

# Building Effective Visualization Tools for Everyday Business: Web Visualization Framework

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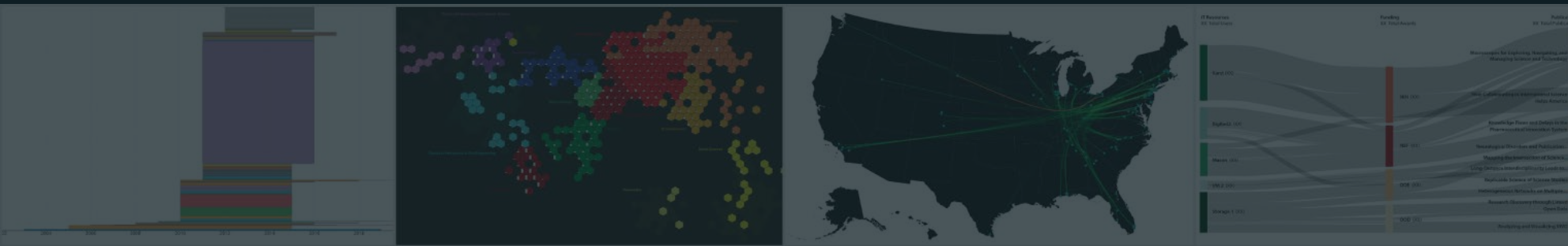


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# Visual Analytics



# Transforming Data into Insight



*Data-Driven Decision Making (credits: PwC)*

# A Research Agenda for the Analytics Age

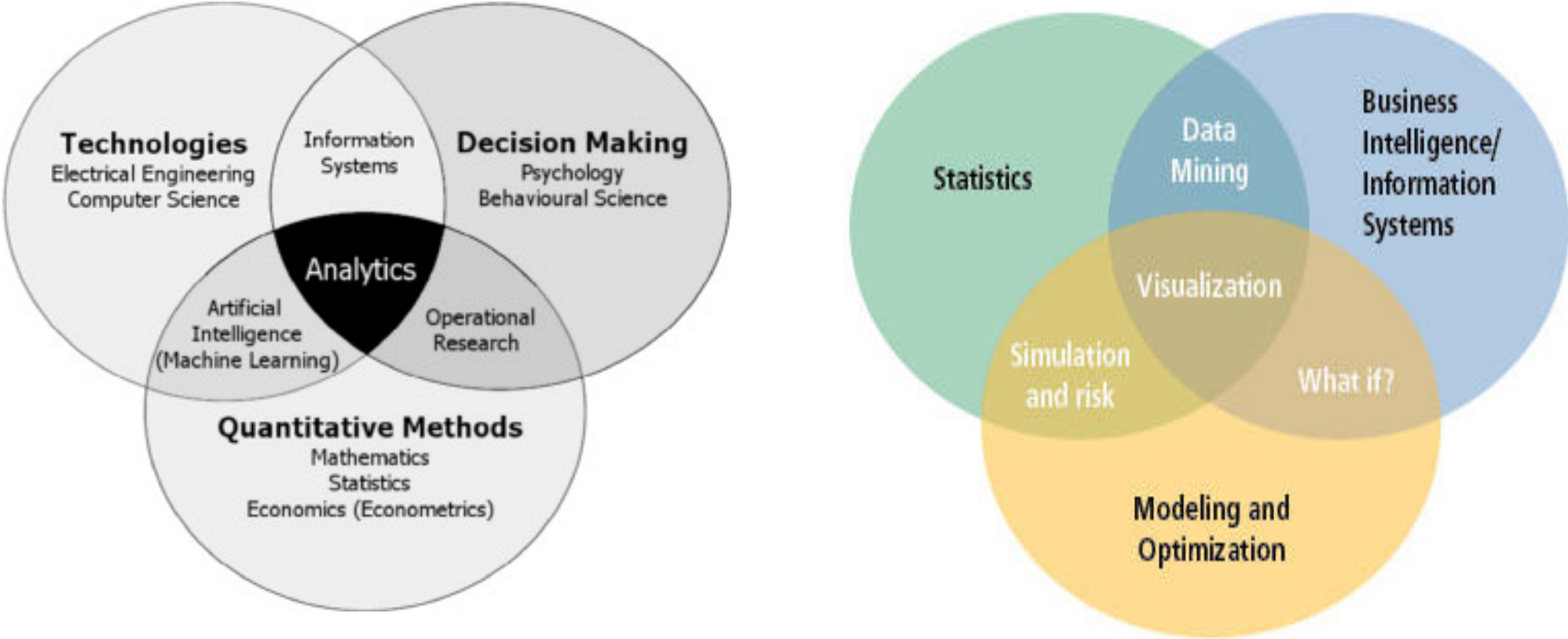


Figure 1. A Taxonomy of Disciplines (Mortenson et al., 2015 and Evans, 2012)



