Supporting Feature-Level Software Maintenance

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Feature Location Techniques

Static
- ASDGs

Textual
- SNIAFL
- DORA
- LSI
- SITIR
- PROMESIR

Dynamic
- FCA
- Software Reconn
Research Goals

• Feature Location
  – What sources of information should be used to most effectively perform feature location?
  – What is the best way to combine those sources of information?

• Feature-Level Impact Analysis
  – Develop and evaluate feature coupling metrics
## Coupling Metrics

<table>
<thead>
<tr>
<th>Coupling Dimension</th>
<th>Structural</th>
<th>Dynamic</th>
<th>Textual</th>
<th>Hybrid</th>
<th>Historical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>![Checkmark]</td>
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</table>
Metrics

• **Structural Feature Coupling (SFC)**
  – Measure of code shared by two features
  – Variant that considers 1\textsuperscript{st} order dependencies

• **Textual Feature Coupling (TFC)**
  – Average similarity of the text of two features source code using LSI
  – Variant that considers max similarity

• **Hybrid Feature Coupling (HFC)**
  – Combines $SFC$ and $TFC$ using affine transformation
Evaluation

**Question**: Are feature coupling metrics good predictors of fault-proneness?
**Method**: Spearman Correlation

**Question**: Can feature coupling metrics be used for impact analysis?
**Method**: Precision and recall

**Question**: Do feature coupling metrics align with developers’ opinions?
**Method**: Survey

**Conclusion**
Using coupling for impact analysis

F1 is coupled to F2 and F4.
Coupling Threshold 0.5

F1 and F2 have Bug B in common.
Evaluation - Impact Analysis

![Graph showing precision and recall for different coupling metric thresholds.]
Contributions

• Aide programmers doing feature-level software maintenance
  – Identify the most efficient approach for locating a feature’s relevant code
  – Determine other coupled features
  – Reduce time and effort spent on maintenance
  – Facilitate development of higher quality software