



Information Visualization for Knowledge Discovery

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Professor, Department of Computer Science
Member, Institute for Advanced Computer Studies



UNIVERSITY OF
MARYLAND





Interdisciplinary research community

- Computer Science & Info Studies
- Psych, Socio, Poli Sci & MITH

(www.cs.umd.edu/hcil)

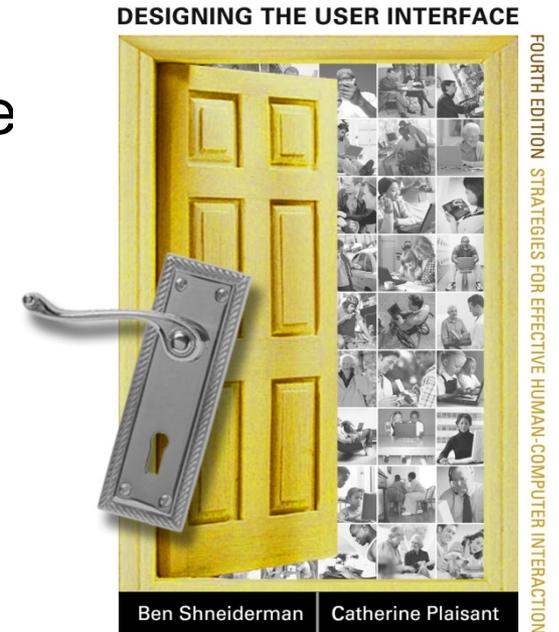


Scientific Approach (~~beyond user friendly~~)

- Specify users and tasks
- Predict and measure
 - time to learn
 - speed of performance
 - rate of human errors
 - human retention over time
- Assess subjective satisfaction
(Questionnaire for User Interface Satisfaction)
- Accommodate individual differences
- Consider social, organizational & cultural context

Design Issues

- Input devices & strategies
 - Keyboards, pointing devices, voice
 - Direct manipulation
 - Menus, forms, commands
- Output devices & formats
 - Screens, windows, color, sound
 - Text, tables, graphics
 - Instructions, messages, help
- Collaboration & communities
- Manuals, tutorials, training



www.awl.com/DTUI

U.S. Library of Congress



- Scholars, Journalists, Citizens
- Teachers, Students

Visible Human Explorer (NLM)

- Doctors
- Surgeons
- Researchers
- Students

Quit Subject Image Type About... Help...

Overview

Image Select

Range Select

Local Image Directory:
/tmp/vhimages

Images: 309 MBytes: 2201

Retrieve Full-Size Image...

Retrieve Full-Size Images...

Copyright (c) 1995
Human-Computer
Interaction Lab
University
of Maryland
at College Park

NASA Environmental Data

- Scientists
- Farmers
- Land planners
- Students

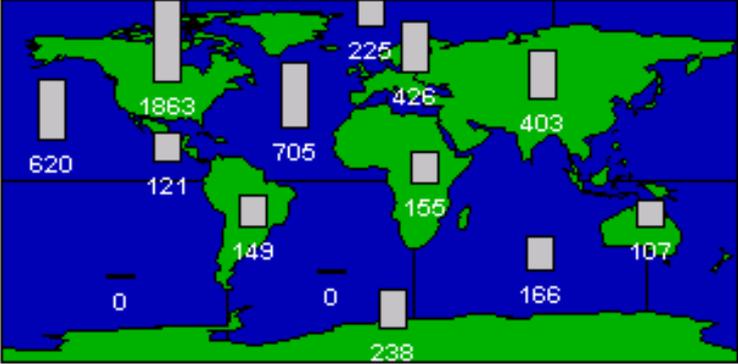


Global Change Master Directory

Global Change Master Directory

Query Preview

Area Selection:



Select attributes of interest by clicking on map area.

Topic Selection:

Atmosphere	2151
Biosphere	1083
Cryosphere	313
Human Dimensions	595
Hydrosphere	643
Land Surface	802
Oceans	1321
Paleoclimate	120
Radiance Or Imagery	738
Solar Physics	113
Solid Earth	429
Not Specified	0

Year Selection:

Prehistoric	0
0001 - 1699	21
1700 - 1799	51
1800 - 1849	91
1850 - 1899	283
1900 - 1929	409
1930 - 1939	415
1940 - 1949	498
1950 - 1959	711
1960 - 1969	978
1970 - 1979	1649
1980 - 1989	2445
1990 - 1999	2391
Not Specified	644

Bureau of the Census



- Economists, Policy makers, Journalists
- Teachers, Students

American FactFinder™

NSF Digital Government Initiative



- Find what you need
- Understand what you Find

Census,
NCHS,
BLS, EIA,
NASS, SSA



www.ils.unc.edu/govstat/

FEDSTATS



International Children's Digital Library



INTERNATIONAL CHILDREN'S DIGITAL LIBRARY

A Library for the World's Children

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QUICK LINKS

[myICDL Account](#)

- [Register / Sign in](#)
- [Select language](#)

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- [Mission & summary](#)
- [General FAQ](#)

For returning visitors

- [Recently added books](#)

For book contributors

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- [Translators](#)



Simple search



Location search

Our Mission

We are a library that provides free access to children's books from around the world. By ensuring access to books from many cultures and in diverse languages, we foster a love of reading, a readiness to learn, and a response to the challenges of world illiteracy.

We invite you to [explore our growing library](#) and learn how you can [contribute to our efforts](#).

FEATURED BOOKS

Colorful illustrations with Jeanette Marin

May 8, 2006 Selected by Jeanette Marin, a student at the University of Maryland. Jeanette has three daughters



Simple Search

[Home](#) > [Read books!](#) > Simple Search



Rainbow Covers



Red Covers



Orange Covers



Yellow Covers



Green Covers

French = 16 books



[Aliou et Jean](#)
French



[The amazing adventures of...](#)
French



[The baby's doll](#)
French



[A big little girl](#)
French



[Collection of 150 prints o...](#)
French



[I'll be a stuntman!](#)
French



Three to Five



Six to Nine



Ten to Thirteen



Make Believe Books



True Books



Short Books



Medium Books



Long Books



Recently Added
Books



Award Winn
Books

Keywords in

Piccolo: Toolkit for 2D zoomable objects

Structured canvas of graphical objects in a hierarchical scenegraph

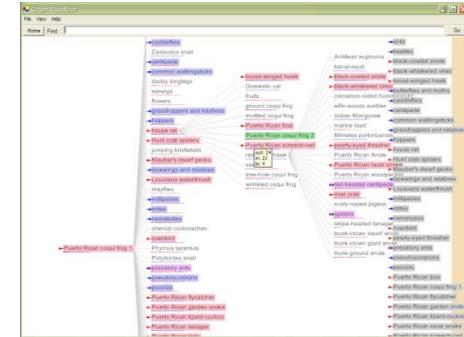
- Zooming animation
- Cameras, layers

Open, Extensible & Efficient
Java, C#, PocketPC versions

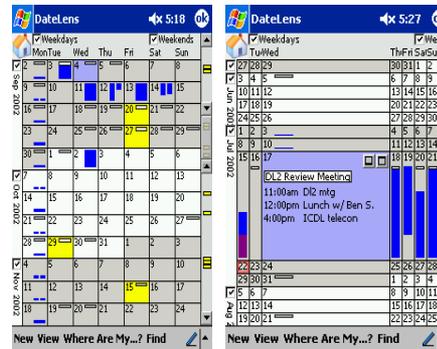
www.cs.umd.edu/hcil/piccolo



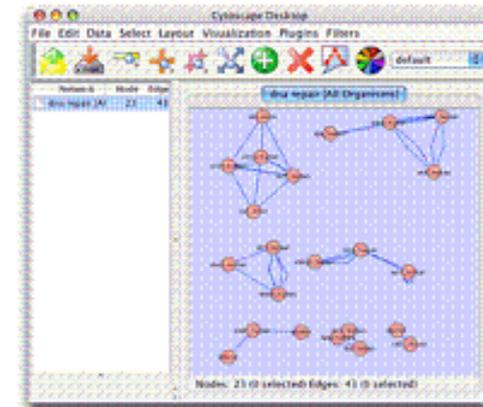
AppLens & Launch Tile
UMD, Microsoft Research



TreePlus
UMD



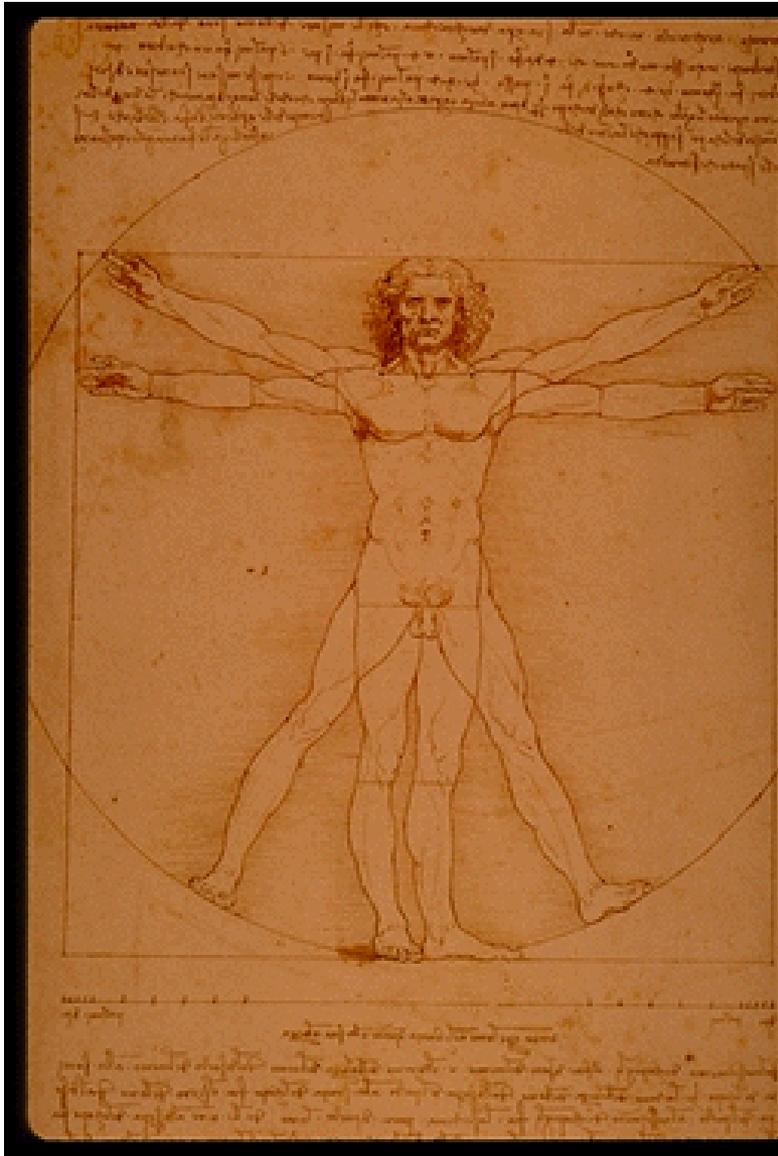
DateLens
Windsor Interfaces, Inc.



