Exploring Visual Comparison of Multivariate Runtime Statistics

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Motivation

Performance data is multivariate

VIS offers techniques for this

let’s apply them
Use Cases of Execution Comparison

Three scenarios:

1. Input changes
2. Code changes
3. Environment changes
Use Cases of Execution Comparison

Three scenarios:

1. **Input changes**
2. Code changes
3. Environment changes

Inputs can vary in shape, size, etc.
Use Cases of Execution Comparison

Three scenarios:

1. Input changes
2. Code changes
3. Environment changes
Use Cases of Execution Comparison

Three scenarios:

1. Input changes
2. Code changes
3. Environment changes

Software runs in different setups and under different conditions.
Visual Design Space

• Use established comparison techniques

• Apply multivariate data visualizations to performance metrics

Grid-based,
Glyph-based,
PCP
Visual Design Space

(I) Grid-based

<table>
<thead>
<tr>
<th>METHOD #1</th>
<th>METRIC A</th>
<th>METRIC B</th>
<th>METRIC C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
<td>34</td>
<td>17</td>
</tr>
</tbody>
</table>
Visual Design Space

(I) Grid-based comparison

METHOD #1

<table>
<thead>
<tr>
<th>METRIC A</th>
<th>METRIC B</th>
<th>METRIC C</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERSION I</td>
<td>VERSION II</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>50</td>
<td>0</td>
</tr>
</tbody>
</table>
Visual Design Space

(I) Grid-based comparison
Visual Design Space
(II) Glyph-based
Visual Design Space

(II) Glyph-based
Visual Design Space

(II) Glyph-based
Visual Design Space

(II) Glyph-based
Visual Design Space

(III) Parallel Coordinates Plot (PCP)
Visual Design Space

(III) Parallel Coordinates Plot
Visual Design Space

(III) Parallel Coordinates Plot

METRIC A

METRIC B

METRIC C

METRIC D

METRIC E
Visual Design Space

(III) Parallel Coordinates Plot
Application Examples

Apache Commons
COMMONS.APACHE.ORG

JProfiler
EJ-TECHNOLOGIES.COM

Jupyter Notebook
JUPYTER.ORG
Application Examples

Apache Commons -> JProfiler -> Jupyter Notebook

• Opensource Java library
• Already researched by Baltes et al.
• Contains known performance bugs

Application Examples

- Apache Commons ➔ JProfiler ➔ Jupyter Notebook

- State-of-the-art profiler for JVM
- Yields method-level granularity results
Application Examples

- Post-mortem static analysis
- Used to generate static images
Application Examples

• Systematic tests of scenario-visualization combinations

• Scenario-Visualization combinations with highest readability:
  • Input Changes + Radar Charts
  • Code Changes + PCP
  • Environment Changes + grid-based Bar Charts
Application Examples

(I) Input Changes Scenario
Application Examples

(II) Code Changes Scenario
Application Examples

(III) Environment Changes Scenario
Summary

• First steps in using basic visualizations for comparison of multivariate data in a software performance context.

• Three Scenario-Visualization combinations:

  1. Input changes + grid-based Radar Charts
  2. Code changes + PCP
  3. Environment changes + grid-based Bar Charts
Future Work

Visual Analytics System, that features

• multiple coordinated views with a strong interaction concept

• zooming/filtering + overview
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THANK YOU!