

Information Visualization for High Dimensional Data

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



UNIVERSITY OF
MARYLAND





Interdisciplinary research community

- Computer Science & Psychology
- Information Studies & Education

(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.aw1.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 Images...

Retrieve Full-Size Images...

Retrieve Full-Size Images...

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

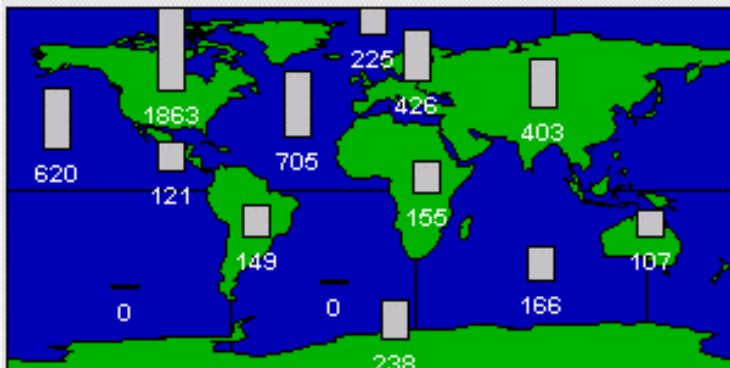
HCIL

NASA Environmental Data

- Scientists
- Farmers
- Land planners
- Students

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



Census,
NCHS,
BLS, EIA,
NASS, SSA

- Find what you need
- Understand what you Find



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

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- [Select language](#)

For first-time visitors

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

For returning visitors

- [Recently added books](#)

For book contributors

- [Contribute books](#)
- [Policies and statements](#)
- [Scanning instructions](#)

For researchers

- [Fast facts](#)
- [Papers](#)
- [Presentations](#)

For volunteers

- [ICDL Ambassadors](#)
- [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



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 Winning
Books

Keywords in English Search

Piccolo: Toolkit for 2D zoomable objects

Structured canvas of graphical objects in a hierarchical scenegraph

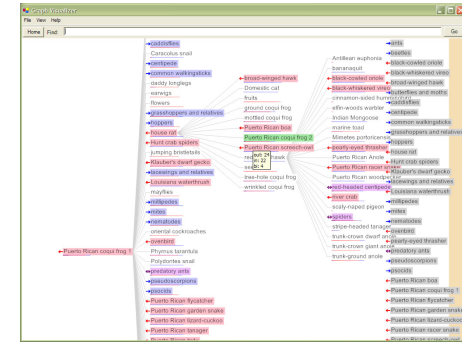
- Zooming animation
- Cameras, layers

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

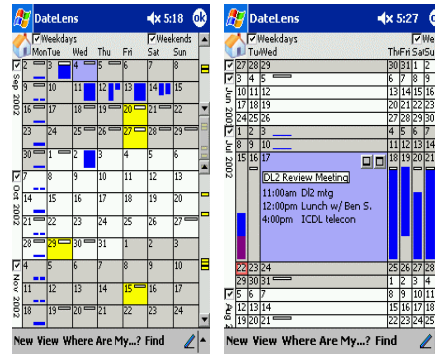
www.cs.umd.edu/hcil/piccolo



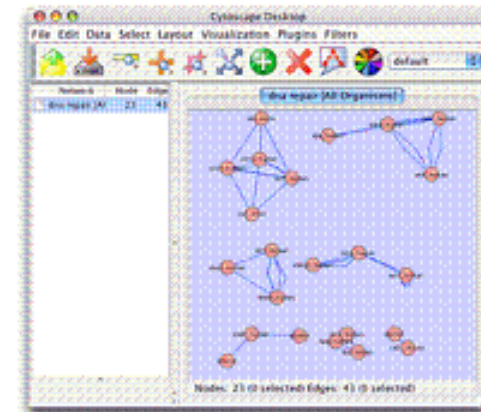
AppLens & Launch Tile
UMD, Microsoft Research



TreePlus
UMD



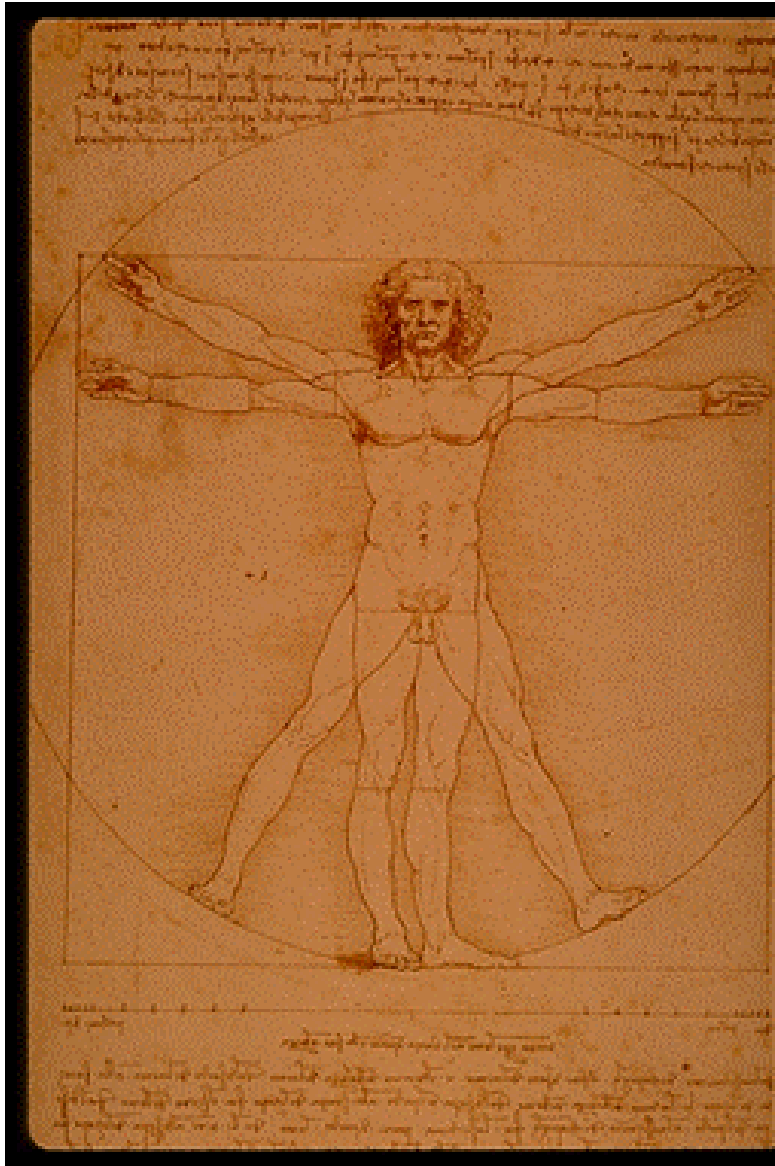
DateLens
Windsor Interfaces, Inc.



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



Information Visualization

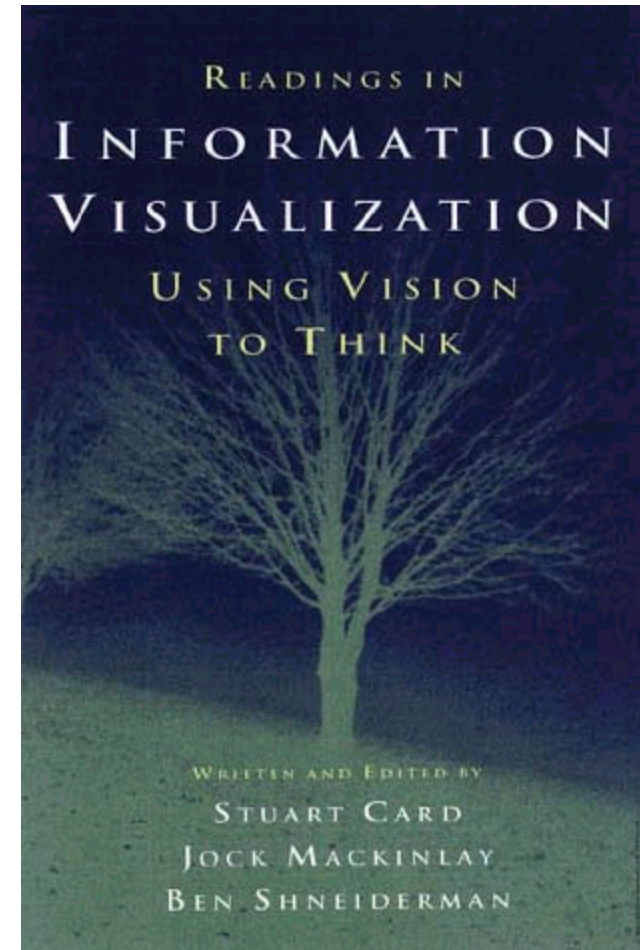


**The eye...
the window of the soul,
is the principal means
by which the central sense
can most completely and
abundantly appreciate
the infinite works of nature.**

Leonardo da Vinci
(1452 - 1519)

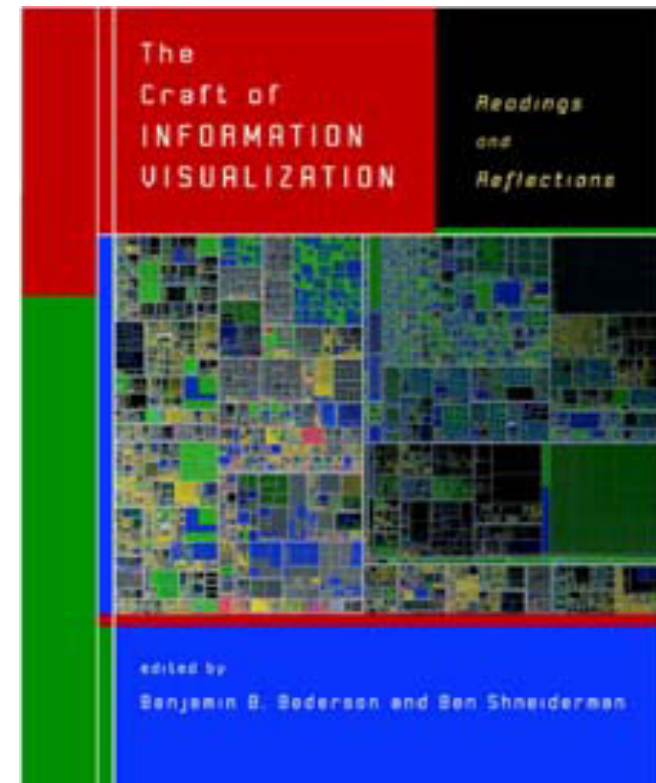
Using Vision to Think

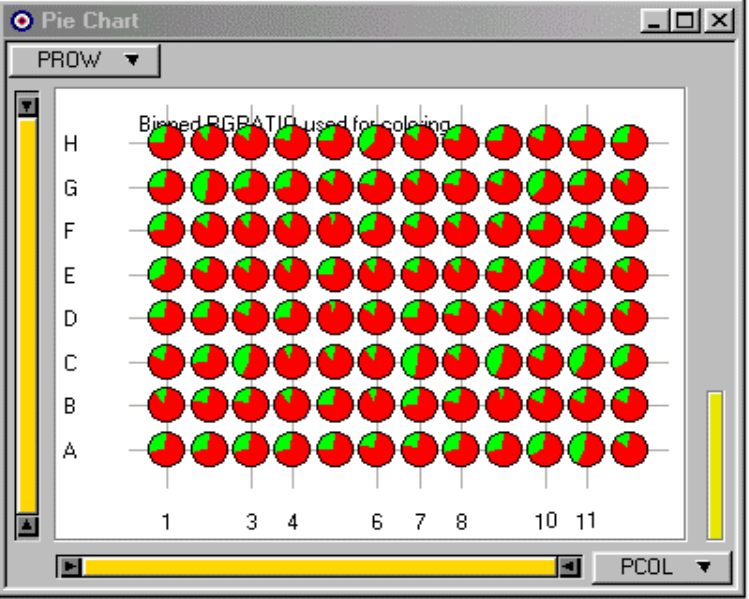
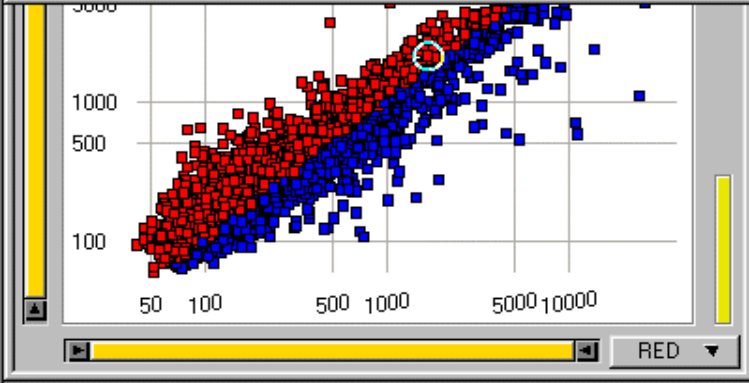
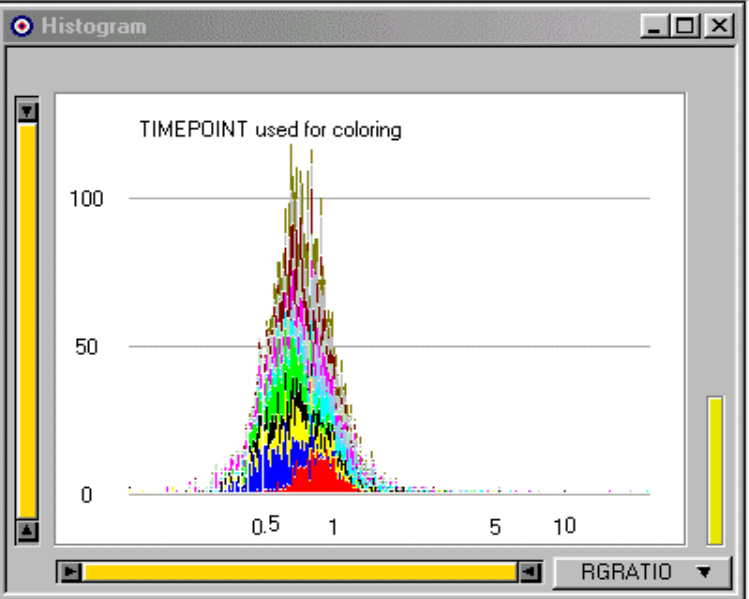
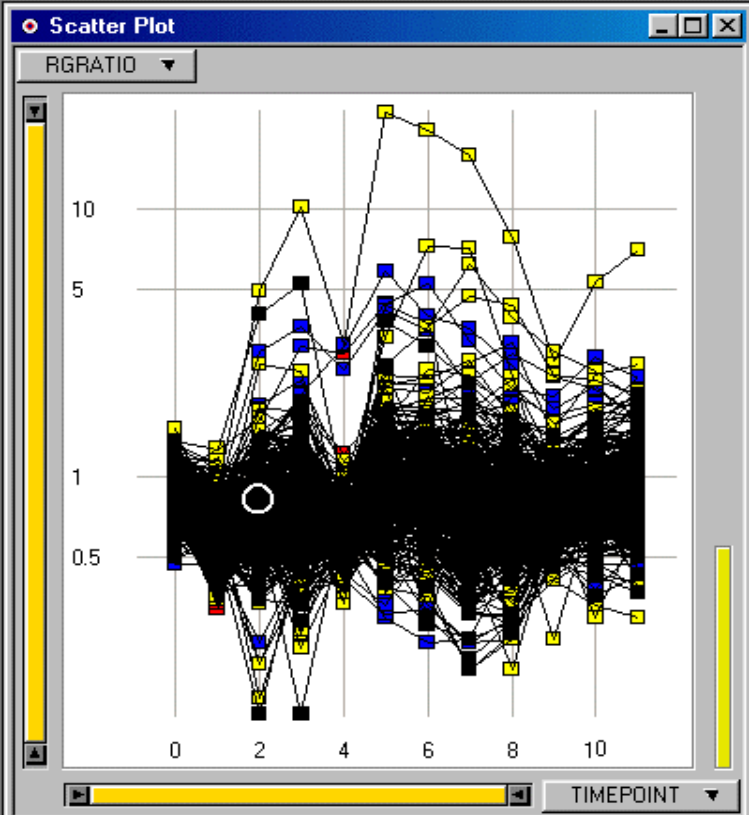
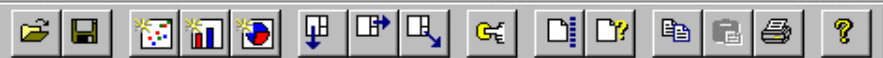
- **Visual bandwidth is enormous**
 - Human perceptual skills are remarkable
 - Trend, cluster, gap, outlier...
 - Color, size, shape, proximity...
 - Human image storage is fast and vast
- **Opportunities**
 - Spatial layouts & coordination
 - Information visualization
 - Scientific visualization &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



