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TEXT MINING, TERM MINING, AND VISUALIZATION

IMPROVING THE IMPACT OF SCHOLARLY PUBLISHING

MONDAY 16 APRIL 2012
NICE, FRANCE

What we will cover today

- Term and Text Mining
- The basics of visualization
- Case studies
- Using subject terms as metrics
- Applications
- Visualizing the results

Definitions

- *Term Mining - a systematic comparison processing algorithmic method to find patterns in text*
- *Text Mining – using controlled vocabulary tags in text to find patterns and directions*
- Term & text mining
  - Many similarities
  - Can be complimentary; not mutually exclusive

Term mining

- Precise
- Meaningful semantic relationships; contextual
- Replicable; repeatable; consistent
- Vetted; controlled
- Based on a controlled vocabulary
- Trends; gaps; relationship analysis; visualizations
- Less data processing load

Text mining

- Algorithmic; formulaic
- Neural nets, statistical, latent semantic, co - occurrence
- Serendipitous relationships
- Sentiment; hot topics; trends
- False drops; noise;
- Misleading semantic relationships
- Heavy processing load

Why take a visual look?

- Humans can process information 17 times faster in visual presentations
- Now data can be analyzed, manipulated and presented as visual displays.
- To see the trends effectively we need to make the data into rich graph-able formats

Visualization of data

- Needs
  - Measurement
  - Metrics
  - Numbers
- Shows
  - Adjacency
  - Relationships
  - Trends
  - Co – occurrence
  - Conceptual distance
- Is richer with
  - Linking
  - Semantic enrichment
  - Classification
- Supports
  - Forecasting
  - Trend analysis
  - Segmentation
  - Distribution

Man’s attention to visual display to convey knowledge is ancient

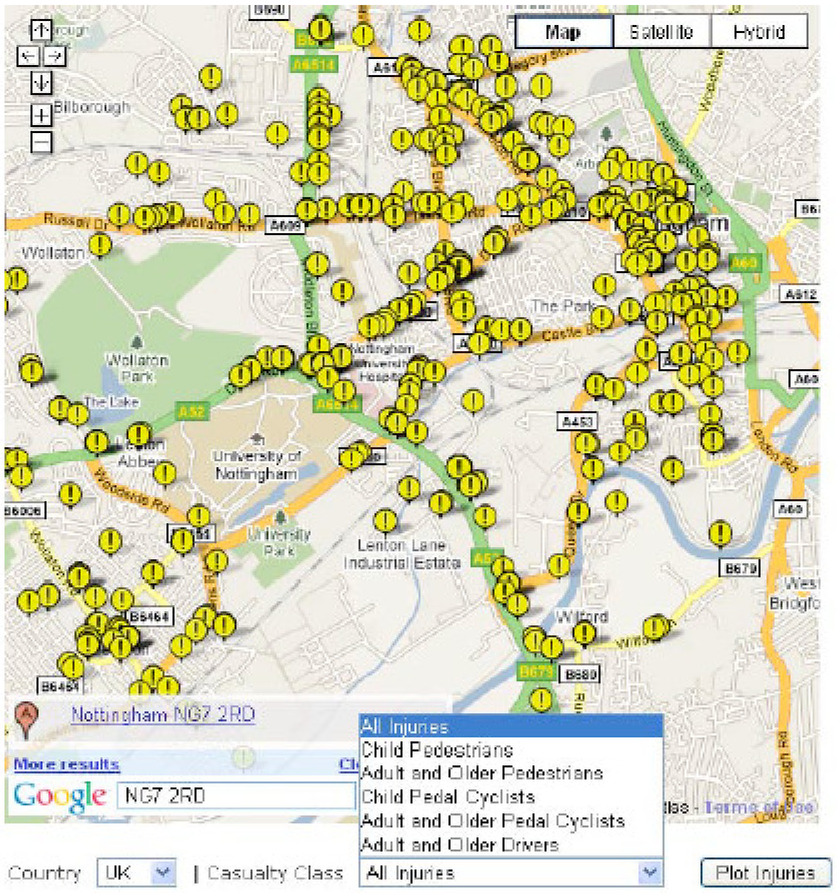
The art in maps is a longstanding tradition

NOVA ORBIS TABULA, AD USUM SERENISSIMI BURGUNDIÆ DUCIS. Authore H. Jaillot. Parisiis 1694
MAPPE MONDE
DU GLOBE

Credits: Raremaps

LEO BELGICVS

Super imposing data is now common
A mash up example



Country: UK | Casualty Class: All Injuries

Figure 1: *Traffic Injury Map showing incidents in the Nottingham area*

Traffic Injury Map

UK Data Archive

US National Highway Safety Administration

Google Maps Base

Accident categories include

children

automobile

bicycle

etc.

Data

time

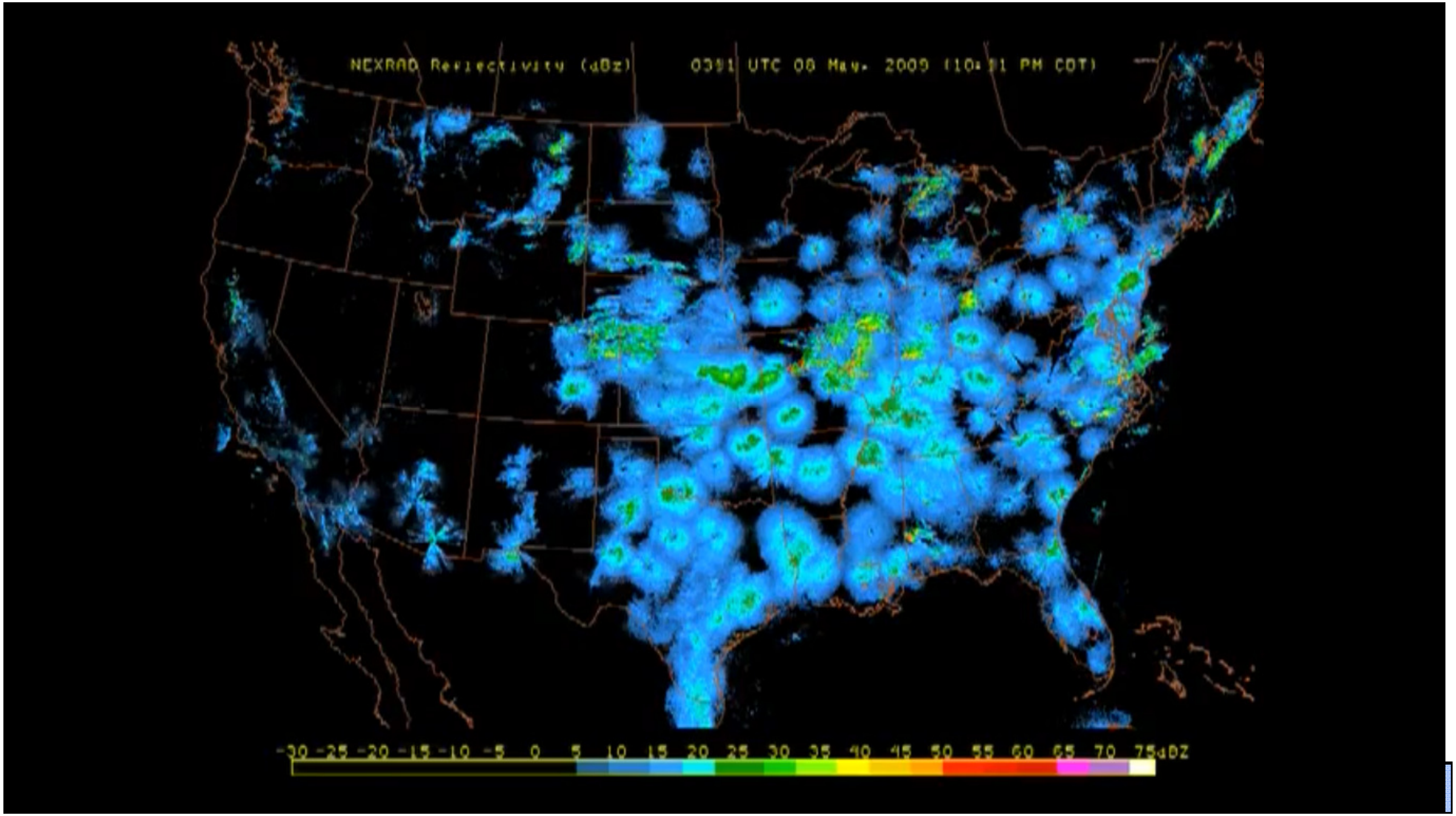
place

type

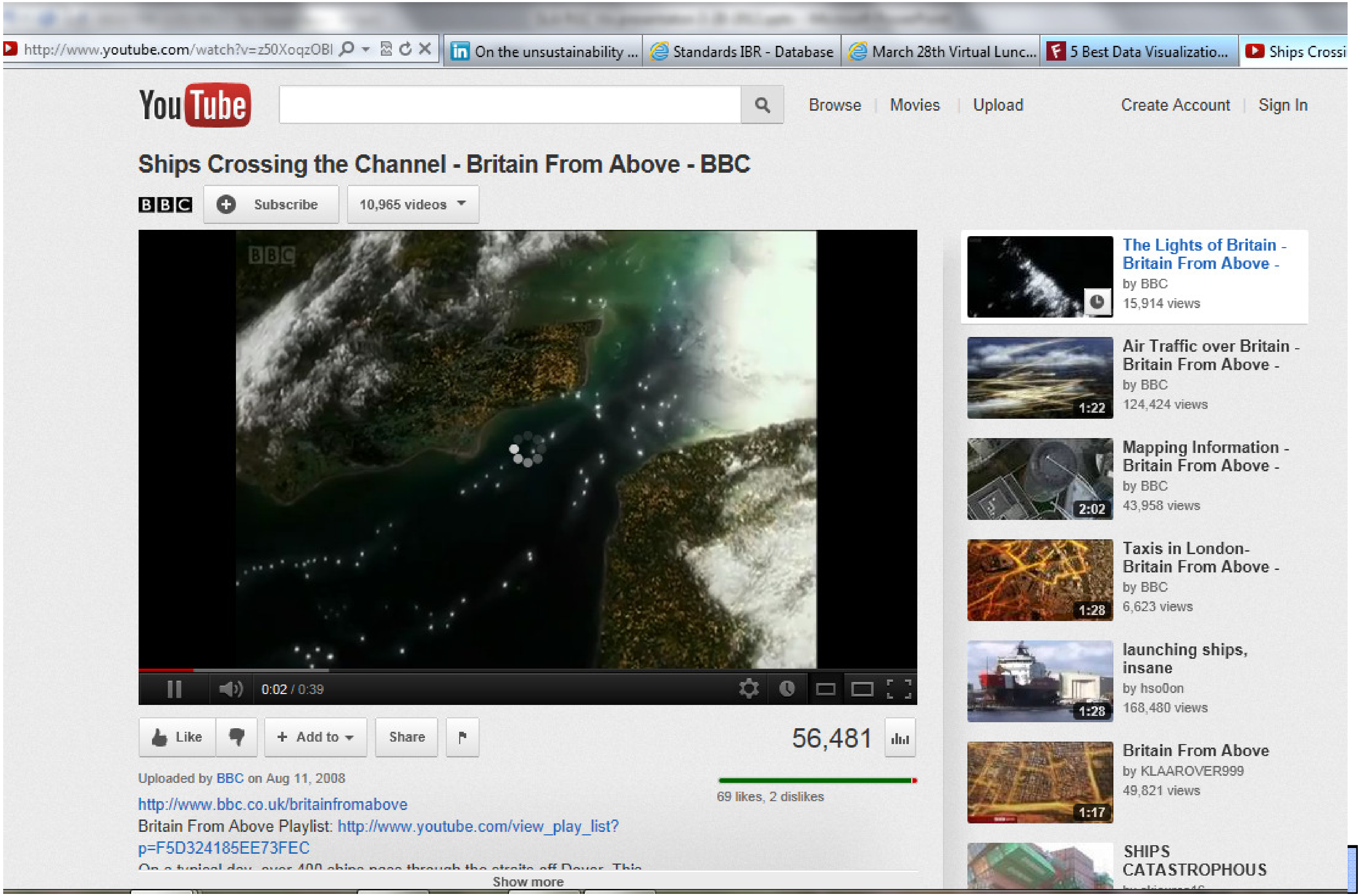
Source:
JISC TechWatch: Data Mash-ups September 2010