# Dresner Advisory Report (2016): Embedded Business Intelligence Market Study

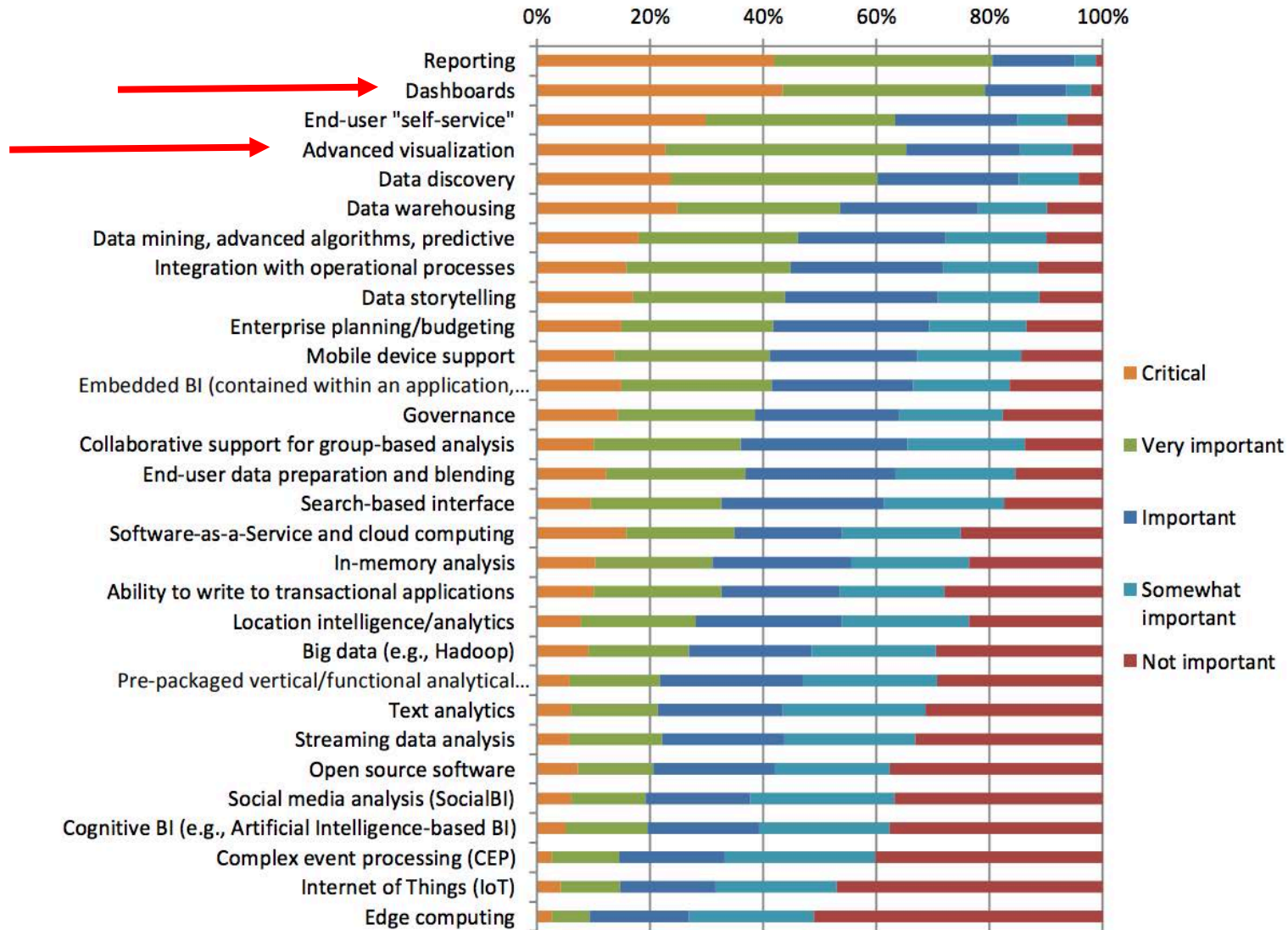


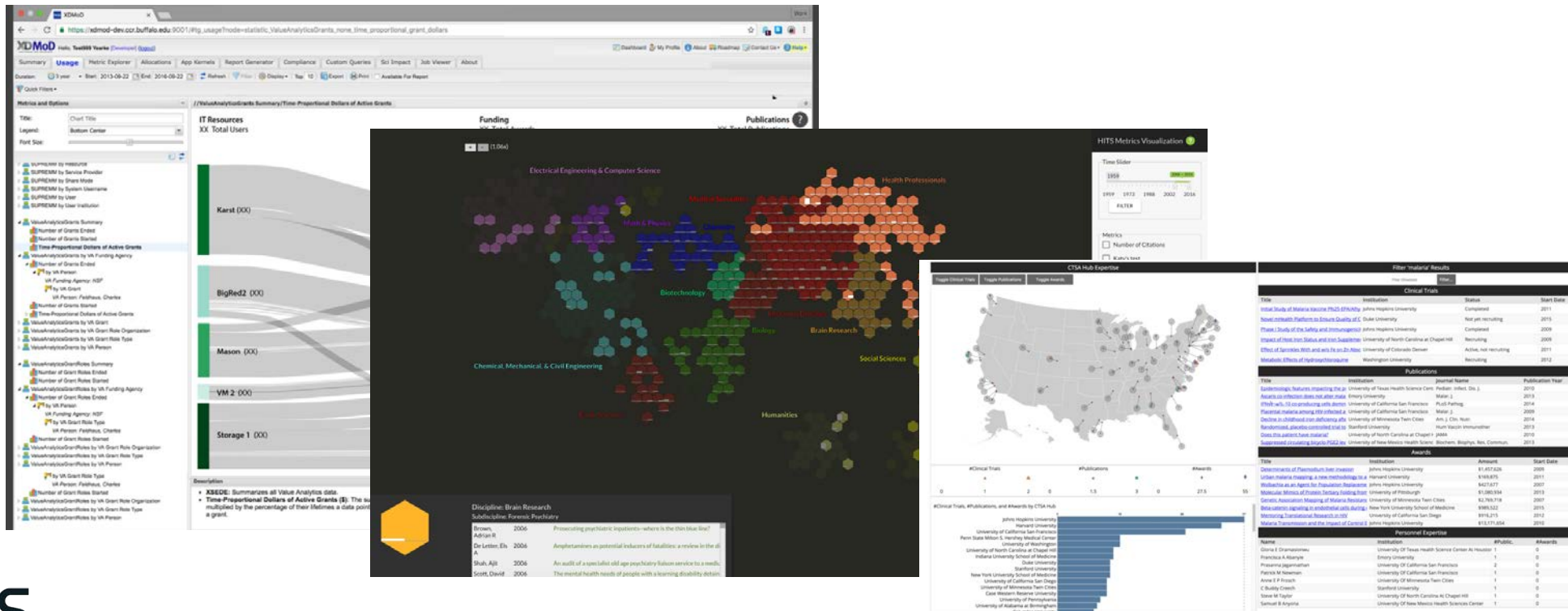
Figure 2. Technologies and Initiatives Strategic to Business Intelligence

# Dashboards

“

What's happening? What's happened? What's going to happen? Check the dashboard! (Markus, 2006)

”



# Data Visualization

“ *The goal is to turn data into information, and information into insight.*  
(Carly Fiorina, 2004) ”

“ *The purpose of visualization is insight, not pictures.*  
(Ben Shneiderman, 1999) ”



# Web Application versus Software Visualization

“ *The impact of data scientists' work depends on how well others can understand their insights to take further actions.*  
*(Jorge Castañón, 2016)* ”

1. Interactive display and manipulation of data
2. No installation required
3. Easy to develop and share with clients and project teams
4. Open source libraries

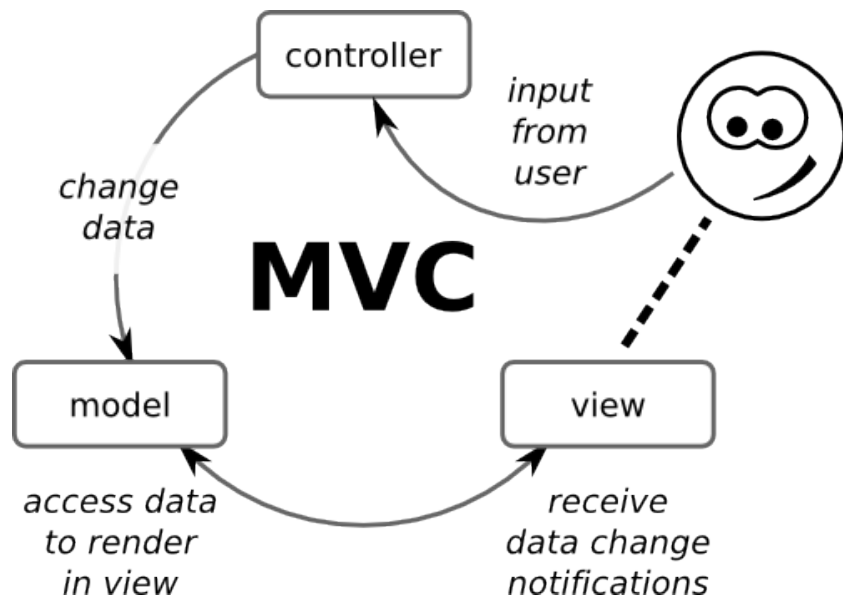
# Past: Imperative Web Frameworks

“

*The controller is essential and explicit: you have to specify what to do when you receive user requests and what resources you are going to mobilize to carry out the necessary tasks outlined in the model.*

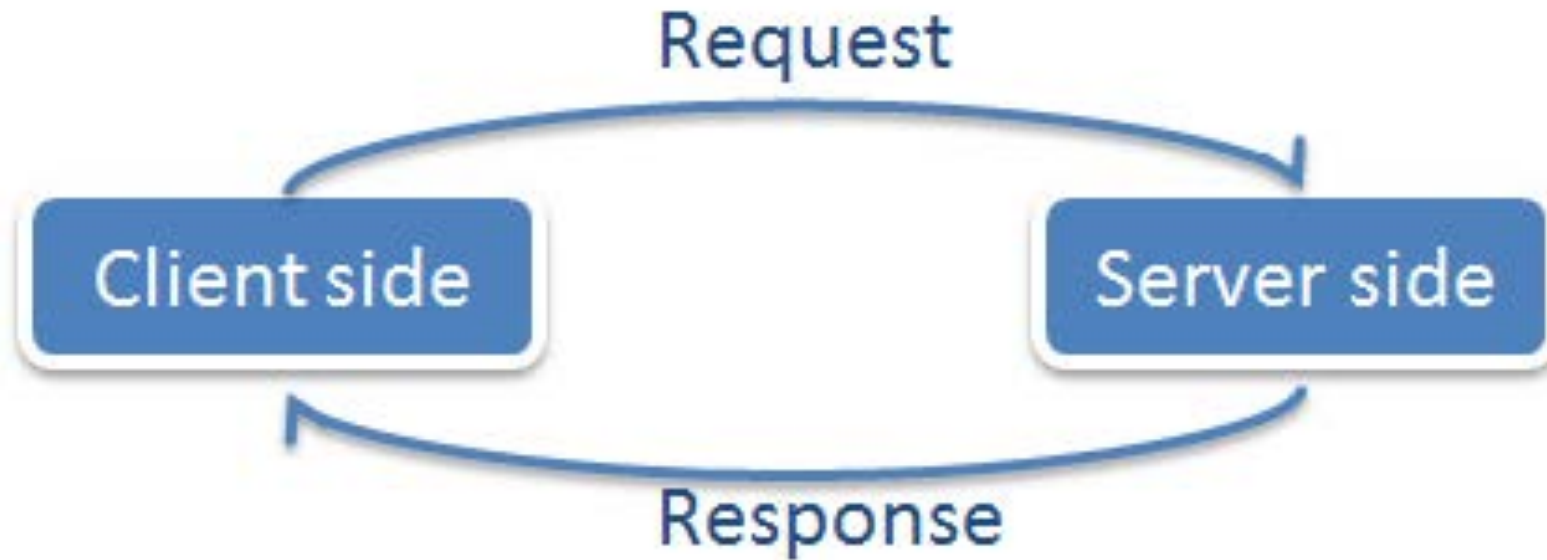
*(Ribeiro 2016)*

”



The Model-View-Controller was invented at Xerox Parc by Trygve Reenskaug in 1979.