Information Visualization: US Research Centers

- Xerox PARC
 - 3-D cone trees, perspective wall, spiral calendar
 - table lens, hyperbolic trees, document lens
- Univ. of Maryland
 - dynamic queries, range sliders, starfields, treemaps, timeboxes, zoombars
 - tight coupling, dynamic pruning, lifelines
- IBM, Microsoft, AT&T
- Georgia Tech, MIT Media Lab
- Univ. of Wisconsin, Minnesota, Calif-Berkeley, CMU
- Pacific Northwest National Labs





RED 42 38938

RGRAT 0.13 23

REGR -1.48 10.17

CORR -0.64 1

AROW

- 7
- 8
- 9
- 10

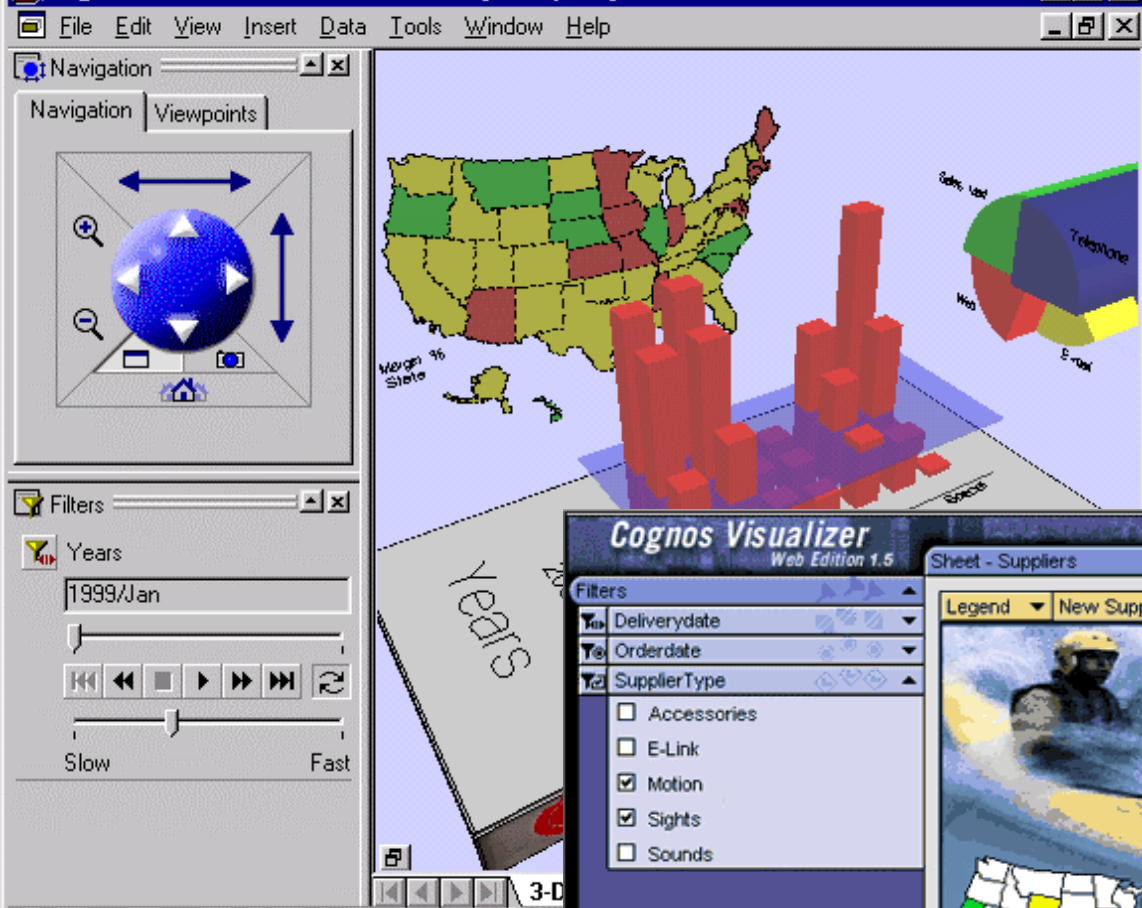
ACOL 1 51

PLAT

- 14
- 15
- 16

TIMEPOINT	2
DESCRIPTION	ESTs
TYPE	cDNA
GENENAME	R71468
GREEN	2089
RED	1706
RGRATIO	0.82
REGR	1.28
CORR	0.95
AROW	8
ACOL	41
PLAT	15
PROW	E
PCOL	4





Cognos Visualizer
Web Edition 1.5

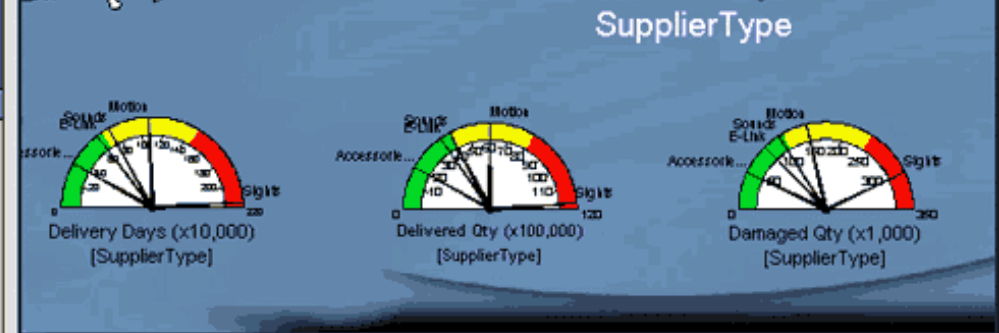
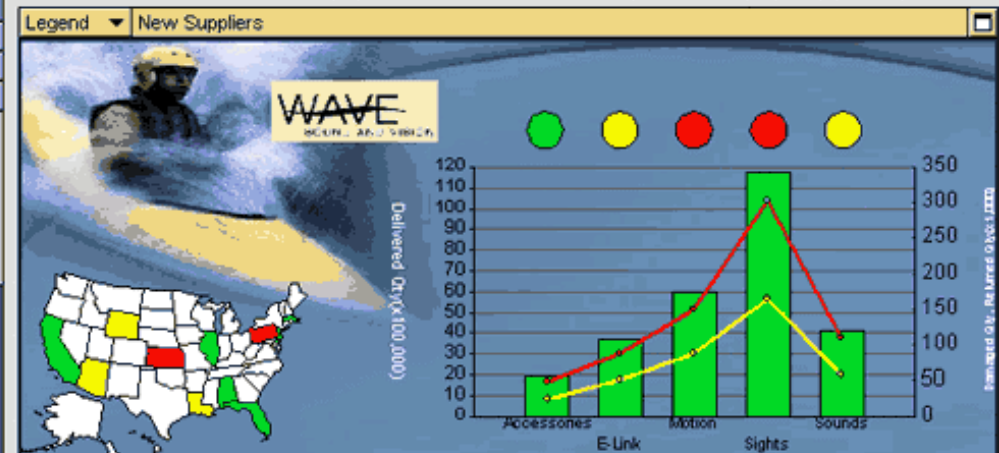
- Filters
- Deliverydate
 - Orderdate
 - SupplierType
 - Accessories
 - E-Link
 - Motion
 - Sights
 - Sounds

Explain

Chart 10:

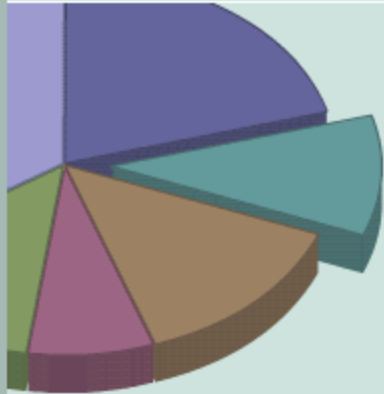
SupplierType = Sights
Damaged Qty= 302,316

Sheet - Suppliers



PopChart 5.0

Interactive Charts & Graphs



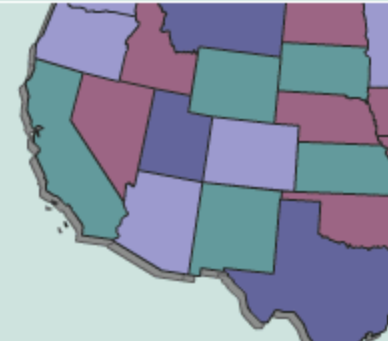
The most powerful system available for creating sophisticated interactive charting and graphing solutions.

see it in action . .

NEW OptiMap 5.0

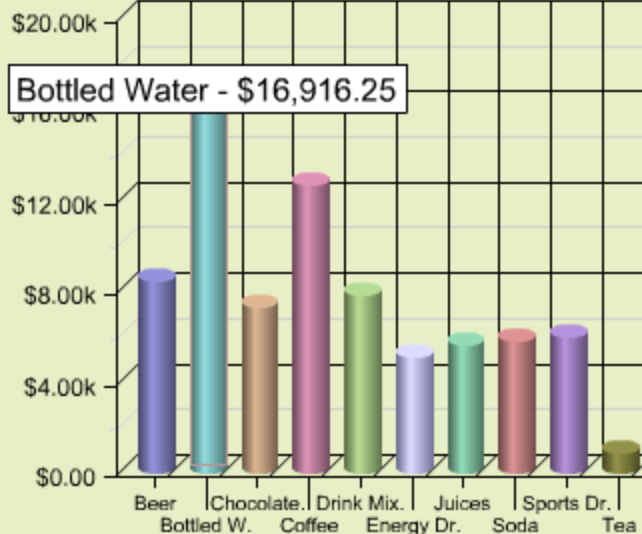
Interactive Mapping Solution

The ultimate system for quickly creating powerful interactive geographic or other spatial maps from your data.