Mash up of bird flight migrations and weather patterns

http://www.youtube.com/watch?v=uPff1t4pXiI&feature=youtu.be


NEXRAD Reflectivity (dBz)
0331 UTC 08 May. 2009 (10:31 PM CDT)
-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 dBZ

http://www.youtube.com/watch?v=nokQBjk1s_8&feature=player_embedded



Ships Crossing the Channel - Britain From Above - BBC

Uploaded by BBC on Aug 11, 2008

http://www.bbc.co.uk/britainfromabove

Britain From Above Playlist: http://www.youtube.com/view_play_list?p=F5D324185EE73FEC

On a typical day, over 400 ships pass through the straits off Dover. This

69 likes, 2 dislikes

The Lights of Britain - Britain From Above -
by BBC
15,914 views

Air Traffic over Britain - Britain From Above -
by BBC
124,424 views
1:22

Mapping Information - Britain From Above -
by BBC
43,958 views
2:02

Taxis in London- Britain From Above -
by BBC
6,623 views
1:28

launching ships, insane
by hso0on
168,480 views
1:28

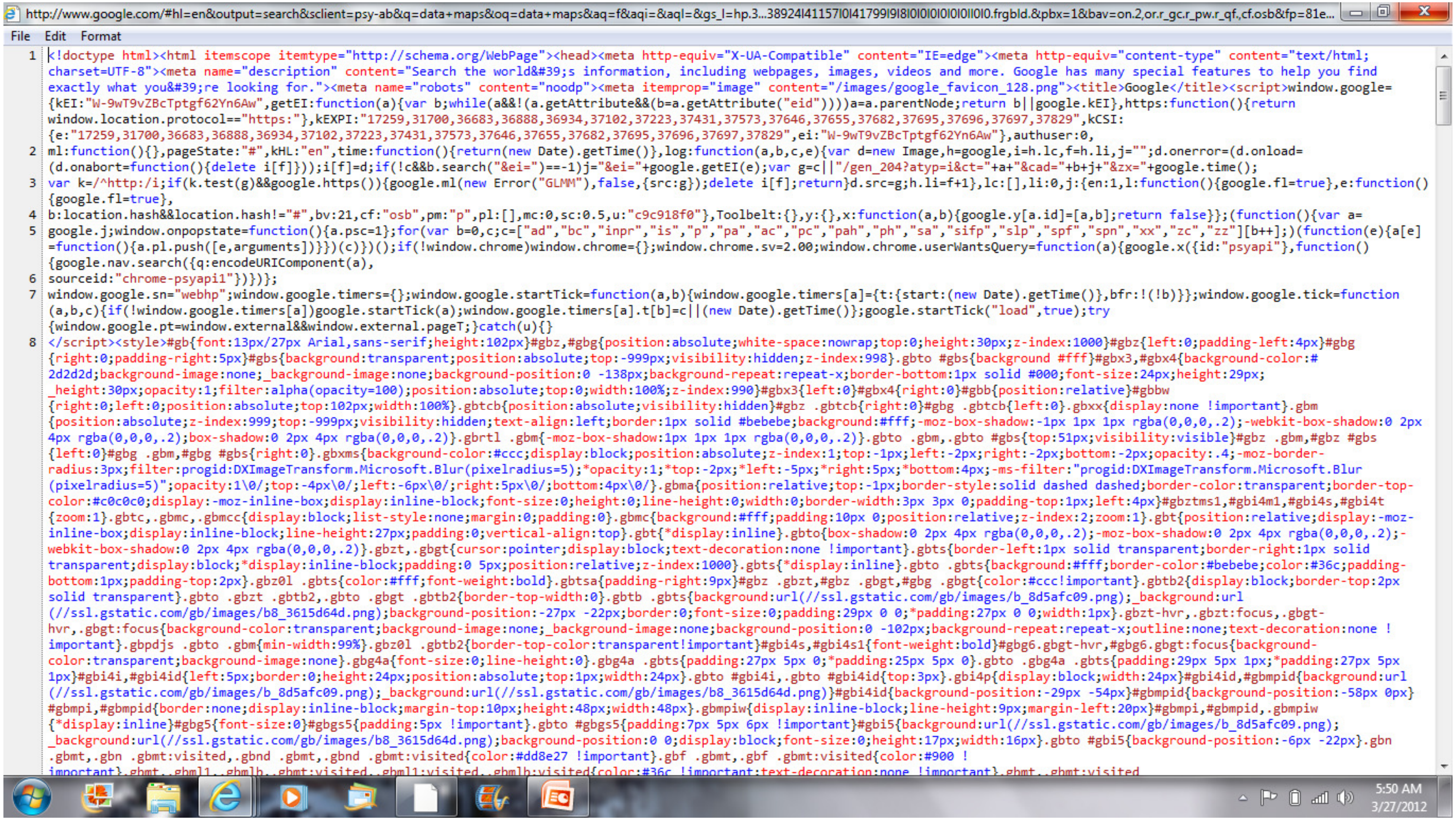
Britain From Above
by KLAAROVER999
49,821 views
1:17

SHIPS CATASTROPHOUS

How does it work?

- Develop controlled vocabulary
  - Prefer one with hierarchy
- Apply to full text
  - Or to the “heads”
- Decide on data points to convey information
- Divide the XML into graphable sections

Start with data – like this XML file



http://www.google.com/#hl=en&output=search&sclient=psy-ab&q=data+maps&oq=data+maps&aq=f&aqi=&aql=&gs_l=hp.3...38924l41157l0l41799l9l8l0l0l0l0l0l0l0l0l0.frgbld.&pbx=1&bav=on.2,or.r_gc.r_pw.r_qf.,cf.osb&fp=81e...

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(d.onabort=function(){delete i[f]}));i[f]=d;if(!c&&b.search("&ei=")==-1)j="&ei="+google.getEI(e);var g=c||"/gen_204?atyp=i&ct="+a+"&cad="+b+j+"&zx="+google.time();
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sourceid:"chrome-psyapi1"})})};
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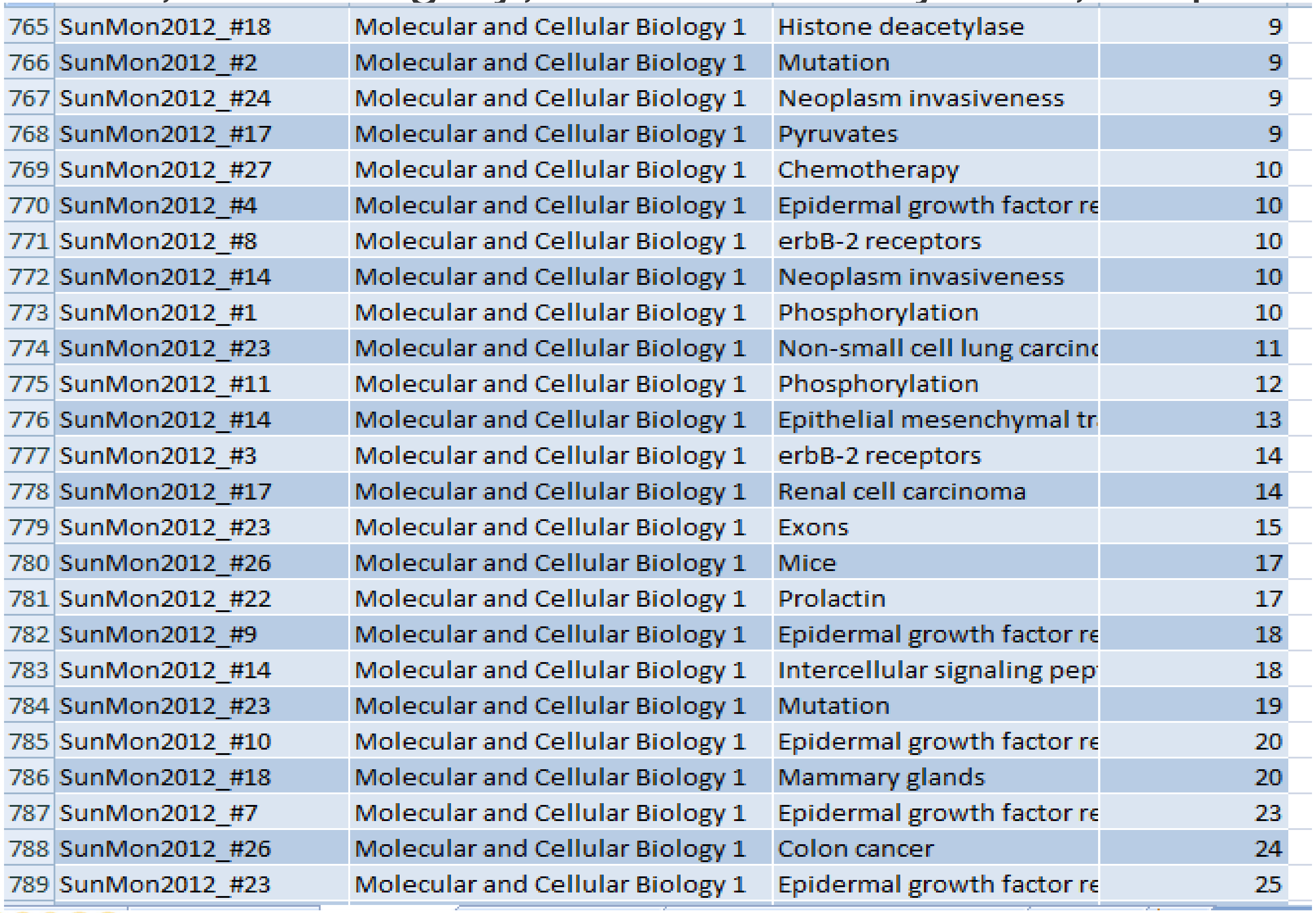
Index or tag using subject terms from thesaurus or taxonomy

- date, category, taxonomy term, frequency



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771	SunMon2012_#8	Molecular and Cellular Biology 1	erbB-2 receptors	10
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774	SunMon2012_#23	Molecular and Cellular Biology 1	Non-small cell lung carcinc	11
775	SunMon2012_#11	Molecular and Cellular Biology 1	Phosphorylation	12
776	SunMon2012_#14	Molecular and Cellular Biology 1	Epithelial mesenchymal tr	13
777	SunMon2012_#3	Molecular and Cellular Biology 1	erbB-2 receptors	14
778	SunMon2012_#17	Molecular and Cellular Biology 1	Renal cell carcinoma	14
779	SunMon2012_#23	Molecular and Cellular Biology 1	Exons	15
780	SunMon2012_#26	Molecular and Cellular Biology 1	Mice	17
781	SunMon2012_#22	Molecular and Cellular Biology 1	Prolactin	17
782	SunMon2012_#9	Molecular and Cellular Biology 1	Epidermal growth factor re	18
783	SunMon2012_#14	Molecular and Cellular Biology 1	Intercellular signaling pep	18
784	SunMon2012_#23	Molecular and Cellular Biology 1	Mutation	19
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786	SunMon2012_#18	Molecular and Cellular Biology 1	Mammary glands	20
787	SunMon2012_#7	Molecular and Cellular Biology 1	Epidermal growth factor re	23
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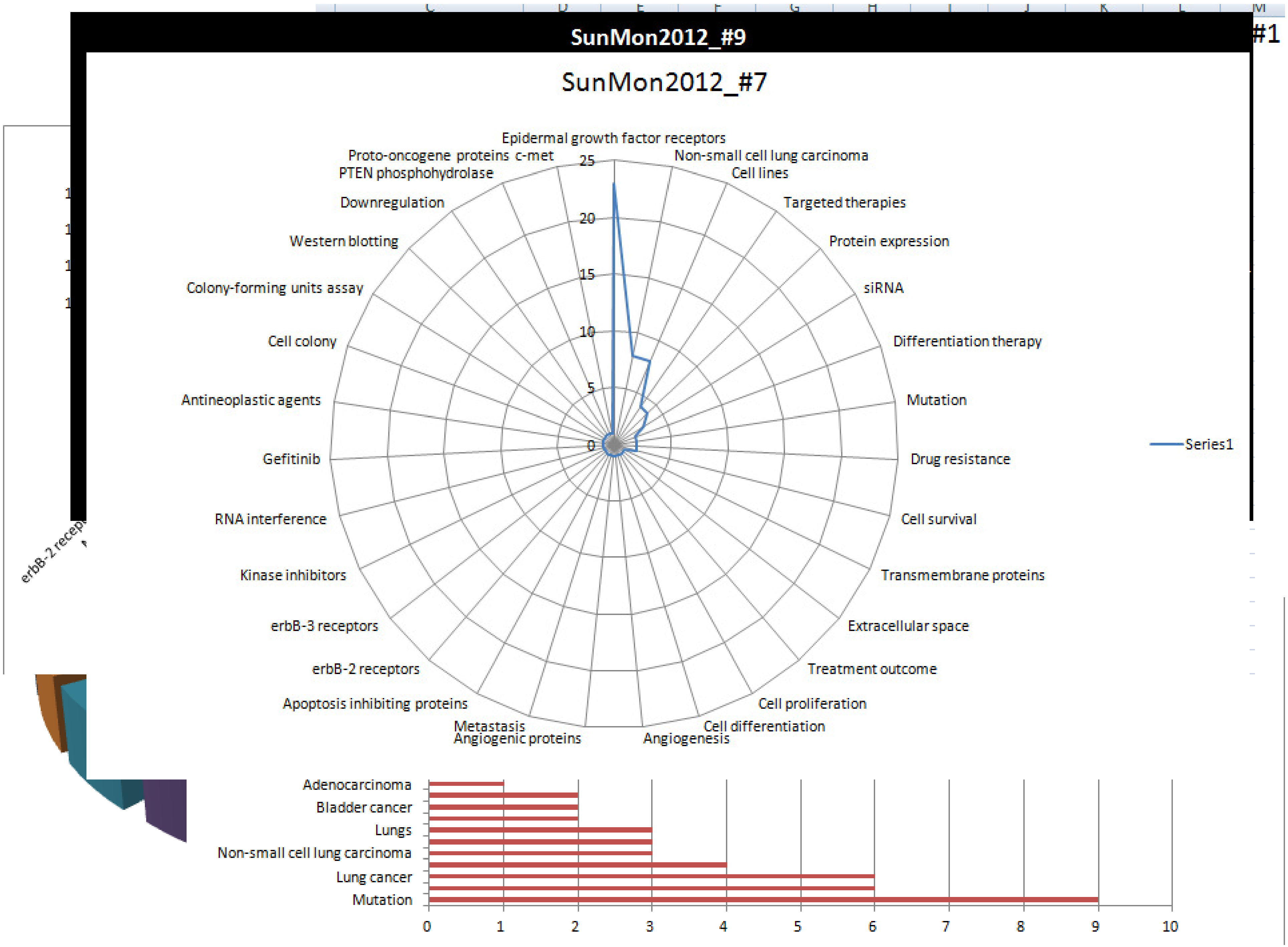
789	SunMon2012_#23	Molecular and Cellular Biology 1	Epidermal growth factor re	25