# Present: Reactive Web Frameworks

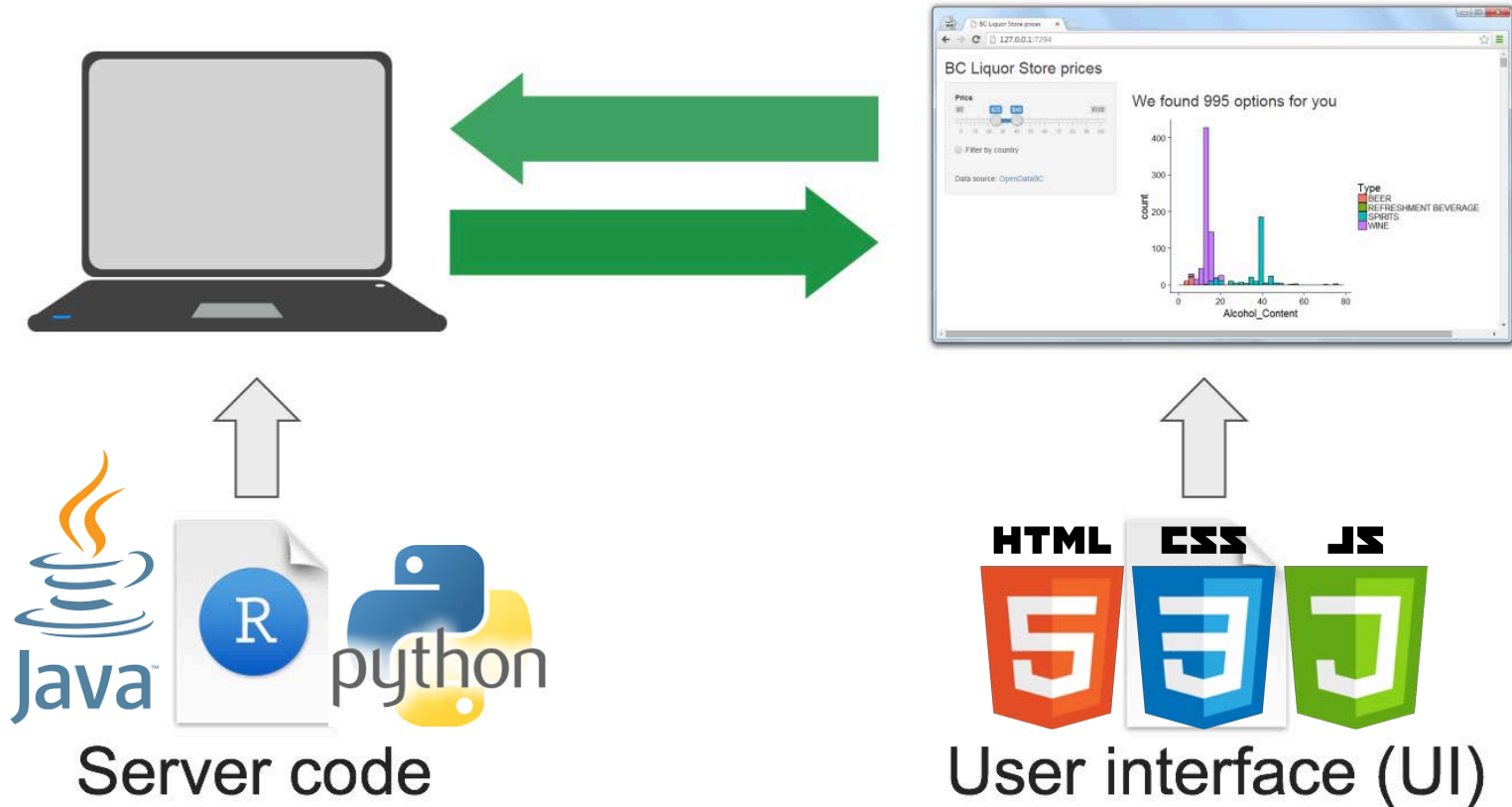


“*Reactive Systems are highly responsive, giving users effective interactive feedback.*”

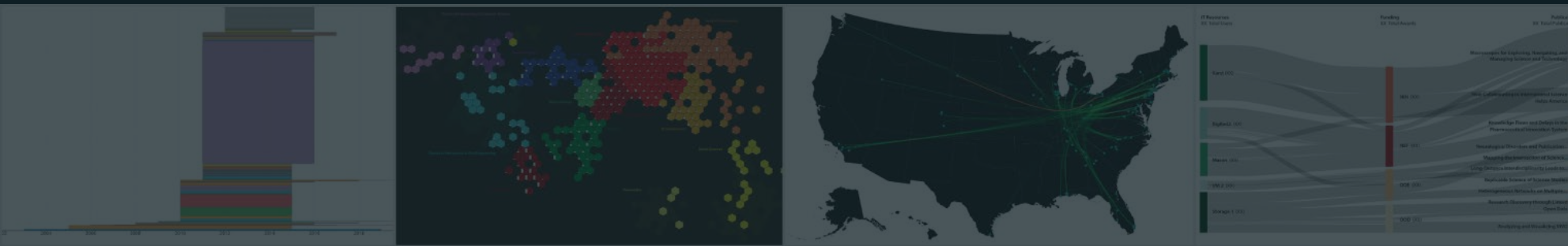
Reactive Manifesto - <http://www.reactivemanifesto.org/>

Image credit: <http://littleactuary.github.io/blog/Web-application-framework-with-Shiny/>

# General Architecture



# Web Visualization Framework: Shiny





# Shiny Application

Major Losses Reserving Tool (v1.0.1)

Corporate Solutions  
redefining standards

INPUT: J:\Actuarial\Stage\Doc\_Hien\Major Loss; OUTPUT: C:\documents\625269\Desktop\Nouvi

CSV FORMAT: Date Format: dd/mm/YYYY; Separator: Semicolon; Decimal: Comma

ACCIDENT YEARS: First year: 2005; Last year: 2015

THRESHOLDS: GBR (in GBP): 2000; CHE (in CHF): 4000; ASIA (in USD): 5000; Others (in EUR): 3000

EXCHANGE RATES: Input Currency: EUR; EUR/GBP: 0.8; EUR/CHF: 1.09; EUR/USD: 1.1

INFLATION RATE: Material inflation rate: 0.03; Bodily inflation rate: 0.06

Material claims number/ All claims number: 1

Claim	Branch	Accident year	dev1	dev2	dev3	dev4	dev5	dev6	dev7	dev8	dev9	dev10	dev11
2	AXA CS GERMANY	2006	12 455	12 598	12 976	13 345	13 746	14 158	14 583	15 020	15 471	15 935	15 935
3	AXA CS UNITED KINGDOM	2007	22 407	24 367	22 455	23 175	23 891	24 692	25 442	19 305	19 884	19 884	19 884
4	AXA CS FRANCE	2008	3 401	2 321	2 391	2 484	2 558	2 635	1 055	1 087	1 087	1 087	1 087
5	AXA CS FRANCE	2009	6 780	4 480	3 022	3 113	3 206	3 302	3 401	3 401	3 401	3 401	3 401
6	AXA CS UNITED KINGDOM	2010	14 025	8 802	13 430	13 833	14 247	14 675	14 675	14 675	14 675	14 675	14 675
7	AXA CS FRANCE	2011	13 455	13 960	9 338	9 632	9 915	9 915	9 915	9 915	9 915	9 915	9 915
10	AXA CS FRANCE	2009	766	3 100	3 227	3 359	3 460	3 564	3 671	3 671	3 671	3 671	3 671
12	AXA CS FRANCE	2011	0	0	0	1 892	4 286						
13	AXA CS GERMANY	2011	56 100	93 507	96 312	99 202	102 178	102 178	102 178	102 178	102 178	102 178	102 178
16	AXA CS FRANCE	2015	28 880										
17	AXA CS FRANCE	2005	2 109	2 578	2 925	1 742	1 794	5 848	13 738	1 960	2 019	2 080	2 142
21	AXA CS FRANCE	2006	0	1 868	2 568	2 654	2 733	2 811	2 895	2 982	3 071	3 163	3 163
23	AXA CS FRANCE	2011	2 370	3 102	3 232	3 329	3 429	3 429	3 429	3 429	3 429	3 429	3 429
24	AXA CS GERMANY	2006	0	6 295	5 418	5 560	5 726	5 898	6 075	6 257	6 445	6 639	6 639
27	AXA CS FRANCE	2009	0	12 412	17 439	15 238	17 485	17 727	18 259	18 259	18 259	18 259	18 259

1. Primary language: R
2. Shiny is an R package open-sourced by Rstudio in 2012
3. HTML, CSS, JavaScript, D3 - optional
4. Shiny dashboards are comparable to Business Intelligence (BI) tools, such as Tableau, Spotfire, Qlikview

# Shiny Application: Get Inspired

Shiny Gallery

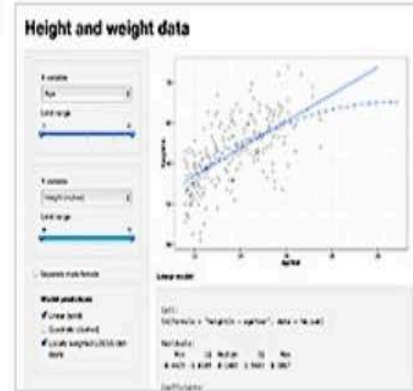
## Default Shiny layout

[View App](#) | [View Code](#)



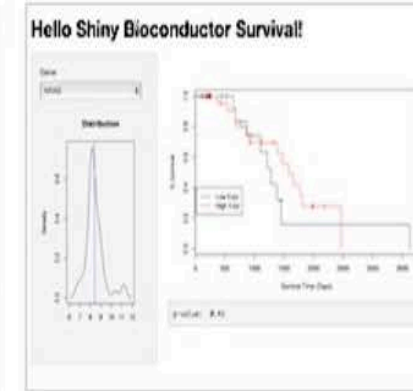
## Modeling and table output

[View App](#) | [View Code](#)



