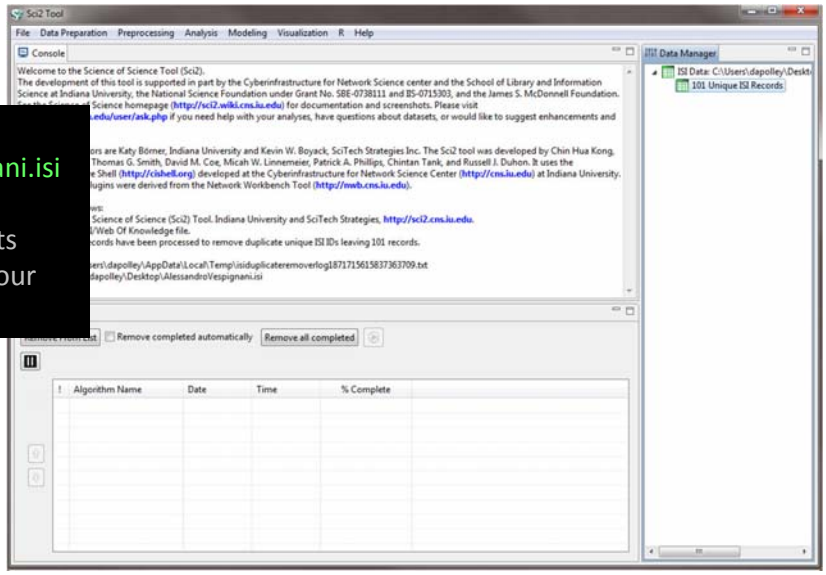
- Visualizes numeric data over time
- It accepts a CSV file as input, including NSF grant data
- Start and end dates for each record are necessary to use the temporal bar graph visualization algorithm
- The output of the visualization consists of labeled horizontal bars that correspond to records in the original dataset.

Temporal Analysis: Burst Detection

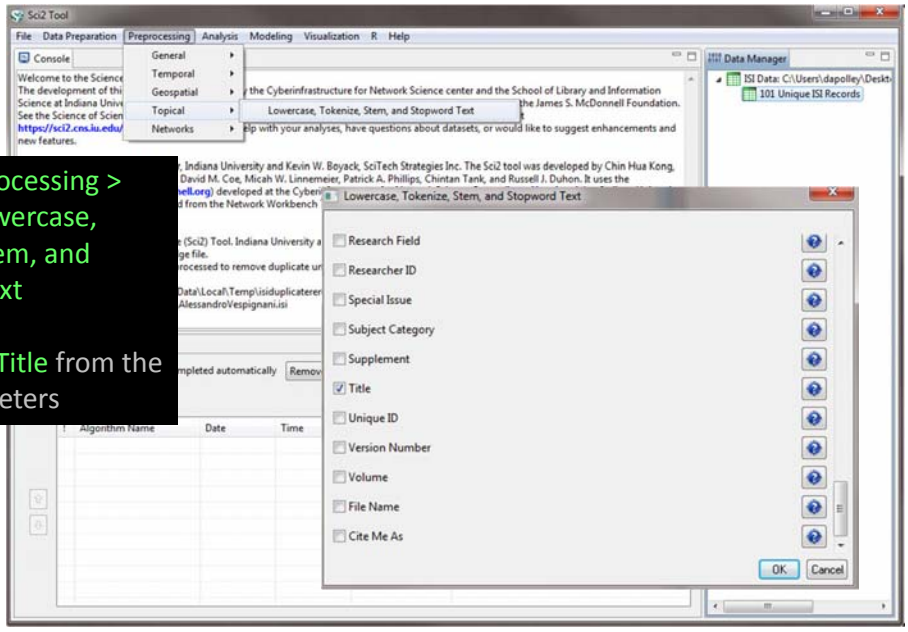
For this workflow we will be using the AlessandroVespignani.isi file, which is available from 2.5 Sample Datasets

File > Load > AlessandroVespignani.isi

Load this file from its saved location on your computer



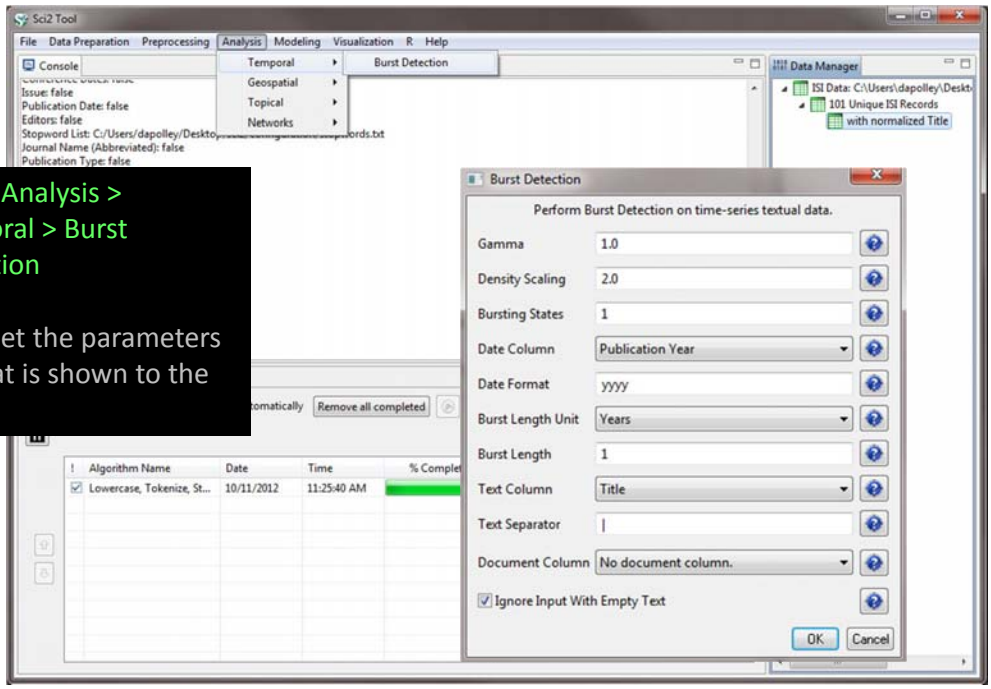
Temporal Analysis: Burst Detection



Select Preprocessing > Topical > Lowercase, Tokenize, Stem, and Stopword Text

Then select Title from the input parameters

Temporal Analysis: Burst Detection



Select Analysis > Temporal > Burst Detection

Then set the parameters to what is shown to the right

Temporal Analysis: Burst Detection

Gamma – the higher this value, the smaller the list of generated bursts**.**

Density Scaling – determines how much "more bursty" each level is beyond the previous one.

Bursting states – determines how many bursting states there will be, beyond the non-bursting states.

Date Column – name of the column in the original data with date/time when events/topics happen.