SunMon2012_#9
#1
SunMon2012_#7
Epidermal growth factor receptors
Non-small cell lung carcinoma
Cell lines
Targeted therapies
Protein expression
siRNA
Differentiation therapy
Mutation
Drug resistance
Cell survival
Transmembrane proteins
Extracellular space
Treatment outcome
Cell proliferation
Cell differentiation
Angiogenesis
Angiogenic proteins
Metastasis
Apoptosis inhibiting proteins
erbB-2 receptors
erbB-3 receptors
Kinase inhibitors
RNA interference
Gefitinib
Antineoplastic agents
Cell colony
Colony-forming units assay
Western blotting
Downregulation
PTEN phosphohydrolase
Proto-oncogene proteins c-met
0
5
10
15
20
25
Series1
erbB-2 recep
Adenocarcinoma
Bladder cancer
Lungs
Non-small cell lung carcinoma
Lung cancer
Mutation
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1
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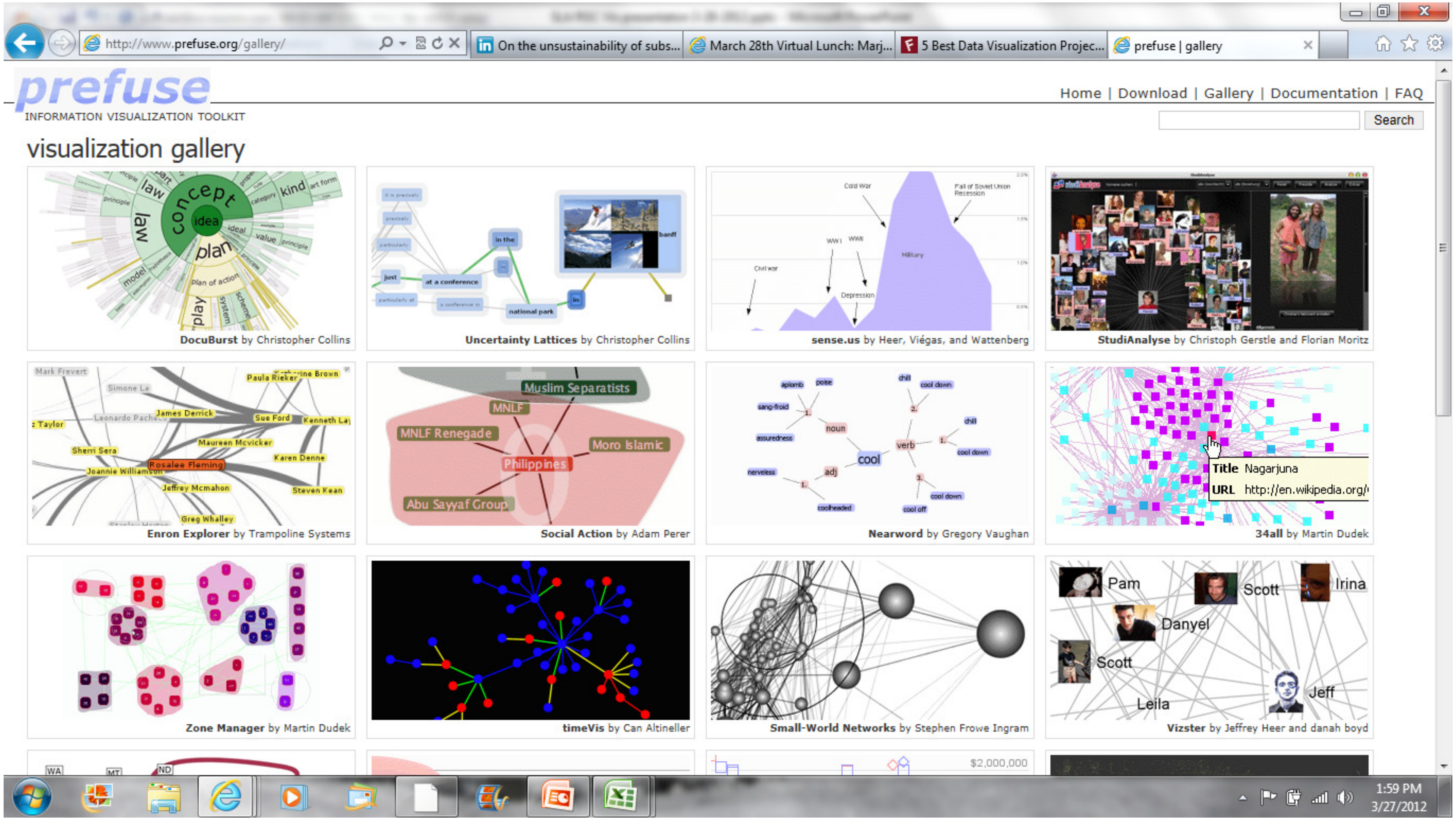
10

Load to a visualization program Like Prefuse



http://www.prefuse.org/gallery/

On the unsustainability of subs... | March 28th Virtual Lunch: Marj... | 5 Best Data Visualization Projec... | prefuse | gallery

