

Interactive Visual Discovery in Temporal Event Sequences: Electronic Health Records & Other Applications

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Professor, Department of Computer Science
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Interdisciplinary research community
- Computer Science & Info Studies
- Psych, Socio, Educ, Jour & MITH

www.cs.umd.edu/hcil
vimeo.com/72440805



Design Issues

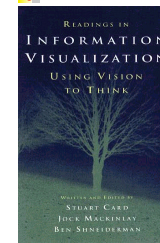
- Input devices & strategies
 - Keyboards, pointing devices, voice
 - Direct manipulation
 - Menus, forms, commands
- Output devices & formats
 - Screens, windows, color, sound
 - Text, tables, graphics
 - Instructions, messages, help
- Collaboration & Social Media
- Help, tutorials, training
- Search • Visualization



www.awl.com/DTUI
Fifth Edition: 2010



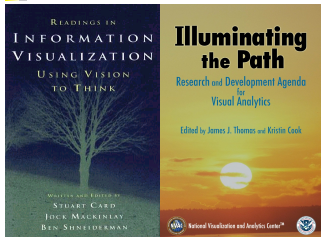
Information Visualization & Visual Analytics



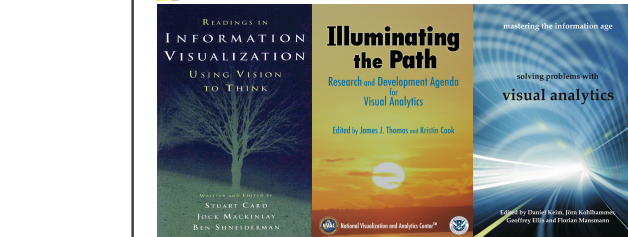
1999



Information Visualization & Visual Analytics

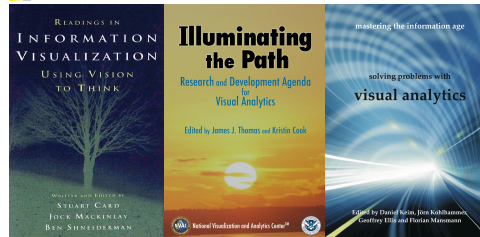


1999



2004

Information Visualization & Visual Analytics



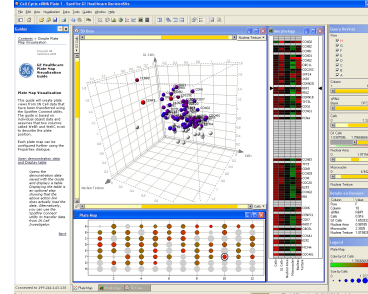
1999

2004

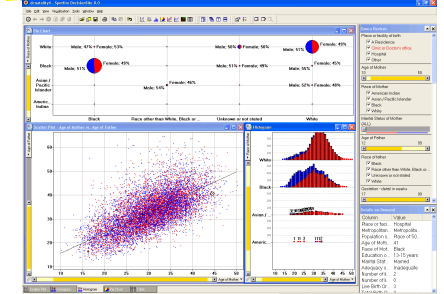
2010



Spotfire: Retinol's role in embryos & vision



Spotfire: DC natality data



http://registration.spotfire.com/eval/default_edu.asp



10M - 100M pixels: Large displays



16M pixels: My New Workstation



100M-pixels & more



1M-pixels & less Small mobile devices



Information Visualization: Mantra

- Overview, zoom & filter, details-on-demand
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(The Eyes Have It, IEEE VL, 1996)



Information Visualization: Data Types

- | | | |
|---------|--------------|---|
| SciViz | • 1-D Linear | Document Lens, SeeSoft, Info Mural |
| | • 2-D Map | GIS, ArcView, PageMaker, Medical imagery |
| | • 3-D World | CAD, Medical, Molecules, Architecture |
| InfoViz | • Multi-Var | Spotfire, Tableau, Qliktech, Visual Insight |
| | • Temporal | EventFlow, TimeSearcher, Palantir, RecordedFuture |
| | • Tree | Windows Explorer, SpaceTree, Treemap |
| | • Network | Pajek, UCINET, NodeXL, Gephi, Tom Sawyer |

flowingdata.com visualcomplexity.com eagereyes.org
infosthetics.com perceptualledge.com datakind.org
visual.ly visualizing.org infovis.org



