Workshop:
Interactive Visual Exploration of Electronic Health Records

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Introduction:
Interactive Visual Exploration of Electronic Health Records

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Temporal Data is Pervasive!

- Health records
- Stock market trades
- Web log analysis
- Crime/terror activities
- Maintenance records

Business takes action

- General Dynamics **buys** MayaViz
- Agilent **buys** GeneSpring
- Google **buys** Gapminder
- Oracle **buys** (Hyperion **buys** Xcelsius)
- Microsoft **buys** Proclarity
- InfoBuilders **buys** Advizor Solutions
- SAP **buys** (Business Objects **buys** Infomersion & Inxight & Crystal Reports)
- IBM **buys** (Cognos **buys** Celequest)
- TIBCO **buys** Spotfire
Temporal Data: TimeSearcher 1.3

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

www.cs.umd.edu/hcil/timesearcher

Temporal Data: TimeSearcher 2.0 & 3.0

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

www.cs.umd.edu/hcil/timesearcher
Temporal data: Word frequencies
Finding Patterns in Temporal Events

- Types of Time Data
  - Numerical Values (e.g., TimeSearcher)
  - Categorical Events & Intervals (e.g., LifeLines)
  - Categorical Events

- Goal: Find Temporal Patterns across Millions of Records
  - SQL makes it difficult to specify
Comparison with SQL

```
SELECT P.*
FROM Person P, Event E1, Event E2, Event E3, Event E4
WHERE P.PID = E1.PID
AND P.PID = E2.PID
AND P.PID = E3.PID
AND P.PID = E4.PID
AND E1.type = "Medication"
AND E1.class = "Anti Depressant"
AND E1.name = "Remeron"
AND E2.type = "Medication"
AND E2.class = "Anti Depressant"
AND E2.name = "Remeron"
AND E3.type = "Medication"
AND E3.class = "Anti Depressant"
AND E3.name = "Remeron"
AND E2.value > E1.value
AND E3.value >= E2.value
AND E2.date > E1.date
AND E3.date >= E2.date
AND E4.type = "Visit"
AND E4.class = "Hospital"
AND E4.name = "Emergency"
AND E4.value = "Heart Attack"
AND E4.date >= E3.date
AND 180 <= (E4.date – E3.date)
```

Patients with increasing dosages of Remeron followed by a heart attack within 180 days

PatternFinder Interface

```
Patients with increasing dosages of Remeron followed by a heart attack within 180 days
```
Result set visualization: ball & chain

Five matches!

Patients with increasing dosages of Remeron followed by a heart attack within 180 days

www.cs.umd.edu/hcil/patternfinder

Current work

Washington Hospital Center & Partners HealthCare
- Developing taxonomy of simple queries based on interviews with physicians
- Designed interface to fit in Azyxxi-Amalga

- Lab value [HGB] increases by 50% in 10 days
- Lab value [Platelets] is high in a patient on heparin, then decreases > 20%
- Patient seen at ER & discharged, then returns to ER within 14 days & condition = [dead]
LifeLines2: Align-Rank-Filter

Take Away Messages

Queries for temporal events are possible!
  • Visual specification
  • Rapid execution
  • Visualization of results: ball & chain view

  • Goal:
    Facilitate medical treatment & research

Thanks to:
Washington Hospital Center & Partners HealthCare

www.cs.umd.edu/hcil/patternfinderinAzyxxi
www.cs.umd.edu/hcil/lifelines2