prefuse

INFORMATION VISUALIZATION TOOLKIT

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visualization gallery

DocuBurst by Christopher Collins

Uncertainty Lattices by Christopher Collins

sense.us by Heer, Viégas, and Wattenberg

StudiAnalyse by Christoph Gerstle and Florian Moritz

Enron Explorer by Trampoline Systems

Social Action by Adam Perer

Nearword by Gregory Vaughan

34all by Martin Dudek

Title Nagarjuna

URL http://en.wikipedia.org/

Zone Manager by Martin Dudek

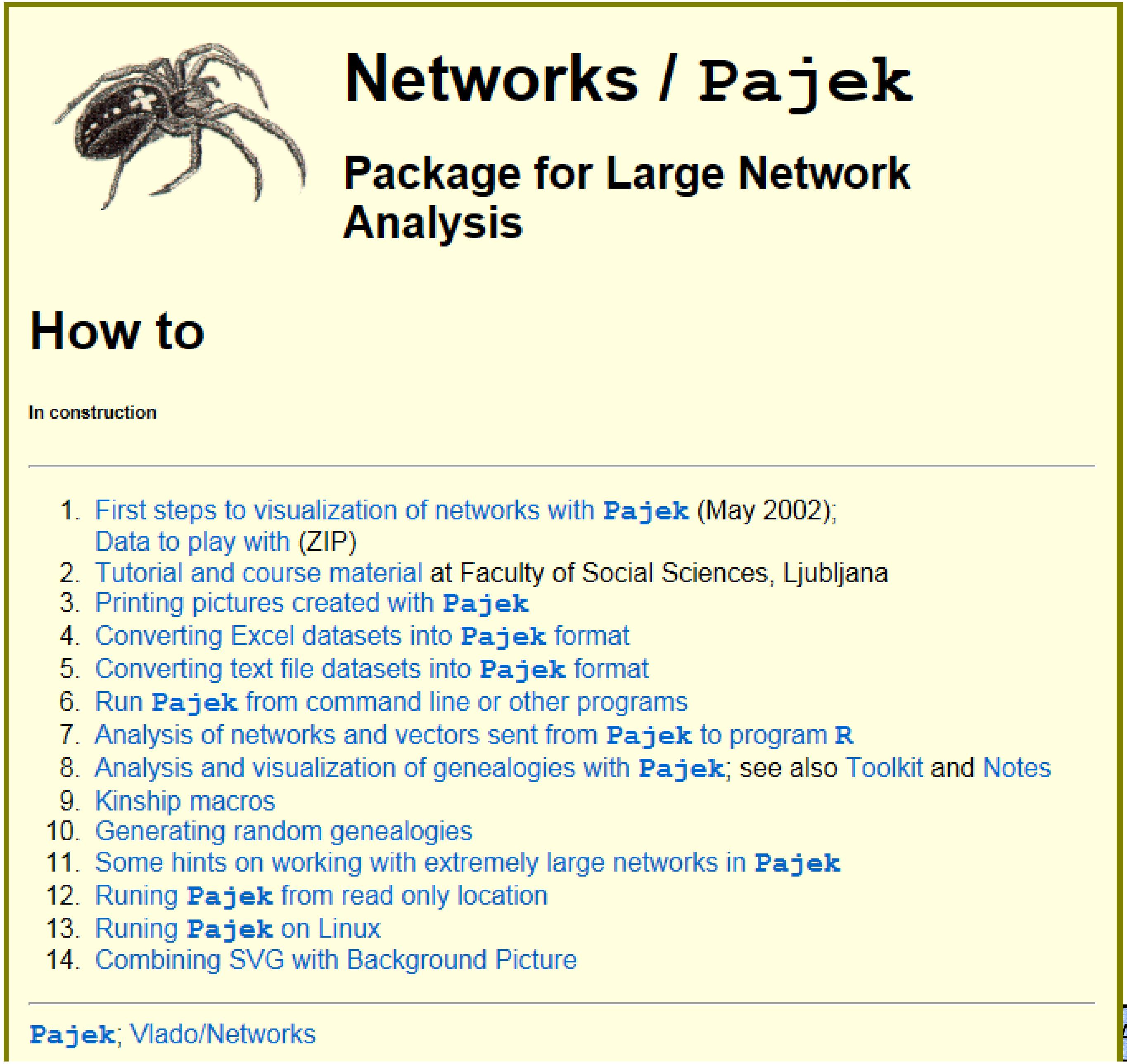
timeVis by Can Altineller

Small-World Networks by Stephen Frowe Ingram

Vizster by Jeffrey Heer and danah boyd

1:59 PM
3/27/2012

Or Pajek



Networks / Pajek

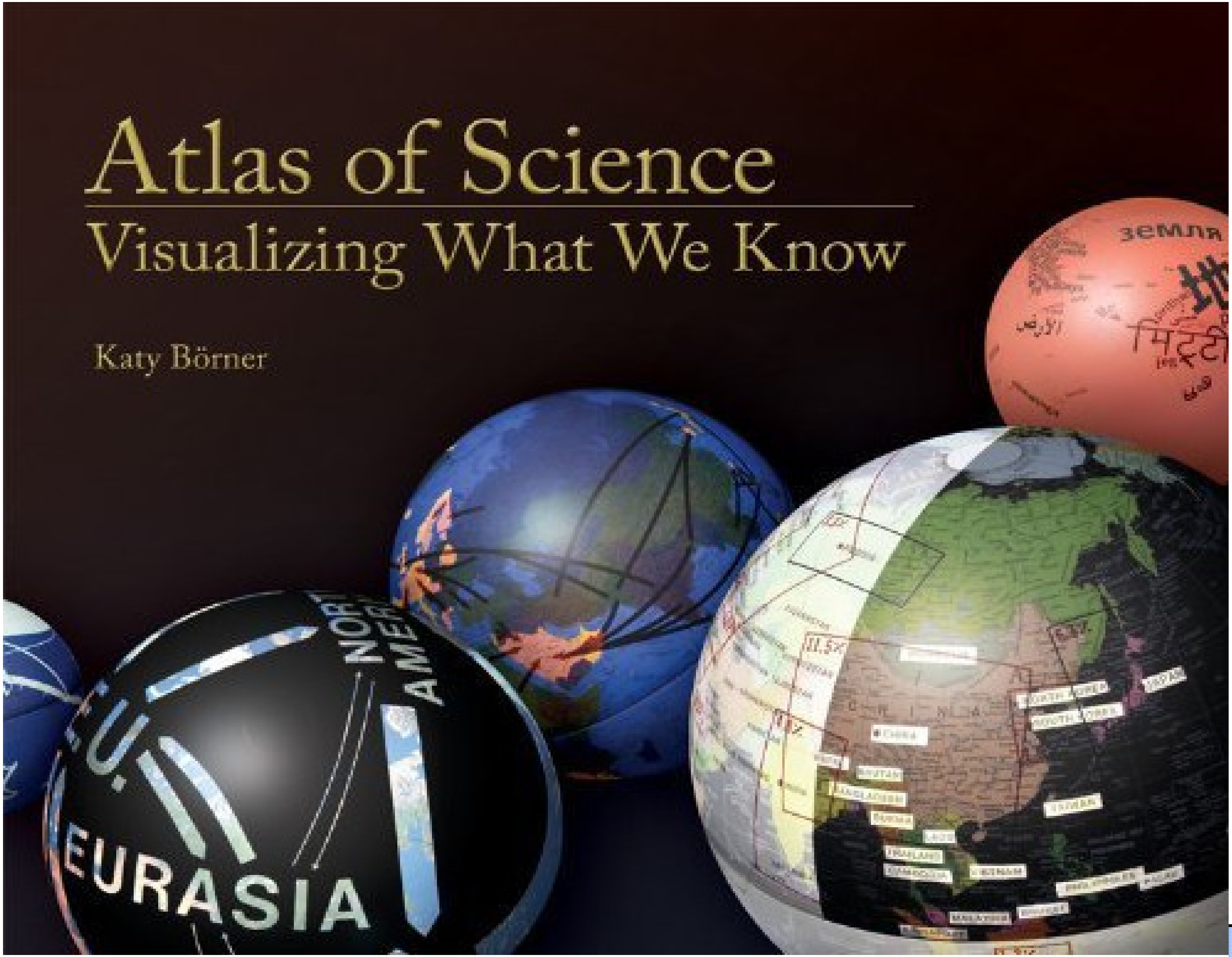
Package for Large Network Analysis

How to

In construction

1. First steps to visualization of networks with **Pajek** (May 2002);
   Data to play with (ZIP)
2. Tutorial and course material at Faculty of Social Sciences, Ljubljana
3. Printing pictures created with **Pajek**
4. Converting Excel datasets into **Pajek** format
5. Converting text file datasets into **Pajek** format
6. Run **Pajek** from command line or other programs
7. Analysis of networks and vectors sent from **Pajek** to program **R**
8. Analysis and visualization of genealogies with **Pajek**; see also Toolkit and Notes
9. Kinship macros
10. Generating random genealogies
11. Some hints on working with extremely large networks in **Pajek**
12. Runing **Pajek** from read only location
13. Runing **Pajek** on Linux
14. Combining SVG with Background Picture

Pajek; Vlado/Networks



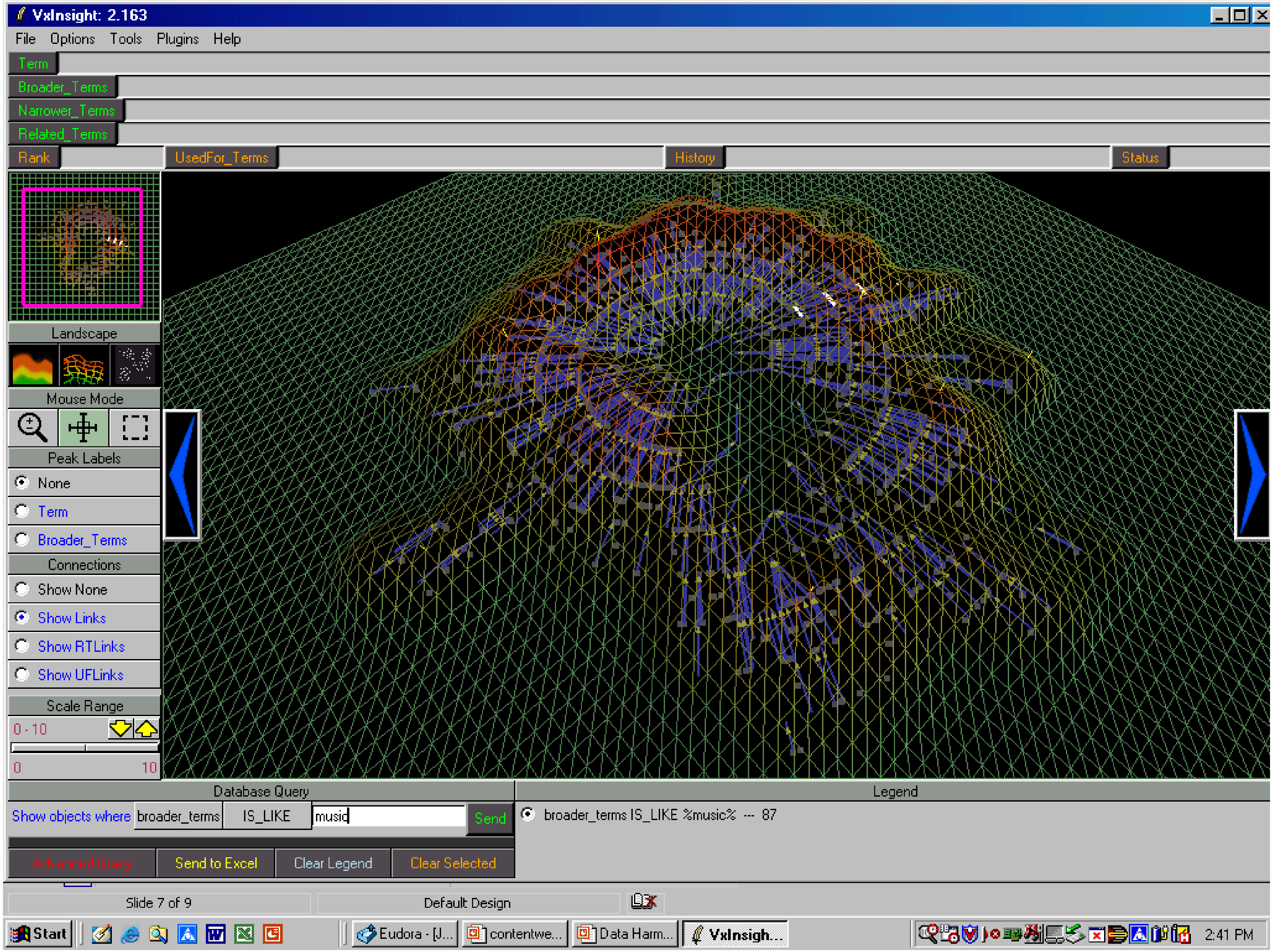
Atlas of Science

Visualizing What We Know

Katy Börner

National Information Center for Educational Media

- Albuquerque’s own
  - Sandia developed VxInsight
  - Access Innovations = NICEM
- Same data – several views
- Primary and Secondary Education in US
- Shows the US Valley of Science
- Little Science taught in elementary years

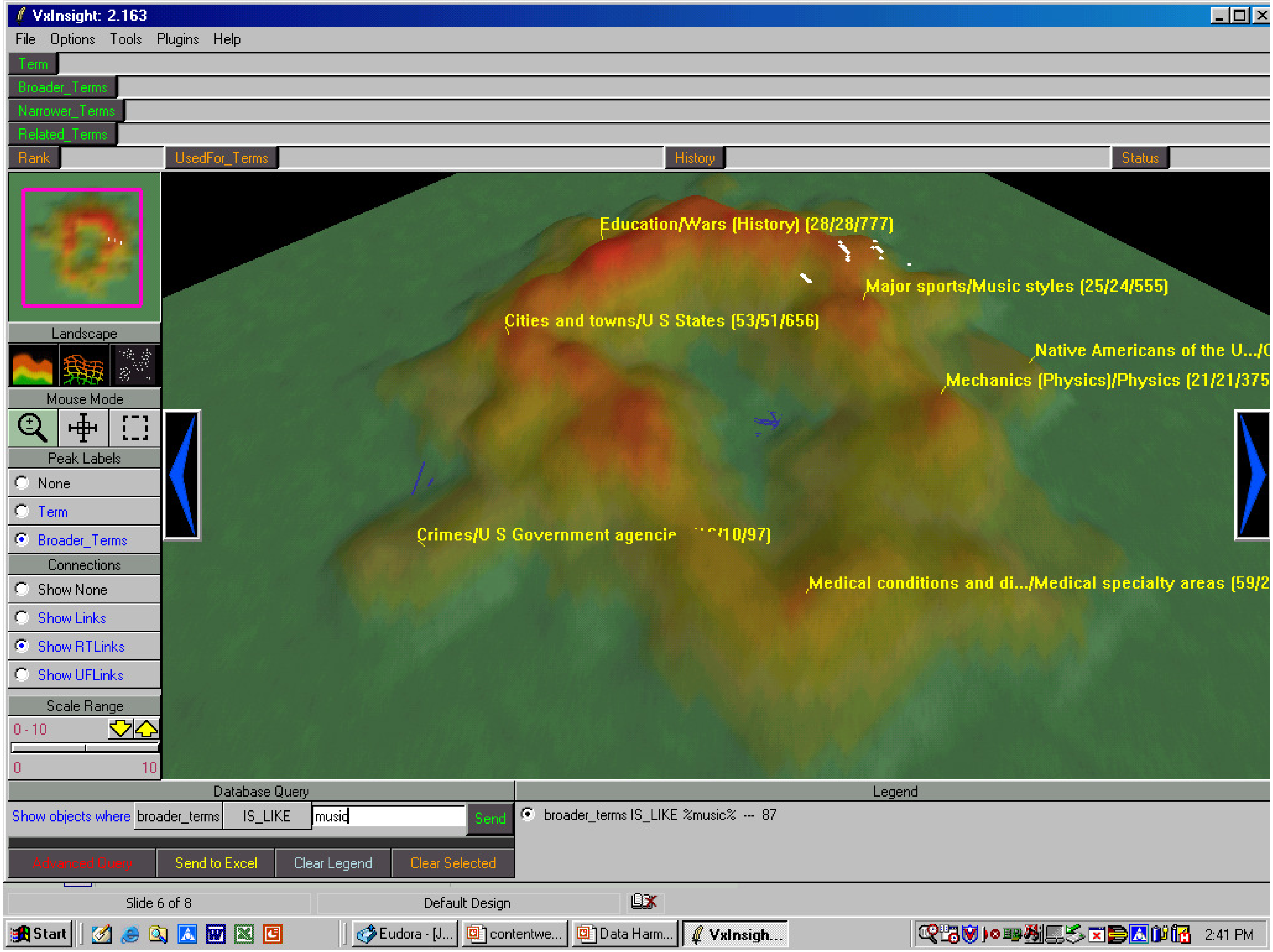


Peak Labels
● None
○ Term
○ Broader_Terms

Connections
○ Show None
● Show Links
○ Show RTLinks
○ Show UFLinks

Show objects where broader_terms IS_LIKE music

● broader_terms IS_LIKE %music% --- 87



Peak Labels: ○ None ○ Term ● Broader_Terms

Connections: ○ Show None ○ Show Links ● Show RTLinks ○ Show UFLinks

Scale Range: 0 - 10 (0 – 10)