Date Format – specifies how the date column will be interpreted.

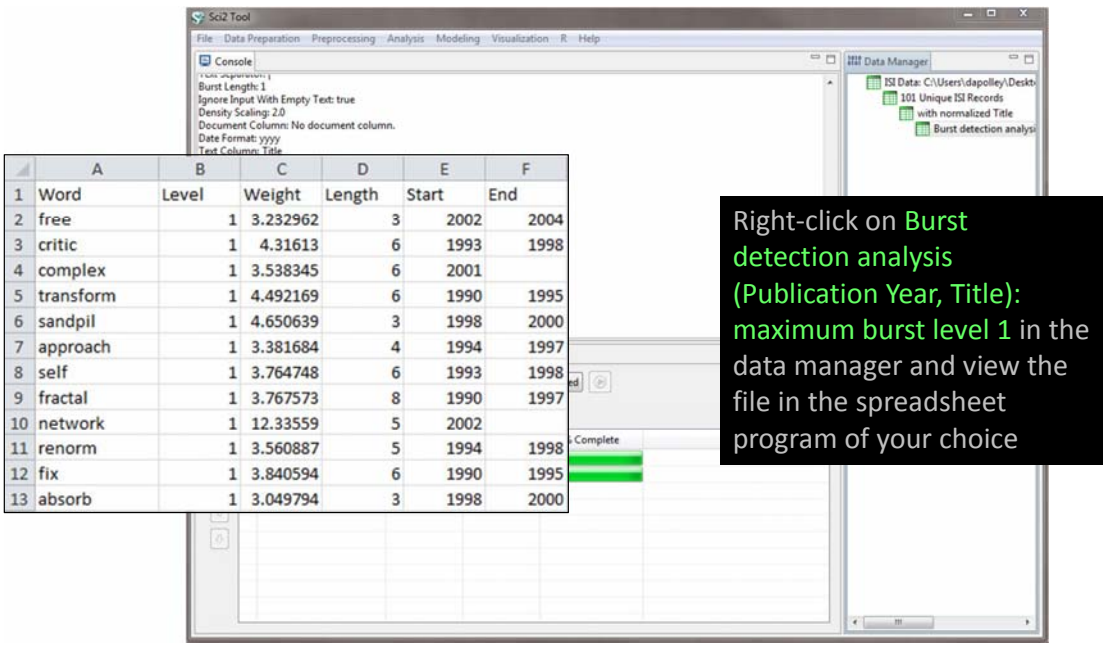
Burst Length Unit – specifies how to divide the date range into burstable units.

Burst Length – specifies the number of burstable units per burstable period.

Text Column – the name of the column with values (delimiter and tokens) to be computed for bursting results.

Text Separator – delimits the tokens in the text column.

Temporal Analysis: Burst Detection



	A	B	C	D	E	F
1	Word	Level	Weight	Length	Start	End
2	free	1	3.232962	3	2002	2004
3	critic	1	4.31613	6	1993	1998
4	complex	1	3.538345	6	2001	
5	transform	1	4.492169	6	1990	1995
6	sandpil	1	4.650639	3	1998	2000
7	approach	1	3.381684	4	1994	1997
8	self	1	3.764748	6	1993	1998
9	fractal	1	3.767573	8	1990	1997
10	network	1	12.33559	5	2002	
11	renorm	1	3.560887	5	1994	1998
12	fix	1	3.840594	6	1990	1995
13	absorb	1	3.049794	3	1998	2000

Right-click on Burst detection analysis (Publication Year, Title): maximum burst level 1 in the data manager and view the file in the spreadsheet program of your choice

Temporal Analysis: Burst Detection

Add the End date of 2006 to those records missing and End date

	A	B	C	D	E	F
1	Word	Level	Weight	Length	Start	End
2	free	1	3.232962	3	2002	2004
3	critic	1	4.31613	6	1993	1998
4	complex	1	3.538345	6	2001	
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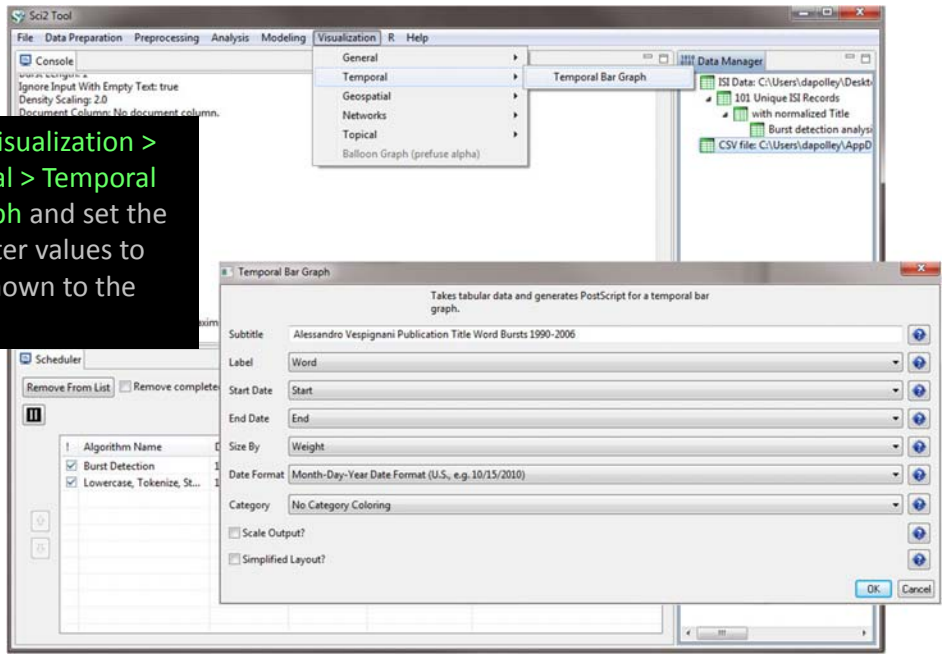
12	fix	1	3.840594	6	1990	1995
13	absorb	1	3.049794	3	1998	2000

Save the file as a .CSV file and load it back into Sci2, selecting the Standard CSV format