## Using plots as input

[View App](#) | [View Code](#)



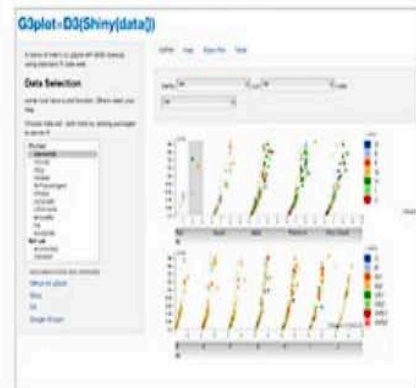
## Visualizing survey results

[View App](#) | [Article 1](#) | [Article 2](#)



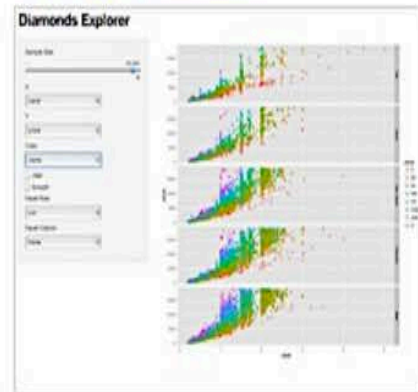
## D3 and Shiny

[View App](#) | [View g3plot](#)



## Dataset exploration tool

[View App](#) | [View Code](#)



## Leveraging maps as input

[View App](#) | [View Code](#)



## Interactive Dashboard

[View App](#) | [View Code](#)

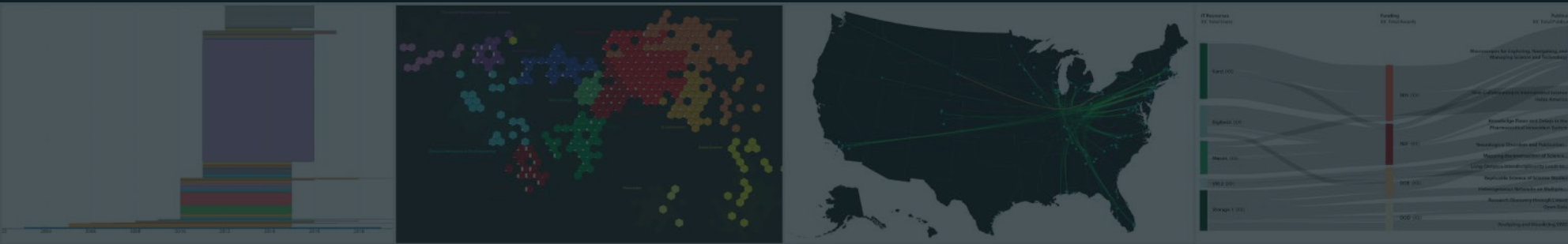


## Full website using Shiny

[View App](#) | [Article](#)



# CNS Shiny Framework: Examples



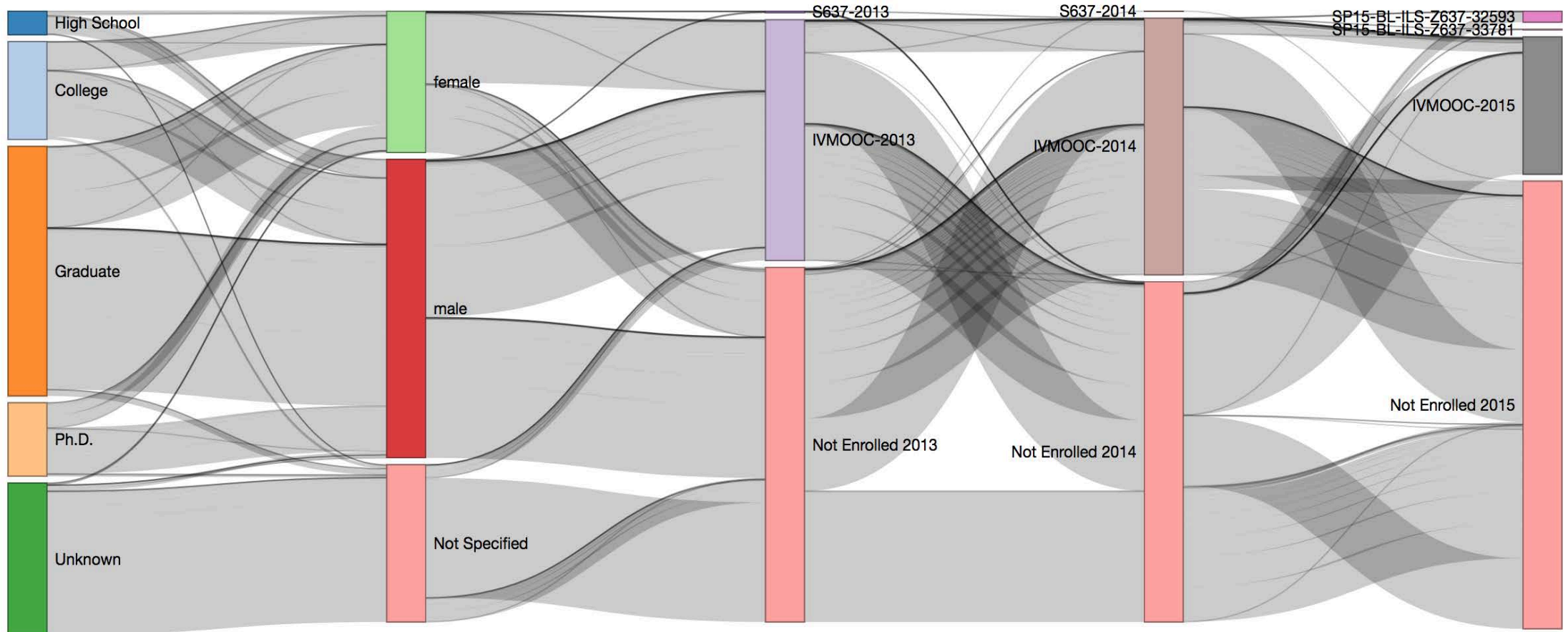
# Visualization: Sankey

## IVMOOC Student Enrollment Data

Sankey Network

Alluvial Sankey Network

GoogleViz Sankey Network





# Visualization: Streamgraph

## Stream Plot Visualization Tool

Please upload a .csv file with a time, categorical and count field.

**Choose CSV file to upload**

Header

**Separator**

Comma

Semicolon

Tab

**Quote**

None

Double Quote

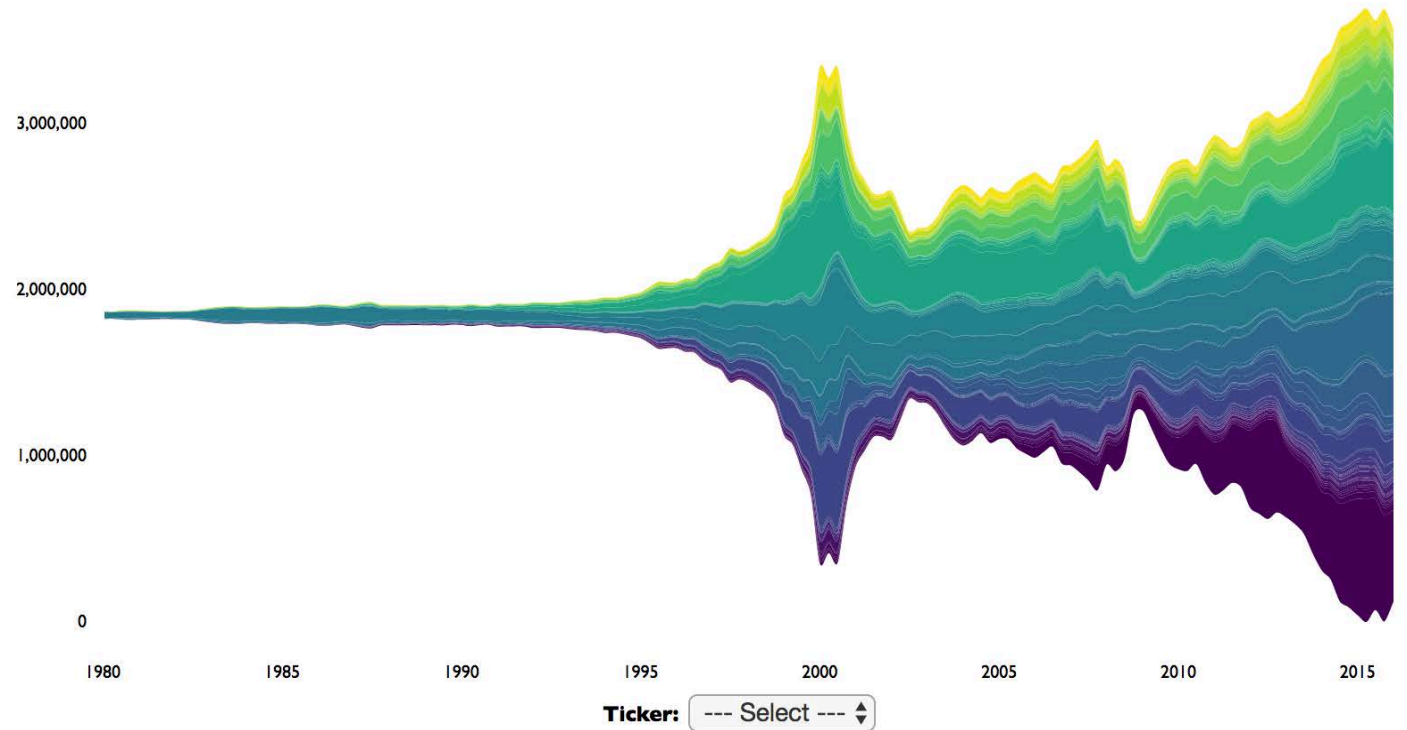
Single Quote

[Streamgraph example 1](#)

