Workshop Introduction: Exploring Temporal Patterns in Electronic Health Record Data

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Agenda

• 10:40am - WORKSHOP: Morning Session
• 12:05pm - LUNCH
• 1:00pm - WORKSHOP: Afternoon Session
• 2:55pm - BREAK
• 3:20pm - WORKSHOP: Afternoon Session II
• 5:00pm - Workshop ends
• 5:15pm - Symposium Demos & Posters + RECEPTION
• 6:30pm - Symposium ends
Goals

• Create a community on Visualization of EHR Data
• Share experiences (good & bad) in data analysis
• Review publication & conference opportunities
• Catalog top research challenges
• Discuss how to commercialize mature work
• Identify who else to reach out to
• ???
Participants

• Sponsors (THANKS!): Oracle, Adobe, ICF
• UMCP+UMB
• Medical: MedStar, PartnersHealthCare, Mayo…
• Medical Companies
• Big Companies
• Small Companies
• Govt: NIH Walter Reed, FDA
• Academics: Harvard, Yale, NYU, OHSU, Purdue, SUNY, Univ of Konstanz
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

infosthetics.com visualcomplexity.com eagereyes.org
flowingdata.com perceptualedge.com datakind.org
visual.ly visualizing.org infovis.org
EHRs: Temporal data

Numerical Events

<table>
<thead>
<tr>
<th>Stock: Microsoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/26/2010 10:00</td>
</tr>
<tr>
<td>04/26/2010 10:15</td>
</tr>
<tr>
<td>04/26/2010 10:30</td>
</tr>
<tr>
<td>04/26/2010 10:45</td>
</tr>
<tr>
<td>04/26/2010 11:00</td>
</tr>
</tbody>
</table>

Categorical Events

- 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

<table>
<thead>
<tr>
<th>Tool</th>
<th>Event Types</th>
<th>Records</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>LifeLines</td>
<td>Points, Intervals</td>
<td>One</td>
<td>Individual</td>
</tr>
<tr>
<td>LifeLines2</td>
<td>Points</td>
<td>Many</td>
<td>Individual, Summary</td>
</tr>
<tr>
<td>Similan</td>
<td>Points</td>
<td>Many</td>
<td>Individual</td>
</tr>
<tr>
<td>LifeFlow</td>
<td>Points</td>
<td>Many</td>
<td>Individual, Aggregate</td>
</tr>
<tr>
<td>EventFlow</td>
<td>Points, Intervals</td>
<td>Many</td>
<td>Individual, Aggregate</td>
</tr>
</tbody>
</table>
LifeLines2: Align-Rank-Filter & Summarize

www.cs.umd.edu/hcil/lifelines2
LifeFlow: Interface with User Controls

- Control Panel
- Horizontal Zoom
- Alignment Control
- Legend
  - Arrival
  - Emergency
  - ICU
  - Floor
  - Die
  - Discharge-Alive

Tallest bar at the end = Most frequent pattern
Time to root
Time to previous event
Arrival > ER > "Exit-DISC"

4591 instances
65.2% of displayed data
65.2% of original data
Time to previous event
Median: 5:41:00 hrs
Mean: 8:07:05 hrs
SD: 1 days 19:08:01 hrs
Time to root: 9:30:42 hrs
EventFlow: Temporal Events
EventFlow: Temporal Events

http://youtu.be/dz86_nSxt-M
Children’s Hospital Trauma Data
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UM-Baltimore: CHIB Projects

Radiation Therapy: Metastatic Prostate Cancer

Warfarin Usage in Patients with Traumatic Brain Injury
Future Directions

• Refine software to add business features
• Make backend database
• Scalability of many kinds
• Validation across usage domains
• Build community
• Launch startup company
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Thanks for getting us to this stage

• LifeLines, LifeLines2 (David Wang)
• LifeFlow (Krist Wangsuphasawat)
• EventFlow team
  • Megan Monroe, Sana Malik, Fan Du, Chris Imbriano

• Sponsors: NIH, Oracle, CHIB
31st Annual Symposium
May 29, 2014

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