COMPARING AVERAGES IN TIME SERIES DATA

MICHAEL CORRELL, DANIELLE ALBERS, STEVE FRANCONERI, MICHAEL GLEICHER
INTRODUCTION
OUTLINE

Motivation
Visual Design
Experiment
Discussion
MOTIVATION
INFOVIS MANTRA

1. Overview
2. Zoom & Filter
3. Details on Demand
MOTIVATION

Daily Temperature

°C  Trend
MOTIVATION

Daily Temperature

- °C
- μ
- μ+σ
- μ-σ
- Trend
- min
- max

Graph showing daily temperature fluctuations with mean (μ), standard deviation (±σ), and trend line.
RESEARCH QUESTIONS

Can users extract aggregate statistics from time series data?

Can different encodings improve performance at this task?
SHAPE AVERAGING
SHAPE AVERAGING

Daily Temperature

°C
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
SHAPE PERMUTATION?
SHAPE PERMUTATION?
OUTLINE

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DESIGN
WEAVING
WEAVING
WEAVING
WEAVING
WEAVING
OUTLINE

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Experiment
Discussion
Which month had the highest average sales?
CONDITIONS

• **Linegraphs:**
  • Regular or 1D permuted

• **Colorfields:**
  • Regular or woven
1. Colorfields outperform linegraphs.

2. Woven colorfields outperform standard colorfields.

3. Permutation doesn’t help in the linegraph case.
CONDITIONS

Noise of signal

Gap between winner and distractor

Number of distractor months
CONDITIONS

\[ d = 10 \]

\[ d = 2 \]
CONDITIONS

d = 10

d = 2
PARTICIPANTS

• Recruited using Amazon’s Mechanical Turk

• Ishihara plates used to exclude color blind users

• Task time used to detect “click through” behavior
PARTICIPANTS

• 30 questions each

• 74 participants:
  • North Americans
  • 42 female
  • 32 male
  • Ages 18-62
HYPOTHESES

1. Colorfields outperform linegraphs.

2. Woven colorfields outperform standard colorfields.

3. Permutation doesn’t help in the linegraph case.
COLORFIELD

Accuracy

<table>
<thead>
<tr>
<th>Woven</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.99</td>
<td>0.88</td>
</tr>
</tbody>
</table>
LINEGRAPH

Accuracy

Permutated

Standard
RESULTS

Accuracy vs. Difference Between Averages (d)

- Woven Colorfield
- Colorfield
- Linegraph
- Permutated Linegraph

Graph showing the accuracy of different visualizations as a function of the difference between averages.
\( D=1 \)
D=1
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FUTURE WORK

Exploring limits of aggregation ability

Exploring different kinds of aggregate statistics

Exploring tradeoffs in weaving

Deploying more systems
ACKNOWLEDGMENTS

Thanks for listening!
Contact me at mcorrell@cs.wisc.edu

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COLOR WEAVING

Hagh-Shenas et al., 2007
COLORFIELD

Difference between avgs.

Noise level

Accuracy

0 0.2 0.4 0.6 0.8 1

Woven

Ordered

Accuracy

0 0.2 0.4 0.6 0.8 1

Woven

Ordered
Difference between avgs.

Noise level

- Accuracy
- Permuted
- Ordered

- Accuracy
- Permuted
- Ordered
LINEGRAPH PERMUTATION
COLOR AGGREGATION
COLOR AGGREGATION
COLOR AGGREGATION
DESIGN

Year

Sales

Q1  Q2  Q3  Q4

Sales
DESIGN

Year at a glance
DESIGN

Year at a glance
DESIGN