EventFlow Team: Oracle support



www.cs.umd.edu/hcil/eventflow

www.undrightnow.umd.edu/news/umd-research-team-developing-powerful-data-visualization-tool-support-team



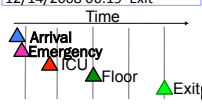
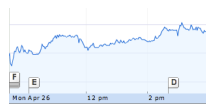
EHRs: Temporal data

Numerical Events

Categorical Events

Stock: Microsoft	
04/26/2010 10:00	31.03
04/26/2010 10:15	31.01
04/26/2010 10:30	31.02
04/26/2010 10:45	31.08
04/26/2010 11:00	31.16

Patient ID: 45851737	
12/02/2008 14:26	Arrival
12/02/2008 14:36	Emergency
12/02/2008 22:44	ICU
12/05/2008 05:07	Floor
12/14/2008 06:19	Exit



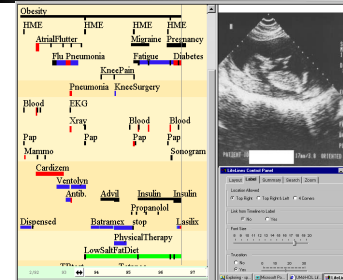
Patient Histories: Our Research

Tool	Event Types	Records	Display
LifeLines	Points, Intervals	One	Individual
LifeLines2	Points	Many	Individual, Summary
Similan	Points	Many	Individual
LifeFlow	Points	Many	Individual, Aggregate
EventFlow	Points, Intervals	Many	Individual, Aggregate

www.cs.umd.edu/hcil/toolname



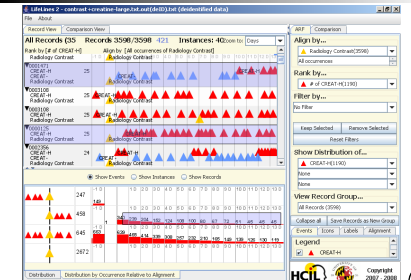
LifeLines: Patient Histories



www.cs.umd.edu/hcil/lifelines



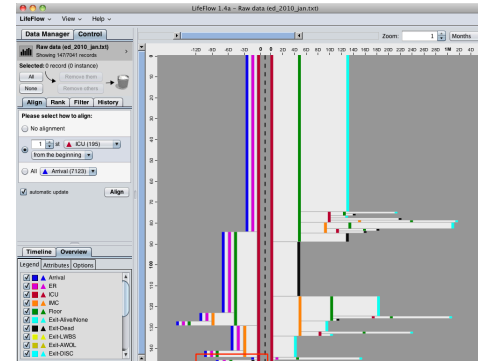
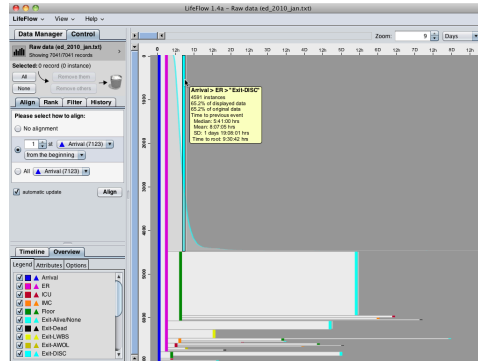
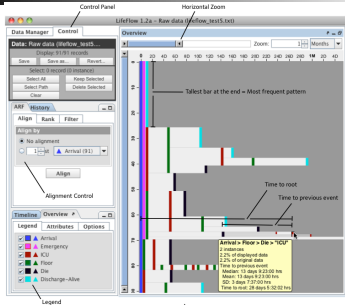
LifeLines2: Align-Rank-Filter & Summarize



