SBSelector: Search Based Component Selection for Budget Hardware

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Introduction

SBSelector: Component Selection

Research Questions

Experiments and Results

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Introduction

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Component based Software Engineering

Defining, implementing and composing loosely coupled independent components into systems
Select component: iteratively select desired component.
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**SBSelector: Component Selection**

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SBSelector: Component Selection

SBSelector: a search based component selector.

Formulate component selection as a search problem.

Construct dependencies between components.

- precedence
Objective one: number of components (plugins)

\[ \text{Maximize component}(\vec{x}) = \sum_{i=1}^{n} (x_i) \]

Objective two: worst-case memory consumption

\[ \text{Minimise memory}(\vec{x}) \]
Kate is a C/C++ based multi-platform text editor with component (plug-in) support.
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**RQ1.** Does the extra memory consumed by enabling all plugins of Kate simply equals to the summation of the extra memories consumed by enabling one of those plugins at a time?

\[
\Delta(\vec{x}_i) = \text{memory}(\vec{x}_i) - \text{memory}(\vec{x}_\emptyset)
\]

\[
\sum_i \Delta \vec{x}_i = \Delta \vec{x}_{all}
\]
Research Questions

**RQ2.** How effectively can SBSelector find optimised combination of enabled plugins compared to random search method and a greedy strategy selection?

Assuming human developers (or users) may include components randomly or greedily based on the memory consumed.
Research Questions

**RQ3.** Given some mandatory plugins, can SBSelector still find combinations of optional plugins that only trade a little amount of memory consumption?

Scenario S1: all Python plugins, `Search and Replace`, and `SQL Plugin` are essential for Python developers.

Scenario S2: all components are open to select.
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Answer to RQ1

RQ1.

\[ \sum_i \Delta \bar{x}_i \approx 45.78 \text{MB} \]

\[ \Delta \bar{x}_{all} \approx 22.18 \text{MB} \]

\[ \text{Max} \Delta(\bar{x}_i) \approx 14.26 \text{MB} \]

\[ \text{Min} \Delta(\bar{x}_i) \approx 0.00 \text{MB} \]
Answer to RQ2

RQ2.

The Median Attainment Surface

- NSGAII median
- Random median
- Greedy-algorithm

number of components

memory consumptions (MByte)

0 5 10 15 20 25 30 35

45 55 65
Answer to RQ3

RQ3.

The Comparison between S1 and S2

memory consumptions (MByte)

number of components

scenario S2
scenario S1
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We demonstrated that component selection problem can be treated as an instance of SBSE, and addressed it using search based techniques.

The results illustrate the trade-off between two types of user experiences.

The results also highlight some solutions that, when embedding the same number of components, our approach can reduce considerable memory consumption.

In one specific use case, SBSSelector can find a solution that provides 16 more components while only increase negligible memory consumption.
\[ \sum \Delta \vec{x}_i \approx 45.78 \text{MB} \]
\[ \Delta \vec{x}_{all} \approx 22.18 \text{MB} \]
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