Cytoscape
*Institute for Systems Biology
Memorial Sloan-Kettering
Institut Pasteur UCSD*



Information Visualization

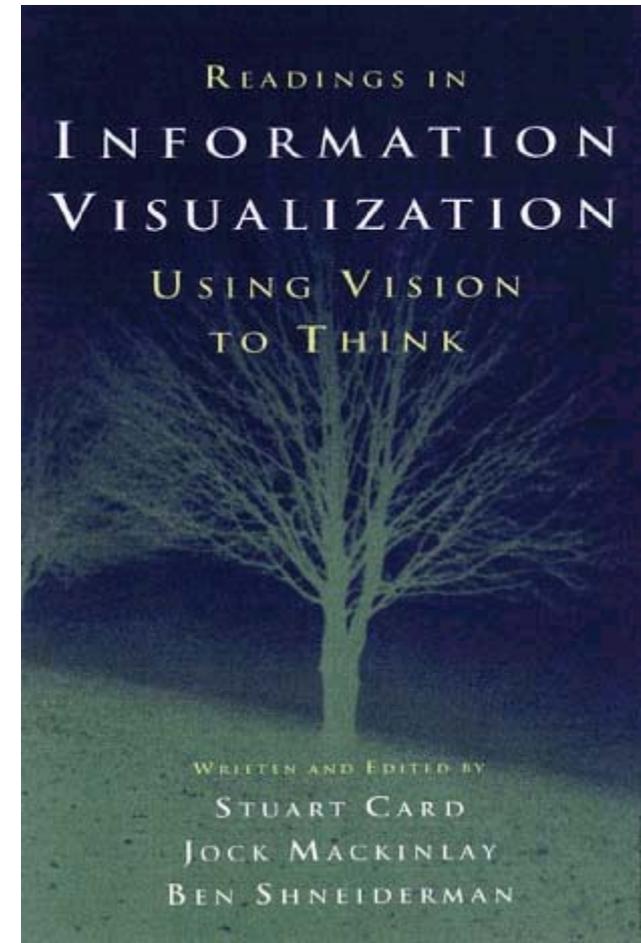


**The eye...
the window of the soul,
is the principal means
by which the central sense
can most completely and
abundantly appreciate
the infinite works of nature.**

***Leonardo da Vinci*
(1452 - 1519)**

Using Vision to Think

- **Visual bandwidth is enormous**
 - Human perceptual skills are remarkable
 - Trend, cluster, gap, outlier...
 - Color, size, shape, proximity...
 - Human image storage is fast and vast
- **Opportunities**
 - Spatial layouts & coordination
 - Information visualization
 - Scientific visualization & simulation
 - Telepresence & augmented reality
 - Virtual environments



Spotfire: Retinol's role in embryos & vision

Cell Cycle siRNA Plate 1 - Spotfire GE Healthcare DecisionSite

File Edit View Visualization Data Tools Guides Window Help

Guides

Contents > Simple Plate Map Visualisation

Copyright GE Healthcare 2006



GE Healthcare Plate Map Visualisation Guide

Plate Map Visualisation

This guide will create plate views from IN Cell data that have been transferred using the Spotfire Connect utility. The guide is based on individual object data and assumes that two columns called WellR and WellC exist to describe the plate position.

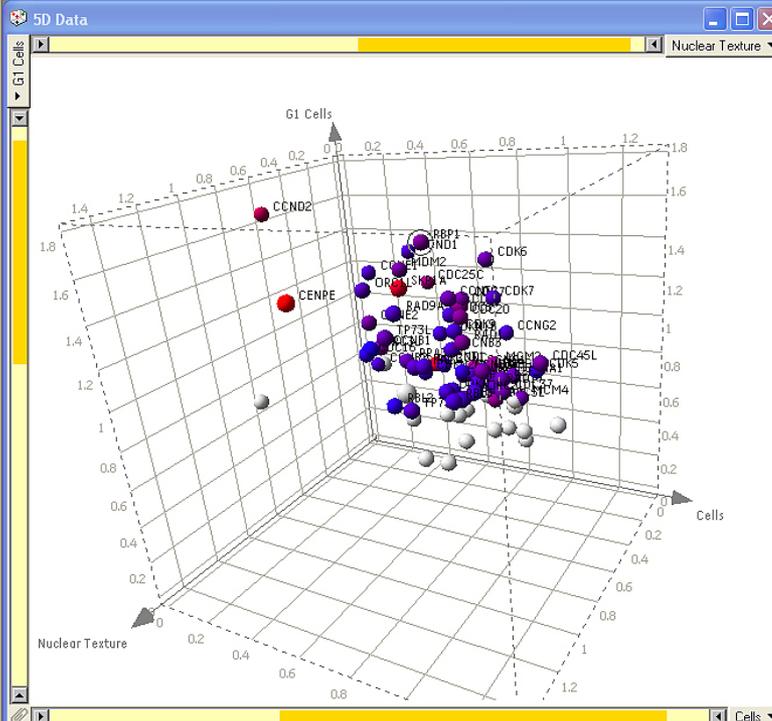
Each plate map can be configured further using the Properties dialogue.

[Open demonstration data and Display table](#)

Opens the demonstration data saved with the Guide and displays a table. Displaying the table is an optional step showing that the above action link does actually load the data. Alternatively, you can use the Spotfire Connect utility to transfer data from IN Cell Investigator.

[Next](#)

5D Data



Morphology

CCND2	
CCN82	
CCN81	
CCND1	
CCNE2	
ORC1L	
CDC25C	
SKP1A	
SKP2	
CDKN2D	
RBP1	
RBL2	
CDKN18	
TP73L	
CDC6	
CCNG1	
PCNA	
CCN83	
TP73	
CDK9	
CCND3	
CEN1	
CDC20	
E2F3	
CCNG2	
RB1	
CDK6	
CENPC1	
CDK7	
RAD17	
DRCSL	
CCNA1	
E2F2	
MCM4	
CDC45L	

Query Devices

Row

- H
- G
- F
- E
- D
- C
- B
- A

Column

1 12

siRNA

Blank TP73L

Cells

0 1.322

G1 Cells

1.0387596... 1.78666666...

Nuclear Area

0 1.971544

Micronuclei

0 4.9425

Nuclear Texture

Details-on-Demand

Column	Value
Row	F
Column	10
siRNA	FBP1
Cells	0.916
G1 Cells	1.653333333...
Nuclear Area	0.98185
Micronuclei	2.3025
Nuclear Texture	1.015828947...

Legend

Plate Map

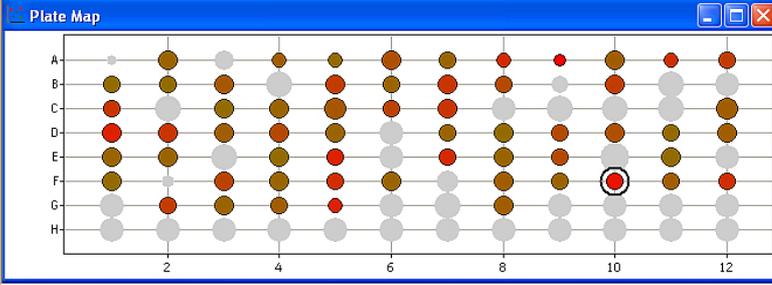
Color by G1 Cells:

0 1.78666666...

Size by Cells:

0 1.322

Plate Map



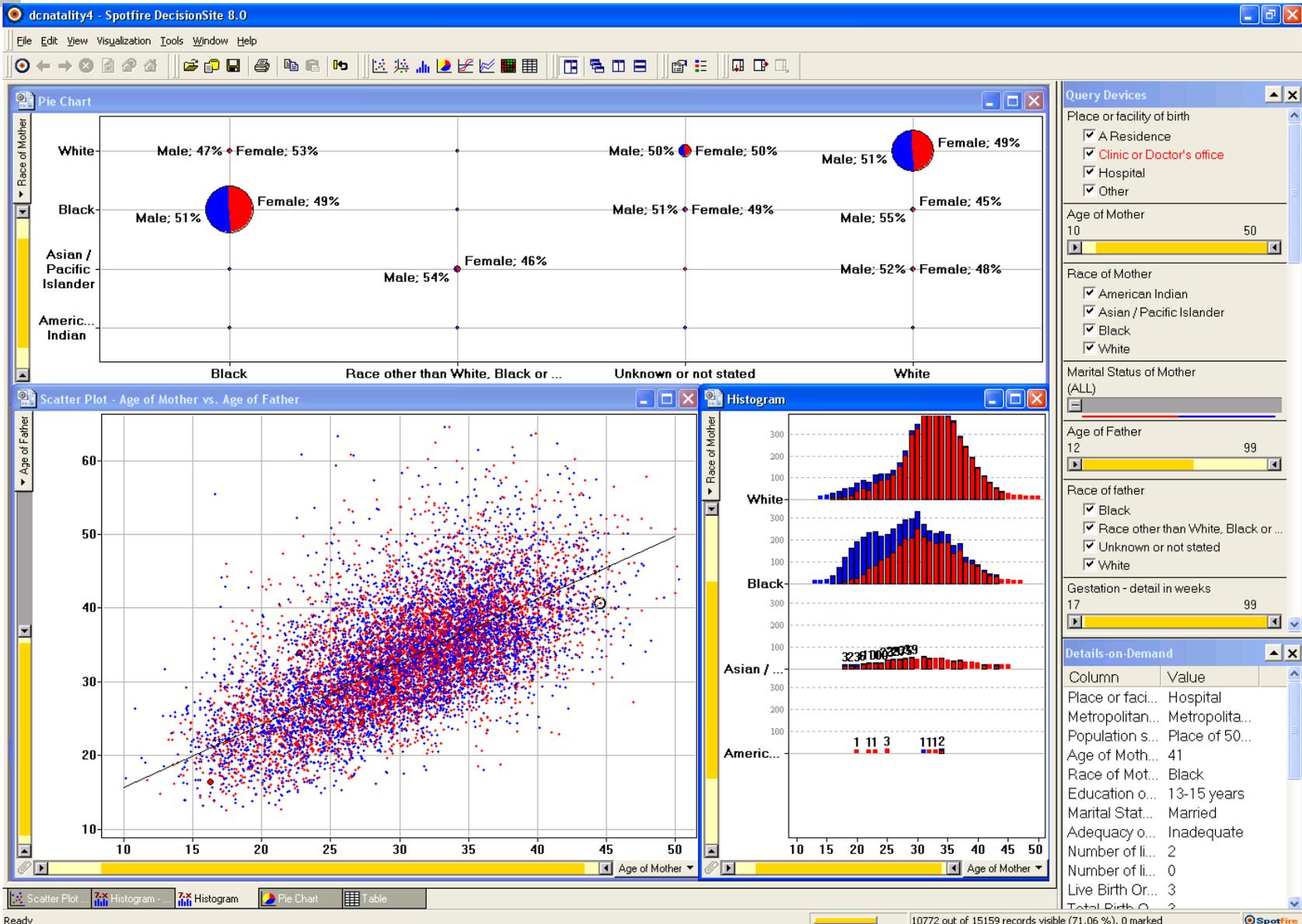
Connected to 199.244.143.138

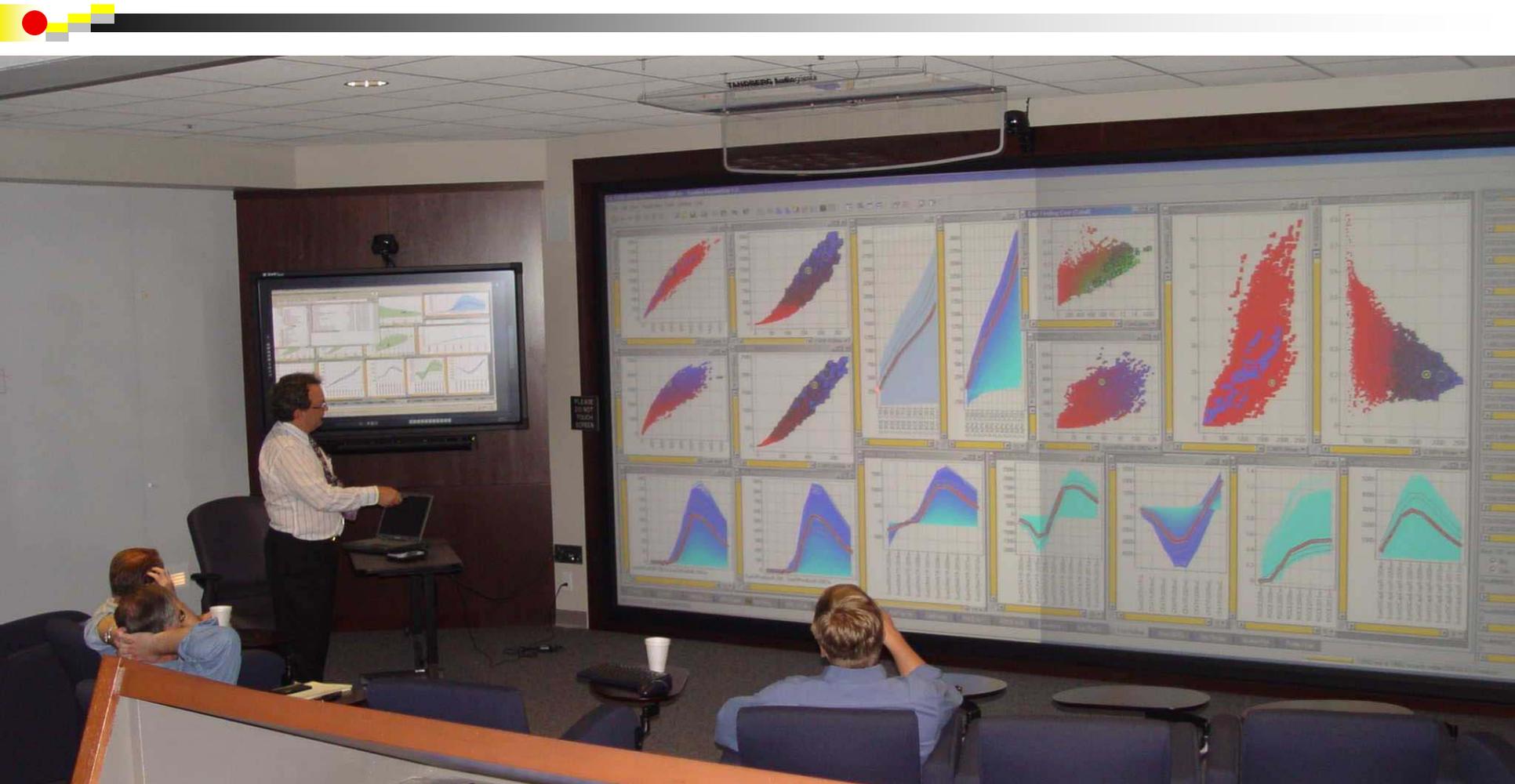
Ready

59 out of 96 records visible (61.46%), 0 marked



Spotfire: DC natality data





Information Visualization: Mantra

- Overview, zoom & filter, details-on-demand

Information Visualization: Data Types

SciViz

- **1-D Linear** Document Lens, SeeSoft, Info Mural, Value Bars
- **2-D Map** GIS, ArcView, PageMaker, Medical imagery
- **3-D World** CAD, Medical, Molecules, Architecture