Show objects where broader_terms IS_LIKE music

● broader_terms IS_LIKE %music% --- 87

Using visualization to show

- From a society / publisher perspective
  - Identify Core, Boundary and Cross Border
  - Provides Indicators
    - Activity
    - Growth
    - Relatedness
    - Centrality
  - Locates Journal domains

- From a thesaurus perspective
  - Identifies terms that are too broadly defined
  - Potential Improvements in thesaurus structure using topic structures

Case Study:
Mapping IEEE thesaurus space

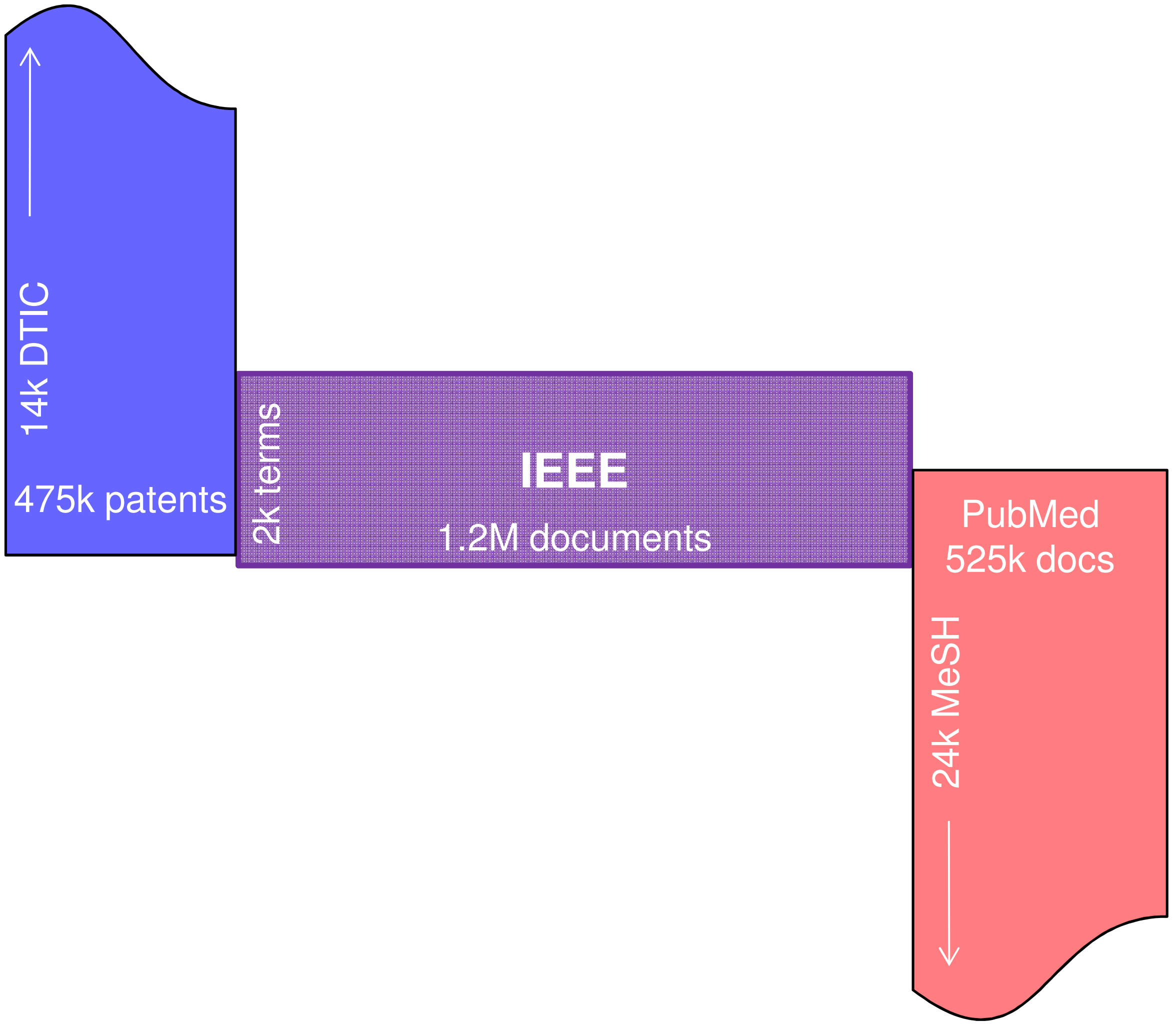
- We are interested in an expanded map that includes adjacencies to the IEEE data
  - Expanded term set shows adjacent white space; opportunities for expansion
- Overlaps and edges of the science
  - We need comparison data
- Learn the directions in the field
  - Low occurrence rate in IEEE documents?
  - Linkage to terms in IEEE documents?
- Where do we find these terms? How can we add them?

The process

- Built a rule base to auto index IEEE content
  - » "90 % accuracy out of the box on journal data"*
  - » "80% out of the box on proceedings data"*
- **The overlapping data sets**
  - » Auto indexed 1.2 million Xplore records
  - » Auto indexed 10 years of US Patent data
  - » Auto indexed 10 years of Medline
- Term sets used
  - » IEEE thesaurus terms rule base
  - » Medical Subject Headings (MeSH) (and simple rule base)
  - » Defense Technical Information Center (DTIC) Thesaurus (and simple rule base)
  - » Similar level of detail to current IEEE thesaurus terms