[Streamgraph example 2](#)

[Data upload plot](#)

### Stock Market example



Offset Type

silhouette



# Interactive Text Mining Suite

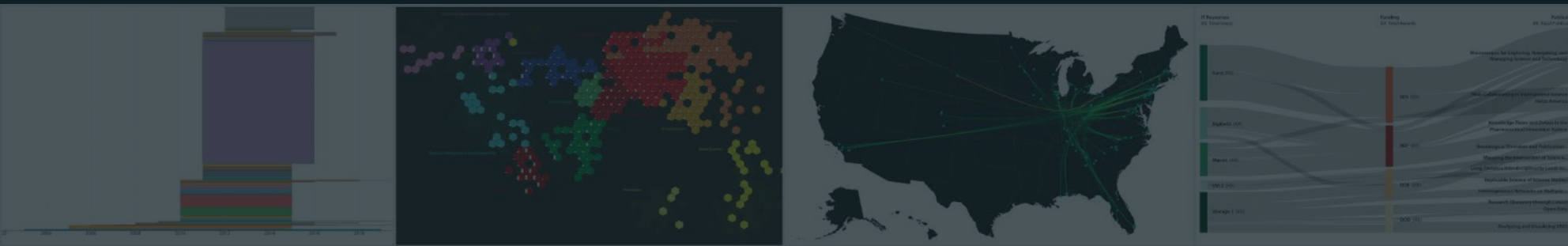
The screenshot displays the Interactive Text Mining Suite (ITMS) interface. At the top, there is a navigation bar with the ITMS logo and menu items: About, File Uploads (active), Data Preparation, and Data Visualization. Below the navigation bar, the interface is divided into several sections:

- File Upload Options:** A sidebar on the left lists options: Text Files, PDF Files, ZOTERO, Structured Data (highlighted in blue), and POS-Tagged Text.
- Choose file format:** Radio buttons for XML, JSON, and Google Books Search (selected).
- Search Terms:** A text input field containing "megaputer" and a Submit button.
- Search Results:** A table showing search results with columns for titles, authors, dates, and corpus. The first result is for "Decision Support Systems and Megaputer" by George M. Marakas, published in 2002.

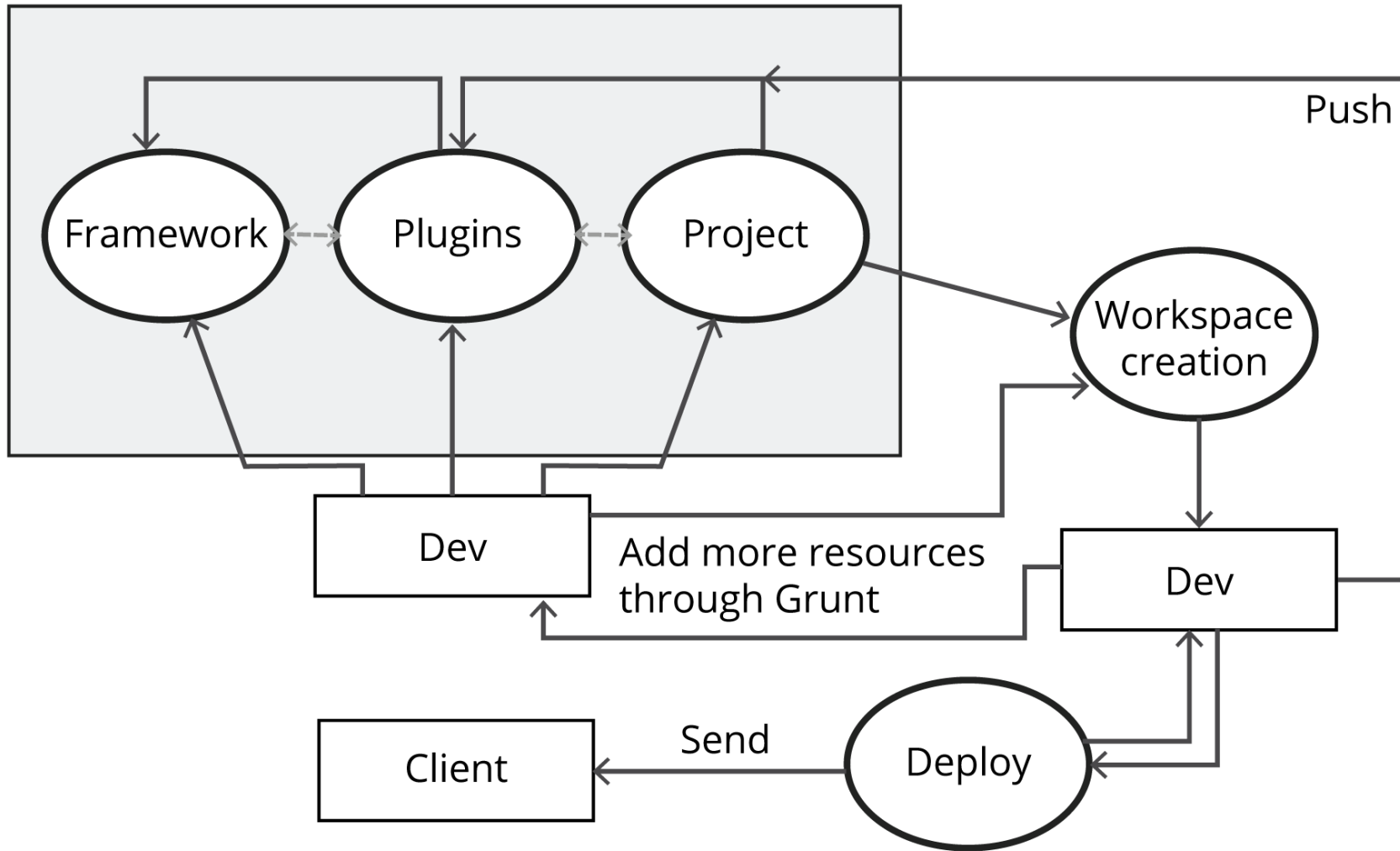
titles	authors	dates	corpus
Decision Support Systems and Megaputer	George M. Marakas	2002	Decision Support Systems and Megaputer Packed with essential information, this valuable volume helps future business management professionals learn to make and support managerial decisions, providing a thorough understanding of the support aspect of DSS. Written from a

Figure 5. Open Source Interactive Text Mining Suite - ITMS

# Web Visualization Framework: WVF



# WVF System Architecture



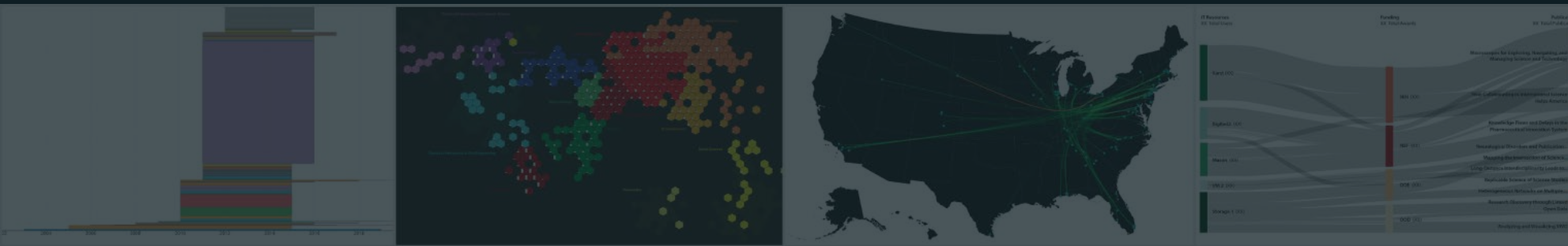
1. Developed by CNS team
2. Primary language: JavaScript
3. Build system: Grunt, NodeJS
4. Libraries: Grunt, AngularJS, D3, jQuery, HTML, CSS
5. Configuration-based customization