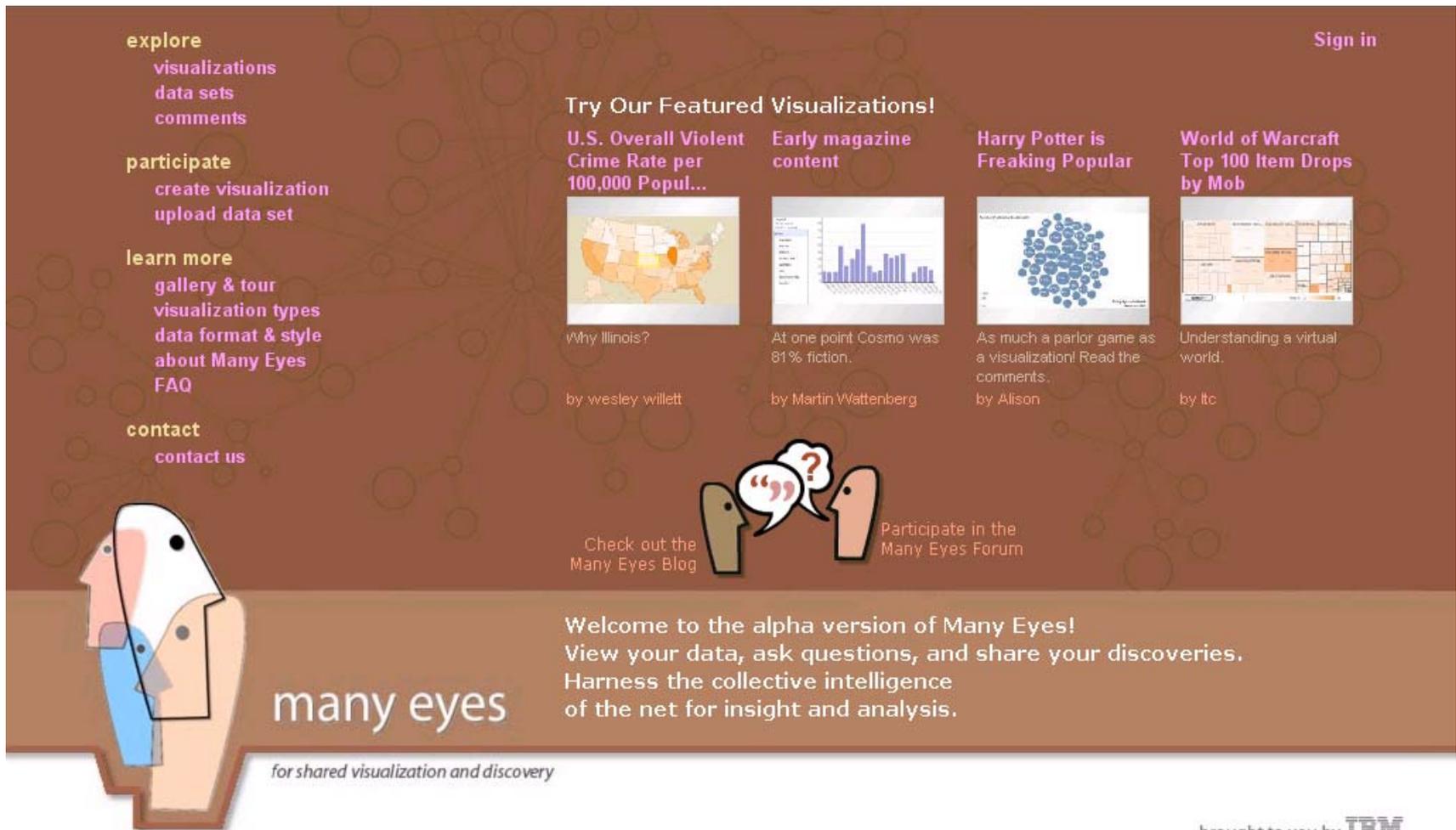
InfoViz

- **Multi-Var** Parallel Coordinates, Spotfire, XGobi, Visage, Influence Explorer, TableLens, DEVisé
- **Temporal** Perspective Wall, LifeLines, Lifestreams, Project Managers, DataSpiral
- **Tree** Cone/Cam/Hyperbolic, TreeBrowser, Treemap
- **Network** Netmap, netViz, SeeNet, Butterfly, Multi-trees

(Online Library of Information Visualization Environments)
otal.umd.edu/Olive



ManyEyes: A web sharing platform



The image shows a screenshot of the ManyEyes website interface. The background is a dark brown color with a pattern of light brown circles. On the left side, there are three main sections: 'explore' with links for visualizations, data sets, and comments; 'participate' with links for creating visualizations and uploading data sets; and 'learn more' with links for a gallery & tour, visualization types, data format & style, about Many Eyes, and FAQ. Below these is a 'contact' section with a 'contact us' link. In the top right corner, there is a 'Sign in' link. The main content area is titled 'Try Our Featured Visualizations!' and features four columns, each with a visualization thumbnail, a title, a brief description, and the author's name. The visualizations include a map of the U.S., a bar chart, a bubble chart, and a treemap. At the bottom of the main content area, there is an illustration of two stylized human heads in profile, one orange and one blue, with speech bubbles between them. Below this illustration, there are two links: 'Check out the Many Eyes Blog' and 'Participate in the Many Eyes Forum'. At the bottom of the page, there is a large white area with the 'many eyes' logo, the tagline 'for shared visualization and discovery', and the text 'Welcome to the alpha version of Many Eyes! View your data, ask questions, and share your discoveries. Harness the collective intelligence of the net for insight and analysis.' In the bottom right corner, there is a logo for 'brought to you by IBM' and the HCIL logo.

explore
visualizations
data sets
comments

participate
create visualization
upload data set

learn more
gallery & tour
visualization types
data format & style
about Many Eyes
FAQ

contact
contact us

Sign in

Try Our Featured Visualizations!

U.S. Overall Violent Crime Rate per 100,000 Popul...

Why Illinois?
by wesley willett

Early magazine content

At one point Cosmo was 81% fiction.
by Martin Wattenberg

Harry Potter is Freaking Popular

As much a parlor game as a visualization! Read the comments.
by Alison

World of Warcraft Top 100 Item Drops by Mob

Understanding a virtual world.
by Itc

Check out the Many Eyes Blog

Participate in the Many Eyes Forum

many eyes
for shared visualization and discovery

Welcome to the alpha version of Many Eyes!
View your data, ask questions, and share your discoveries.
Harness the collective intelligence of the net for insight and analysis.

brought to you by **IBM**

HCIL

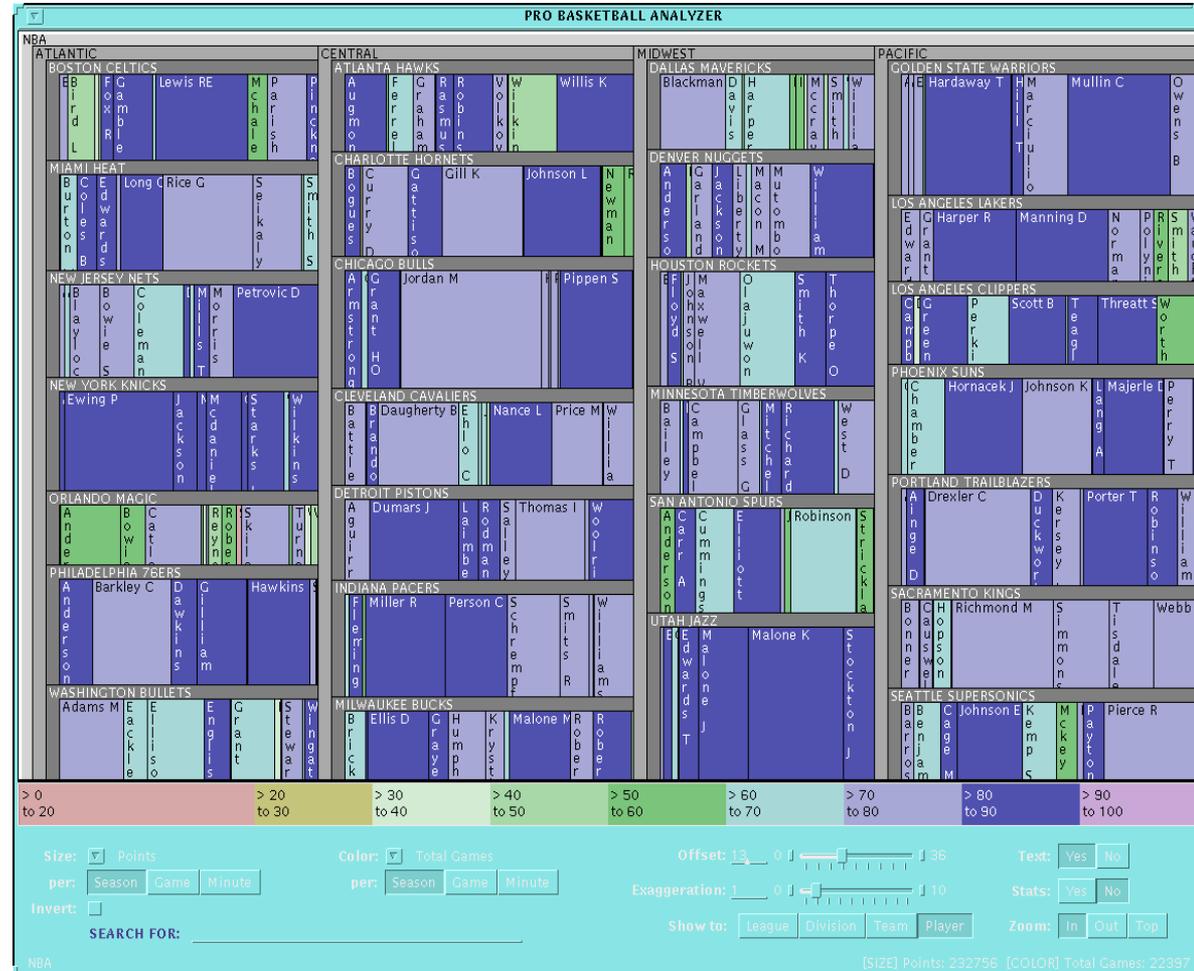
<http://services.alphaworks.ibm.com/manyeyes/app>



Treemap: view large trees with node values

- + Space filling
- + Space limited
- + Color coding
- + Size coding
- Requires learning