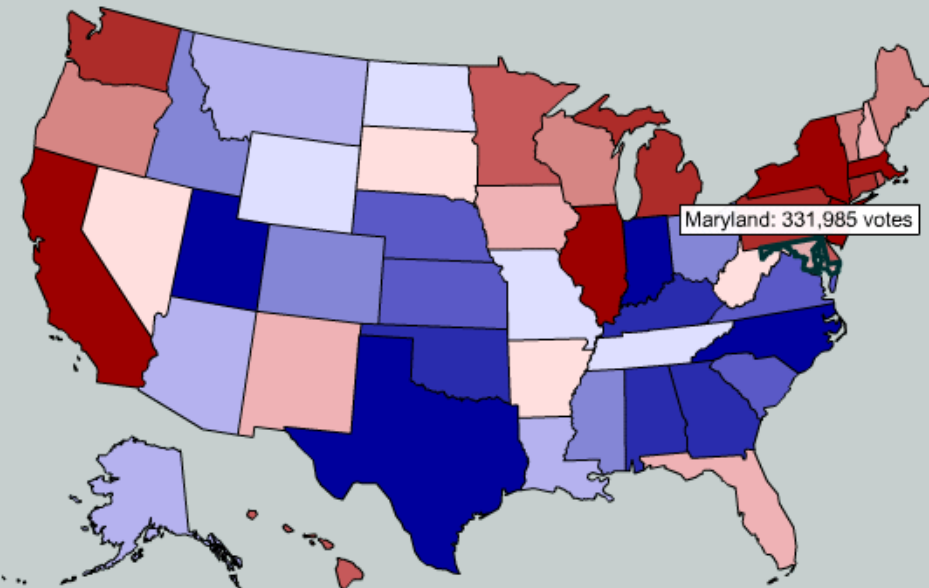
2002 Sales for Beverages

2002 Sales



ACME FOODS

U.S.A. Margin of Victory Bush v. Gore

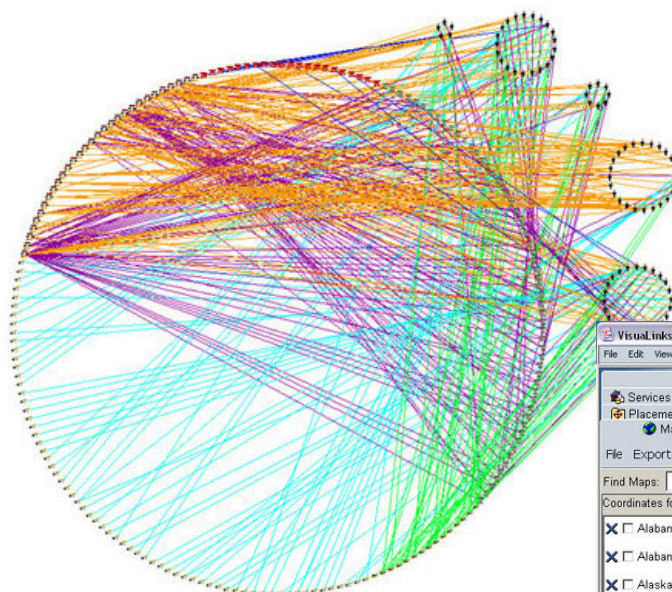
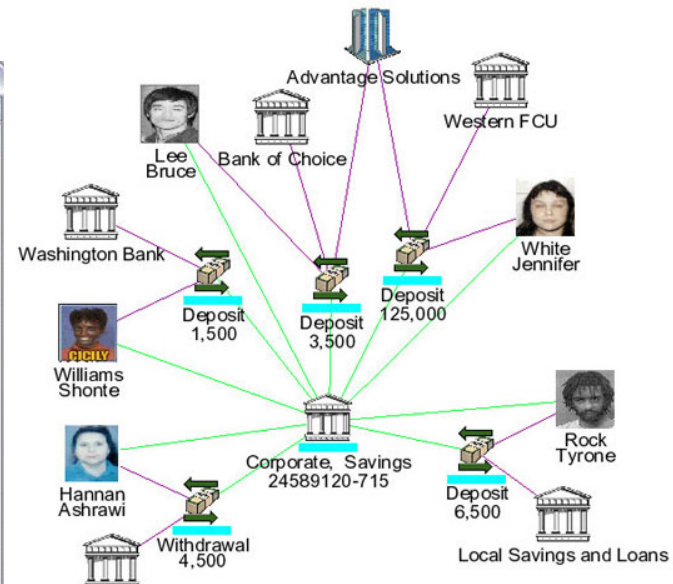


VisualLinks - (<http://www.visualanalytics.com>) - Visual Analytics, Inc.

File Edit View Actions Team Services User Settings Admin Help

Placements Rules Query Results Filter Add Objects Services Details Team

Database Query Cross Database Query Load Name Matcher Duplicate Detector Network Miner Alerts Summarize Word Count Generate Report Manage Information Set Scheduled Services View Query Sessions Note Cards Mapping Relative Time Match Strings Chart/Graph View Filter Model Wizard Disambiguator Database Translator SQL Wizard

VisualLinks - (<http://www.visualanalytics.com>) - Visual Analytics, Inc.

File Edit View Actions Team Services User Settings Admin Help

Add Objects Services Details Team Filter Placements Rules Query Results Mapping (Tracker-All [286,1059])

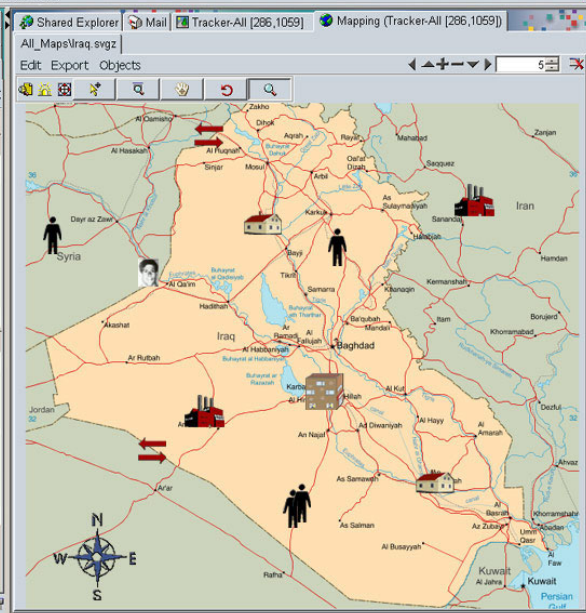
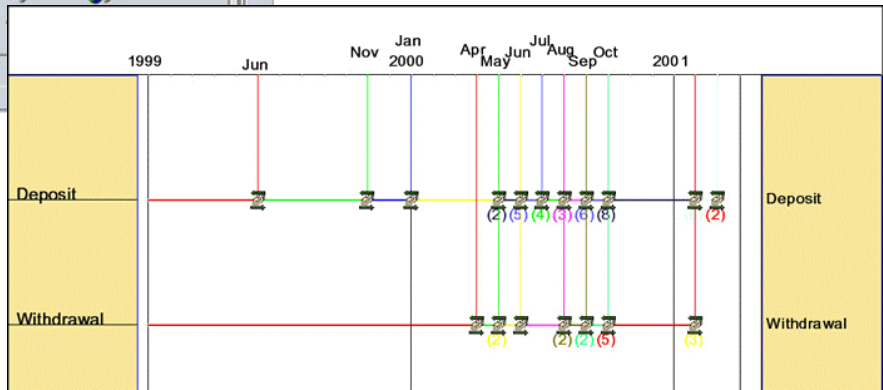
File Export Tab Maps

Find Maps:
Coordinates found in 76 Maps:

- Alabama
- Alabama_Outline
- Alaska_Outline
- Arizona
- Arizona_Outline
- Bahamas_Outline
- Iran_Outline
- Iraq
- Iraq_Outline
- Ireland_Outline
- Israel_Outline

Explore Other Maps:

Latitude Longitude
32°40'07"N 43°47'48"E

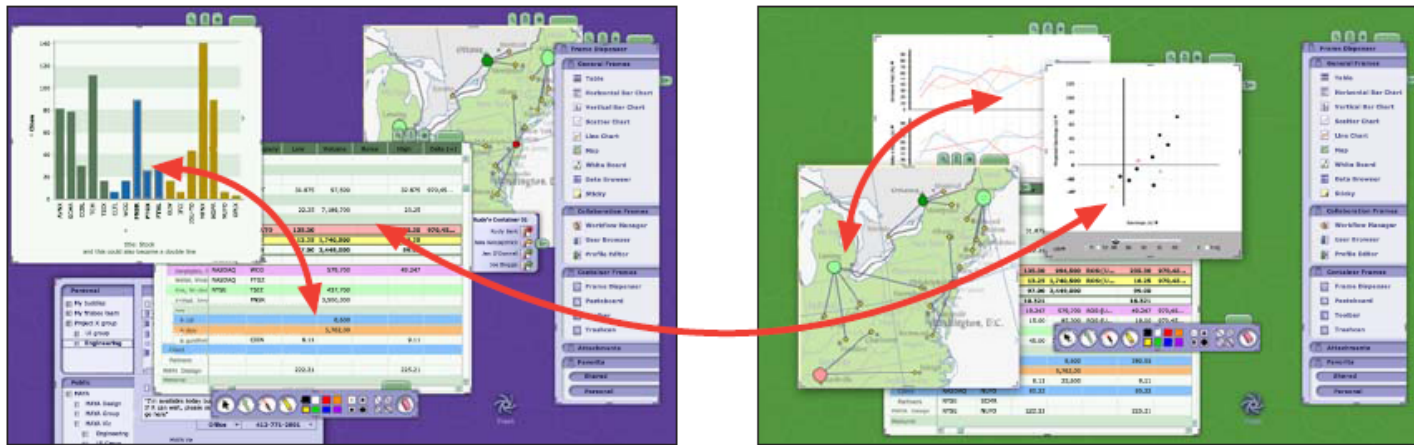
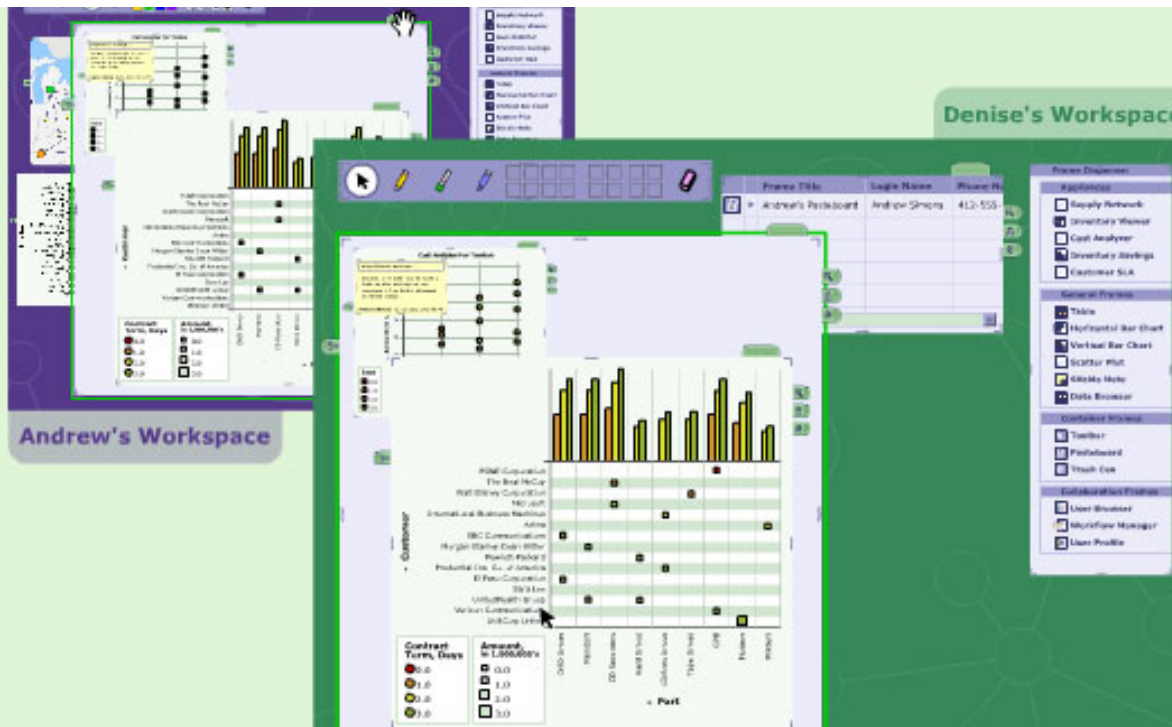




Figure ii: Coordinated shared and private visualizations

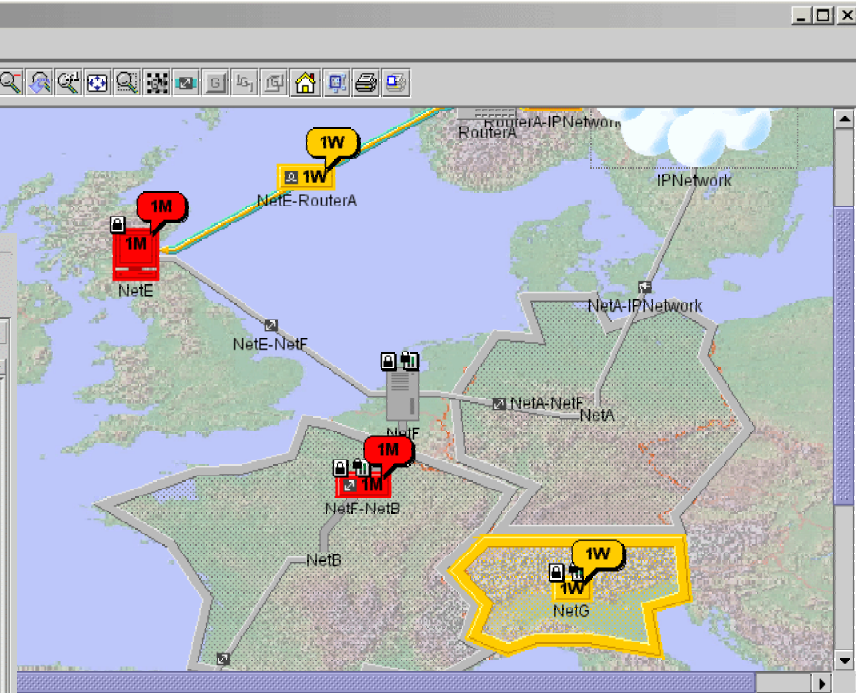
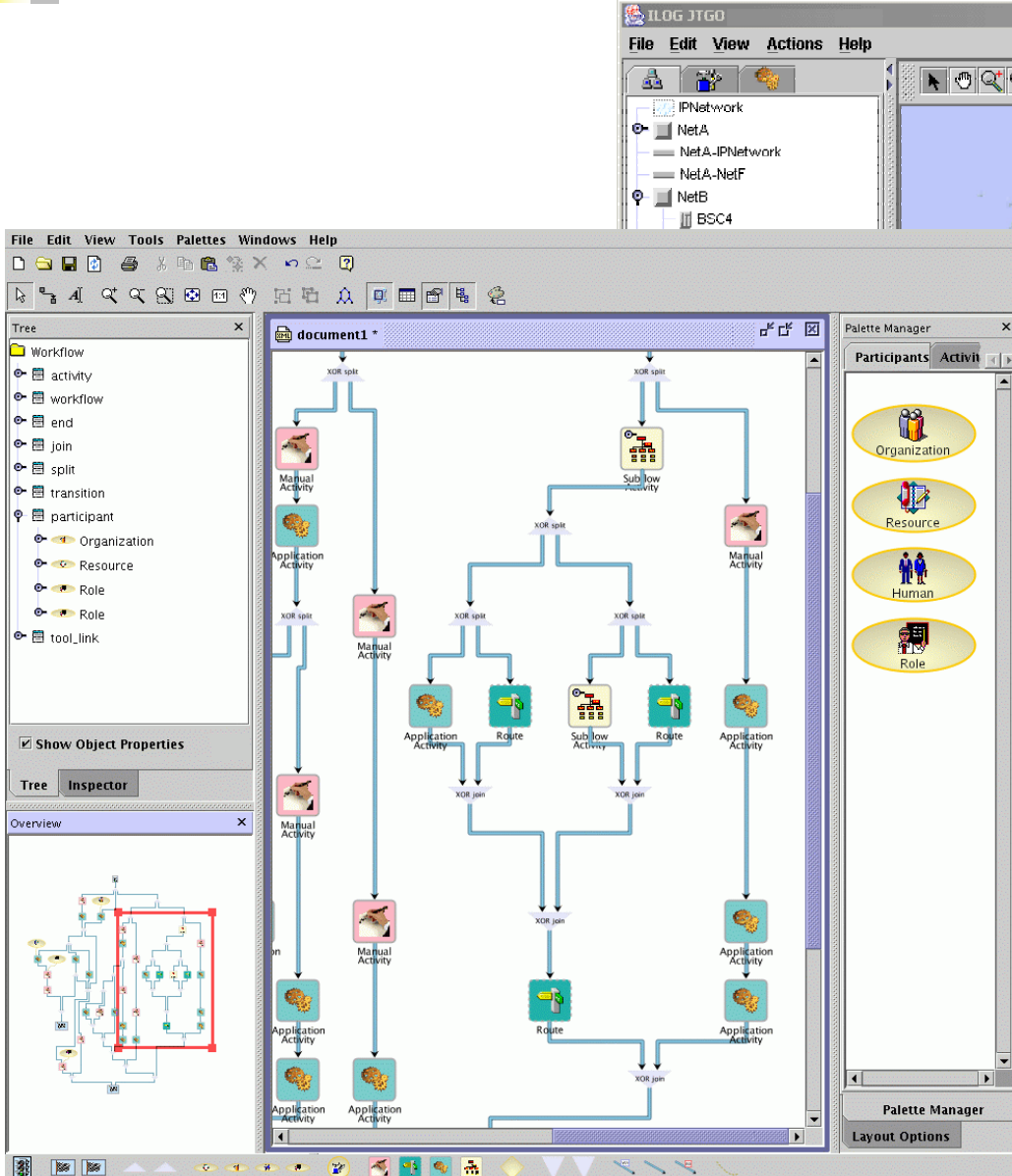