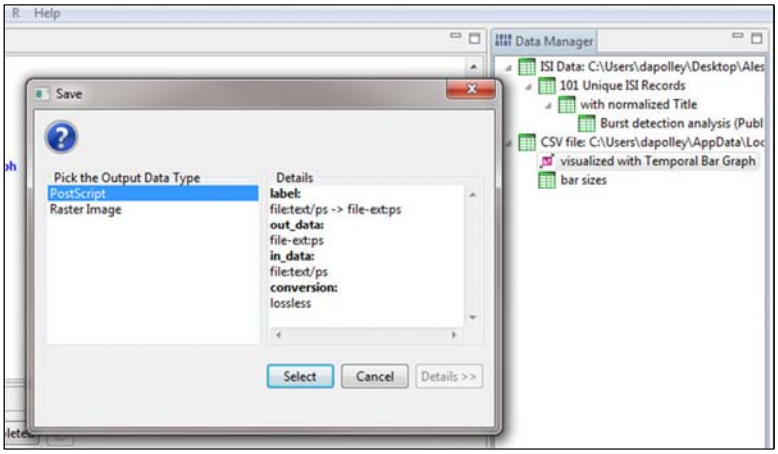
Temporal Analysis: Burst Detection

Select Visualization > Temporal > Temporal Bar Graph and set the parameter values to those shown to the right



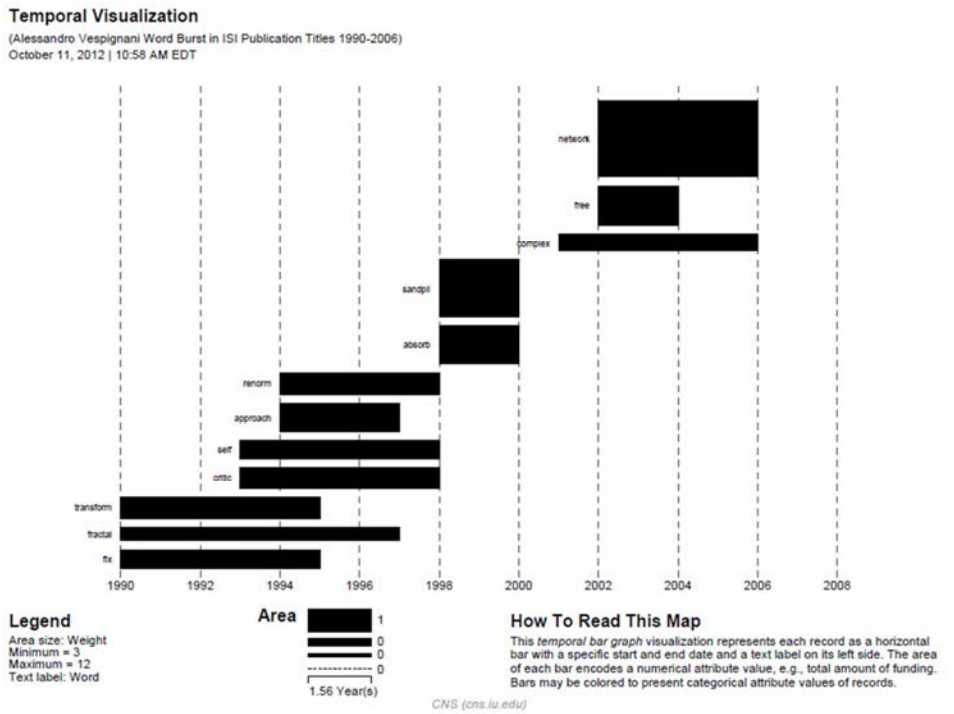
Temporal Analysis: Burst Detection

Right-click on the visualized with Temporal Bar Graph file in the Data Manager and save the PostScript file to your desired location



If you do not have a program to convert PostScript files look here.

Temporal Analysis: Burst Detection

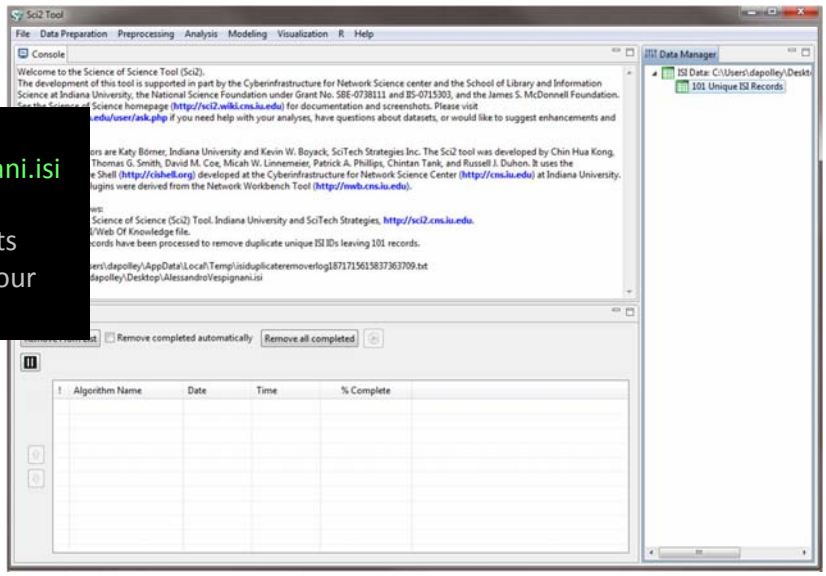


Temporal Analysis: Evolving Co-Authorship Network

For this analysis we will be studying the evolution of Alessandro Vespignani's co-authorship network over time. We will see his network of collaborators grow from 1990 to 2006, giving us a sense of how his scholarly output has grown.