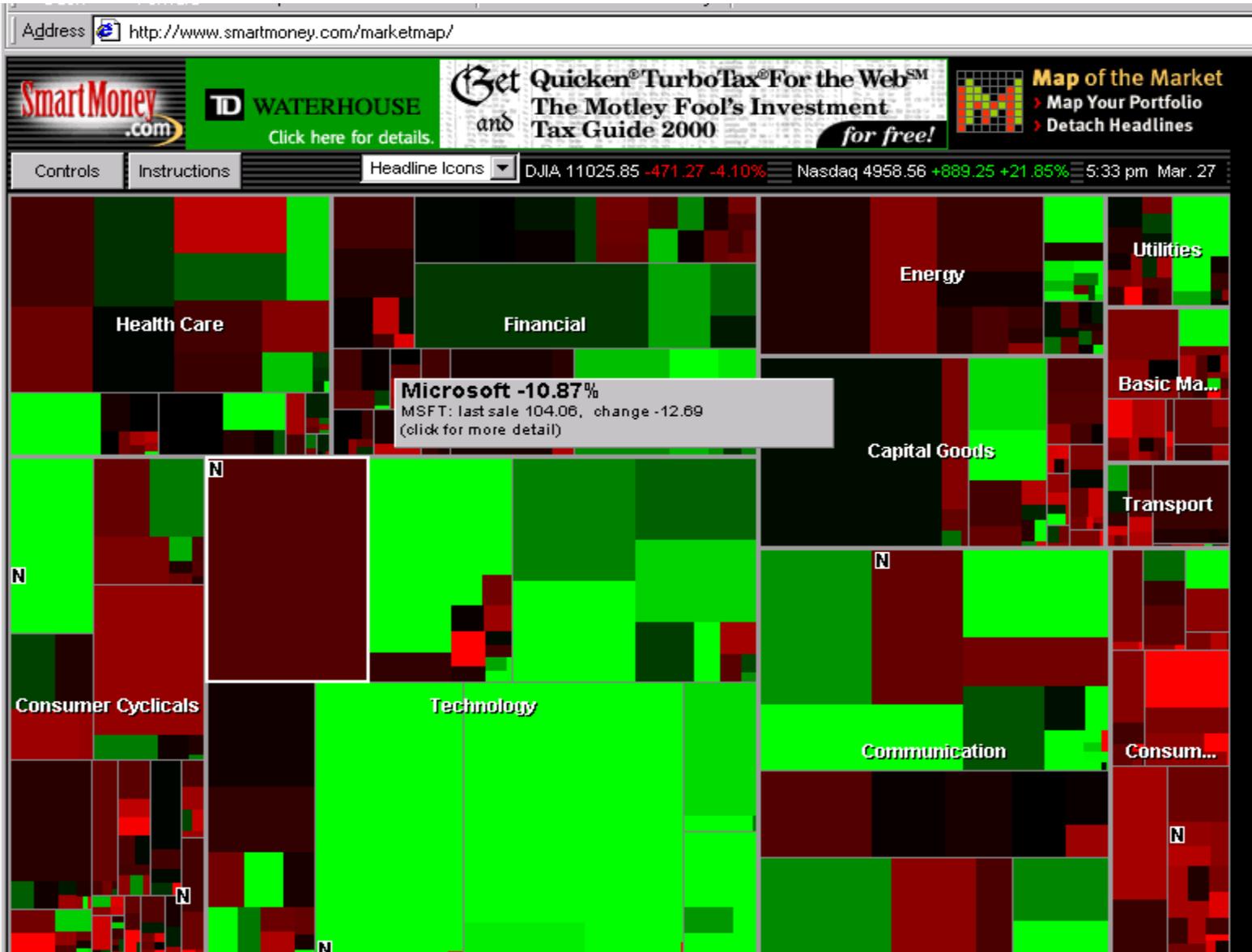
TreeViz (Mac, Johnson, 1992)
NBA-Tree(Sun, Turo, 1993)
Winsurfer (Teittinen, 1996)
Diskmapper (Windows, Micrologic)
SequoiaView, Panopticon,
HiveGroup, Solvern
Treemap4 (UMd, 2004)



(Shneiderman, *ACM Trans. on Graphics*, 1992 & 2003)



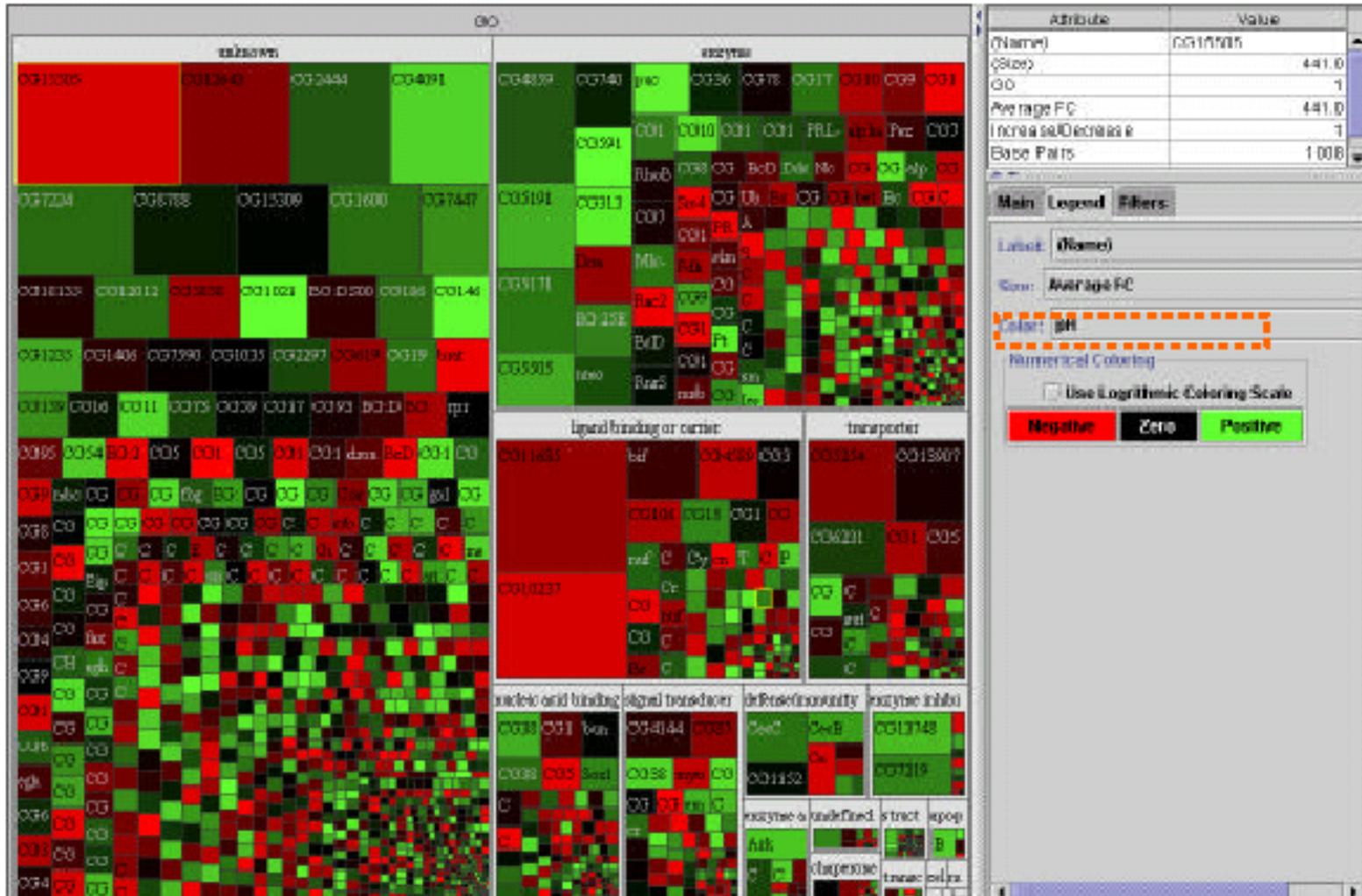
Treemap: Stock market, clustered by industry



Treemap: Newsmap



Treemap: Gene Ontology



<http://www.cs.umd.edu/hcil/treemap/>

Treemap: Product catalogs

www.hivegroup.com

http://www.hivegroup.com/amazon_dyn.html - Microsoft Internet Explorer

The Hive Group Close Window *Audio & Video* *Camera & Photo* *Computer Add-Ons*

Digital Cameras: All Digital Cameras Amazon.com prices subject to change. Generated: Mon Oct 6 22:24:34 2003

HONEYCOMB LAYOUT

GROUP by: Product Manufacturer SIZE represents: Amazon.com - Our Price COLOR represents: Amazon.com - Sales Rank

Filters: 1) Show Only Available Items
 2) Average Customer Review: All
 3) Amazon.com - You Save %: All
 4) Amazon.com - You Save \$: \$0 - \$40, \$41 - \$82, \$83 - \$124, \$125 - \$166, \$167 - \$208, \$209 - \$250
 5) Amazon.com - Our Price: \$36 - \$1029, \$1030 - \$2023, \$2024 - \$3016, \$3017 - \$4010, \$4011 - \$5004, \$5005 - \$5999
 6) Amazon.com - Sales Rank: 96 - 6892, 6893 - 13689, 13690 - 20486, 20487 - 27283, 27284 - 34081

Nikon	Sony	Kodak	Panasonic
	\$1,016.95	\$799.99	\$499.99, \$282.9...
			\$399.99, \$26..., \$26...
			\$399.99, \$26..., \$24...
		Olympus	Fujifilm
		\$349...	\$438...
		\$216...	\$269.94
		\$179.9...	\$326.99
		Yashica	Casio
			\$499.8...
			\$32...
		Minolta	Canon Cameras US
		\$399.99	\$429.99
		\$349.99	\$319...
		\$282.9...	\$129...
		Epson	HP
		\$799.00	\$299.0...
			\$15...

Pentax Optio 555 5MP Digital Camera w/ 5x Optical Zoom



Pentax
List Price: n/a
Our Price: \$599.99
You Save: n/a
Availability: Not yet released

Features:

- 5.0 MegaPixel CCD
- Ultra lightweight aluminum alloy body - Weighs only 7.2 oz
- Voice recording mode - audio capability that rivals stand alone audio recording devices
- Unlimited recording in Movie mode with sound

Average Customer Review: **0.00 Stars (0 Reviews)**
Sales Rank: **3,670**

[Click to View Options](#)

Displaying: 94 of 94 Amazon Products Cell Labels: Price SEARCH:

Peet's Coffee & Tea

SHOP | ROASTING | FRESHNESS | TASTING | ABOUT US

COFFEE TASTING | COFFEE BREWING | TEA TASTING | TEA BREWING

COFFEE SELECTOR

CLICK HERE FOR HELP.

THIS FIELD REPRESENTS THE FULL SPECTRUM OF PEET'S COFFEES.

CLICK ON A COFFEE TO ADD IT TO YOUR CART OR TO LEARN MORE.

LEGEND

GROUP = COFFEE TYPE
SIZE = PRICE
COLOR = BODY

Medium Very Full

CHECK A BOX TO VIEW...

BEST SELLERS
 RECOMMENDED FOR ESPRESSO

Try our Holiday Gift Finder.

Peet's Blends	Decaffeinate
Africa and Arabia	The Pacific
Dark Roast	Americas

Top Blend
Premium coffees from Latin America and the Pacific blended to create full body, sparkling acidity, and spicy notes.
\$10.95 / lb (Click for more)

Click here to let us know what you think of Peet's Coffee Selector.
Powered by [Honeycomb™](#).





MERIT

MARINE CORPS EQUIPMENT READINESS INFORMATION TOOL

USMC BY TAMCN | USMC By MEF | 1 MEF | 2 MEF | 3 MEF | MARCORPS | NAVAS | PREPOSITIONED | BPLI

Home | Readiness by Commodity | Readiness by Functional Area | Feedback | Logout

GROUP Functional Area | **SIZE** S rating - Current | **COLOR** MR rating - Current

FILTER BY PROBLEMS
TAMCNs with problems in every checked area will be displayed.

	Current	This Month	This Quarter	This Year
MR <85	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S <90	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
R <85	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FILTER BY ITEMS
Selected items will be shown.