Defining expanded term space

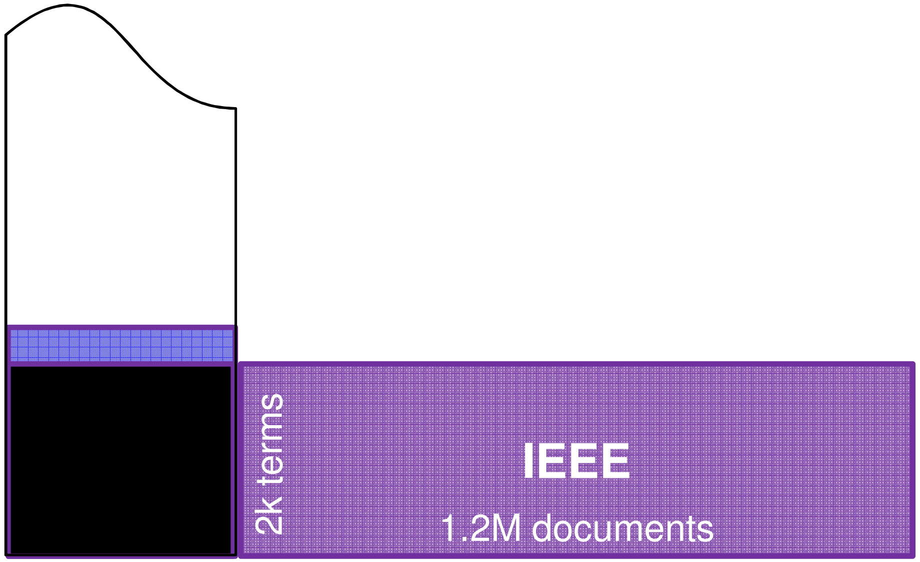
1. The data - Select related corpus



Defining expanded term space

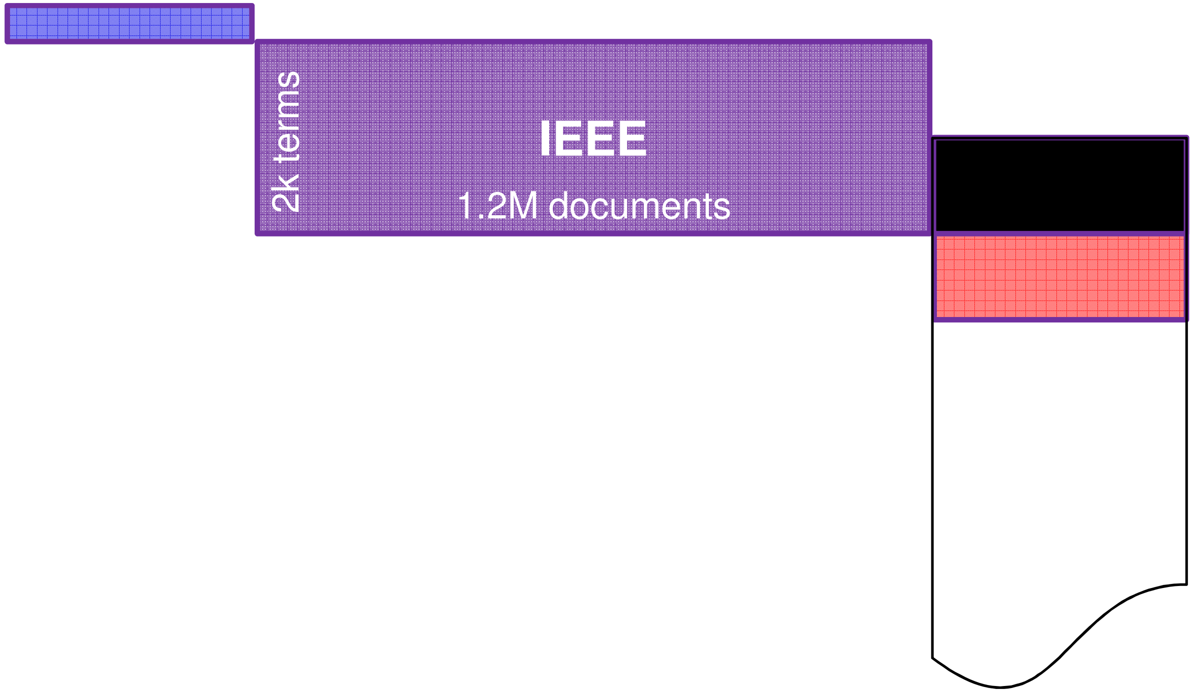
2. Identify related terms

Use the IEEE Thesaurus to index the three collections



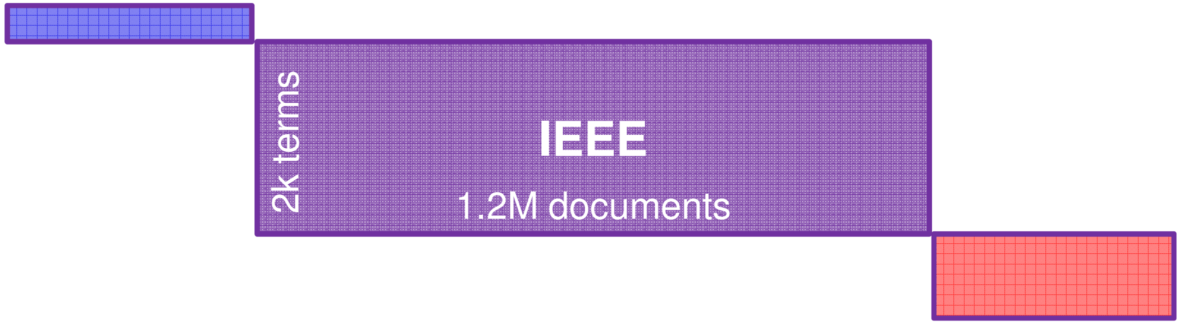
Defining expanded term space

2. Identify related terms
Use MESH and DTIC to also index the three collections



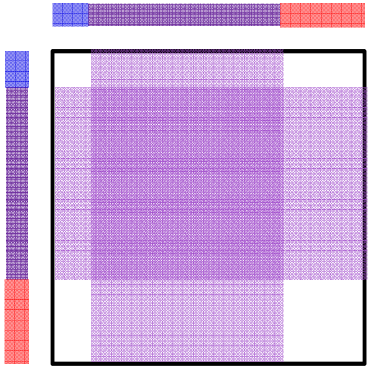
Defining expanded term space

3. Resulting term set
The co-indexed items from the three collections

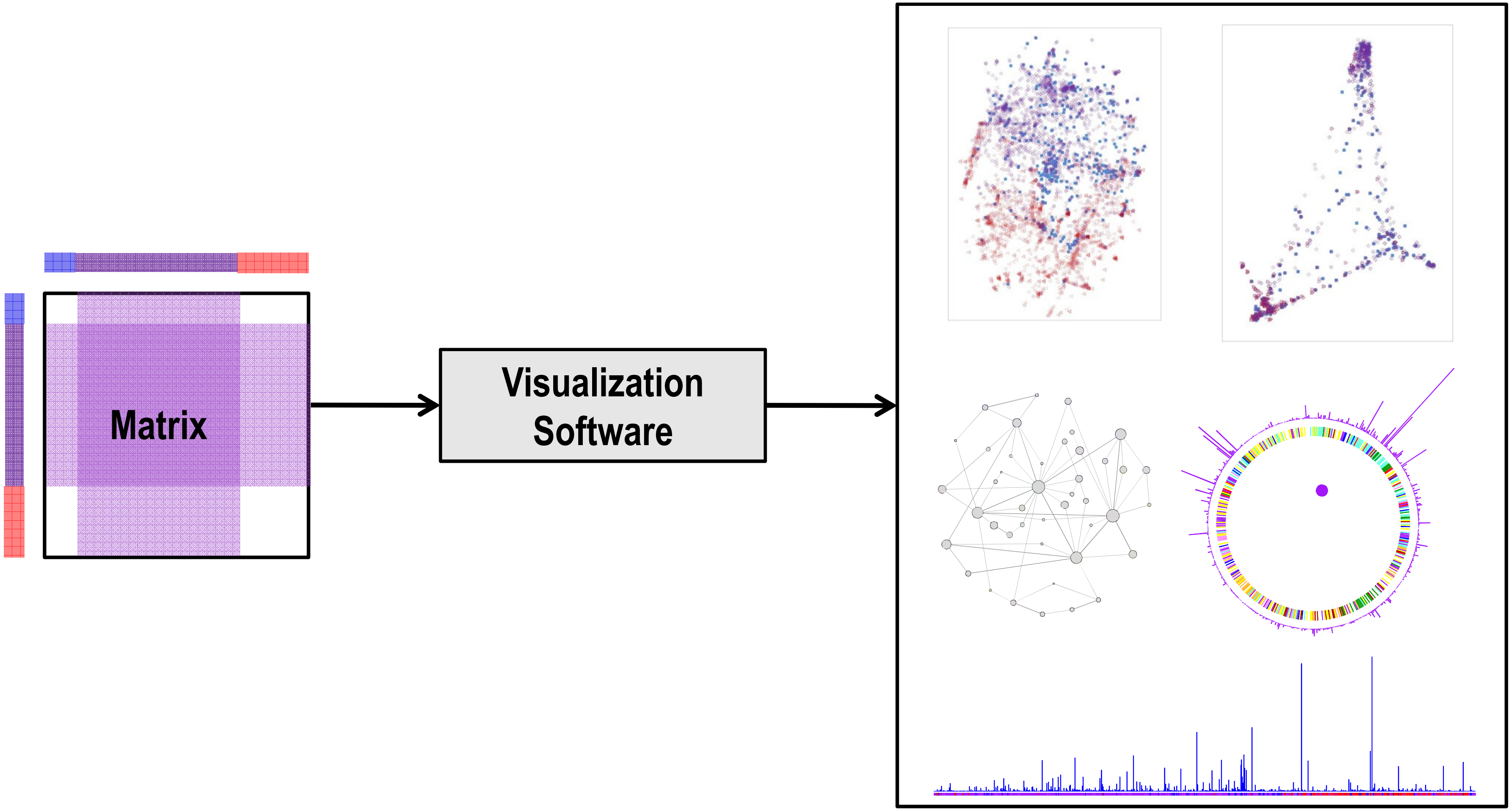


Defining expanded term space

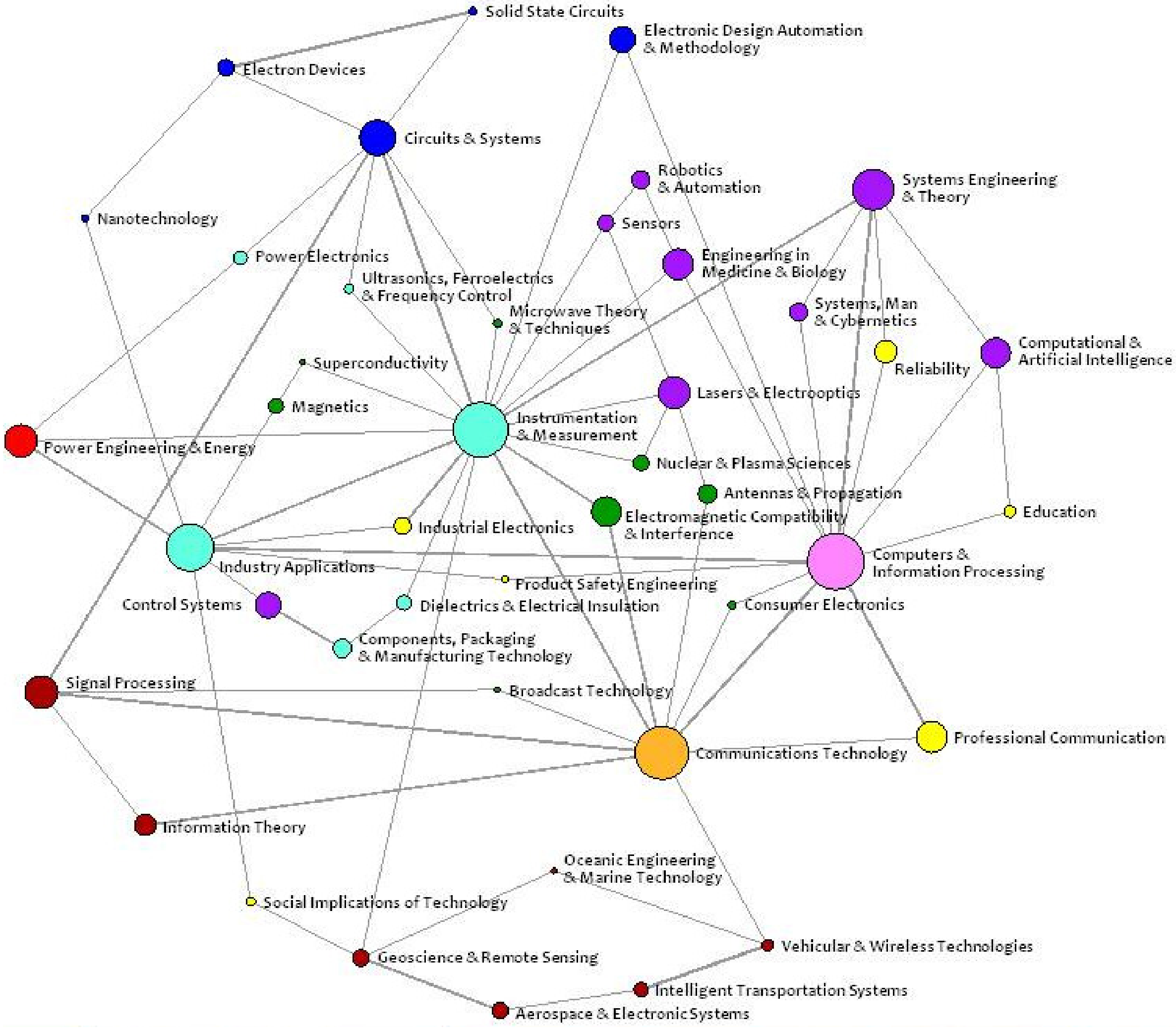
4. Term:Term Matrix
Where do the articles and their indexing intersect?



Visualization Strategies



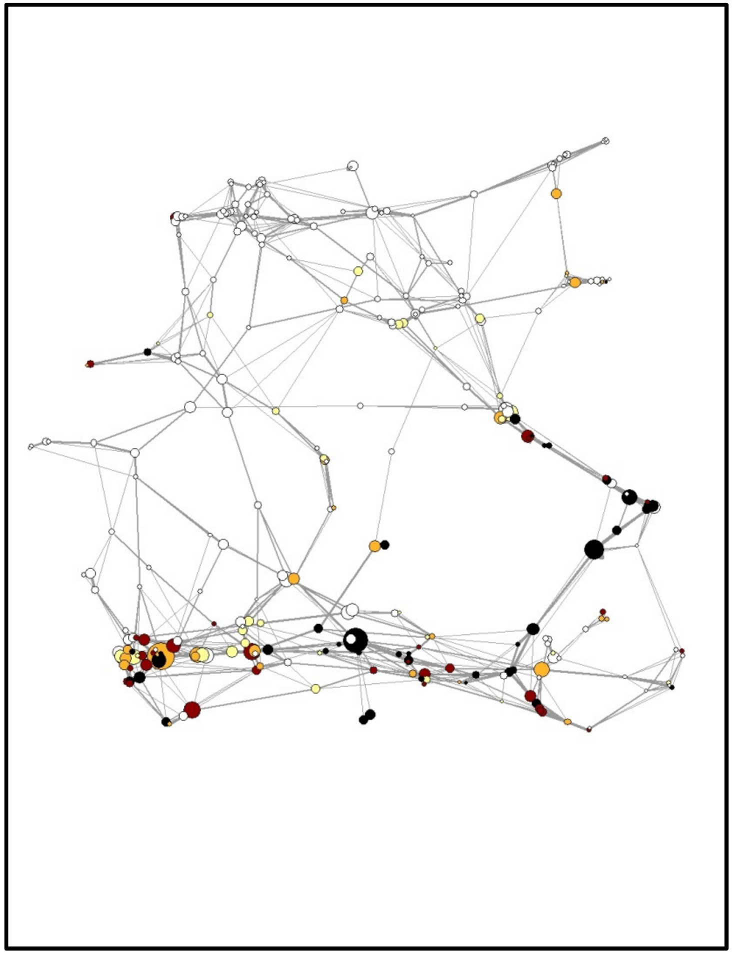
All data up-posted to the top level



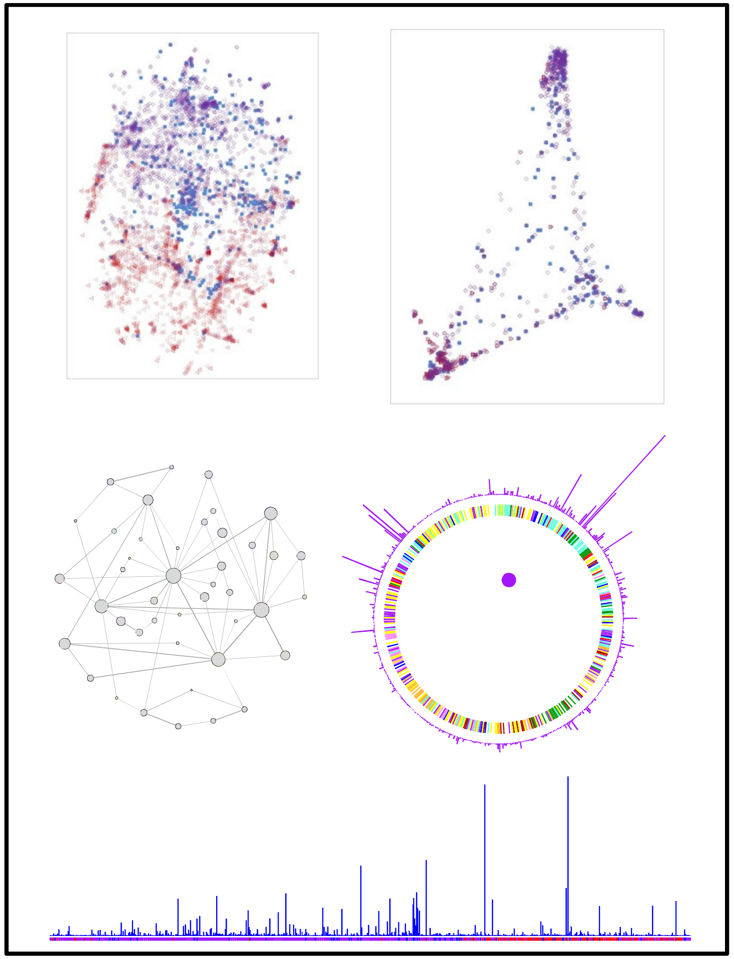
Solid State Circuits
Electronic Design Automation & Methodology
Electron Devices
Circuits & Systems
Robotics & Automation
Systems Engineering & Theory
Nanotechnology
Sensors
Power Electronics
Engineering in Medicine & Biology
Ultrasonics, Ferroelectrics & Frequency Control
Microwave Theory & Techniques
Systems, Man & Cybernetics
Computational & Artificial Intelligence
Superconductivity
Reliability
Magnetics
Lasers & Electrooptics
Instrumentation & Measurement
Power Engineering & Energy
Nuclear & Plasma Sciences
Antennas & Propagation
Education
Electromagnetic Compatibility & Interference
Industrial Electronics
Computers & Information Processing
Industry Applications
Product Safety Engineering
Control Systems
Dielectrics & Electrical Insulation
Consumer Electronics
Components, Packaging & Manufacturing Technology
Signal Processing
Broadcast Technology
Professional Communication
Communications Technology
Information Theory
Oceanic Engineering & Marine Technology
Social Implications of Technology
Vehicular & Wireless Technologies
Geoscience & Remote Sensing
Intelligent Transportation Systems
Aerospace & Electronic Systems