www.cs.umd.edu/hcil/lifelines2



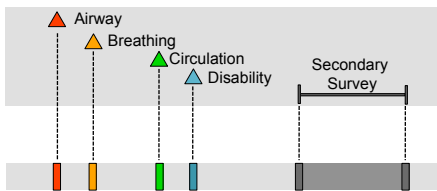
LifeFlow: Interface with User Controls



Children's Hospital in DC: Trauma Bay



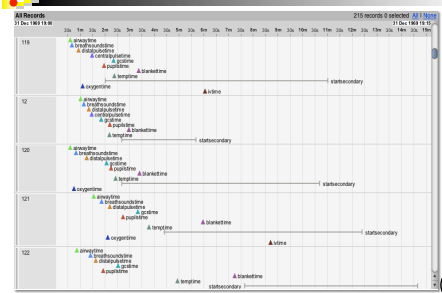
EventFlow



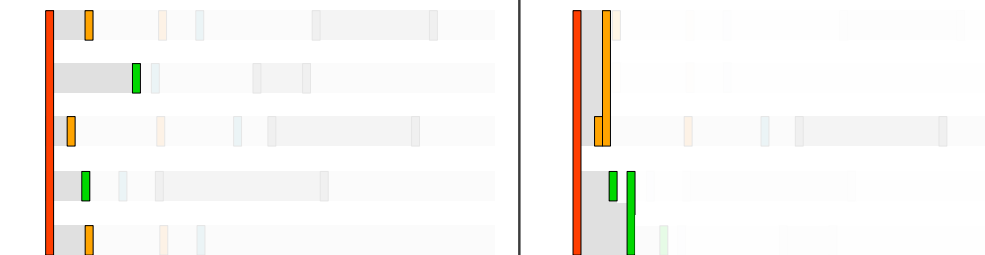
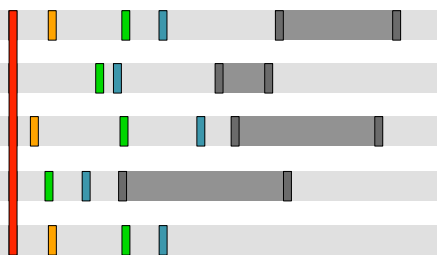
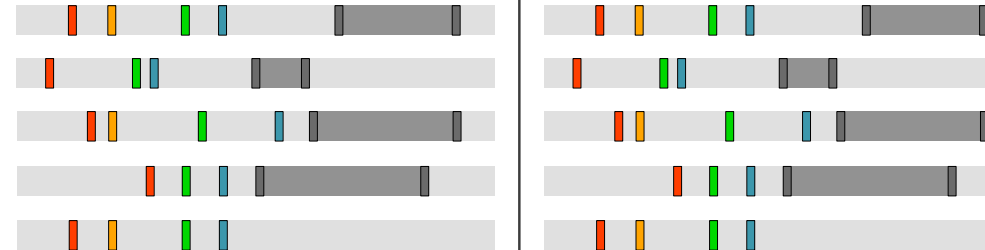
www.cs.umd.edu/hcil/eventflow

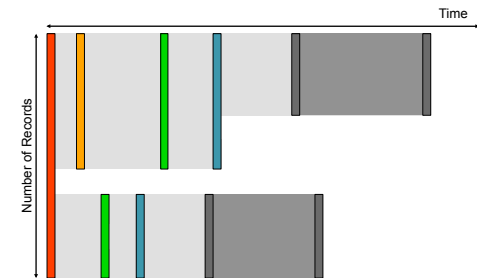
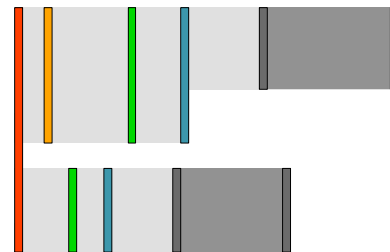
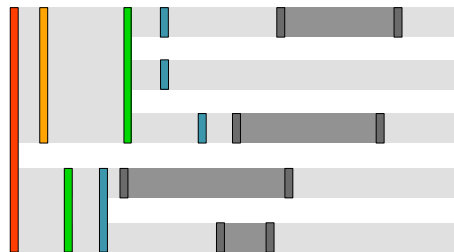