**Framework Workspace** - Default code and libraries

**Plugins Workspace** - D3 visualization code

**Project Workspace** - Project specific code (data, customization, styling, and instanced scripts)

# CNS WVF Framework: Examples



# Visualization: Twitter Network

Project: IAI

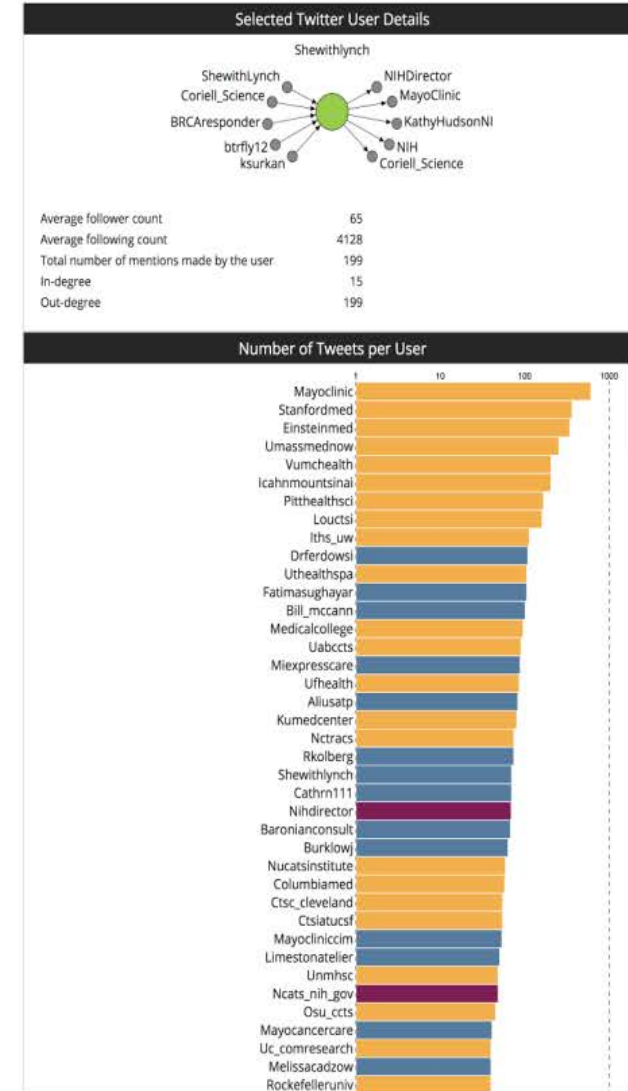
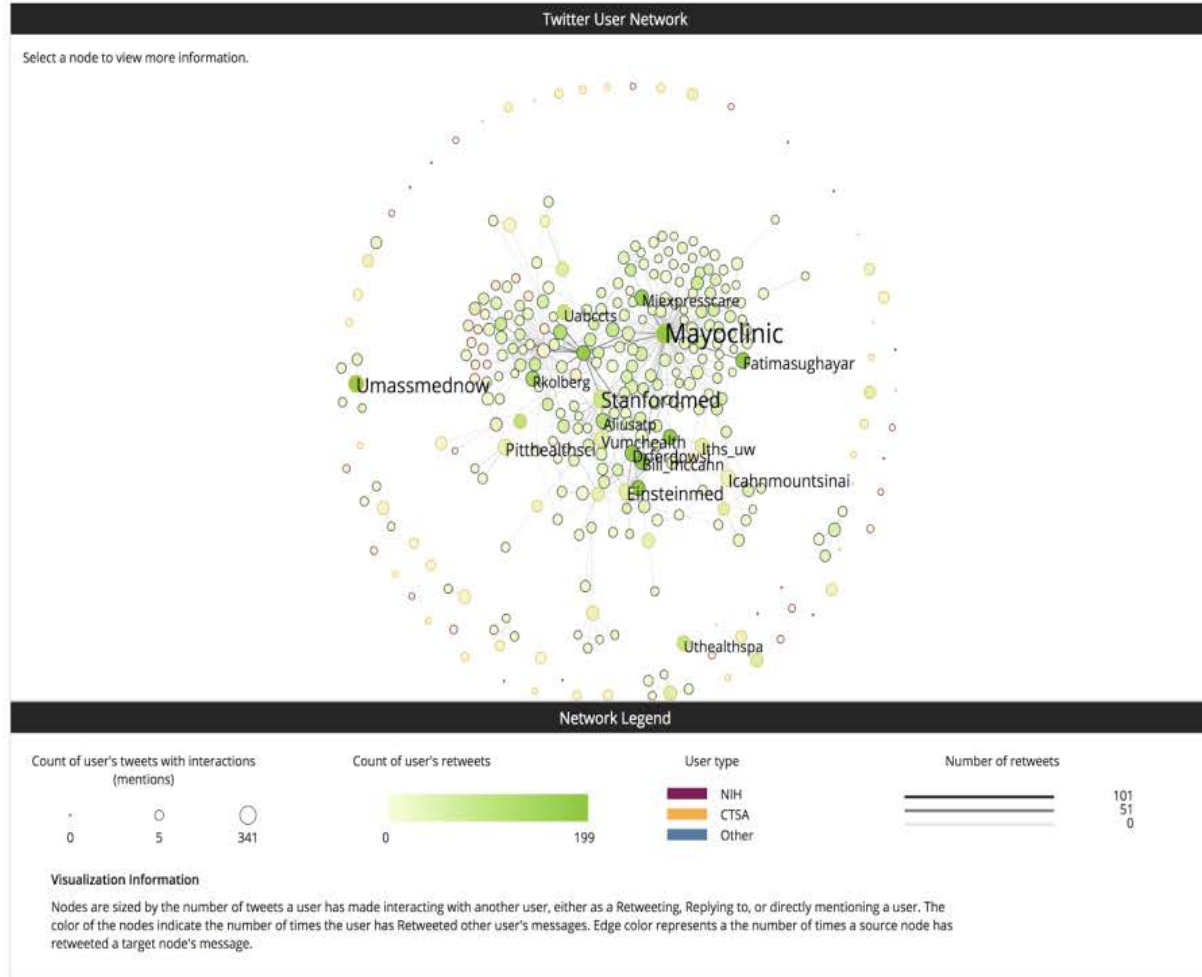


Figure 6. Social Network from CTSA Hub and NIH Activities on Twitter



# Visualization: UCSD Map of Science

Project: ECON [demo.cns.iu.edu/client/econ-ucsdmap](http://demo.cns.iu.edu/client/econ-ucsdmap)