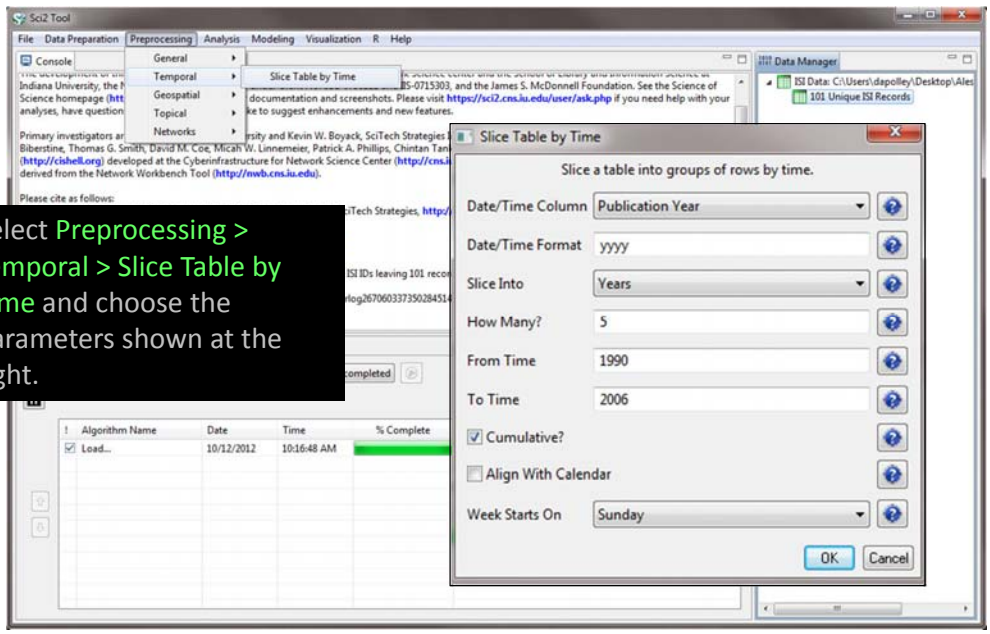
File > Load > AlessandroVespignani.isi

Load this file from its saved location on your computer

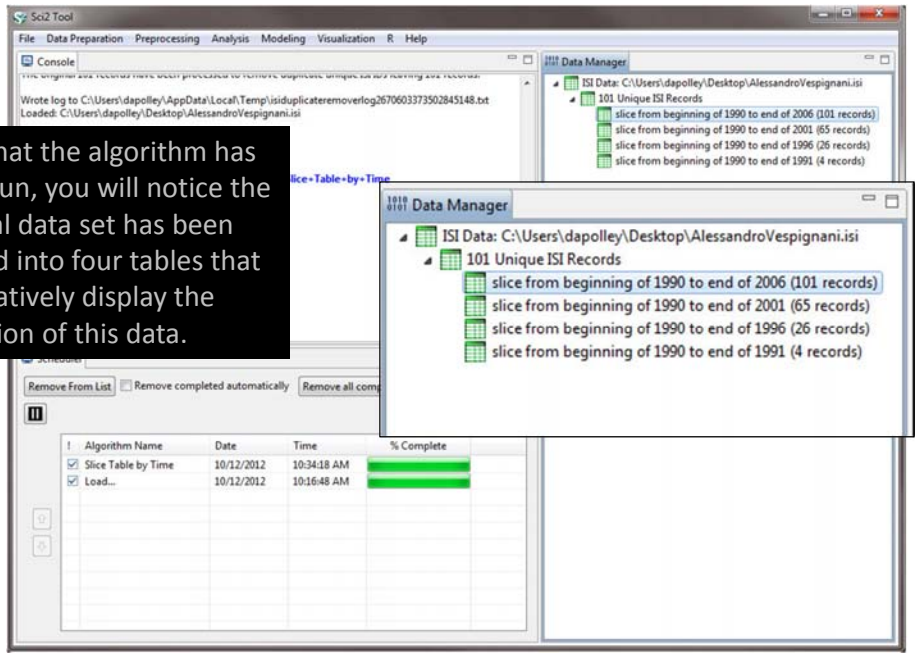


Temporal Analysis: Evolving Co-Authorship Network

Select Preprocessing > Temporal > Slice Table by Time and choose the parameters shown at the right.

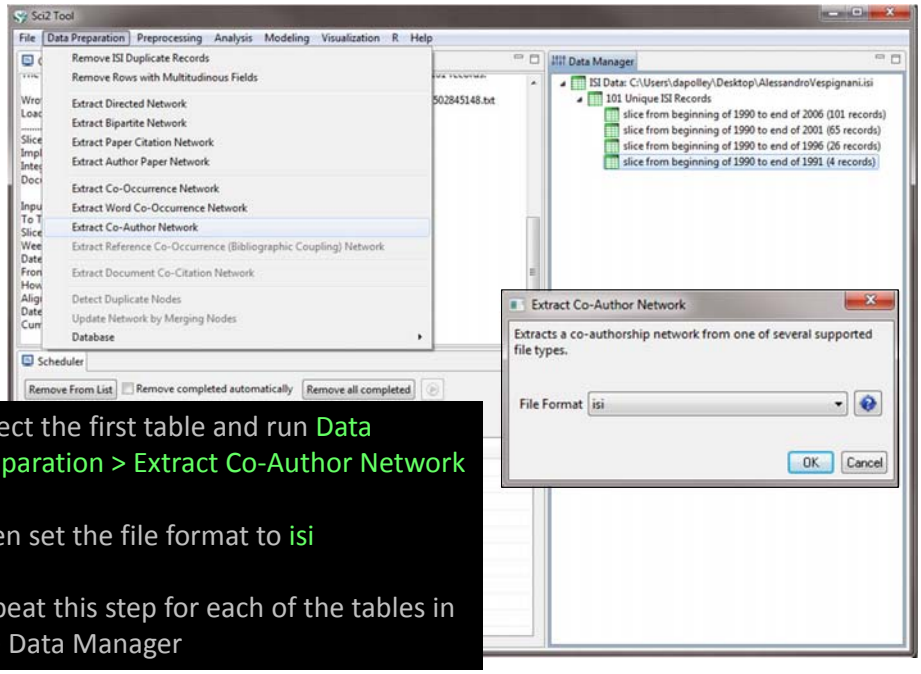


Temporal Analysis: Evolving Co-Authorship Network



Now that the algorithm has been run, you will notice the original data set has been divided into four tables that cumulatively display the evolution of this data.