- 
- Geographic Overview
 - Identify Areas Of Focus
 - Establish The Scope
 - Communicate Intent
 - Begin Collecting Ideas
 - Initiate A Collaboration
- 
- Join A Collaboration
 - Focus Attention
 - Narrow The Scope
 - Change Context

Visualization Toolkits



Changing the rules of business



ver	✓ Ack	Severity	Created	ProbableCause
ath13		Minor	Tue Dec 16 14:08:33 PST 2003	Equipment identifier duplication
32_M...		Warning	Tue Dec 16 14:08:37 PST 2003	Loss of pointer
s1_a...		Major	Tue Dec 16 14:08:39 PST 2003	Power problem
		Critical	Tue Dec 16 14:08:41 PST 2003	Reserved for communication alarm

www.ilog.com



Information Visualization: Mantra

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



Treemap: view large trees with node values

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

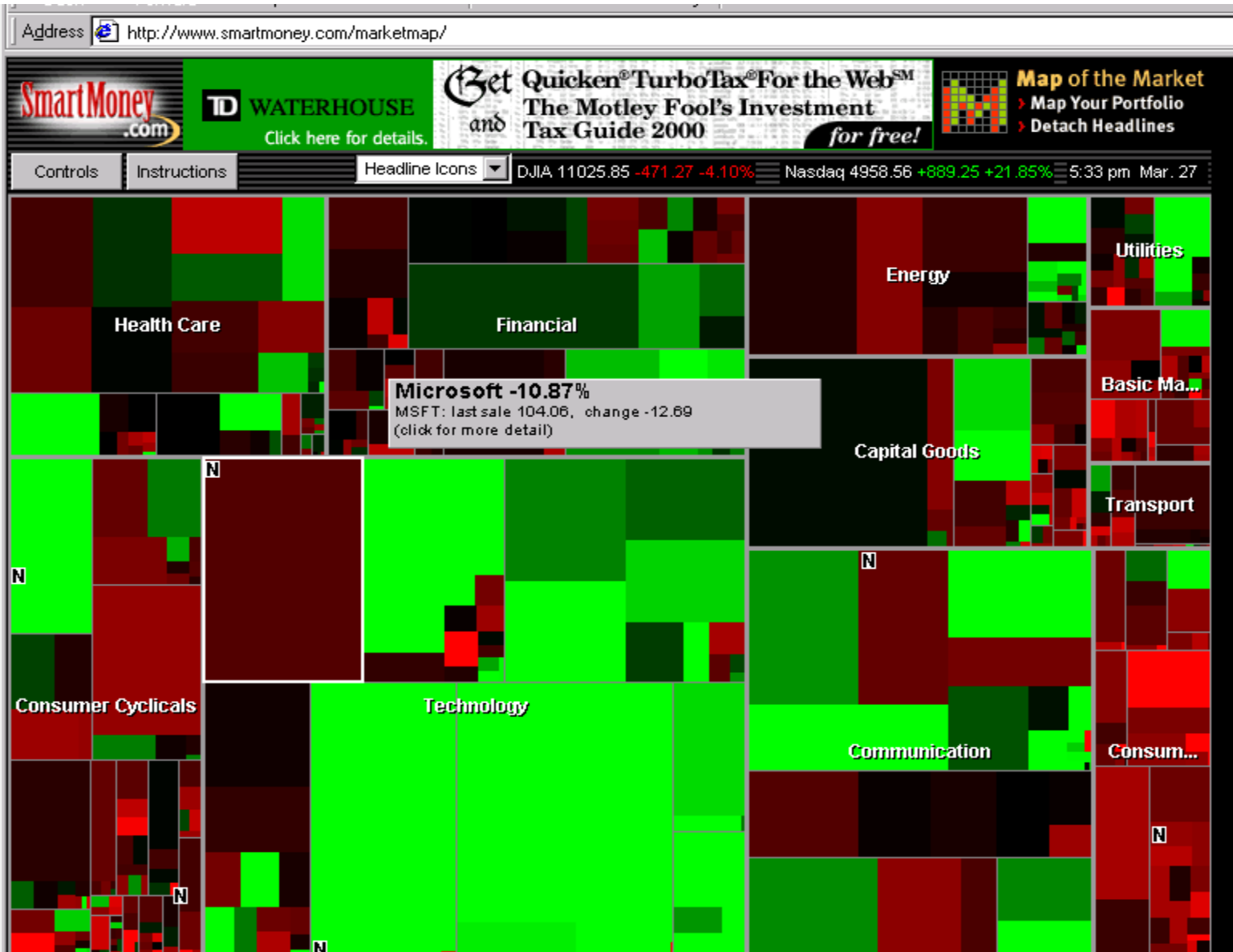
TreeViz (Mac, Johnson, 1992)
NBA-Tree(Sun, Turo, 1993)
Winsurfer (Teittinen, 1996)
Diskmapper (Windows, Micrologic)
SequoiaView, Panopticon,
HiveGroup, Solvern
Treemap4 (UMd, 2004)



(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



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

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)

Americas

Africa and Arabia The Pacific Dark Roast

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: Few Sales Bestsellers n/a

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

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

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



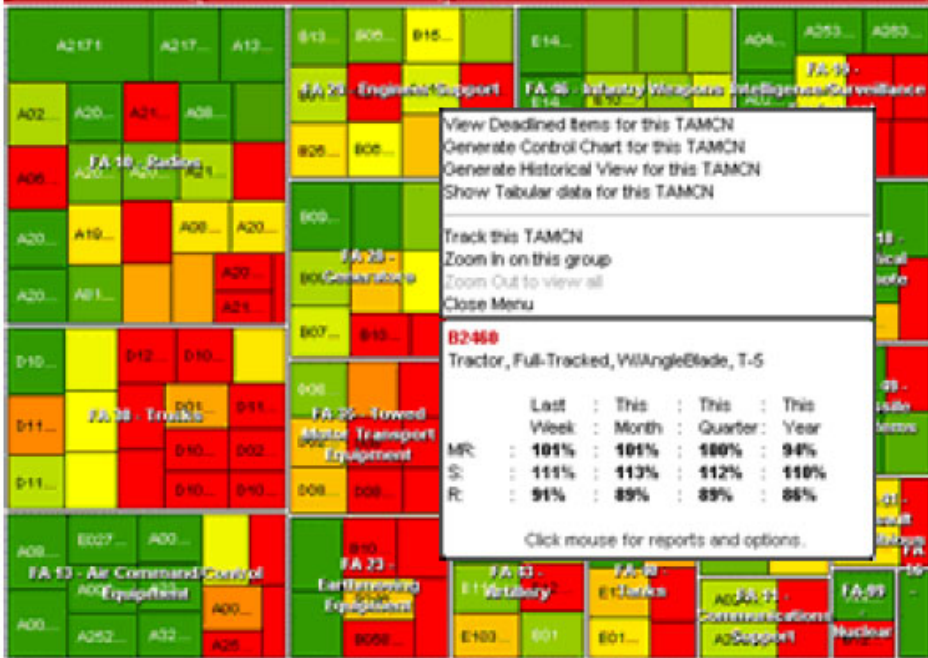
MERIT

MARINE CORPS EQUIPMENT READINESS INFORMATION TOOL

USMC BY TAMCN | USMC By MEF | 1 MEF | 2 MEF | 3 MEF | MARFORPES | NAVAS | PREPOSITIONED | EP&S

Home | [Readiness by Commodity](#) | [Readiness by Functional Area](#) | [Feedback](#) | [Logout](#)

GROUP Functional Area |
 SIZE Rating - Current |
 COLOR MR rating - Current |
 95% 90% 80% 70%



View Deadlined Items for this TAMCN
 Generate Control Chart for this TAMCN
 Generate Historical View for this TAMCN
 Show Tabular data for this TAMCN

Track this TAMCN
 Zoom In on this group
 Zoom Out to view all
 Close Menu

B2469
 Tractor, Full-Track, 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.

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

	Current	This Month	This Quarter	This Year
MR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
R	<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/IFF Equipment
 - 15 - Electronic Equipment
 - 17 - Ground Support Radar
 - 18 - Tactical Remote Sensor Equipme
 - 19 - Intelligence/Surveillance Equipme
 - 20 - Generators
 - 21 - Environmental Control Equipment
 - 23 - Earthmoving Equipment
 - 25 - Materials Handling Equipment
 - 29 - Engineer Support
 - 30 - Trucks
 - 25 - 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
 - 45 - Missile Systems
 - 50 - High Density/Low Deadline
 - 97 - Communications Security Equipme
 - 98 - Assault Craft
 - 99 - Nuclear Biological Chemical Equip

Currently displaying: 186 of 186 items

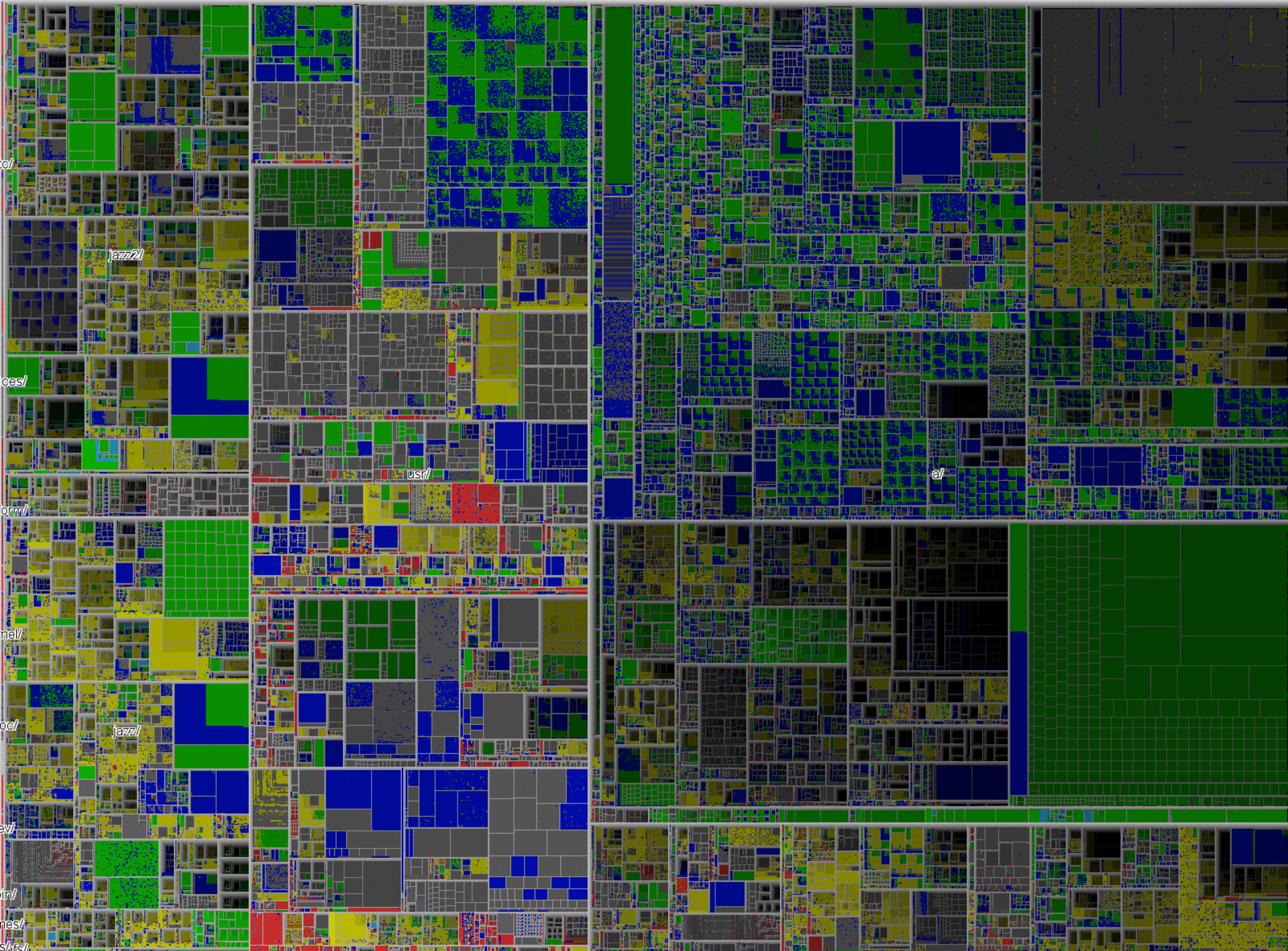
Search by TAMCN # |
 Search by TAMCN Title |
 Filter by Current Excess |
 Label by Current Excess |
 Show Only Pacing Items

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.





ce/

jazz2/

ces/

usr/

a/

orm/

nel/

ocl/

jazz1/

ev/

in/

nes/

bits/

Speed: 5.917fps/0.169spf 971061 items

.root.xml.gz/a/kronos/raid/ /a/users/hsh/src/ ld/build.sh

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 timeline of medical events and a diagnostic image viewer.