- 00 - Unknown
- 10 - Radios
- 11 - Communications Support Equipme
- 13 - Air Command/Control Equipment
- 14 - Air Support Radar/RFF Equipment
- 16 - Electronic Equipment
- 17 - Ground Support Radar
- 18 - Tactical Remote Sensor Equipme
- 19 - Intelligence/Surveillance Equipme
- 20 - Generators
- 21 - Environmental Control Equipment
- 22 - Earthmoving Equipment
- 26 - Materials Handling Equipment
- 29 - Engineer Support
- 30 - Trucks
- 35 - Towed Motor Transport Equipmen
- 40 - Tanks
- 41 - Assault Amphibious Vehicles
- 42 - Light Armored Vehicles
- 43 - Artillery
- 45 - Infantry Weapons
- 48 - Anti-Air Weapon Systems and I
- 49 - Missile Systems
- 50 - High Density/Low Deadline
- 97 - Communications Security Equipme
- 98 - Assault Craft
- 99 - Nuclear Biological Chemical Equip

B2468
Tractor, Full-Tracked, W/AngleBlade, T-5

	Last Week	This Month	This Quarter	This Year
MR:	101%	101%	100%	94%
S:	111%	113%	112%	110%
R:	91%	89%	89%	86%

Click mouse for reports and options.

Currently displaying: 186 of 186 items

Search by TAMCN # | Search by TAMCN Title

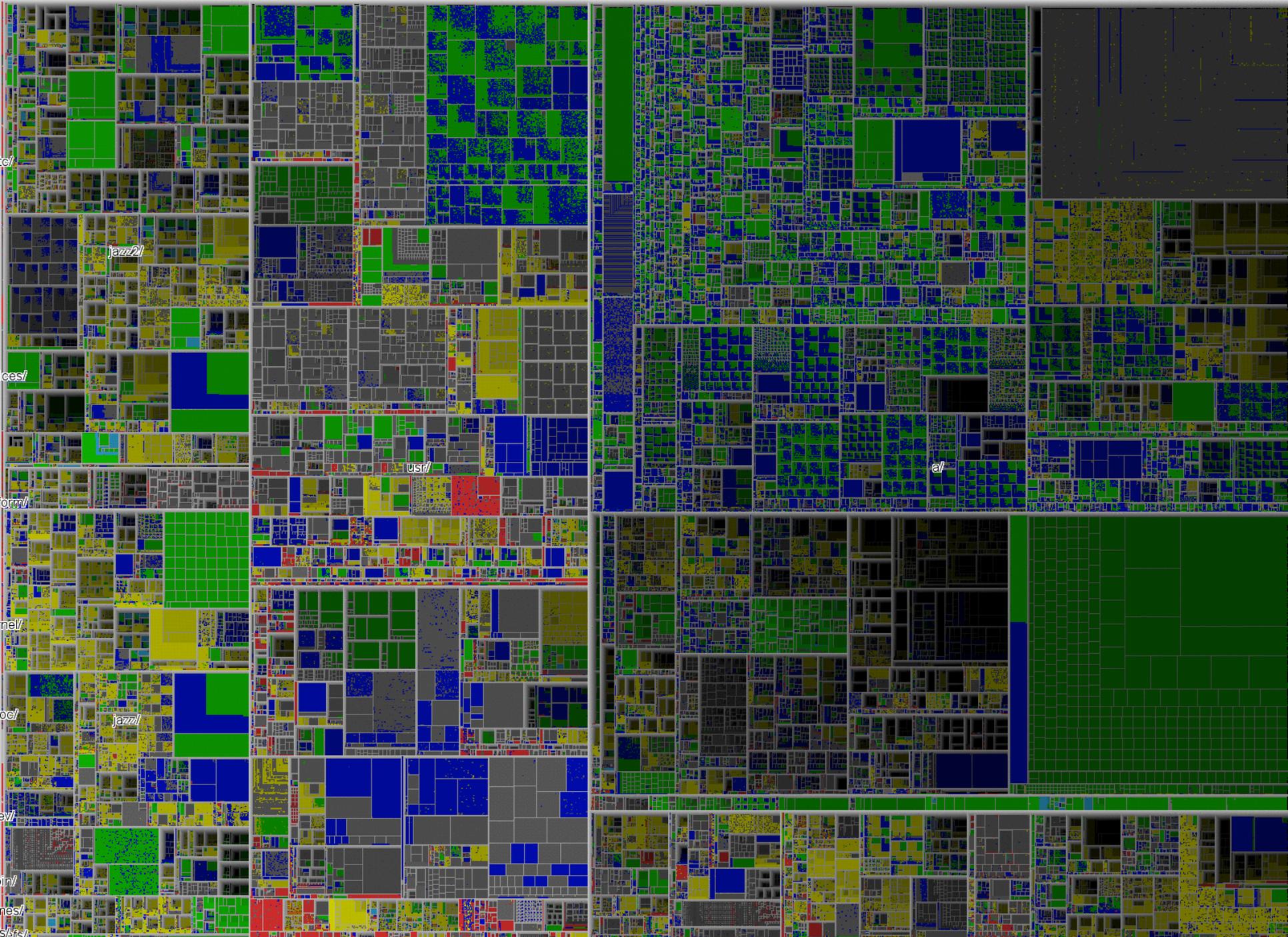
FILTER BY SEARCH CRITERIA
TAMCNs meeting search criteria will be shown.

EXCESS FILTER & LABEL
Isolate items w/excess equipment

FILTER BY PACING ITEM
Pacing Items will be shown.

Manage MyMERIT Portfolio | Filter by MyMERIT Portfolio | Label by MyMERIT Portfolio





LifeLines: Patient Histories

The screenshot displays the LifeLines software interface, which is used for managing patient medical histories. The interface is divided into two main sections: a patient history timeline on the left and an ultrasound image on the right.

Patient History Timeline (Left Panel):

- Obesity:** A thick black horizontal bar spans from year 93 to 97.
- Diagnoses:**
 - Atrial Flutter:** Red vertical bar at year 93.
 - Flu Pneumonia:** Red and blue horizontal bars from year 93 to 94.
 - Migraine:** Red vertical bar at year 95.
 - Fatigue:** Blue horizontal bar from year 95 to 96.
 - Pregnancy:** Red vertical bar at year 96.
 - Diabetes:** Red and blue horizontal bars from year 96 to 97.
 - Knee Pain:** Blue horizontal bar from year 94 to 95.
 - Pneumonia:** Red vertical bar at year 94.
 - Knee Surgery:** Blue horizontal bar from year 94 to 95.
- Tests:**
 - Blood:** Red vertical bars at years 93 and 94.
 - EKG:** Red vertical bar at year 94.
 - Xray:** Red vertical bar at year 94.
 - Blood:** Red vertical bars at years 95 and 96.
 - Blood:** Red vertical bars at years 96 and 97.
 - Pap:** Red vertical bars at years 93, 94, 95, and 96.
 - Mammo:** Red vertical bars at years 93 and 94.
 - Sonogram:** Red vertical bar at year 97.
- Medications:**
 - Cardizem:** Red horizontal bar from year 93 to 94.
 - Ventolyn:** Blue horizontal bar from year 94 to 95.
 - Antib.:** Blue horizontal bar from year 94 to 95.
 - Advil:** Red horizontal bar from year 95 to 96.
 - Insulin:** Red horizontal bars from year 95 to 96 and year 96 to 97.
 - Propranolol:** Red horizontal bar from year 95 to 96.
 - Dispensed:** Blue horizontal bar from year 93 to 94.
 - Batramex stop:** Blue horizontal bar from year 94 to 95.
 - Lasilix:** Red horizontal bar from year 96 to 97.
 - Physical Therapy:** Blue horizontal bar from year 95 to 96.
 - Low Salt Fat Diet:** Green horizontal bar from year 94 to 97.

Ultrasound Image (Right Panel):

- Shows a cross-sectional view of a heart or chest area.
- Technical details on the right side: SCALE MARKS 1 cm, DIST. 80mm, ENH, H, P, P, P, H, EAR 13, FAR 19, BAL 22, POWER 672.
- Patient information at the bottom: PATIENT ID [redacted] 17mm/3.8 ORIENTED R/L.

LifeLines Control Panel (Bottom Right):

- Buttons: Layout, Label, Summary, Search, Zoom.
- Location Allowed: Top Right, Top Right & Left, 4 Corners.
- Link from Timeline to Label: No, Yes.
- Font Size: Slider from 8 to 20.
- Truncation: No, Yes.

Timeline Navigation (Bottom Left):

- Timeline markers: 2/92, 93, 94, 95, 96, 97.
- Navigation arrows and a double-headed arrow.

LifeLines: Customer Histories



Mrs Linda Simpson
Maryland 41
Allergic to polyester

5-26-1998 black p6 **Linda** BD "url" 13

Linda Simpson ORDER#614345 (MOST RECENT)
 11-1-1997,\$150, Visa card, order by phone

[D45F224: Boots - 4 - Black](#)

----> **BACKORDER - estimated shipping 12-15**

[D45F236: Gloves - Black - M](#)

[A78156: Corduroy pants - Tan - L](#)

[157826: Hat - Grey - M](#)

Kids Backcountry hiking boots
 Leather boots with super grip soles.

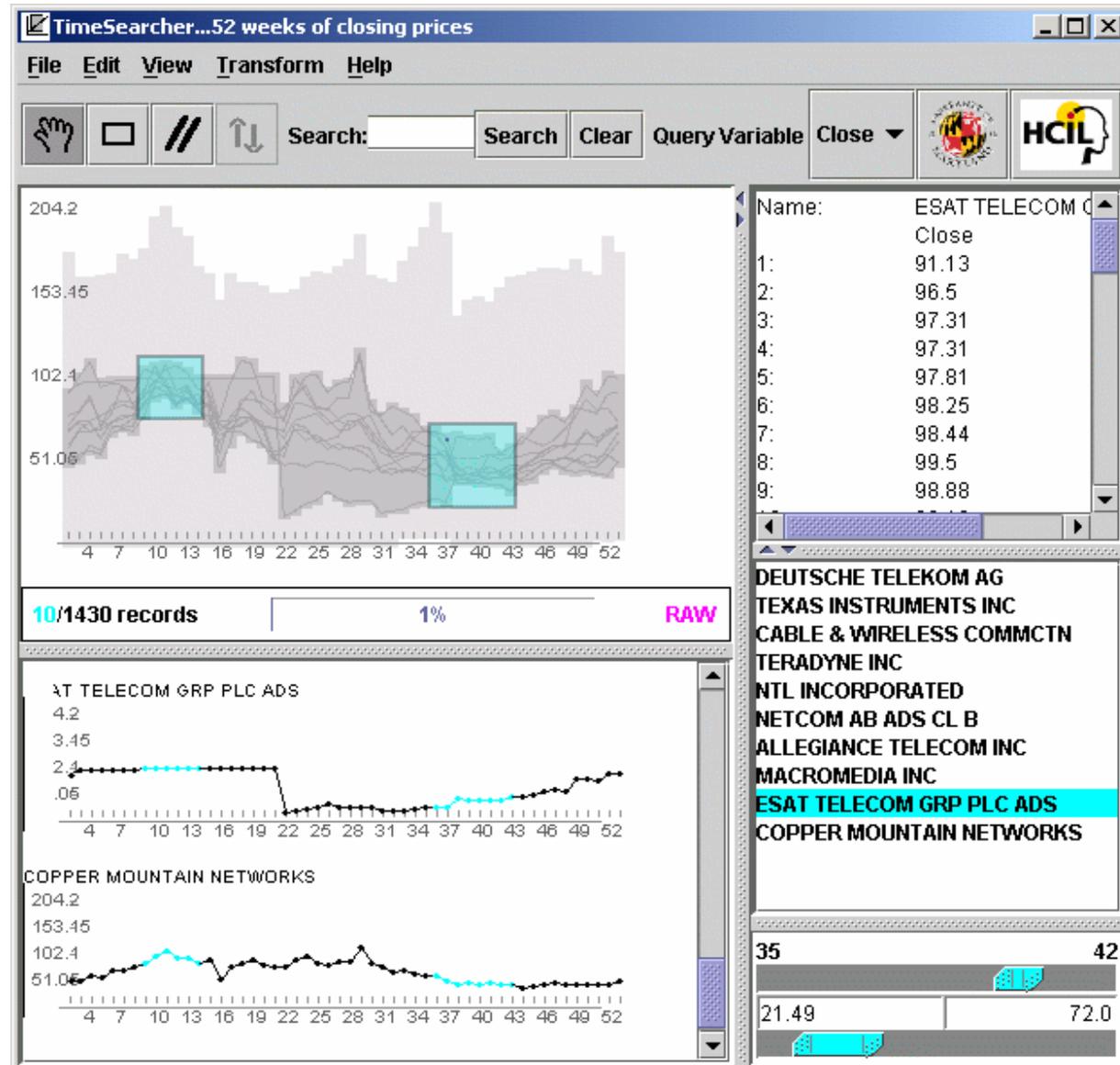


LifeLine

	10/9596	97	98	99
▼ Catalogs	Fall95 Spring96	Fall96 Spring97	Fall97 Spring98	Fall98 Custom cata Summerspecial98
▼ Store		Store		
▼ WWW		Web	Web Web	Web
▼ PURCHASES				
▼ Clothes		\$101 \$194	\$127	\$150back
▼ Week-end		\$160		
▼ Accessories		\$152		\$27
▼ House		\$152		
▼ Specials				
▼ Return		too-small		
▼ Credit		Credit Refused		
▼ Birthday		Linda BD	Linda BD	Linda BD