EventFlow: Temporal Events

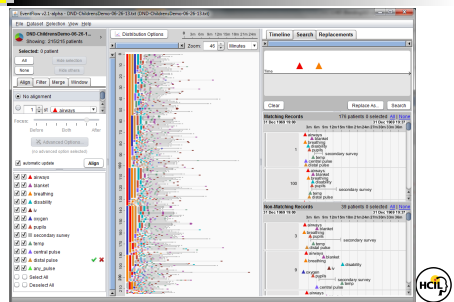


http://youtu.be/dz86_nSxt-M

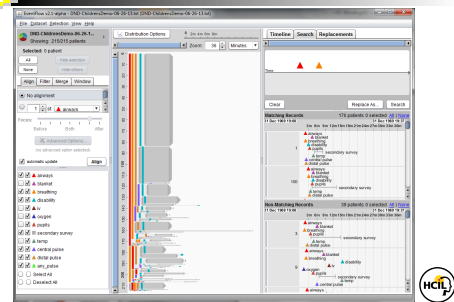




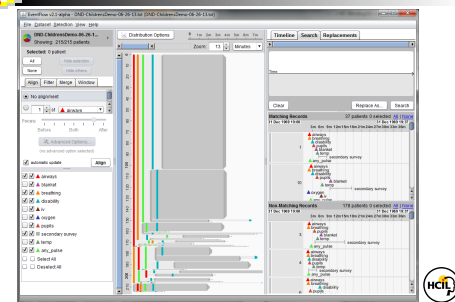
Children's Hospital Trauma Care: EventFlow



Children's Hospital Trauma Care: EventFlow

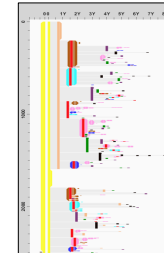


Children's Hospital Trauma Care: EventFlow

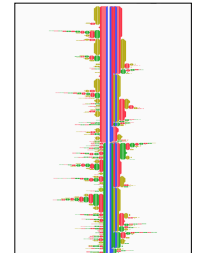


UM-Baltimore: CHIB Projects

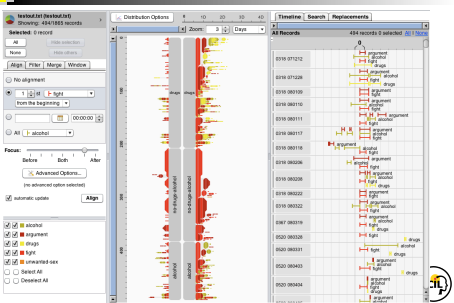
Radiation Therapy: Metastatic Prostate Cancer



Warfarin Usage in Patients with Traumatic Brain Injury



Yale Medical: Seth Powsner & Tami Sullivan

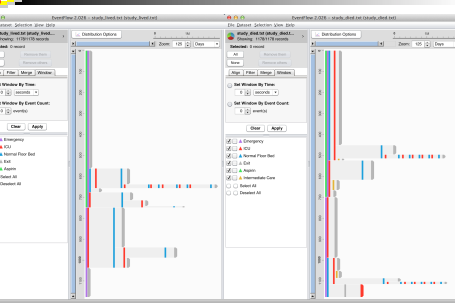


Future Directions: EventFlow

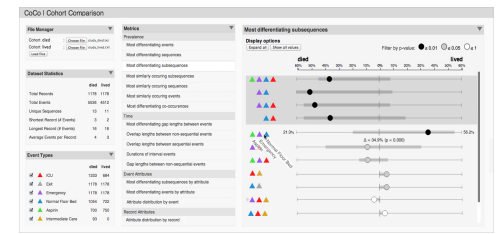
- Refine software to add business features
- Make backend database
- Scalability of many kinds
- Validation across usage domains
- Build community
- Launch startup company?



Cohort Comparison: Dual EventFlow



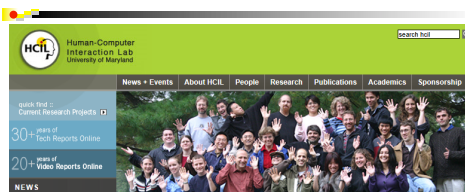
Cohort Comparison: CoCo



Thanks for getting us to this stage

Catherine Plaisant

- LifeLines
- LifeLines2 (David Wang)
- LifeFlow (Krist Wongsuphasawat)
- EventFlow team
 - Megan Monroe, Chris Imbriano →
 - Sana Malik, Fan Du, Chris Musialek, Christi Capati, Duke Chan



@benbendc

Workshop Website

www.cs.umd.edu/hcil/eventflow/workshop2014/



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