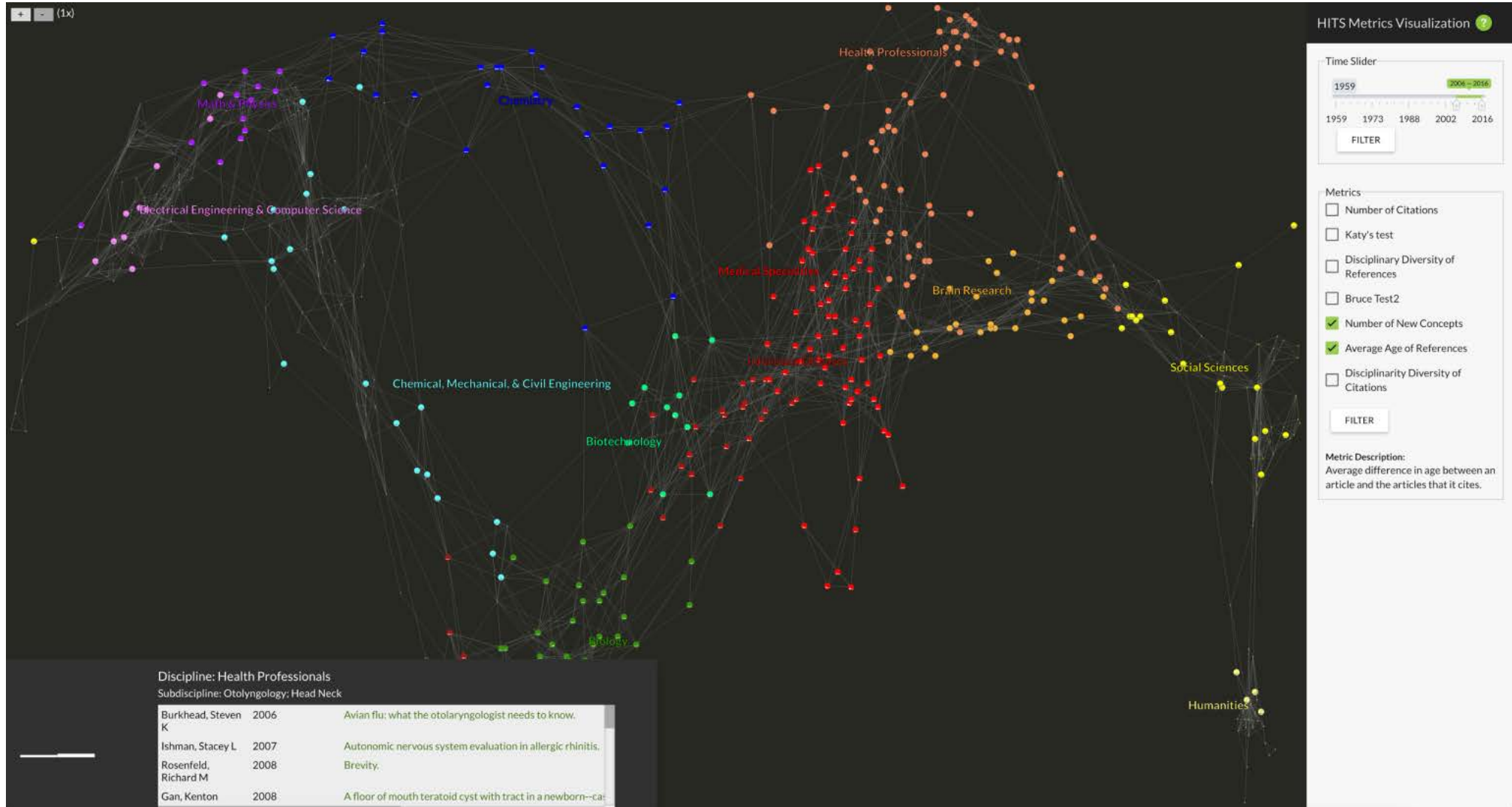
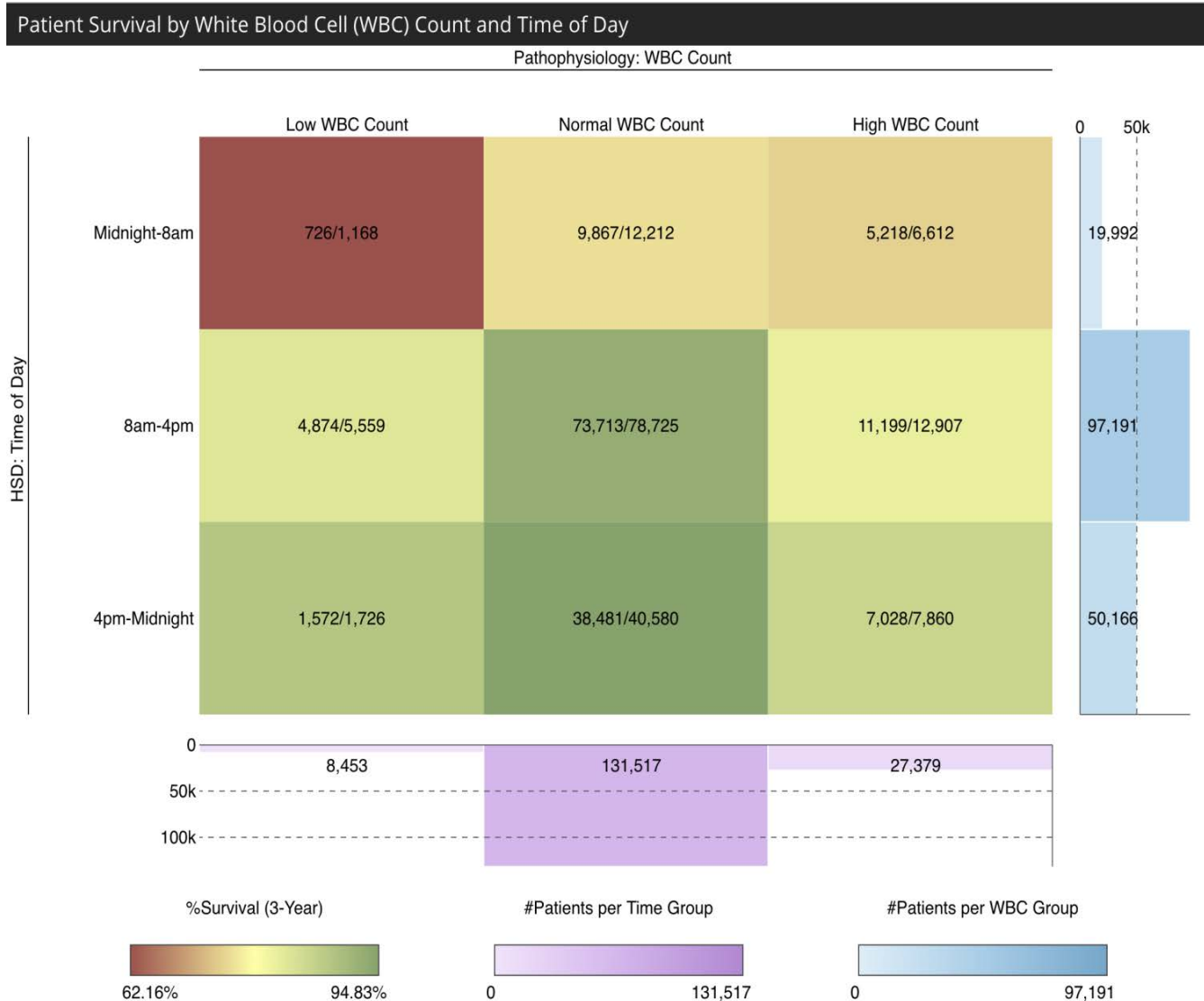


Figure 7. Interactive Map for High-Impact and Transformative Science Metrics

# Visualization: Heatmap

Project: HSD [demo.cns.iu.edu/client/hsd/static/heatmap\\_group.html](http://demo.cns.iu.edu/client/hsd/static/heatmap_group.html)



This visualization shows how white blood cell (WBC) laboratory tests correlate with three-year survival rates. The HSD dimension of the data (rows) is the time of the day of the test; and three-year survival rate (numbers and colors in the boxes) is an outcome variable.

**Aggregation level for the HSD time of day are shown—three 8 hour blocks.** The lowest survival rates are for patients with a low WBC value in the morning (specifically at 6am).

Figure 8. Patient Survival by White Blood Cell Count and Time of Day

# Visualization: Sankey

Project: STEM [demo.cns.iu.edu/webvis/stem](http://demo.cns.iu.edu/webvis/stem)

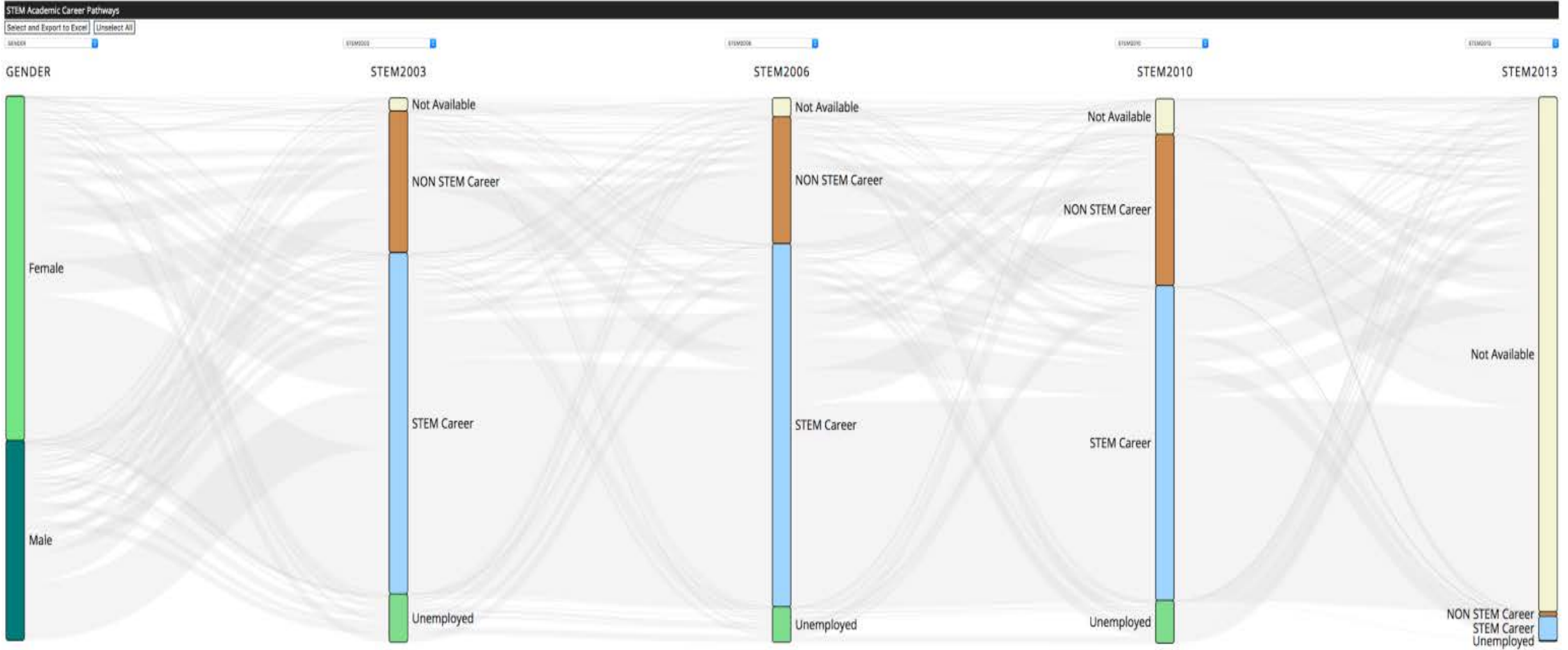


Figure 9. STEM Pathways Visualization

# Visualization: Outlook



## Research



Submitted paper:  
MOOC Visual Analytics

## Latest News



Börner Appointed to  
U.S. Department of  
Commerce - Data  
Advisory Council

## Our Products



We work closely with  
clients to provide  
custom-made data,  
visualization, &  
software solutions