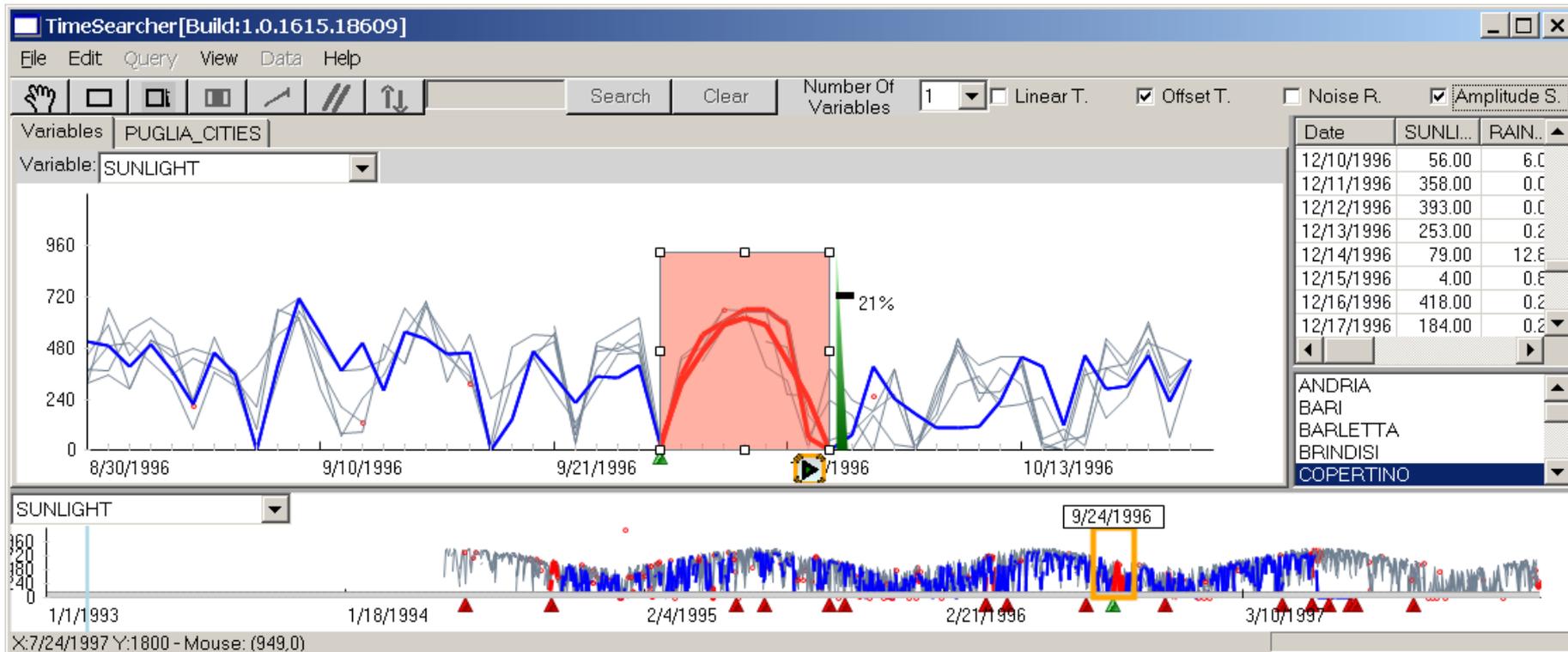
Temporal Data: TimeSearcher 1.3

- Time series
 - Stocks
 - Weather
 - Genes
- User-specified patterns
- Rapid search



Temporal Data: TimeSearcher 2.0

- Long Time series (>10,000 time points)
- Multiple variables
- Controlled precision in match
(Linear, offset, noise, amplitude)



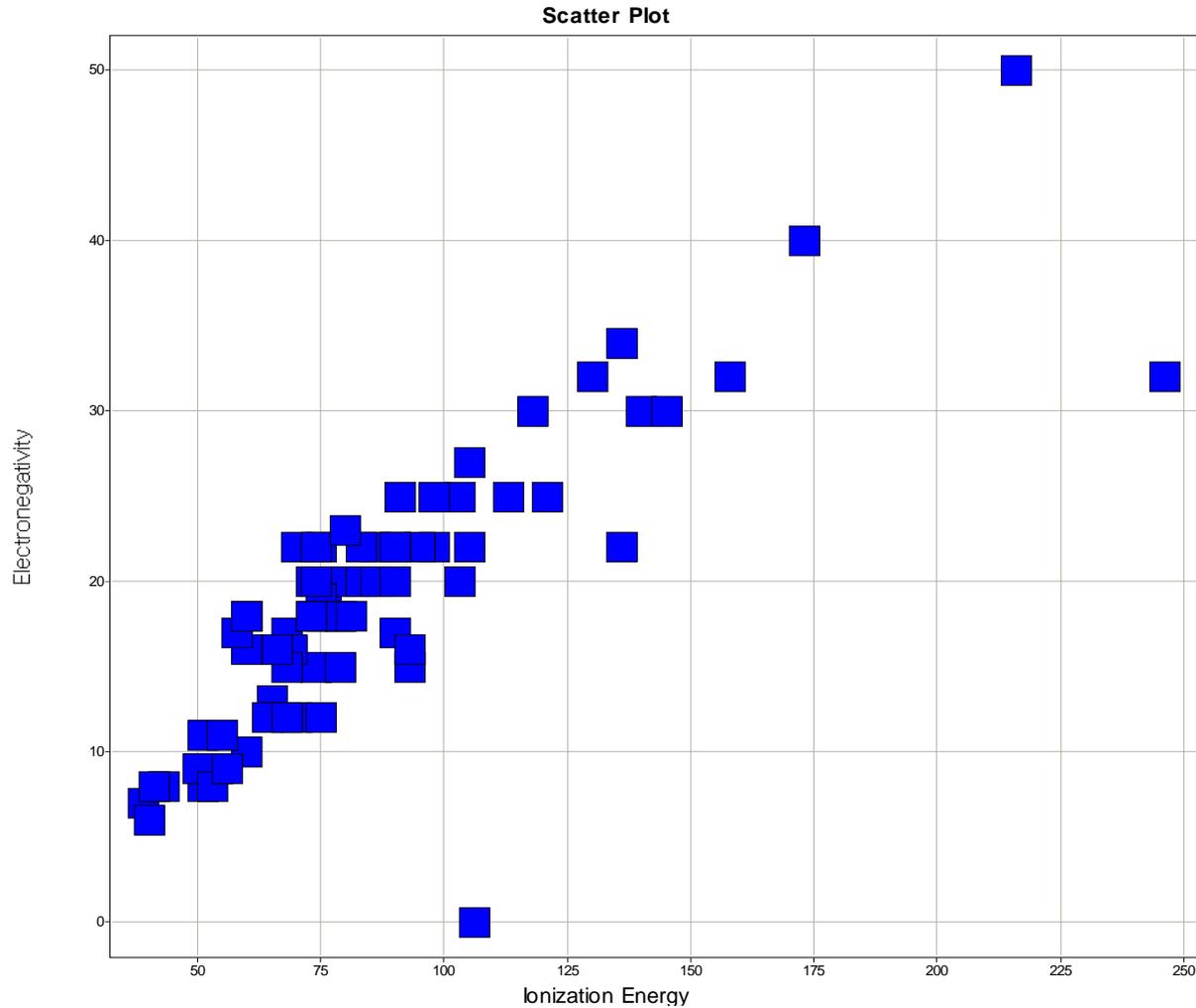
Goal: Find Features in Multi-Var Data

- Clear vision of what the data is
- Clear goal of what you are looking for
- Systematic strategy for examining all views
- Ranking of views to guide discovery
- Tools to record progress & annotate findings

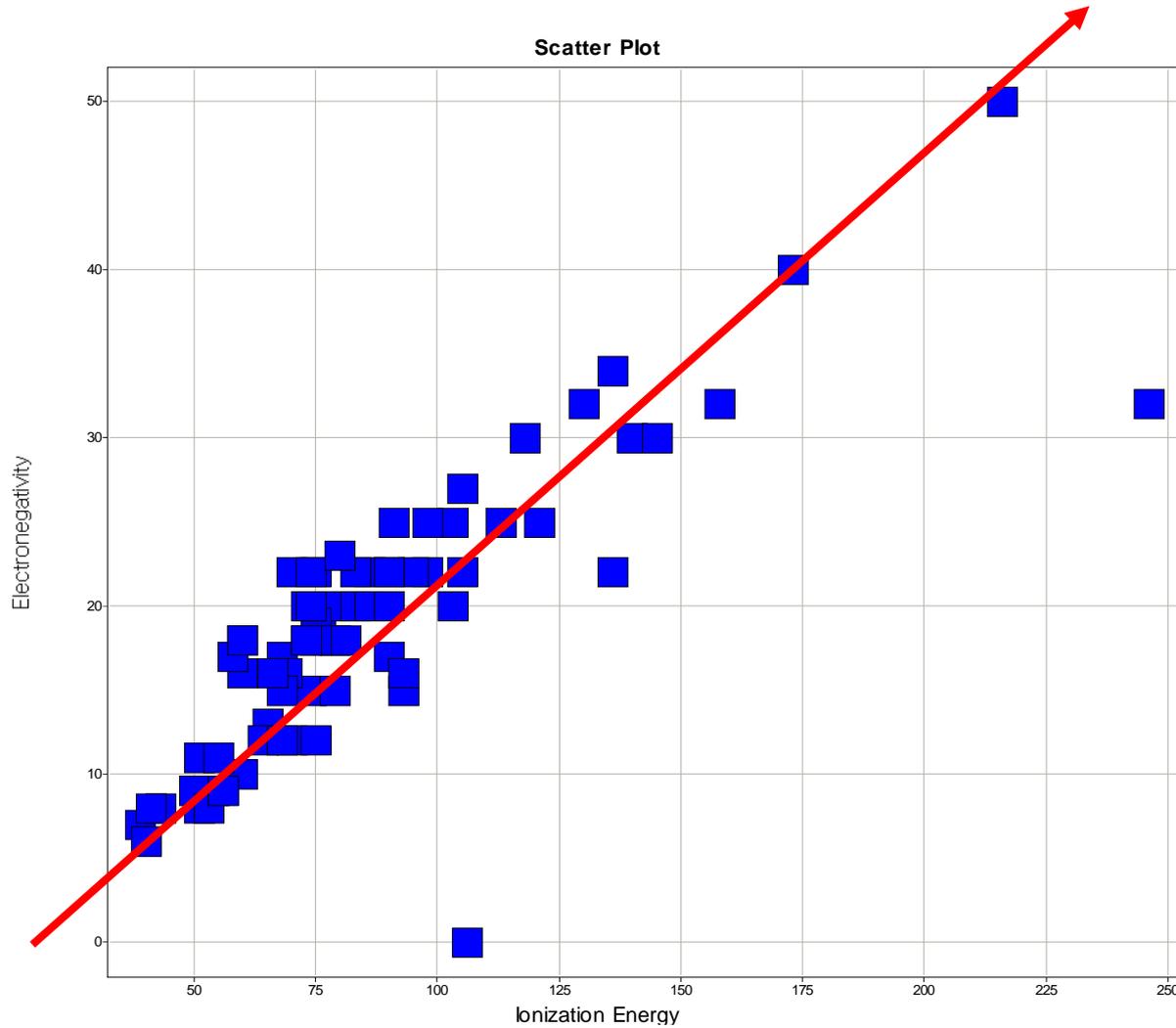
Do you see anything interesting?