Temporal Analysis: Evolving Co-Authorship Network

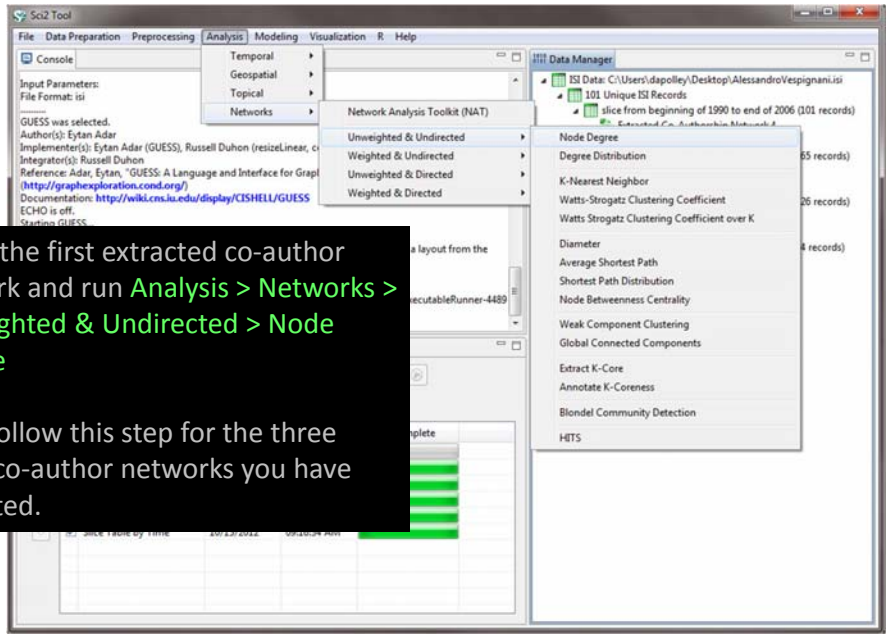


Select the first table and run Data Preparation > Extract Co-Author Network

Then set the file format to isi

Repeat this step for each of the tables in the Data Manager

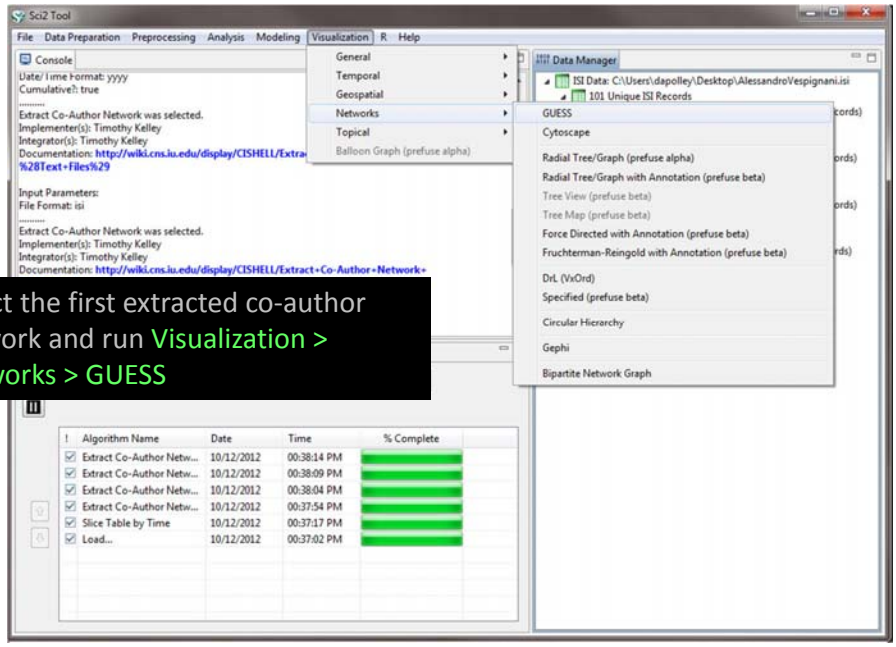
Temporal Analysis: Evolving Co-Authorship Network



Select the first extracted co-author network and run Analysis > Networks > Unweighted & Undirected > Node Degree

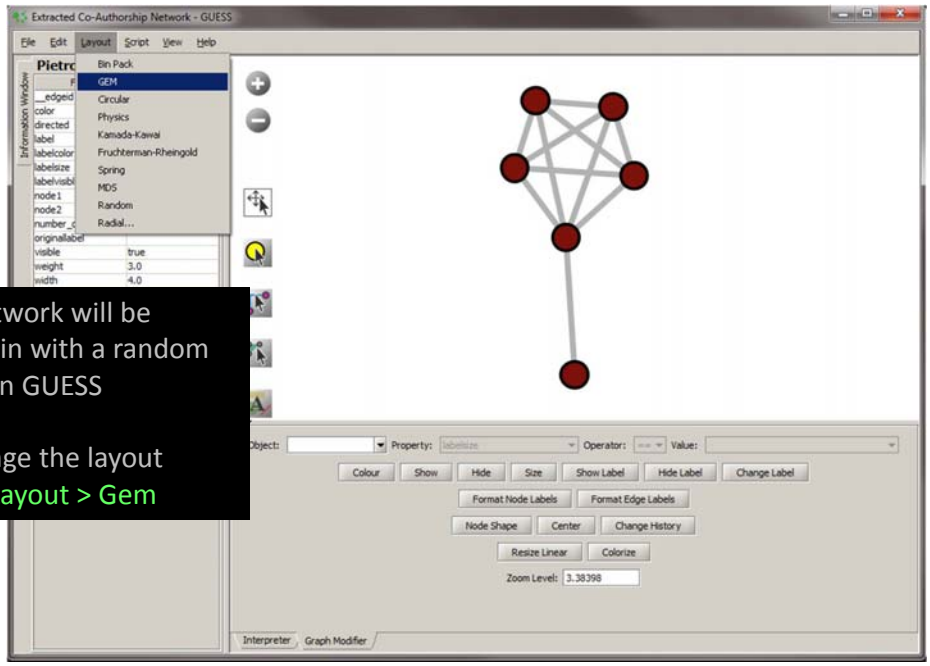
Then follow this step for the three other co-author networks you have extracted.

Temporal Analysis: Evolving Co-Authorship Network



Select the first extracted co-author network and run Visualization > Networks > GUESS

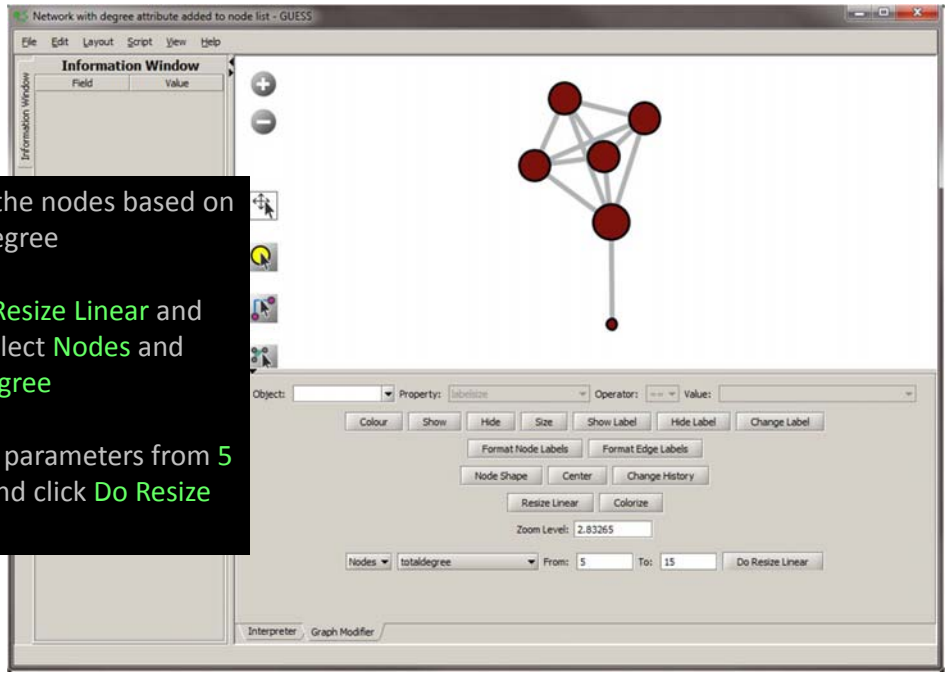
Temporal Analysis: Evolving Co-Authorship Network



