Time Searcher
Interactive Pattern Search in Time Series

Presented by
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Time Series

- electrocardiograms
- seismographs
Use “TimeBox” to filter

Can you see anything?

Better?
Time Searcher I

Demo!
Finding pattern?

Algorithm or Visualization
Do you know what you are looking for?

Yes
Algorithm may help.

NO
Need to Discover Algorithm??

Visualize!
Visualizing Time Series

- Find meaningful patterns
- Identify trends
- Spot Anomalies
Why TimeSearcher?

- Interactive
- Time Searcher I
  - Timebox: filter data and run queries
- Time Searcher II – more features
  - Timebox: Limits scope
  - **Searchbox: Search for pattern**
    - select pattern from the data itself
    - multiple pattern specifications
    - on multiple variables
3 Steps Framework

1. Reduce Scope
3 Steps Framework (2)

1. Reduce Scope
2. Find Pattern
3 Steps Framework (3)

1. Reduce Scope
2. Find Pattern
3. Refine Query
Pattern Discovery
How does it search?

- (Modified) Euclidean distance

\[ d(x, y_i) = \sqrt{\sum_{j=1}^{k} (x_j - y_{ij})^2} \]

- Envelope
Also ...

- **offset translation**
  Subtract by mean

- **magnitude scaling**
  Divide by variance
Also ... (2)

- **linear trend removal**
  Absolute value of the slope taken

- **noise reduction**
  Value averaged
Multiple Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
</tr>
</thead>
</table>

Overview

Details

Items List & Attribute Statistics
Time Searcher 2

Demo!
Limitations

- No multiple, simultaneous pattern searching
- No user-defined simple patterns
- Limited to small datasets
- Slow response time and frequent crashes
Future works

- larger dataset
- improving interaction
  - pure sketching to specify pattern
  - tolerance slider with + - instead of number
  - encourage users to reduce the scope first
- dealing with missing data
  - let users choose how to treat them
Thank you