## Development



Online version of  
*AcademyScope* now  
available on the  
National Academies  
Press website

## Outreach



CDC Museum to Host  
*Places & Spaces:  
Mapping Science*  
Exhibition

## Videos



Watch Katy Börner's  
presentation of  
*Humanexus* at the IU  
CEWiT Faculty Alliance  
Salon

## Teaching



Purchase *Visual  
Insights*, the IVMOOC  
companion textbook

1. More robust workflow
2. Public-facing code and documentation
3. More visualization library support
4. Better cross-visualization integration
5. More visualization plugins

All papers, maps, tools, talks, press are linked from  
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These slides are at <http://cns.iu.edu/presentations.html>

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

Visualizations:

<http://cns.iu.edu/visualizations.html>

Tools:

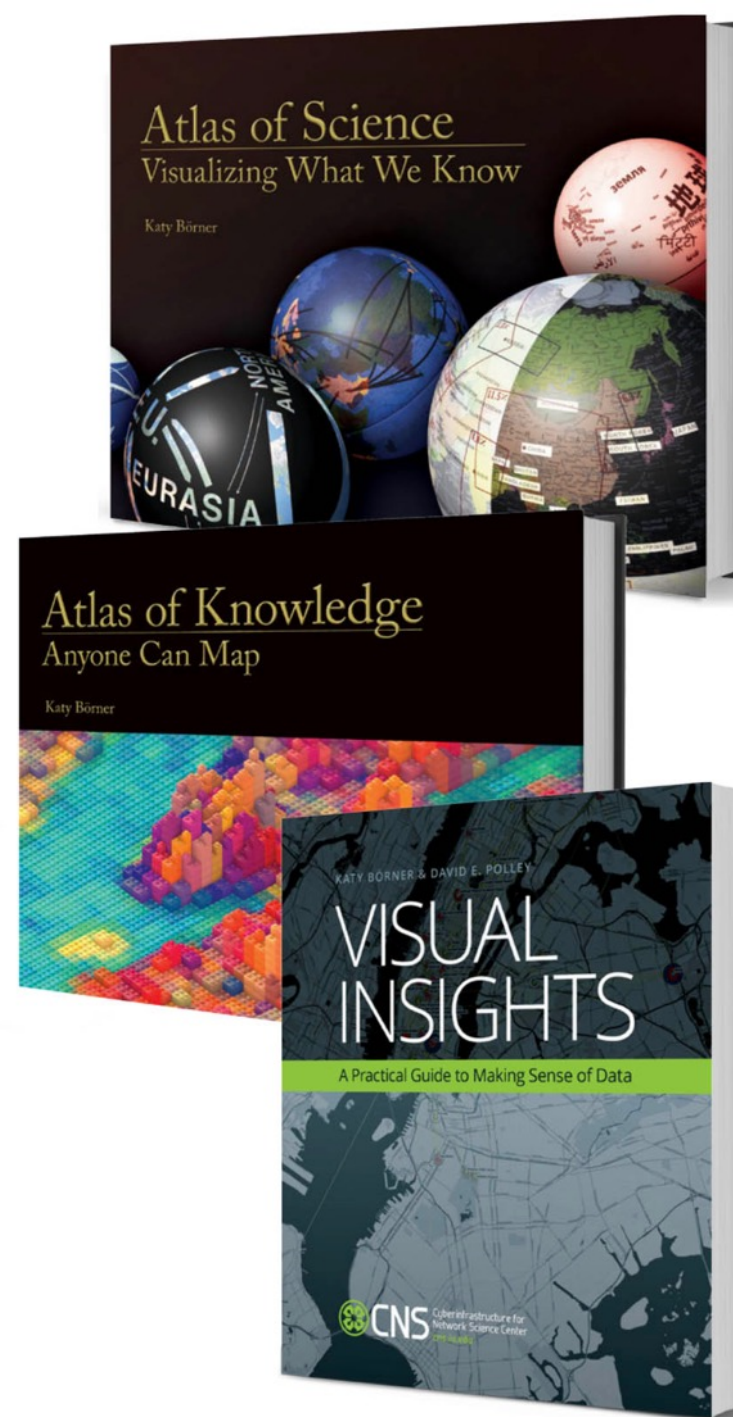
[http://cns.iu.edu/data\\_tools.html](http://cns.iu.edu/data_tools.html)



## 2018 IVMOOC

This course provides an overview about the state of the art in information visualization. It teaches the process of producing effective visualizations that take the needs of users into account.

Register for free: [ivmooc.cns.iu.edu](http://ivmooc.cns.iu.edu).  
Class started Jan 9, 2018.







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## KEYNOTES

**Zorina Galis**, National Institutes of Health  
"Mapping the Human Body: Splitting, Lumping, and the Rubik's Cube Dilemma"

**Oscar Morales**, VisionTech  
"Important Things You Need to Know to Help You Raise Capital: An Angel Investor Overview"

## SESSIONS

- » Cybersecurity
- » Funders and Funding
- » Visualization
- » Renewable Energy
- » Employer Panel
- » Engineering in Biology and Medicine
- » Résumé Building and Networking

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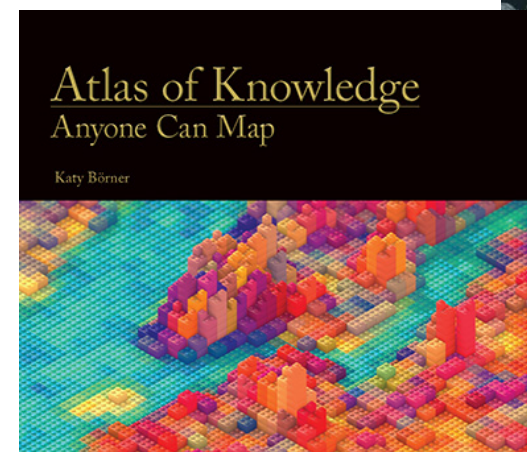
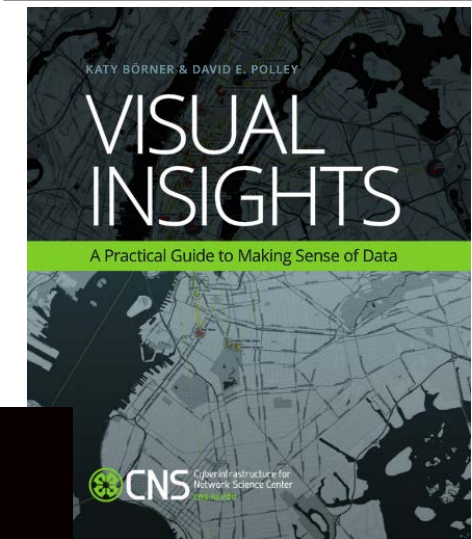
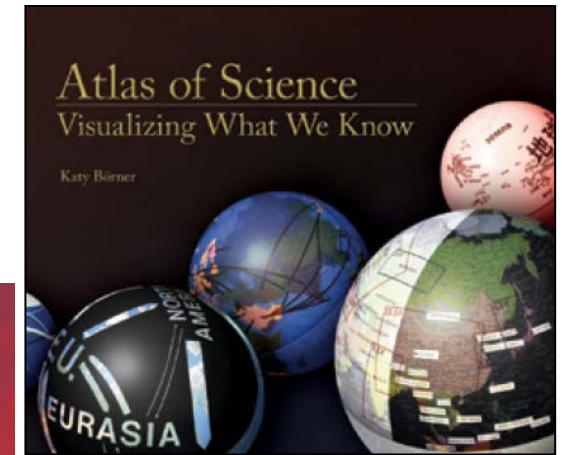
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<http://www.marketwired.com/press-release/dresner-advisory-services-publishes-2016-embedded-business-intelligence-market-study-2174046.htm>

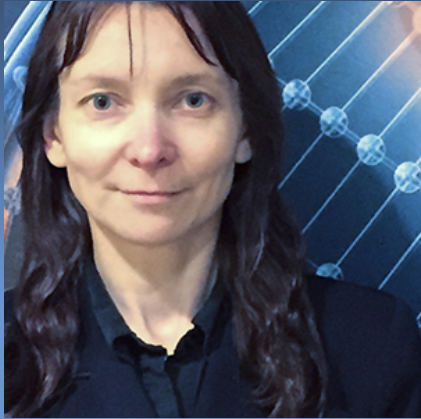
Java - <https://www.planet-source-code.com/vb/default.asp?lngWId=14>

Python - <https://realpython.com/learn/python-first-steps/>

Thank you!

@obscrivn

@cnscenter



PRESENTED BY:

**Olga Scrivner**

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# Questions