Medical History Timeline (Left Panel):

- Obesity:** Indicated by a thick black horizontal bar at the top of the timeline.
- Diagnoses:** Atrial Flutter, Flu, Pneumonia, Migraine, Fatigue, Diabetes, Knee Pain, Pneumonia, Knee Surgery.
- Tests/Procedures:** Blood, EKG, Xray, Pap, Mammo, Sonogram.
- Medications:** Cardizem, Ventolyn, Antib., Advil, Insulin, Propranolol, Lasilix.
- Other Events:** Dispensed, Batramex stop, Physical Therapy, Low Salt Fat Diet.

Diagnostic Image Viewer (Right Panel):

- Image:** A grayscale ultrasound image of a heart, showing the internal structure and motion.
- Technical Data:** SCALE MARKS 1 cm, DIST. 80mm, ENH. H, PWP, 0, HEAR, 13, FAR, 19, BAL, 22, POWER, 672.
- Patient Info:** PATIENT ID [Redacted] 17mm/3.8 ORIENTED R/L.

LifeLines Control Panel (Bottom Right):

- Layout:** Label (selected), Summary, Search, Zoom.
- Location Allowed:** Top Right, Top Right & Left, 4 Corners.
- Link from Timeline to Label:** No, Yes.
- Font Size:** Slider set to 12 (range 8-20).
- Truncation:** No, Yes (range 0-30).

Timeline Navigation (Bottom Left):

- Timeline markers: 2/92, 93, 94, 95, 96, 97.
- Navigation arrows: Left arrow, Right 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.

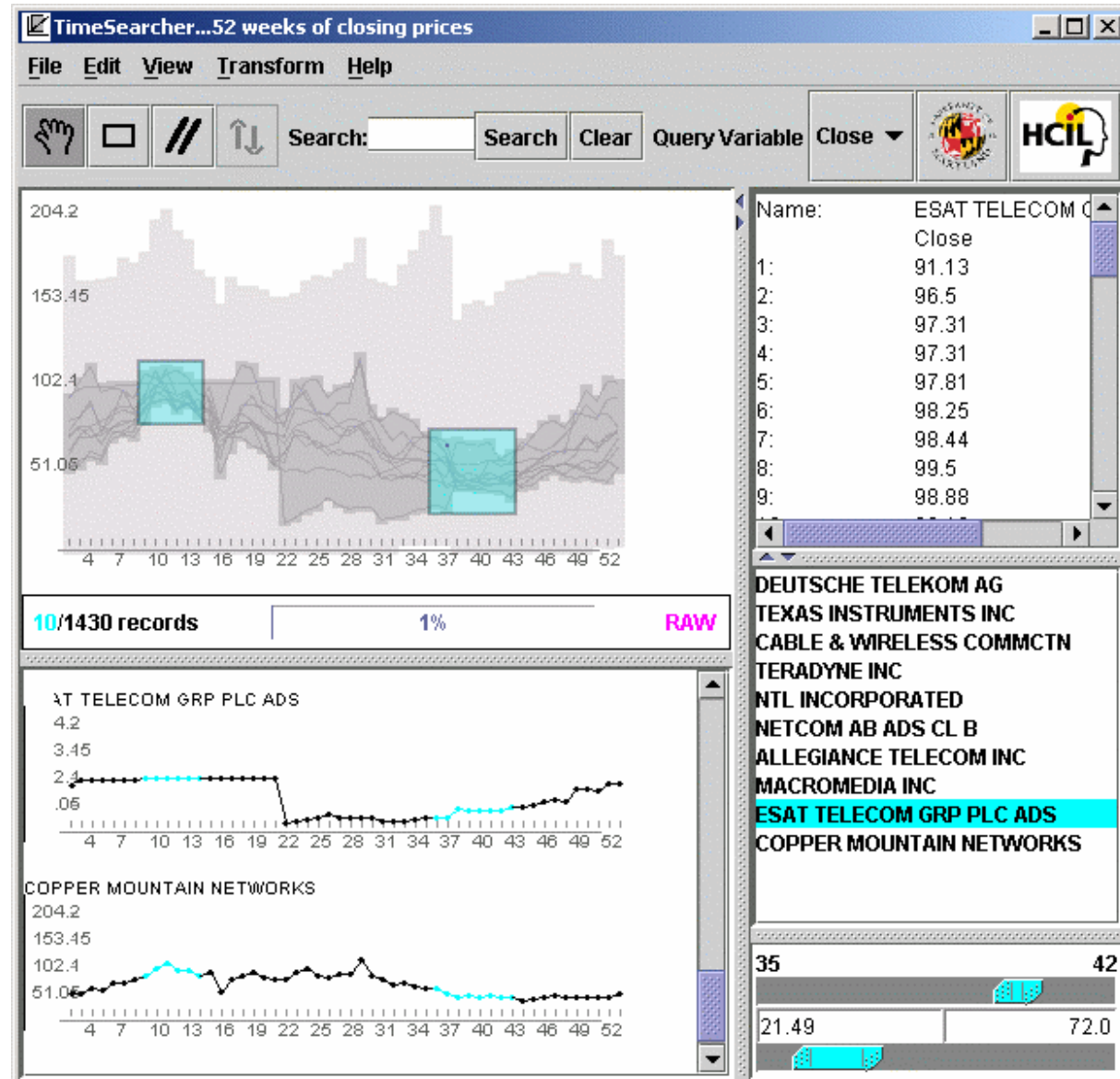


LifeLine

	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

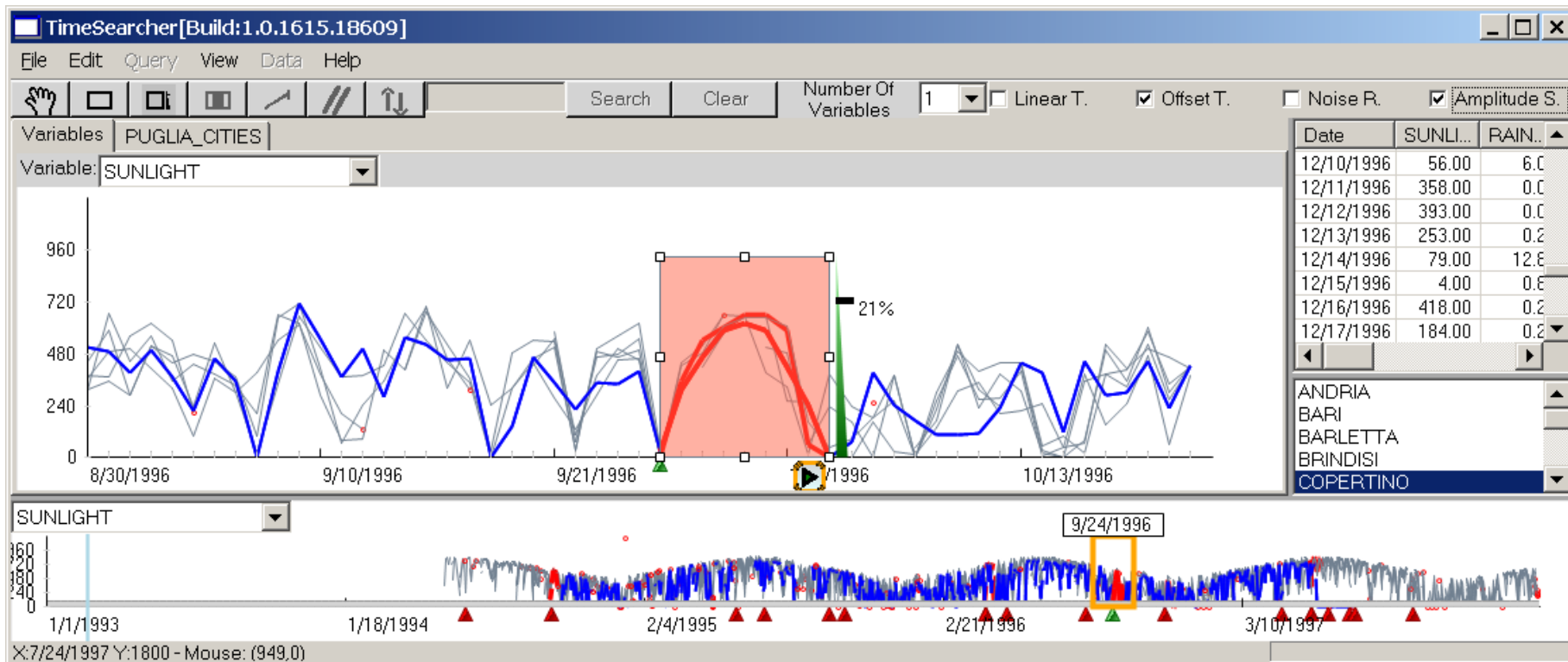
Temporal Data: TimeSearcher 1.3

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



Temporal Data: TimeSearcher 2.0

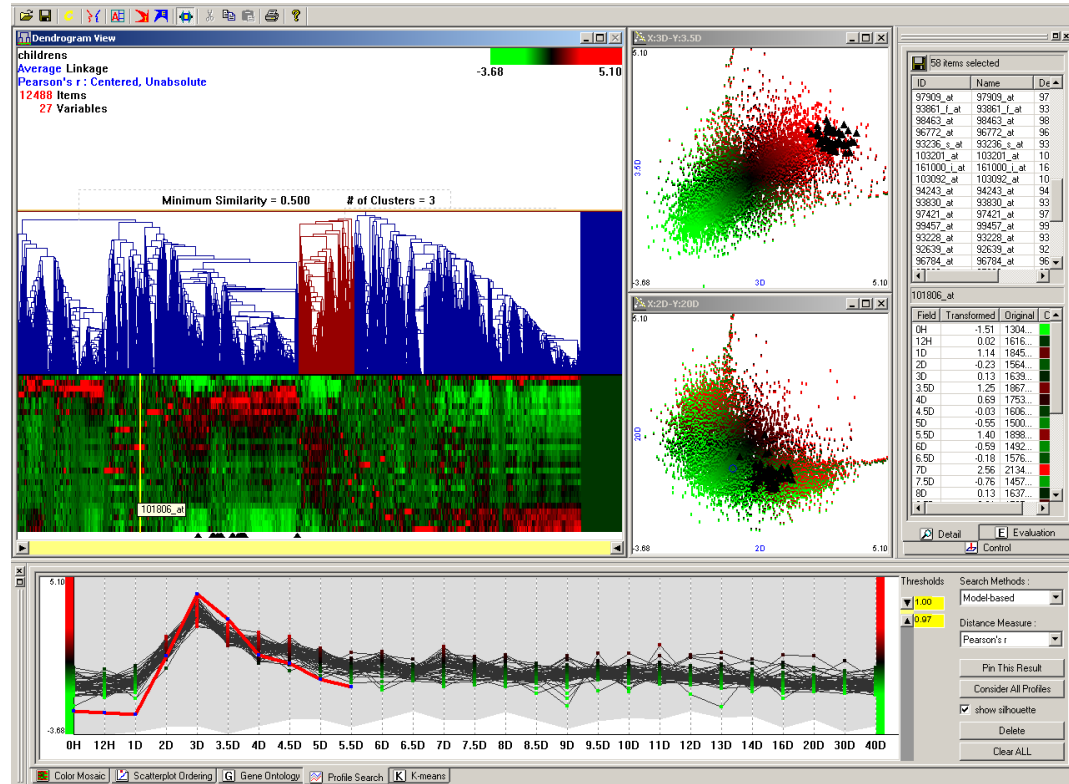
- Long Time series (>10,000 time points)
- Multiple variables
- Controlled precision in match
(Linear, offset, noise, amplitude)