	A	B	C	D	E	F	G	H	I	J	K
1	Element	*P1	*P2	Atomic Num	Atomic Mas	Atomic Radi	Ionic Radius	Ionization E	Electronega	*C1	*C2
2	Ac	140	0	89	227	200	126	51	11	62	56
3	Ag	630	80	47	107	144	129	75	18	124	40
4	Al	750	160	13	27	143	67	60	16	28	25
5	Ar	1050	160	18	39	98	154	158	32	176	51
6	As	870	120	33	75	120	72	98	22	115	33
7	At	990	40	85	210	140	76	95	22	119	22
8	Au	630	40	79	197	144	99	91	25	131	22
9	B	750	200	5	10	85	41	83	20	101	8
10	Ba	80	40	56	137	222	149	51	8	46	56
11	Be	80	200	4	9	112	59	93	15	82	15
12	Bi	870	40	83	209	150	117	73	20	140	27
13	Br	990	120	35	79	114	182	118	30	161	44
14	C	810	200	6	12	77	30	113	25	82	1
15	Ca	80	120	20	40	197	114	60	10	70	51
16	Cd	690	80	48	112	151	109	90	17	113	43
17	Cl	990	160	17	35	100	167	130	32	173	47
18	Co	500	120	27	59	125	83	79	18	120	30
19	Cr	320	120	24	52	128	75	68	17	91	28
20	Cs	20	40	55	132	265	181	39	7	7	56
21	Cu	630	120	29	63	128	87	76	19	118	32
22	F	990	200	9	19	72	119	173	40	39	1
23	Fe	440	120	26	55	126	83	79	18	115	32
24	Fr	20	0	87	223	269	194	40	6	1	56
25	Ga	750	120	31	69	135	76	60	18	89	31
26	Ge	810	120	32	72	122	87	79	20	118	33
27	H	20	240	1	1	32	0	136	22	40	1
28	He	1050	240	2	4	31	93	246	32	1	1
29	Hf	200	40	72	178	159	85	70	12	95	44
30	Hg	690	40	80	200	151	116	103	20	147	27
31	I	990	80	53	126	133	206	105	27	153	44
32	In	750	80	49	114	167	94	58	17	93	42
33	Ir	500	40	77	192	136	82	90	22	116	25
34	K	20	120	19	39	227	152	43	8	37	56
35	Kr	1050	120	36	83	112	169	140	30	163	47

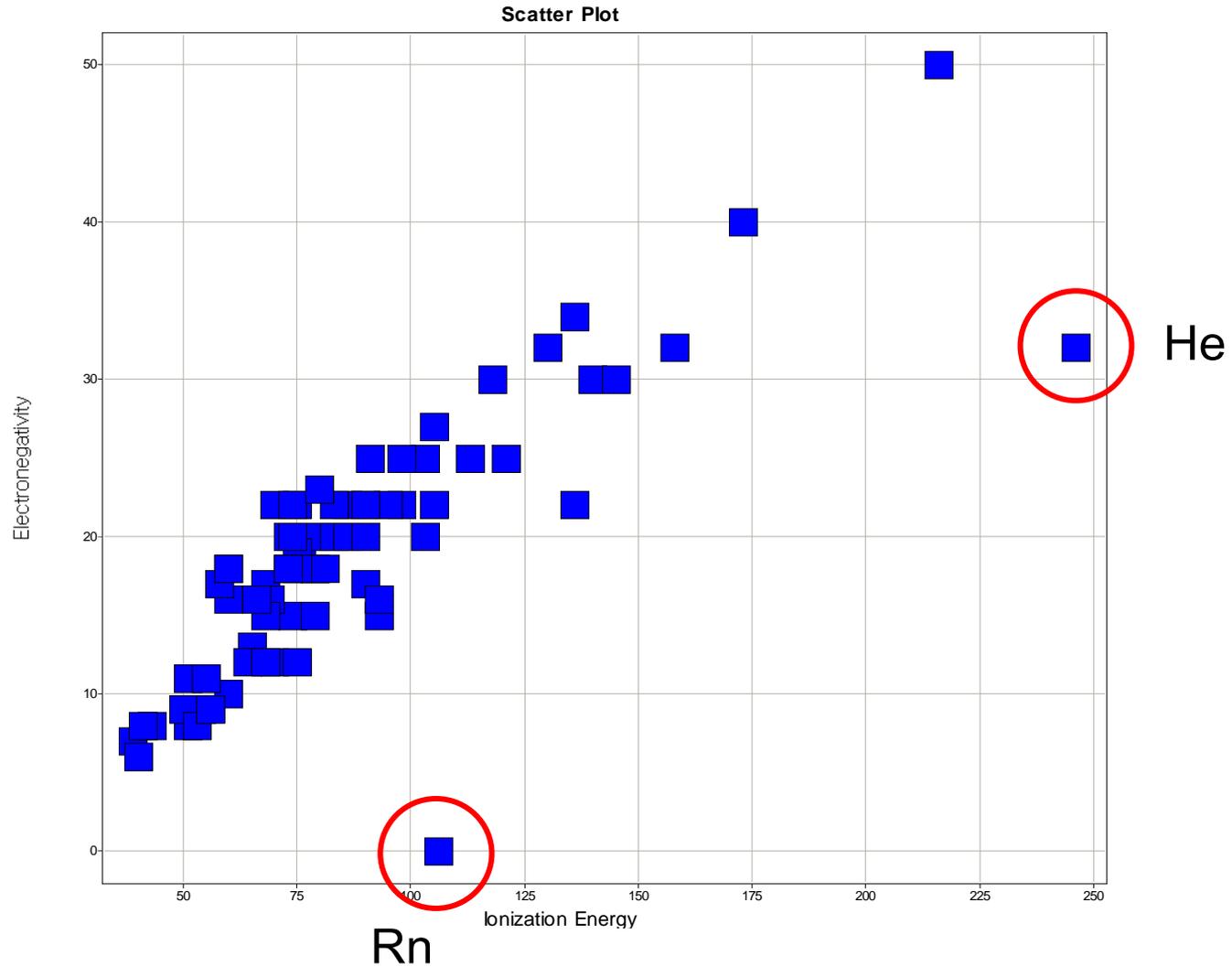
What features stand out?



Correlation...What else?



... and Outliers



Demonstration

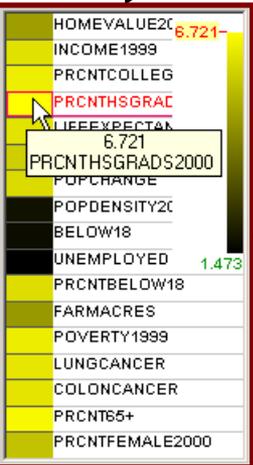


- US counties census data
 - 3138 counties
 - 14 dimensions : population density, poverty level, unemployment, etc.

Rank-by-Feature Framework: 1D

Ranking Criterion

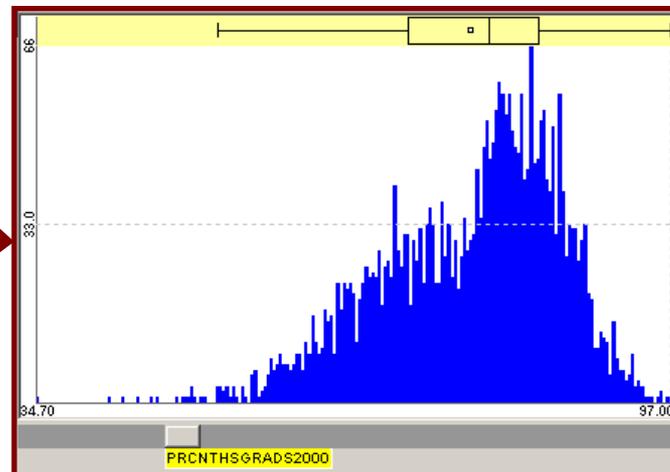
Rank-by-Feature Prism



Score List

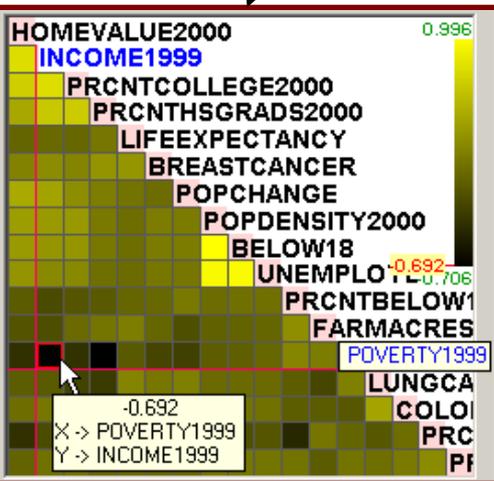
Rank	Column Name	S.	Min	Q1(25%)	Median	Q3(75%)
1	PRCNTHSG...	6.721	34,700	71,200	79,200	84,100
2	PRCNT65+	6.580	1,800	12,100	14,400	17,000
3	PRCNTCOL...	6.370	4,900	11,200	14,500	19,000
4	POVERTY1999	6.350	0,000	9,500	13,000	17,000
5	LUNGCANC...	6.208	10,700	50,200	60,300	69,000
6	COLONCAN...	6.169	7,400	19,300	22,400	25,000
7	LIFEEXPEC...	6.135	65,600	74,200	75,600	76,000
8	INCOME1999	6.096	5213,000	15136,000	16946,000	18986,000
9	PRCNTBEL...	6.019	9,600	23,700	25,300	27,000
10	POPCHANGE	5.979	-10,400	-0,800	0,200	1,000
11	BREASTCA...	5.710	0,000	20,579	23,713	26,000
12	PRCNTFEM...	5.469	32,700	50,000	50,800	51,000
13	HOMEVALU...	4.724	0,000	57900,000	75900,000	96900,000
14	FARMACRES	4.607	0,000	82807,500	186881,000	367063,000
15	POPDENSIT...	1.828	67,000	11223,500	24653,000	61775,000
16	BELOW18	1.729	13,000	2821,500	6310,000	15510,000
17	UNEMPLOY	1.473	3,000	237,000	559,000	1309,000

Manual Projection Browser



Rank-by-Feature Framework: 2D

Ranking Criterion

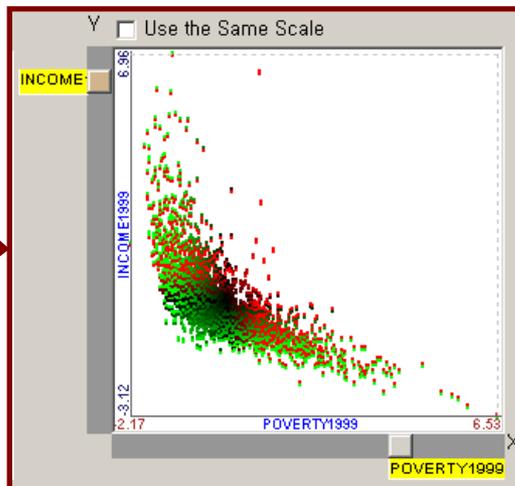


Rank-by-Feature Prism

Rank	X axis	Y axis	Score
118	PRCNT65+	POPDENSITY2...	-0.169
119	PRCNT65+	BELOW18	-0.179
120	FARMACRES	POPCHANGE	-0.180
121	FARMACRES	INCOME1999	-0.184
122	PRCNT65+	INCOME1999	-0.201
123	PRCNTBELO...	INCOME1999	-0.204
124	LUNGCANCER	FARMACRES	-0.237
125	POVERTY1999	BREASTCANC...	-0.247
126	LUNGCANCER	PRCNTCOLLE...	-0.257
127	POVERTY1999	POPCHANGE	-0.276
128	PRCNT65+	PRCNTCOLLE...	-0.293
129	LUNGCANCER	PRCNTHSGRA...	-0.310
130	POVERTY1999	PRCNTCOLLE...	-0.370
131	PRCNT65+	POPCHANGE	-0.381
132	PRCNT65+	HOMEVALUE2...	-0.385
133	POVERTY1999	HOMEVALUE2...	-0.386
134	PRCNT65+	PRCNTBELO...	-0.441
135	POVERTY1999	INCOME1999	-0.692
136	POVERTY1999	PRCNTHSGRA...	-0.706

