BALANCING VALUE AND MODIFIABILITY WHEN PLANNING FOR THE NEXT RELEASE

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Research Problem

- The research is conducted in the context of the next release problem.
- Purpose: Reduce future modification effort.
- Two planning criteria:
  - Release Planning: inclusion of the best set of features (value, effort, and risk).
  - Release modifiability: Inclusion of attractive features in terms of their impact on systems’ modifiability.
- Problem: Perform a trade-off analysis between:
  - the added value provided by new features
  - their predicted impact on system’s modifiability”
NRP-Trade-off Method

Addressing Modifiability Concern

Baseline Release Planning

Object Oriented Feature Modeling (OOFeM)

Re-adjusting Baseline Plan

Trade-off Between Modifiability and Value
OBJECT ORIENTED FEATURE MODELING (OOFeM)

- Purpose: capturing the intra- and inter-structural properties of features.
- Feature is cohesive set of related requirements.
- OO principles are applied to the feature domain.
- Utilize capabilities of class diagram to predict modifiability.
# Object Oriented Feature Modeling (OOFeM)

<table>
<thead>
<tr>
<th>Feature dependency</th>
<th>UML Artifact</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;requires&gt;</td>
<td>Association (arrow)</td>
</tr>
<tr>
<td>&lt;couples&gt;</td>
<td>Association with cardinalities</td>
</tr>
<tr>
<td>&lt;precedes&gt;</td>
<td>Inheritance</td>
</tr>
</tbody>
</table>

## Feature Dependency Diagram

![Diagram showing feature dependency and UML artifacts](image-url)
CASE STUDY: PLANNING FOR RELEASEPLANNER™ TOOL

- A set of 25 existing features
- A set of 15 new features
- Planning for the next release
Adding Modifiability Concerns to the Baseline Release Plan

- Features intra- and inter- structural properties (OOFeM).
- Analyzing features dependencies using OO Mod. Metrics: Complexity, Coupling, Inheritance, Cohesion
- Feature: a point in four dimensional space.
- Modifiability indicator is calculated for each feature.
- Desired feature: low coupling, inheritance, complexity and high cohesion
**FEATURES REPLACEMENT**

- The baseline plan is re-adjusted by replacing low value features with the more modifiable ones.
- Resource constraint should not be violated.
**Value-Modifiability Trade-off**

- Compromises between relative lose in value and relative increase in modifiability.
- The trade-off is used to determine the best number of replacement.

<table>
<thead>
<tr>
<th>Number of features eliminated from baseline</th>
<th>Set of features to be replaced</th>
<th>Set of replacing features</th>
<th>Added normalized modifiability</th>
<th>Decrease in Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>{35}</td>
<td>{36}</td>
<td>0.43</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>{35, 33}</td>
<td>{36, 38}</td>
<td>0.43+ 0.43</td>
<td>1+2</td>
</tr>
<tr>
<td>3</td>
<td>{35, 33, 29}</td>
<td>{36, 38, 37}</td>
<td>0.43+0.43+0.09</td>
<td>1+2+1</td>
</tr>
<tr>
<td>4</td>
<td>{35, 33, 29, 31}</td>
<td>{36, 38, 37, 39}</td>
<td>0.43+0.43+0.09+0.19</td>
<td>1+2+1+6</td>
</tr>
<tr>
<td>5</td>
<td>{35, 33, 29, 31, 28}</td>
<td>{36, 38, 37, 39, 40}</td>
<td>0.43+0.43+0.09+0.19+0.03</td>
<td>1+2+1+6+5</td>
</tr>
</tbody>
</table>

The graph shows the normalized change of modifiability and total value against the number of replaced features.
SUMMARY AND FUTURE WORK

○ NRP-Trade-off aims at reducing future modifications effort.
○ NRP-Trade-off designs modifiable releases.
○ NRP-Trade-off adapt object orientation concepts to the feature domain to achieve this goal.

○ Future Work:
  • More comprehensive validation.
  • Other factors affecting modifiability prediction.
  • Modifiability impact to non-functional requirements.
  • Scalability of whole approach.
REFERENCES


**Backup Slide: Feature Oriented Modifiability Metrics (FOMM)**

- **Feature Complexity Metric (FComp):**
  \[ FComp(n) = \sum_{i=1}^{TR(n)} effort(r(n,i)) \]

- **Feature Inheritance Metric (FInh):**
  \[ FInh(n) = \sum_{i=1..M, i \neq n} isDescendant(f(i),f(n)) \]

- **Feature Coupling Metric (FCoup):**
  \[ FCoup(n) = \sum_{i=1..M} isCoupled(f(i),f(n)) \]

  \[ isCoupled(f(i), f(n)) = \begin{cases} 
  1 & \text{if } f(i) \text{ req/coup } f(n) \\
  1 & \text{if } f(n) \text{ req/coup } f(i) \\
  0 & \text{otherwise} 
\end{cases} \]

- **Feature Cohesion Metric (FCoh):**
  \[ FCoh(n) = \frac{\sum_{i=1}^{TO(n)} \sum_{j=1}^{TR(n)} isAddr(o(n,i), r(n,j))}{TO(n) \times TR(n)} \]