The network will be loaded in with a random layout in GUESS

To change the layout select Layout > Gem

Temporal Analysis: Evolving Co-Authorship Network

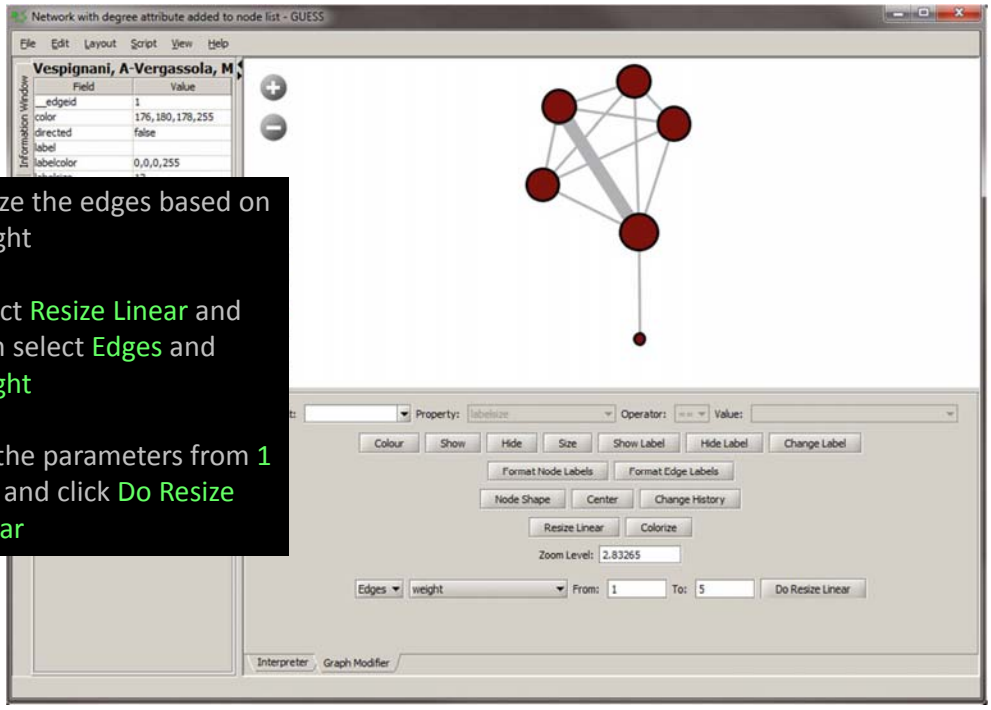


Resize the nodes based on total degree

Select Resize Linear and then select Nodes and totaldegree

Set the parameters from 5 to 15 and click Do Resize Linear

Temporal Analysis: Evolving Co-Authorship Network

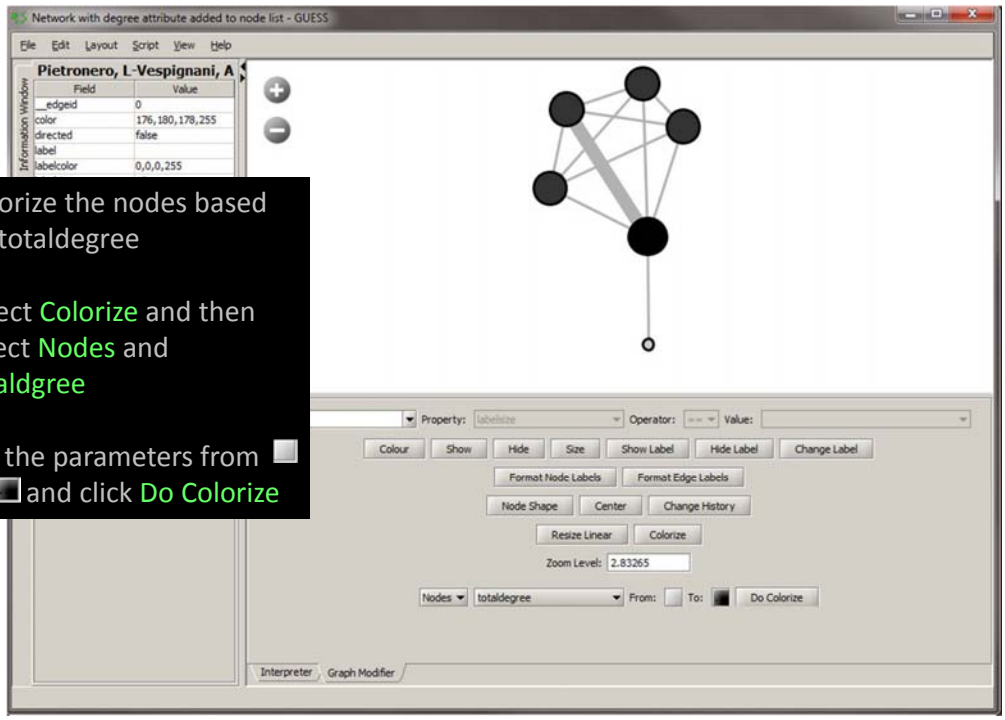


Resize the edges based on weight

Select Resize Linear and then select Edges and weight

Set the parameters from 1 to 5 and click Do Resize Linear

Temporal Analysis: Evolving Co-Authorship Network