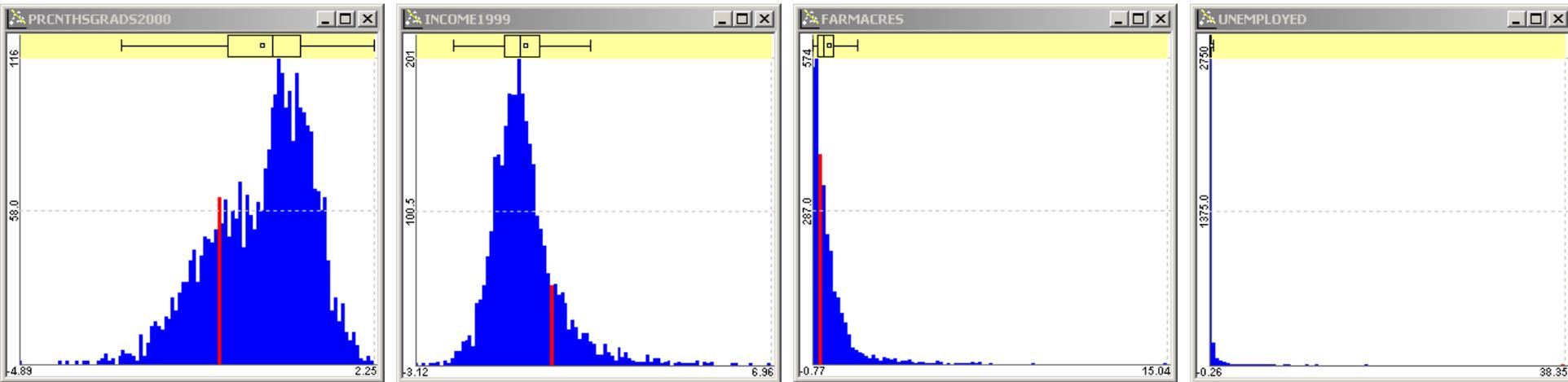
Score List

Manual Projection Browser

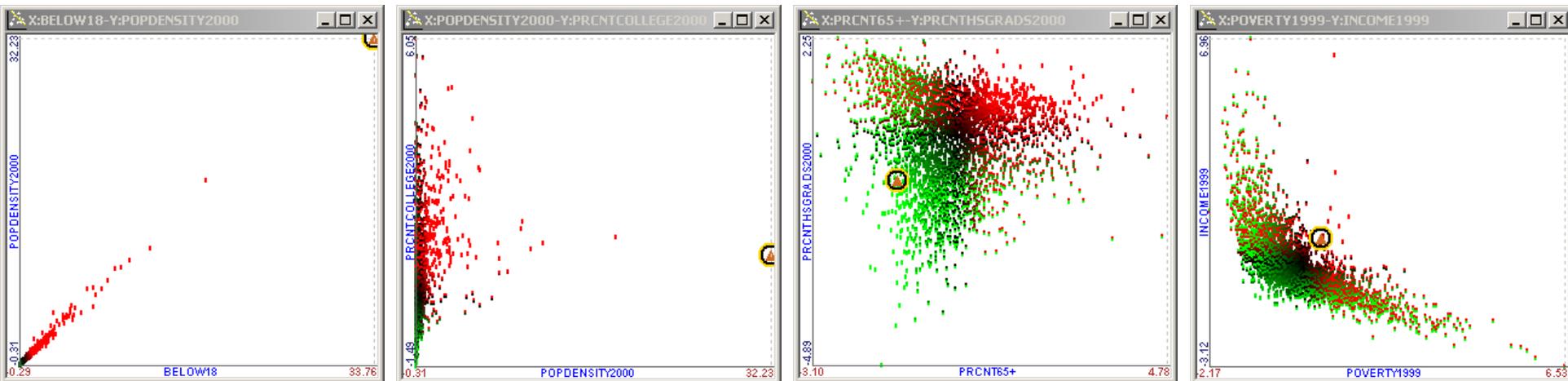


A Ranking Example

3138 U.S. counties with 17 attributes



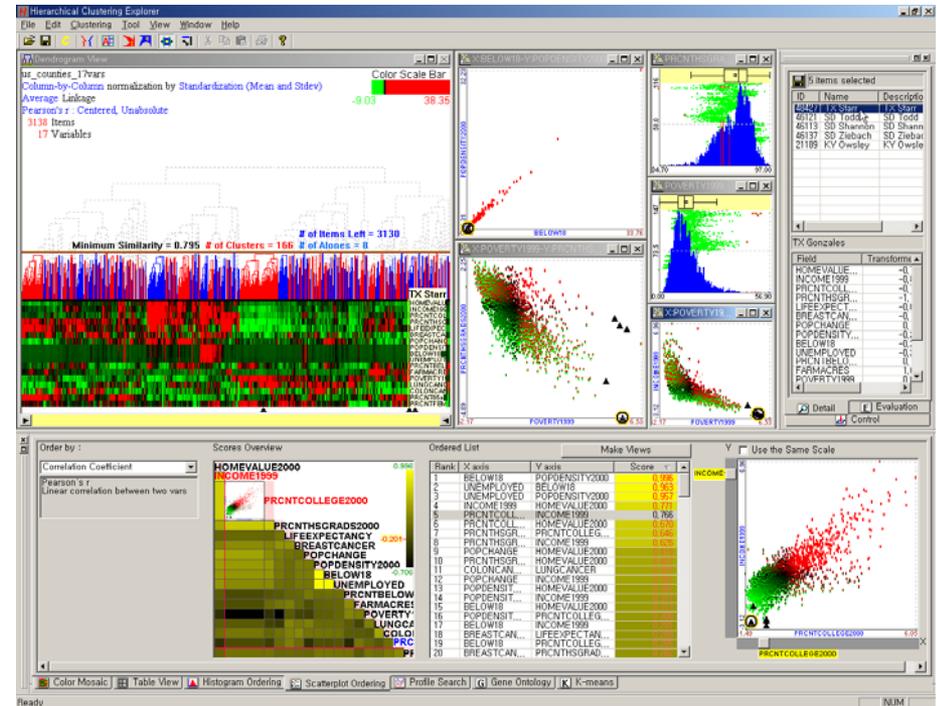
Ranking Criterion: Uniformity (entropy) (6.7, 6.1, 4.5, 1.5)



Ranking Criterion: Pearson correlation (0.996, 0.31, 0.01, -0.69)

HCE Status

- In collaboration and sponsored by Eric Hoffman: Children's National Medical Center
- Phd work of Jinwook Seo
- 72K lines of C++ codes
- 4,000+ downloads since April 2002
- www.cs.umd.edu/hcil/hce



Evaluation Methods

Ethnographic Observational Situated

- Multi-Dimensional
- In-depth
- Long-term
- Case studies

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Ethnographic Observational Situated

- Multi-Dimensional
- In-depth
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- Case studies

Domain Experts
Doing Their Own Work
for Weeks & Months

Evaluation Methods

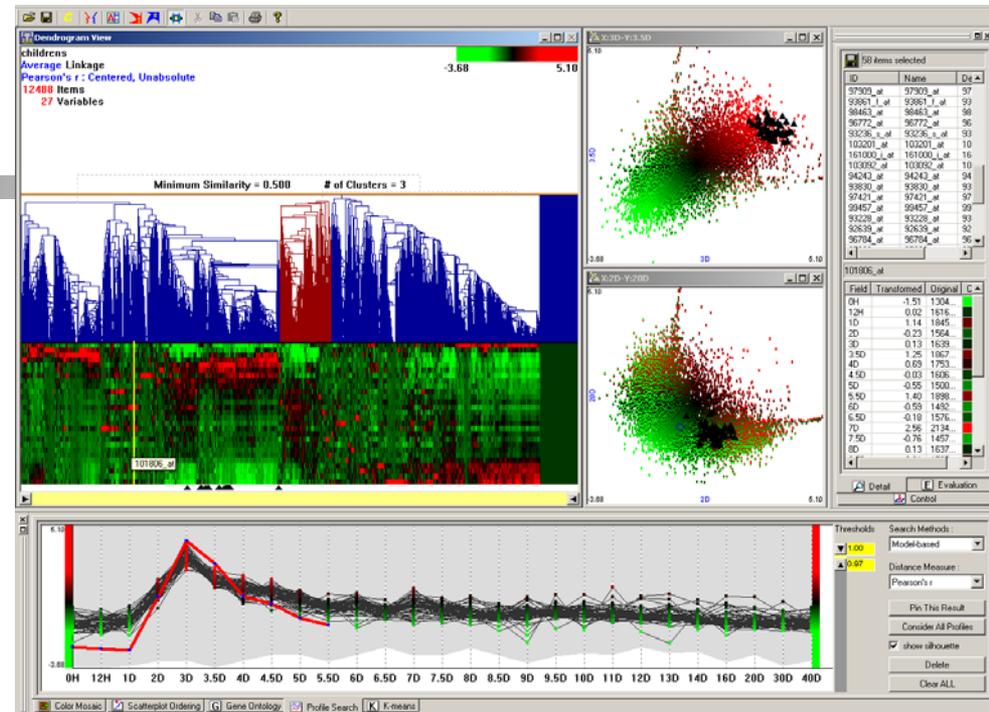
Ethnographic Observational Situated

- Multi-Dimensional
- In-depth
- Long-term
- Case studies

MILCS

MILC example

- Evaluate Hierarchical Clustering Explorer

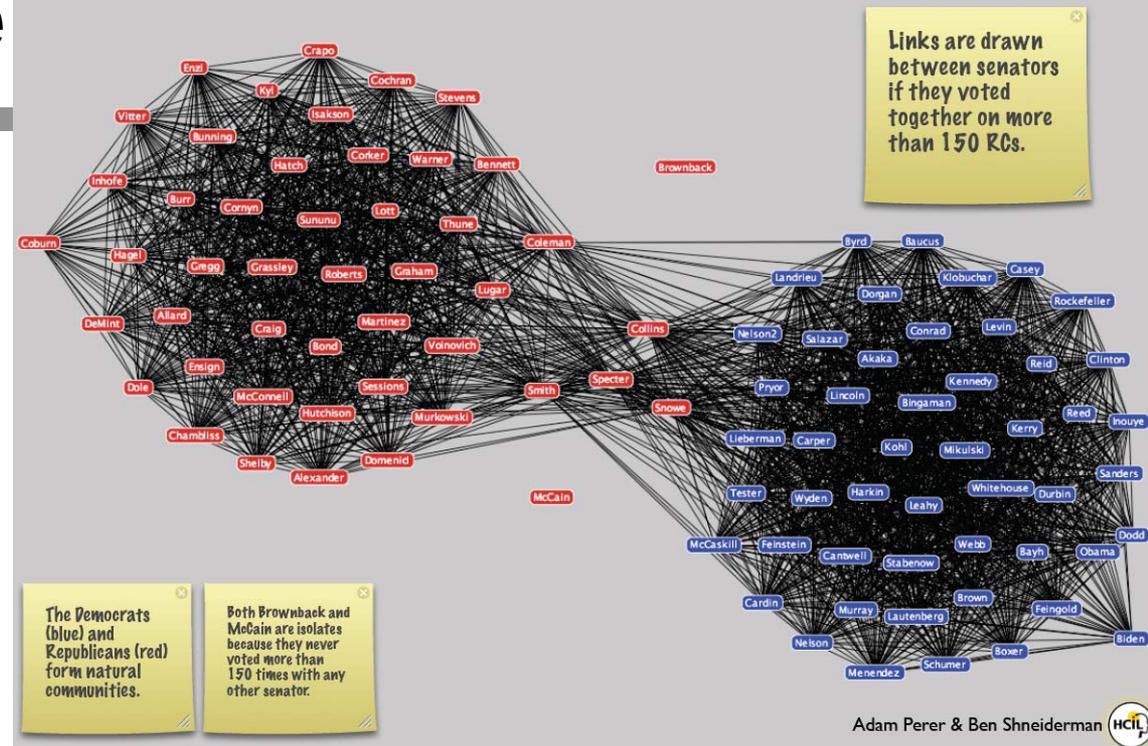


- Focused on rank-by-feature framework
- 3 case studies, 4-8 weeks
(molecular biologist, statistician, meteorologist)
- 57 email surveys
- Identified problems early, gave strong positive feedback about benefits of rank-by-feature

MILC example

Senatorial Social Network

- Evaluate SocialAction



- Focused on integrating statistics & visualization
- 4 case studies, 4-8 weeks (journalist, bibliometrician, terrorist analyst, organizational analyst)
- Identified desired features, gave strong positive feedback about benefits of integration

Case Study Methodology

- 1) Interview (1 hr)
- 2) Training (2 hr)
- 3) Early Use (2-4 weeks)
- 4) Mature Use (2-4 weeks)
- 5) Outcome (1 hr)

Take Away Message

Rank-by-Feature Framework

- Decomposition of complex problems into multiple simpler problems wins
- Ranking guides discovery
- Systematic strategies

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25th Annual Symposium

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