Many map options

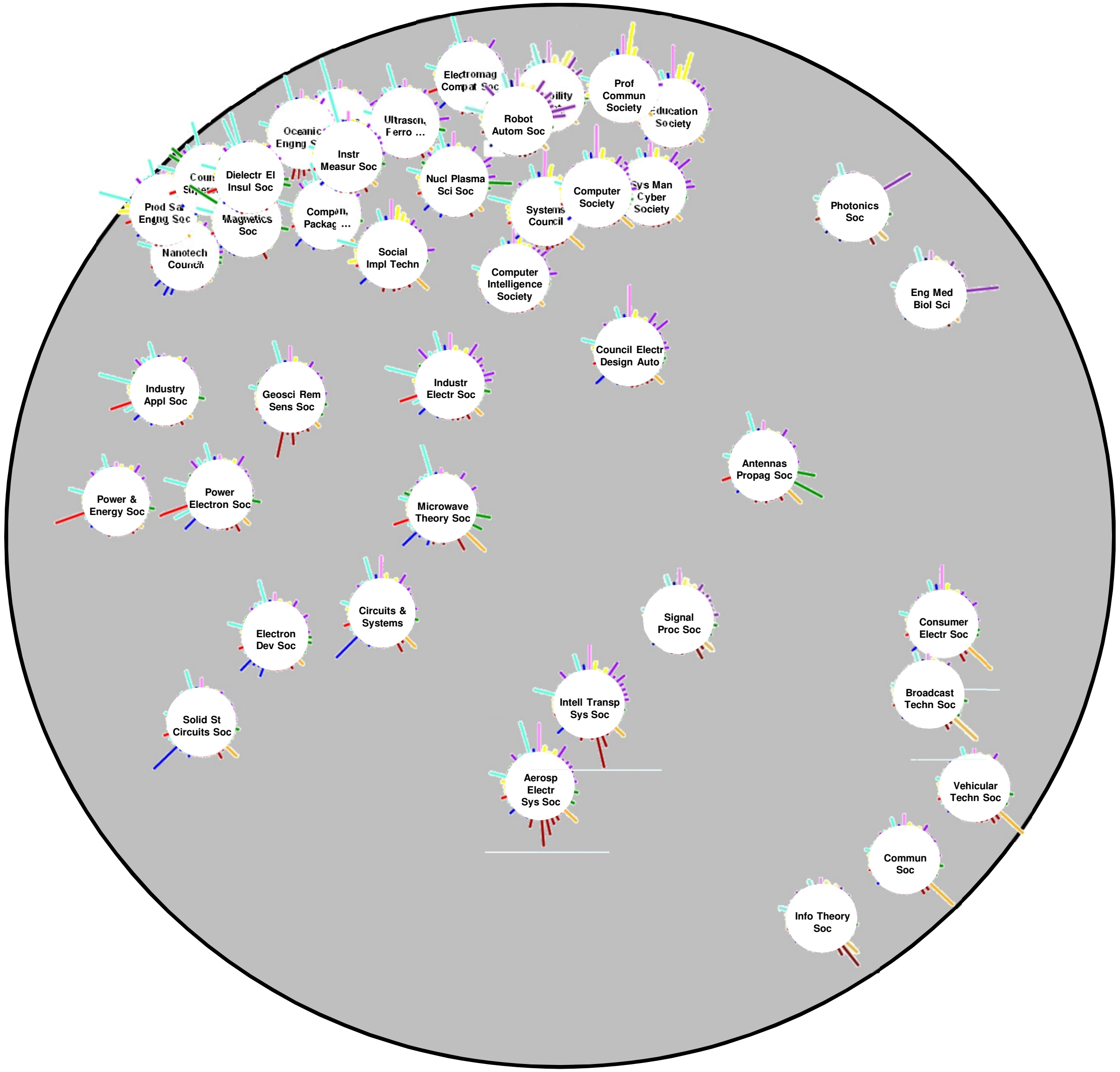
Previous Experience



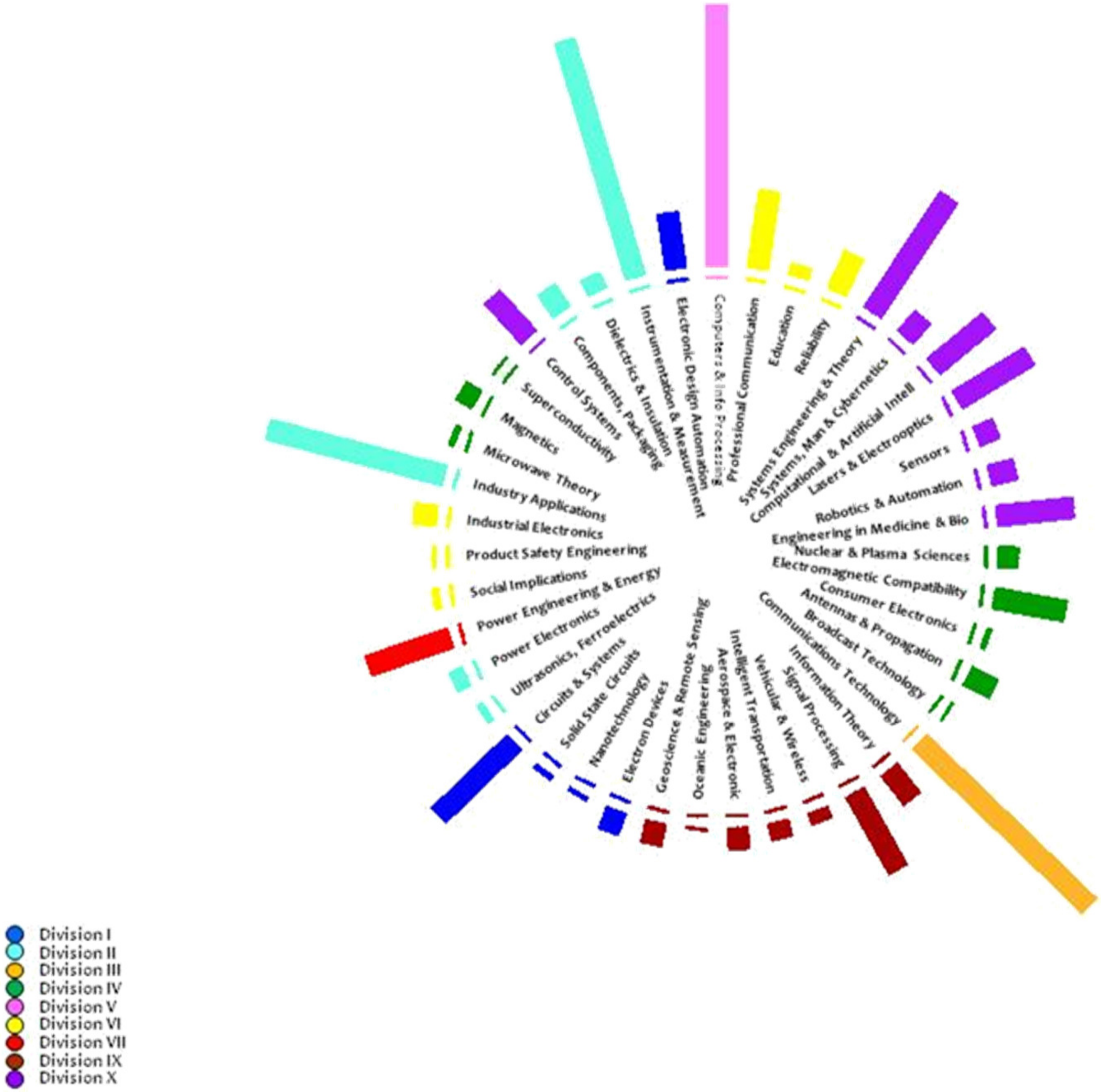
IEEE Experience



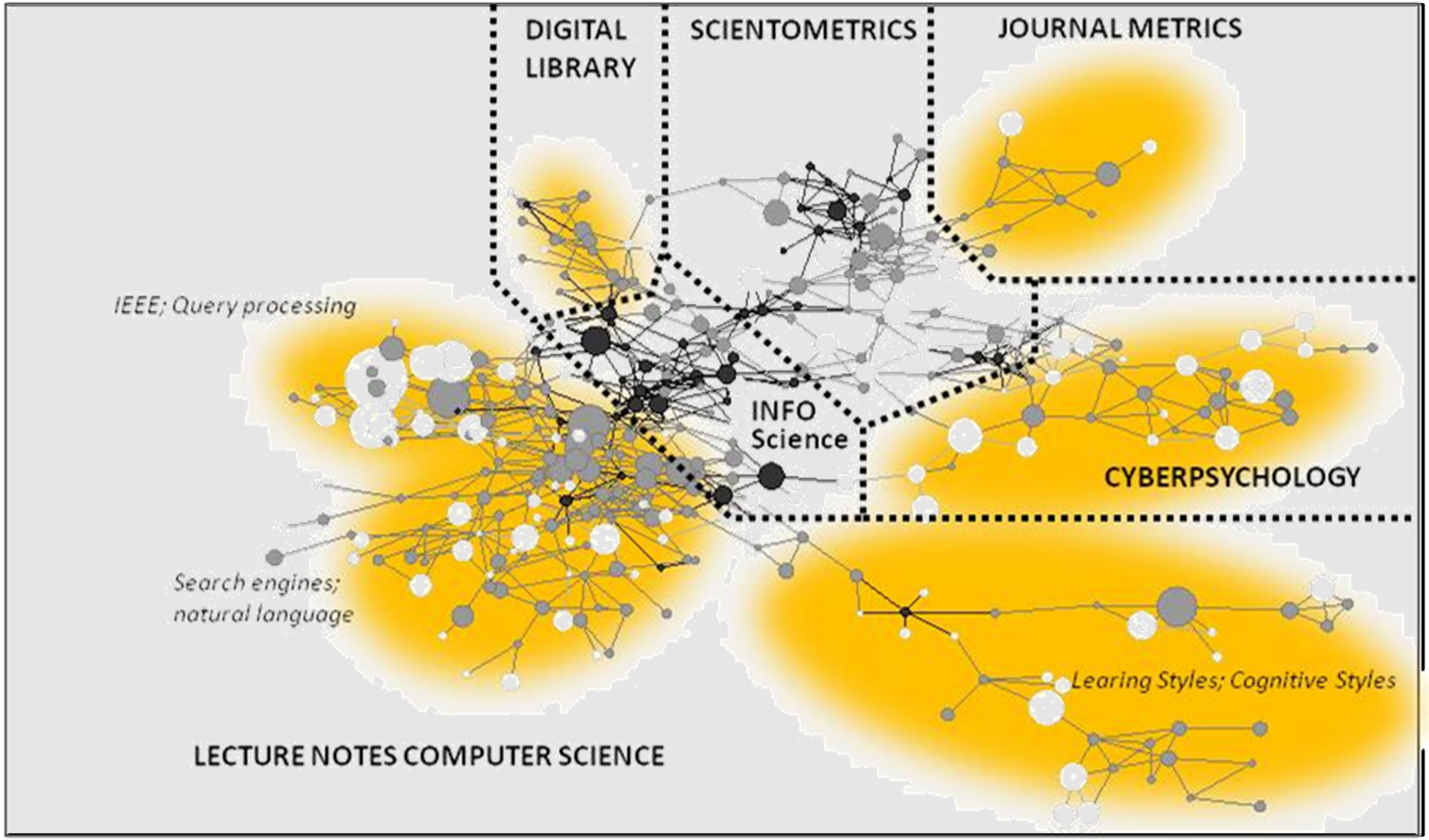
IEEE Portfolio



Radial Visualization

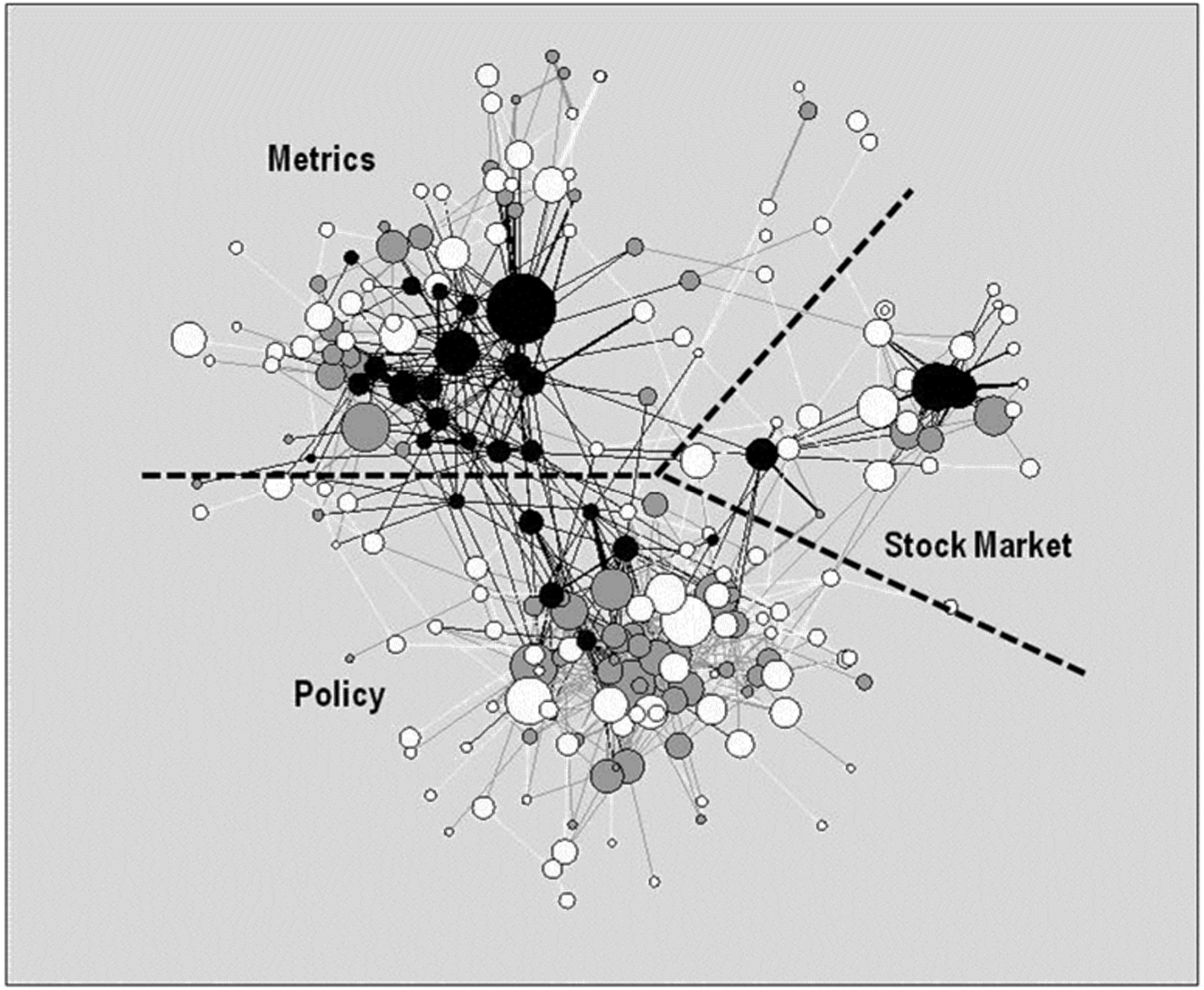


Publication Strategy

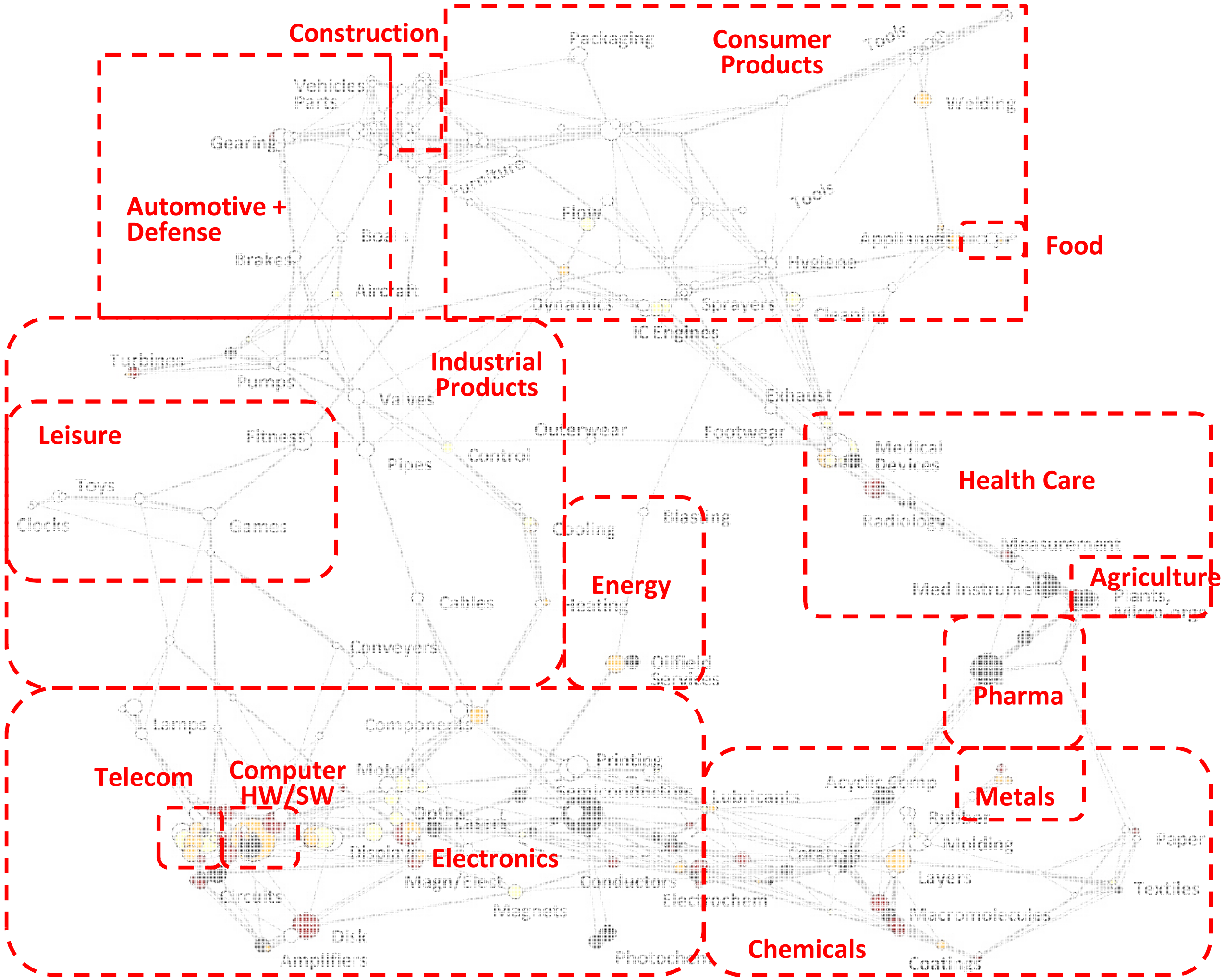

DIGITAL LIBRARY
SCIENTOMETRICS
JOURNAL METRICS
IEEE; Query processing
INFO Science
CYBERPSYCHOLOGY
Search engines; natural language
Learing Styles; Cognitive Styles
LECTURE NOTES COMPUTER SCIENCE

JASIST reference

Conference Strategy



Use a Thesaurus to Label Maps



Questions Answered

- Is there a way, using our own information, to forecast our direction?
- Where is the industry headed? What about by technology sector?
- Does our coverage match our mission and vision?
- Can we become smarter about our data and potential markets using our collection in new ways?
  Are the societies publishing and talking about what their charter indicates they cover?
- What are the trends – are topics emerging/cooling?