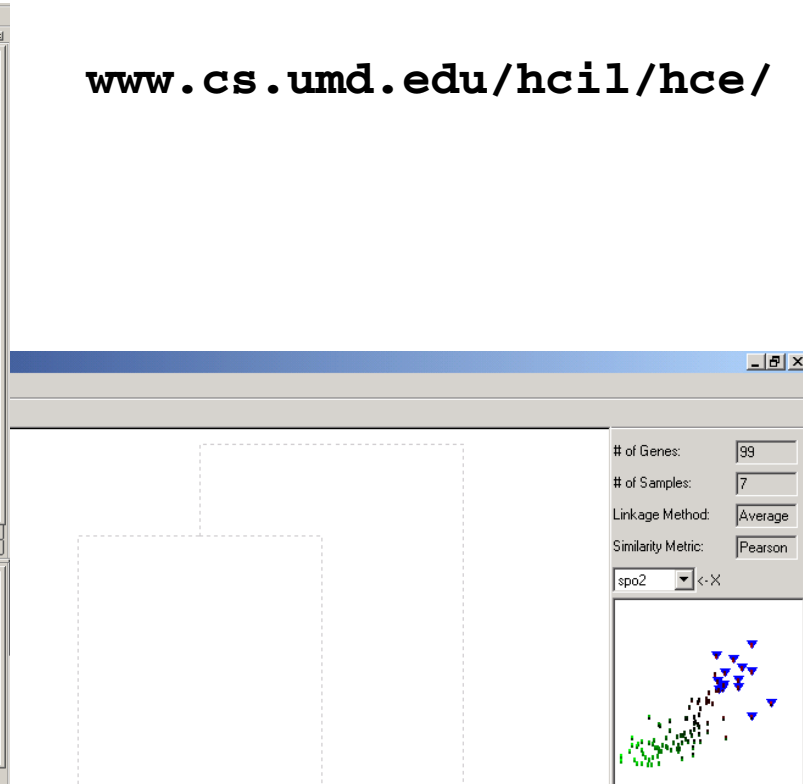
Goal: Find Features in Multi-Var Data

- 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

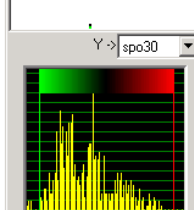
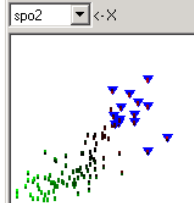
Multi-V: Hierarchical Clustering Explorer



www.cs.umd.edu/hcil/hce/

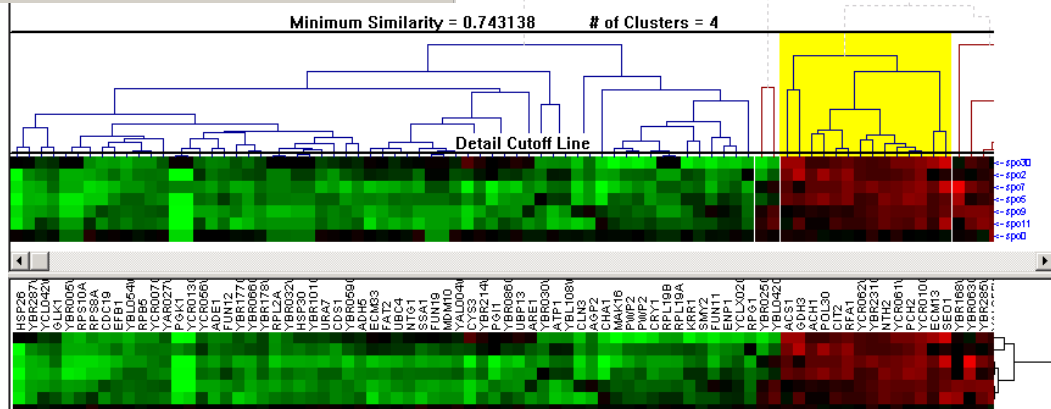


of Genes: 99
 # of Samples: 7
 Linkage Method: Average
 Similarity Metric: Pearson



Selected Cluster Information
 # of Genes: 14
 Similarity: 0.700000

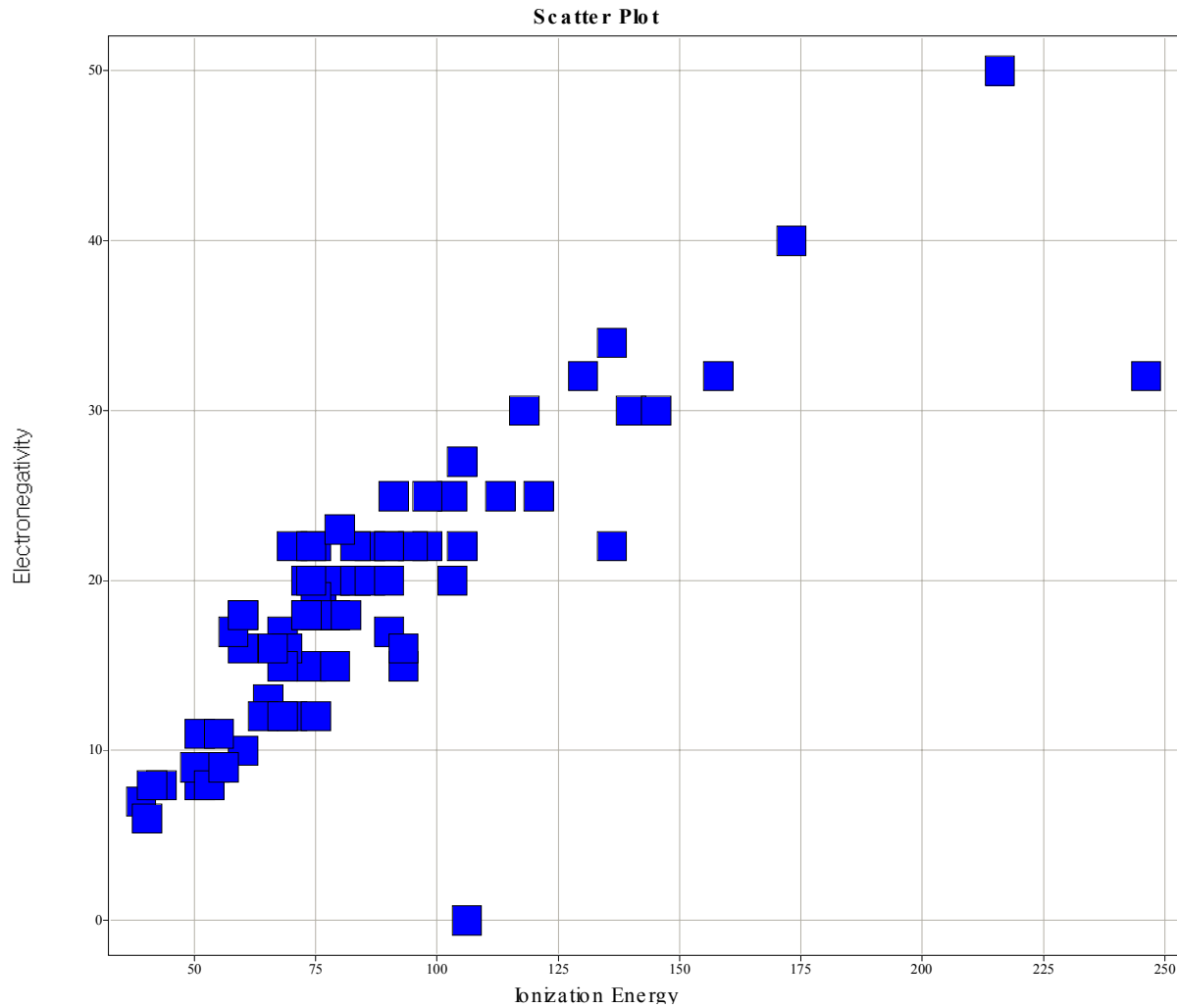
“HCE enabled us to find important clusters that we didn’t know about.”
 - a user



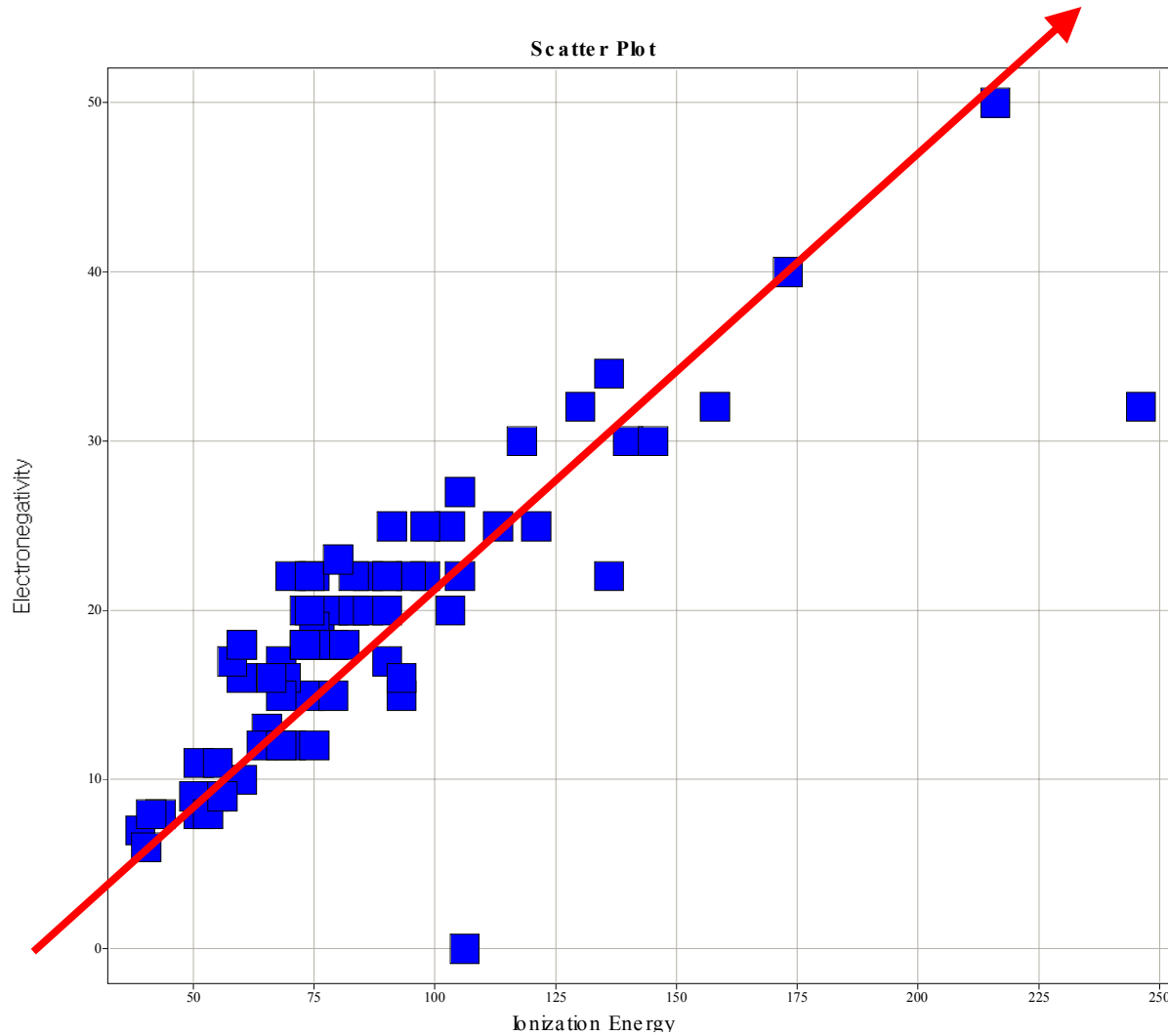
Do you see anything interesting?

	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

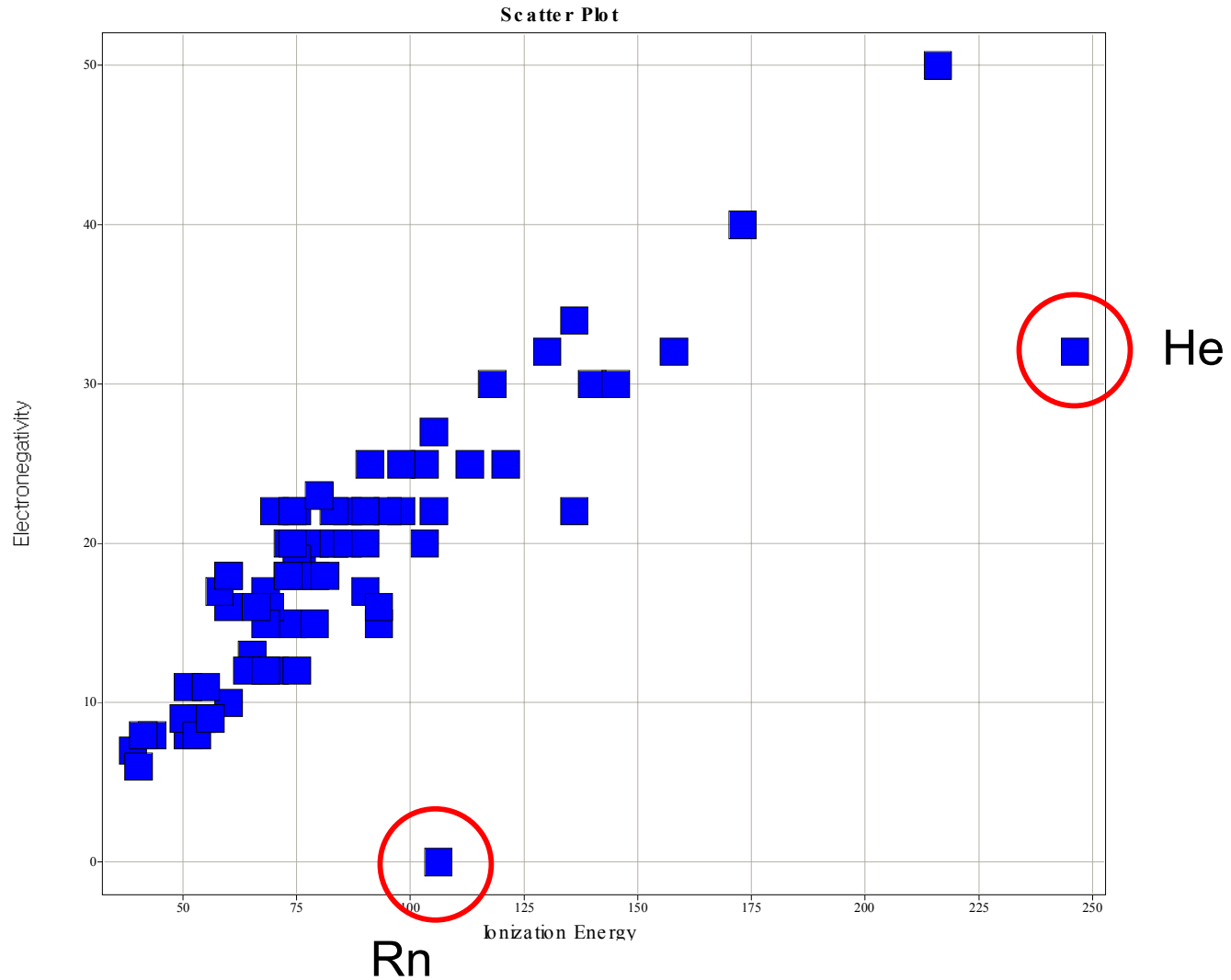
What features stand out?