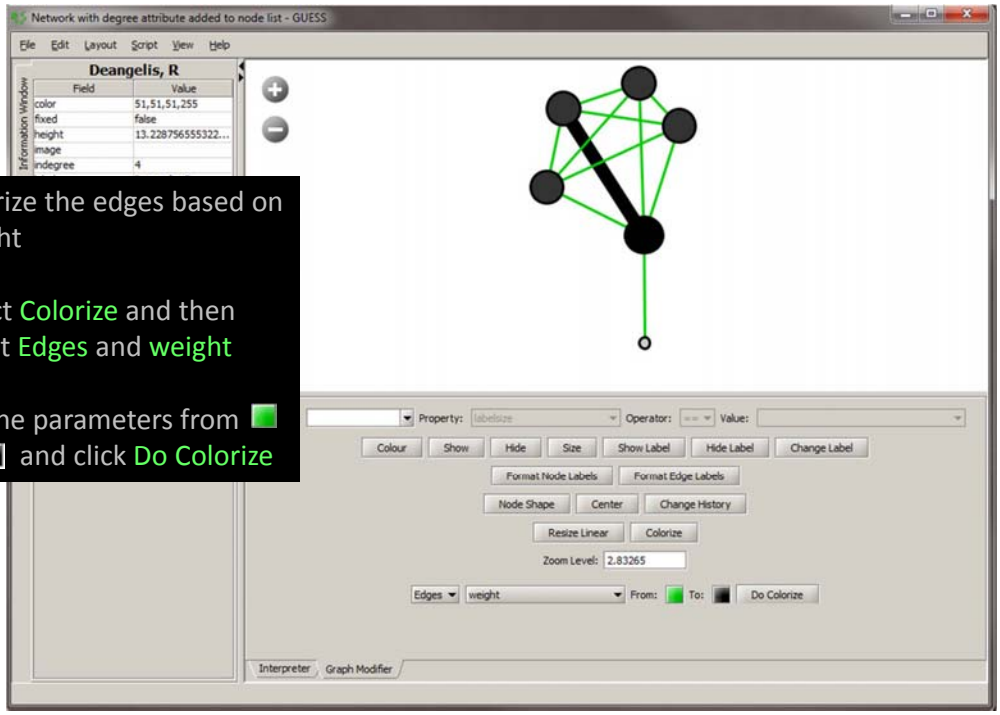


Colorize the nodes based on totaldegree

Select Colorize and then select Nodes and totaldgree

Set the parameters from ⬜ to ⬛ and click Do Colorize

Temporal Analysis: Evolving Co-Authorship Network

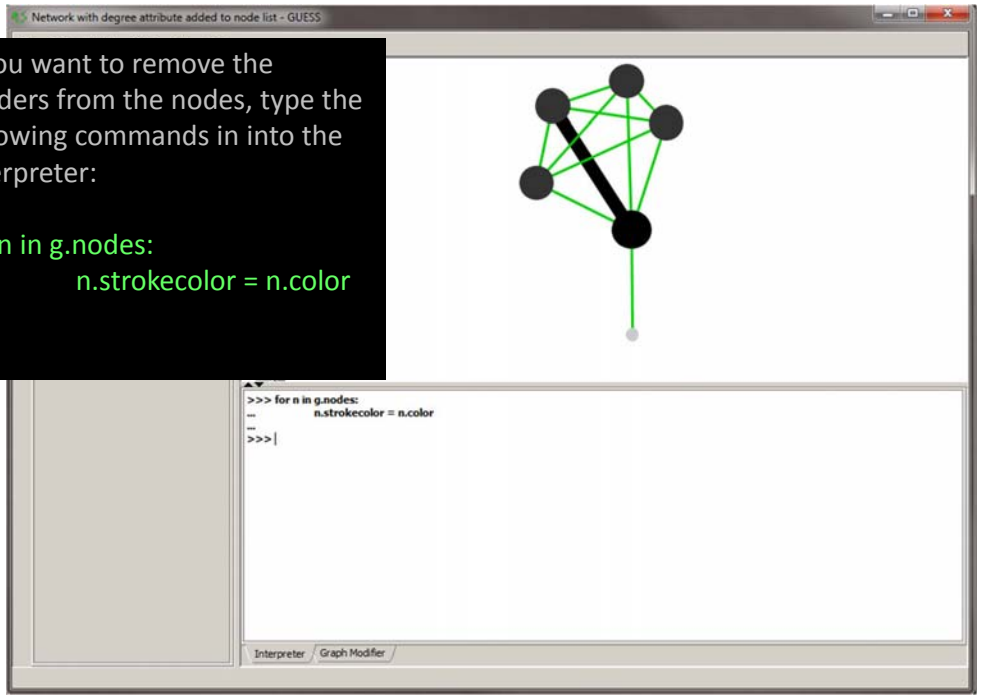


Colorize the edges based on weight

Select Colorize and then select Edges and weight

Set the parameters from ■ to ■ and click Do Colorize

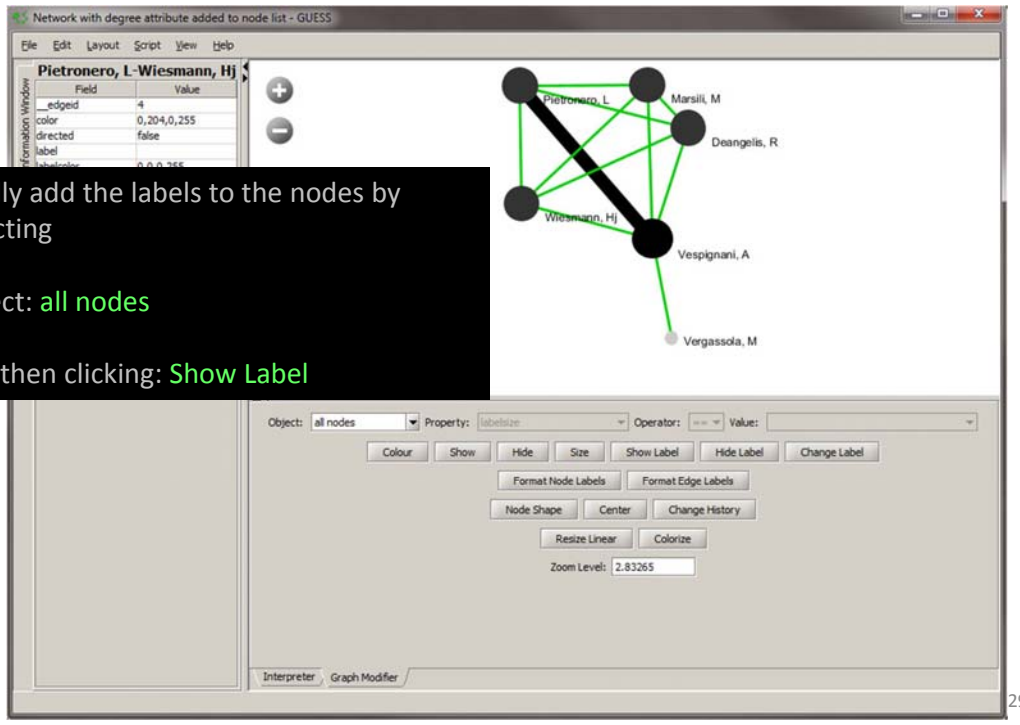
Temporal Analysis: Evolving Co-Authorship Network



If you want to remove the borders from the nodes, type the following commands in into the interpreter:

```
for n in g.nodes:
        n.strokecolor = n.color
```