- Can we use technology and our own data to explore these questions while enhancing our data?

The research team

- Access Innovations / Data Harmony
  - Founded in 1978
  - Data enrichment and normalization
  - Suite of Semantic Enrichment tools

- SciTechStrategies
  - Understanding data through visualization

- IEEE Indexing & Abstracting Group

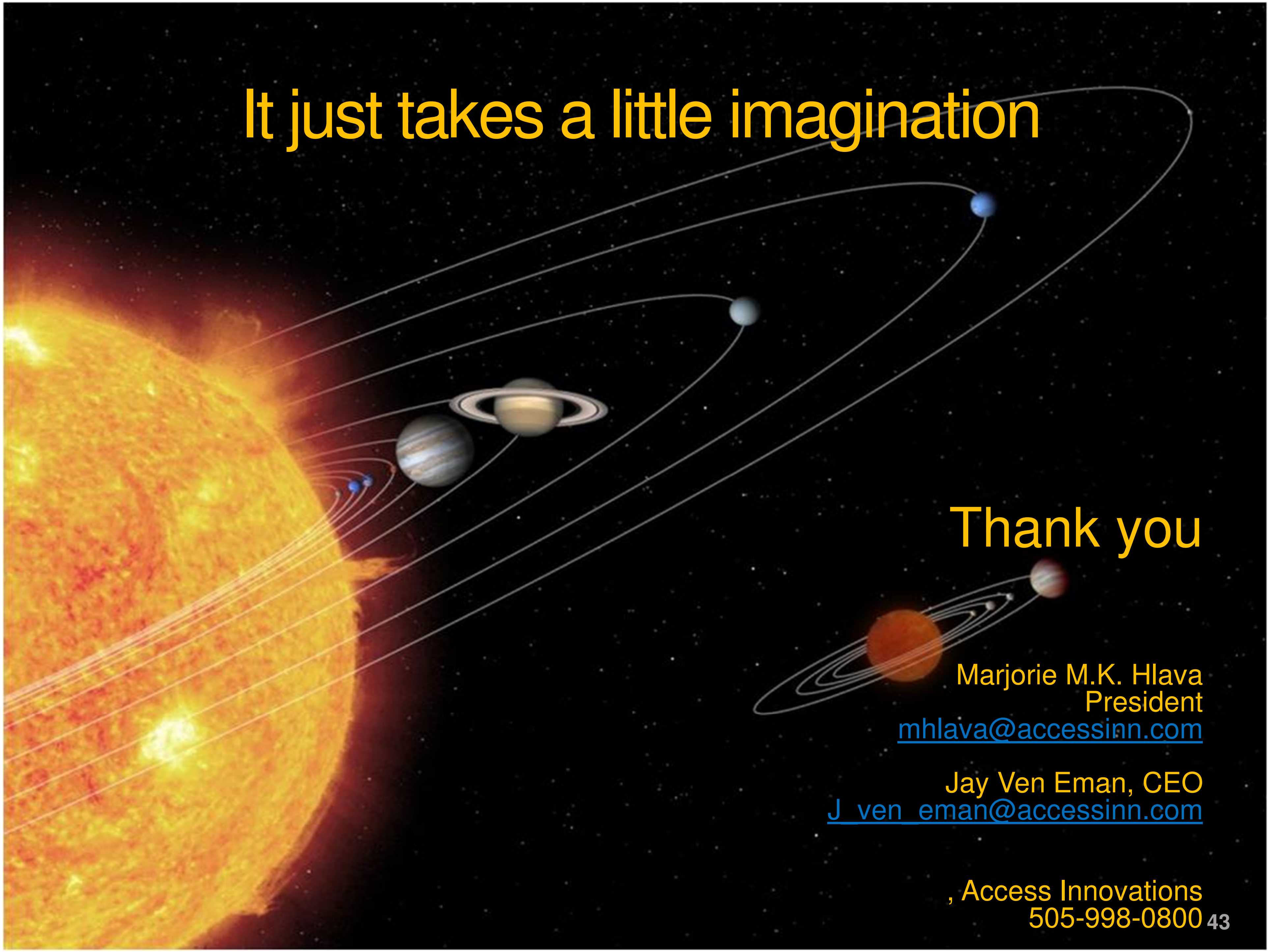
We looked at visualization of data

- Finding the Metrics
  - Measurement
  - Numbers
  - Terms as indicators
- Ways to show
  - Adjacency
  - Relationships
  - Trends
  - Co – occurrence
  - Conceptual distance
- How to enrich with
  - Linking
  - Semantic enrichment
  - Classification
- Maps supporting
  - Forecasting
  - Trend analysis
  - Segmentation
  - Distribution

Effective maps require

- Contextual data
- Detailed data
- Classification methods
- At least two directions in the matrix
- A little art for fun

It just takes a little imagination



Thank you

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