Correlation...What else?



... and Outliers

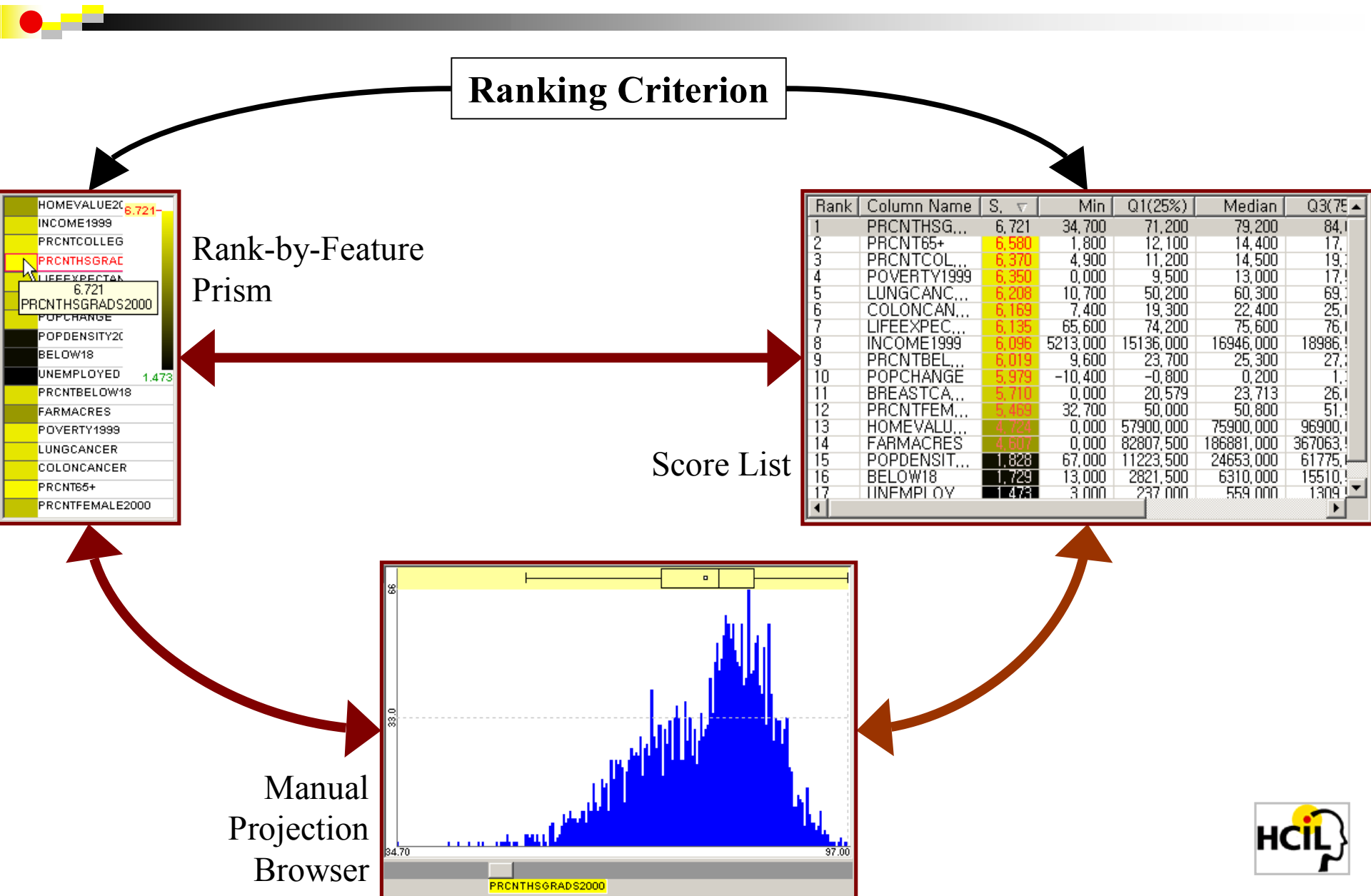


Demonstration



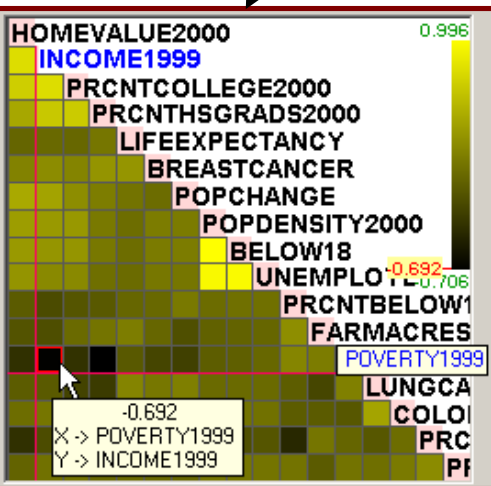
- US counties census data
 - 3138 counties
 - 14 dimensions : population density, poverty level, unemployment, etc.

Rank-by-Feature Framework: 1D



Rank-by-Feature Framework: 2D

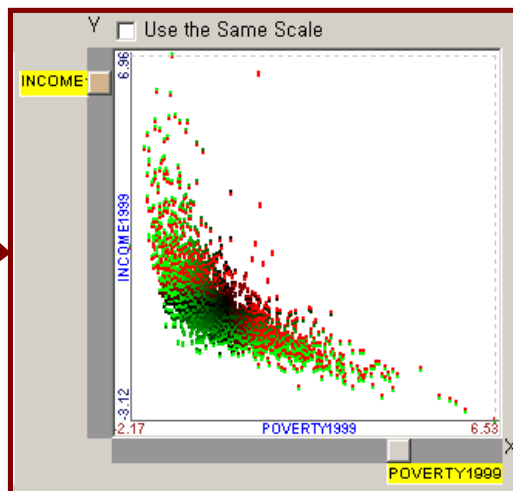
Ranking Criterion



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

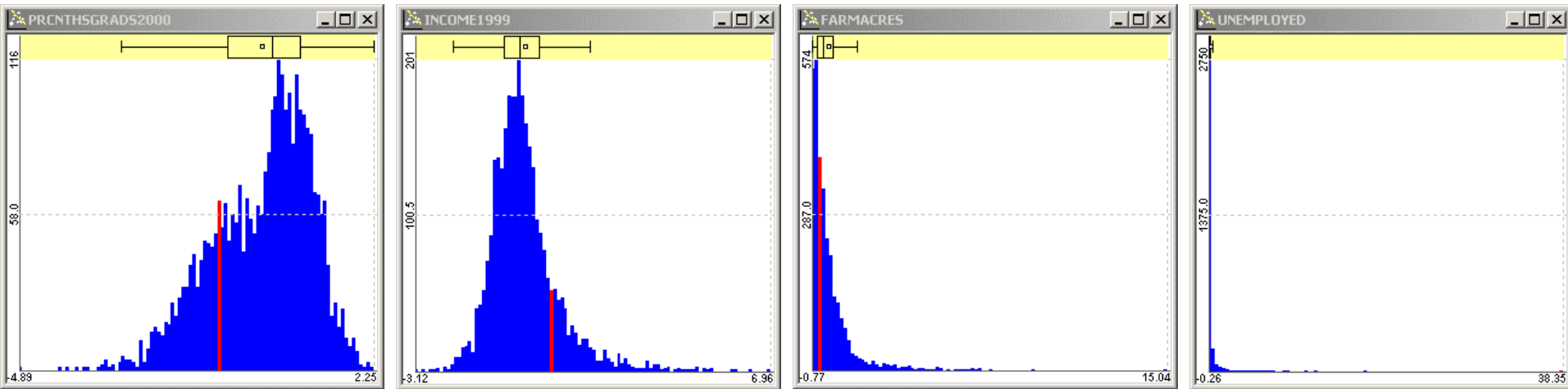
Score List

Manual Projection Browser

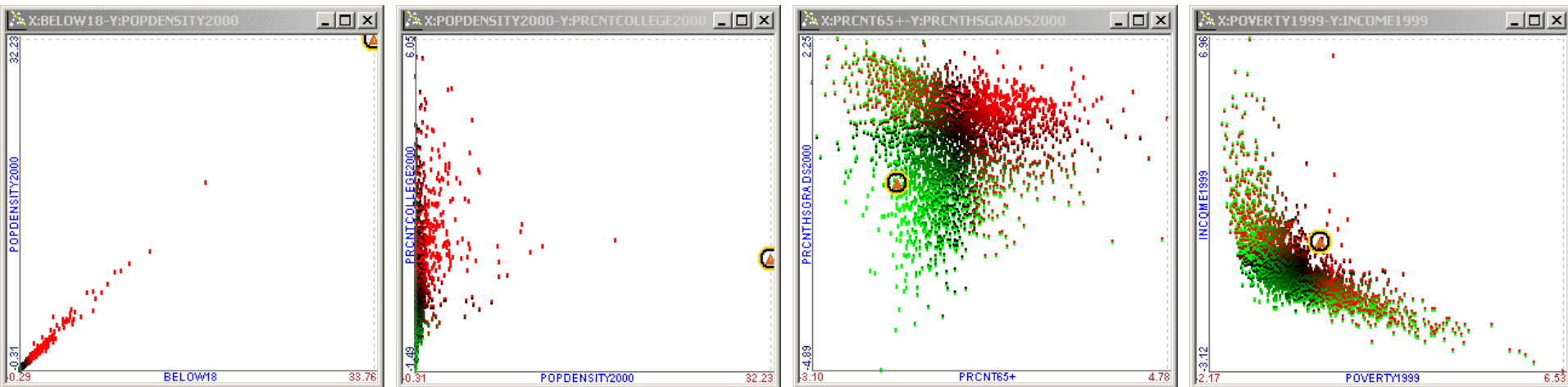


A Ranking Example

3138 U.S. counties with 17 attributes



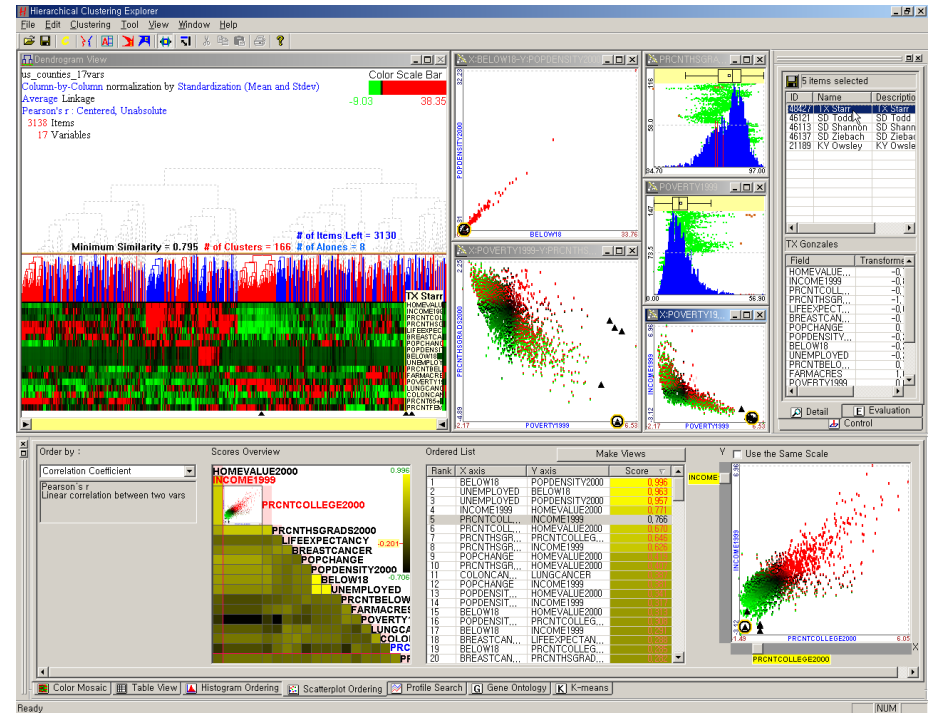
Ranking Criterion: Uniformity (entropy) (6.7, 6.1, 4.5, 1.5)