Temporal Analysis: Evolving Co-Authorship Network

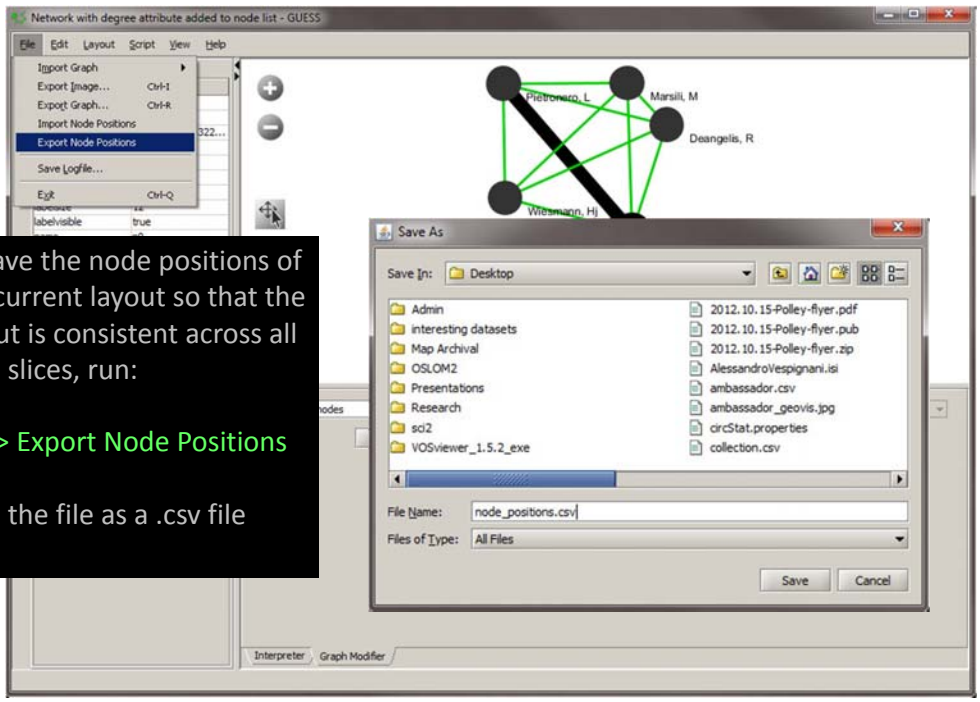


Finally add the labels to the nodes by selecting

Object: all nodes

And then clicking: Show Label

Temporal Analysis: Evolving Co-Authorship Network

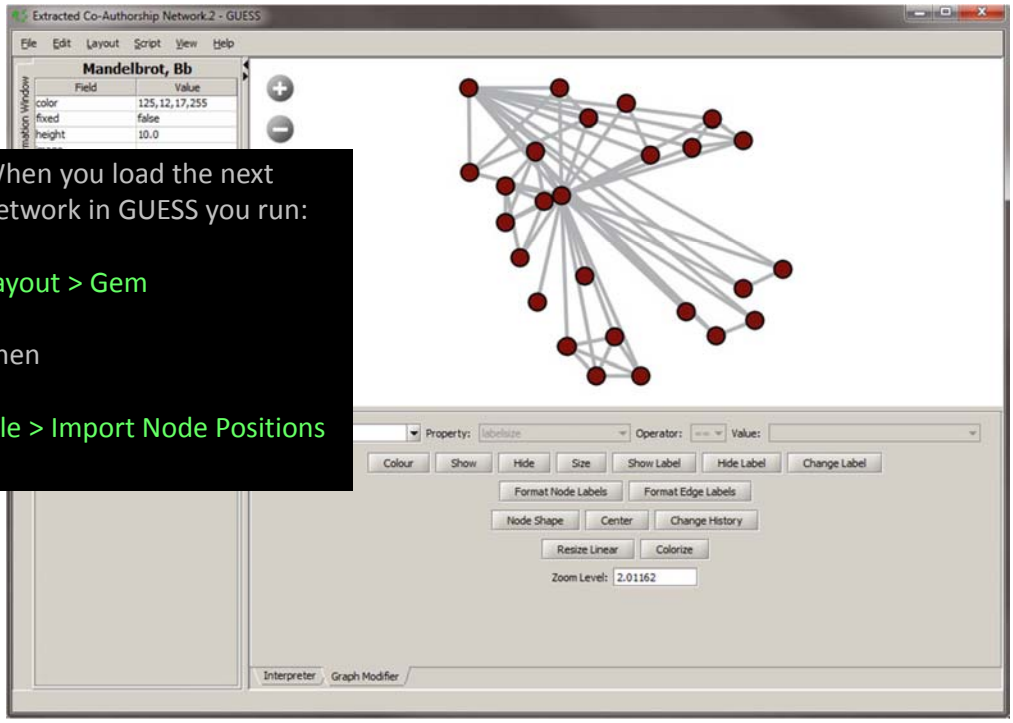


To save the node positions of the current layout so that the layout is consistent across all time slices, run:

File > Export Node Positions

Save the file as a .csv file

Temporal Analysis: Evolving Co-Authorship Network



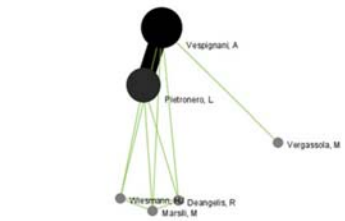
When you load the next network in GUESS you run:

Layout > Gem

Then

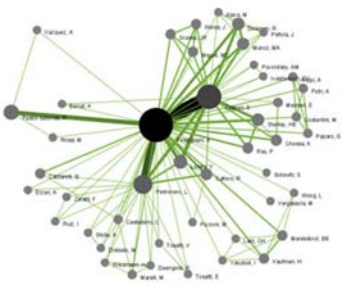
File > Import Node Positions

Temporal Analysis: Evolving Co-Authorship Network



1990-1991

1990-1996



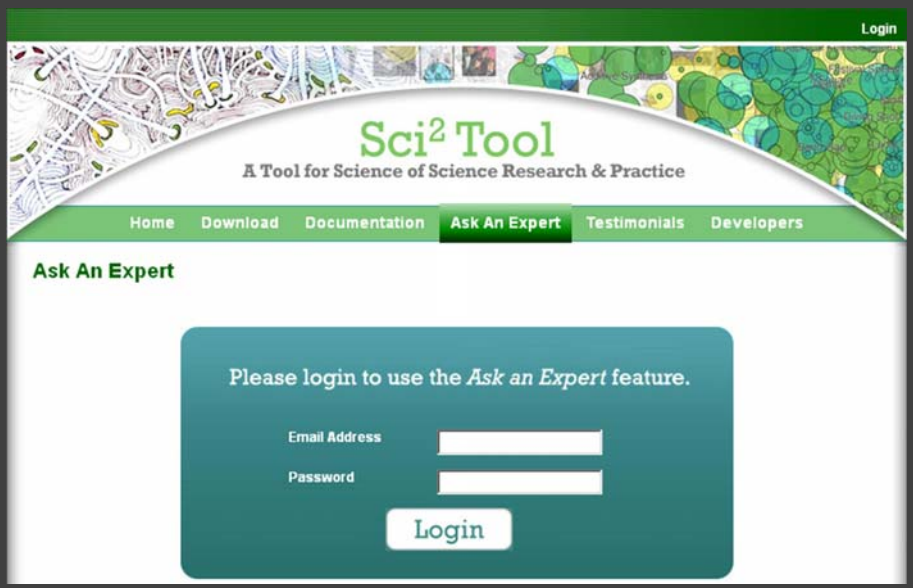
1990-2001

1990-2006

Next session we will each download our own data to use for topical analysis. Please register for the Scholarly Database before the next session on November 19, 2012.

Register for the Scholarly Database at http://sdb.cns.iu.edu/

Questions?



If you have questions feel free to email me dapolley[at]indiana[dot]edu