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

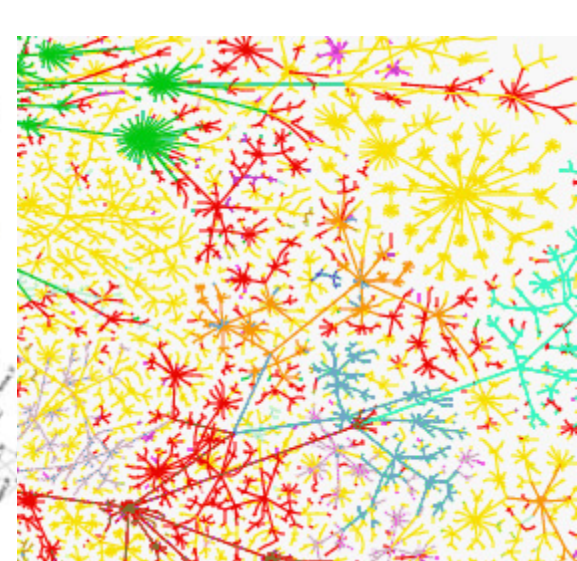
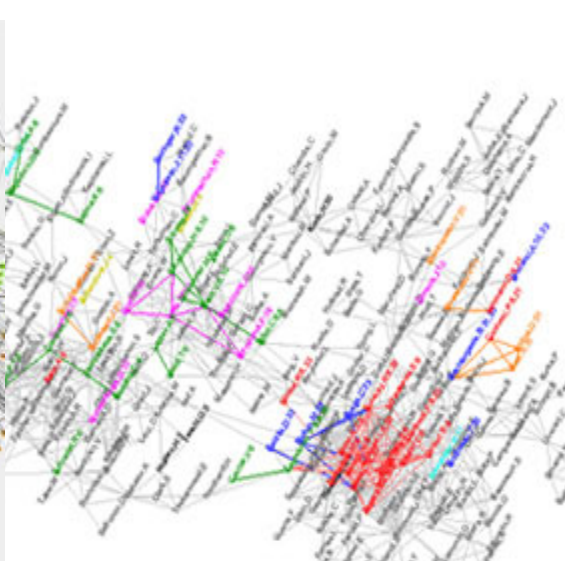
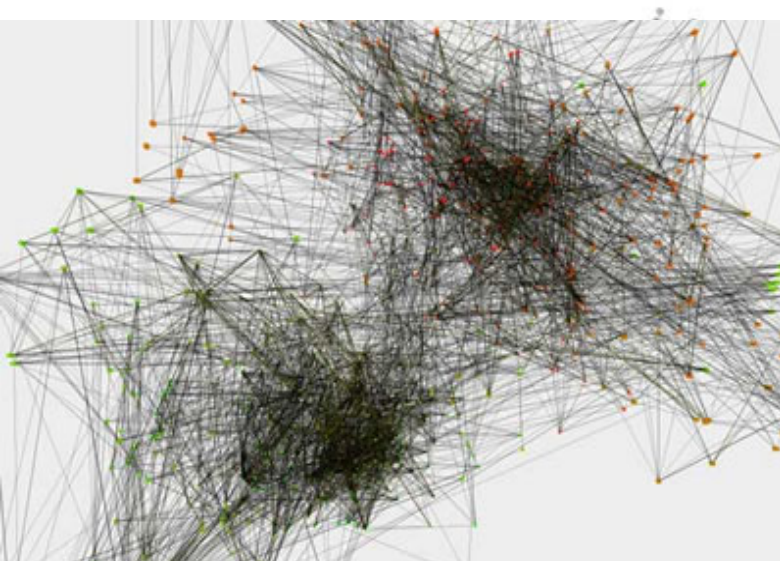
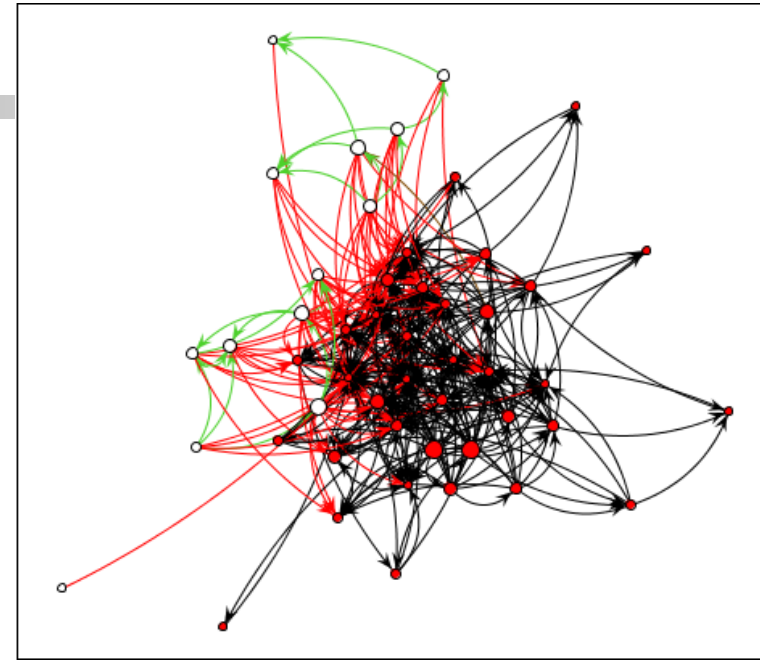
HCE Status

- 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



Network Data

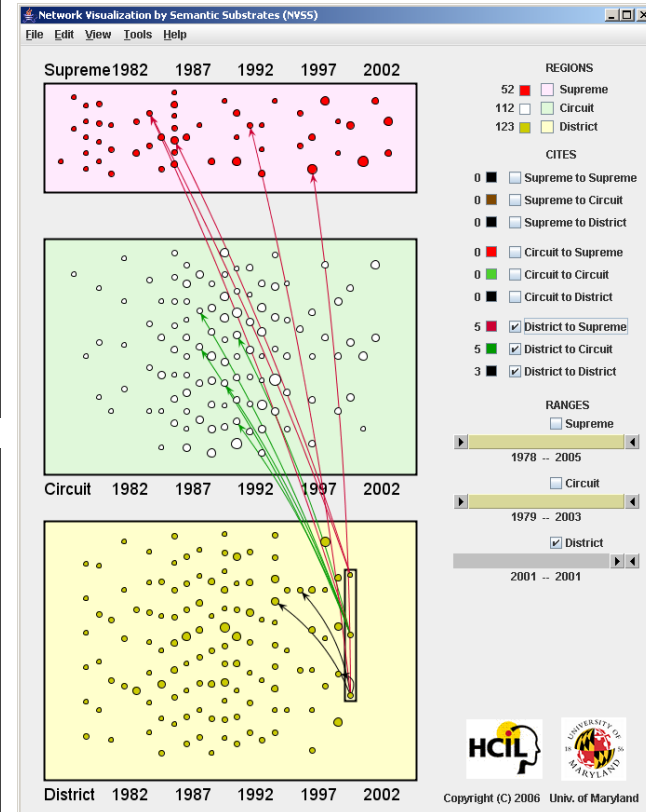
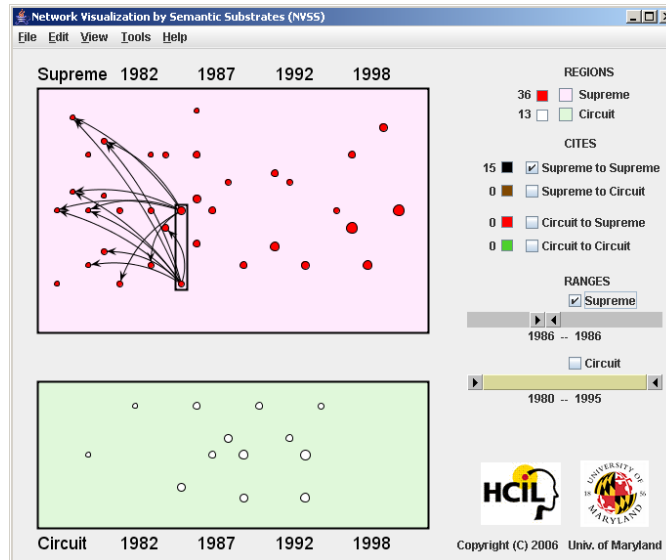
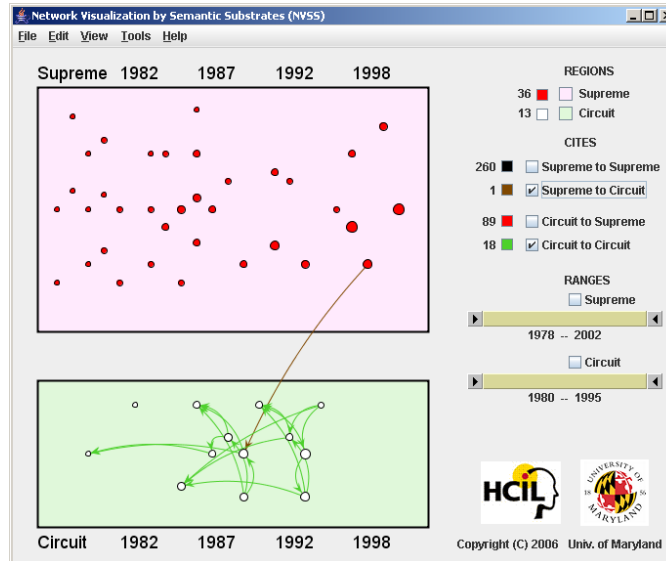
- Nodes & Links
 - Relationships & communication
 - Scientific/legal citations
- Difficult to complete tasks
 - Occlusion
 - Complexity



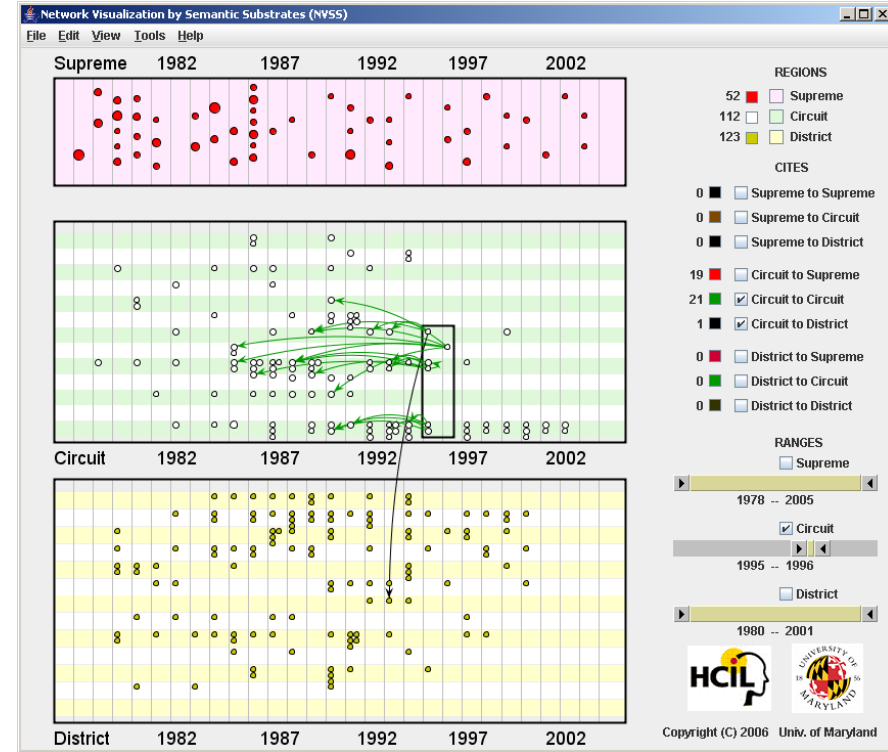
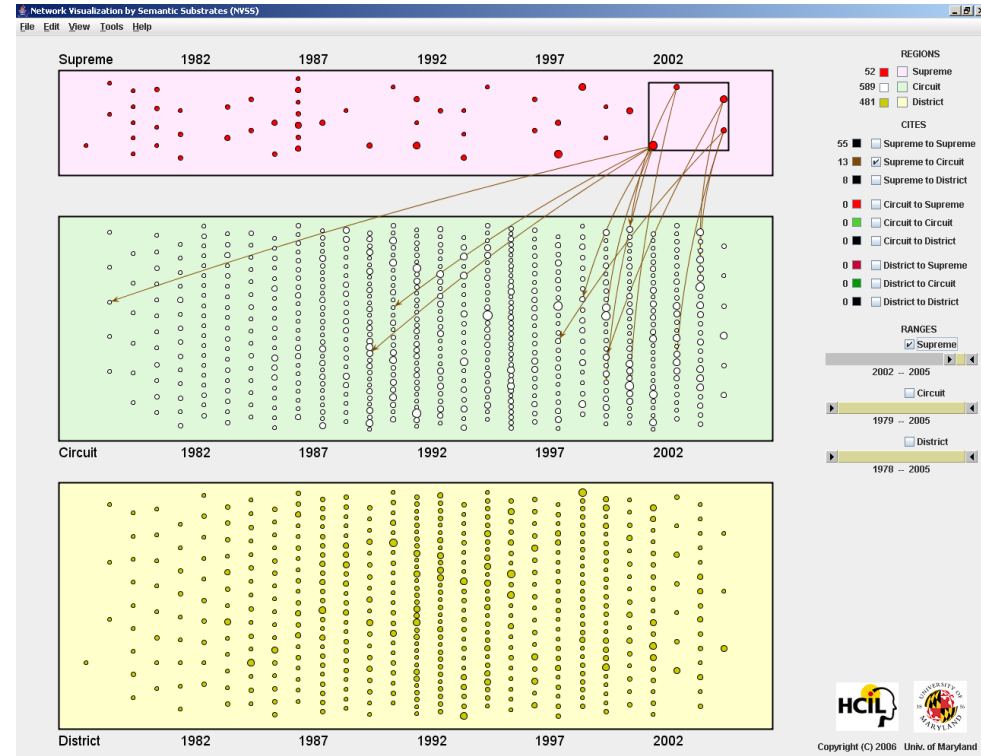
Network Data

Network Visualization with Semantic Substrates

- Meaningful layout of nodes
- User controlled visibility of links



Network Data



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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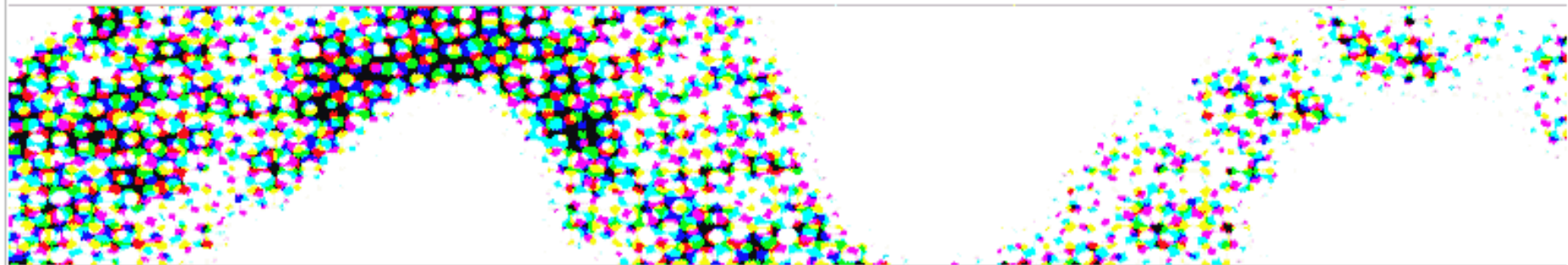


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Notification:	February 19, 2007
Revised papers:	March 19, 2007
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<http://www.cs.umd.edu/hcil/CC2007/>

feature two elegant evening receptions at
prominent washington, DC locations:

the National Academy of Sciences (June 13) and Corcoran Gallery of Art (June 14)