Measuring cohesion and coupling:

A comparison of different metrics and their usefulness in quality analyses

Bachelor's Thesis

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Keywords

`Machine Learning, Data Mining, Software Quality`

Context

Software vendors aim to develop software systems that fulfill all functional requirements, are cheap to build in the first place while also being easy to maintain in the future. Over the past decades, several programming and design paradigms have emerged to ensure *good design* and *easy maintenance*. Most popular among these are e.g. the concepts of low coupling and high cohesion. A multitude of metrics like LCOM, LCOM2, or LCOM5 were developed to measure high and low cohesion [1,2,3], though there is no consensus which metric captures the notion of cohesion best [4]. Hence, the usefulness of these metrics in the context of quality analysis is unclear [5]. Similarly, many coupling metrics are available.

Goal

The objective of this thesis is to analyze existing coupling and cohesion metrics. The ultimate goal is to examine the correlation of these metrics with the actual maintainability of a program. Therefore, the student researches existing metrics and implements an automated tool to extract these metrics. Based on those metrics, the student applies several Data Mining techniques and analyses the correlations between them. In addition, the student investigates the predictive power of the features for maintainability prediction. This analysis provides valuable insights which metrics should be used in automated maintainability analyses and which are not recommendable.

Working Plan

1. Familiarize yourself with the concepts of cohesion, coupling, related metrics and the impact on maintainability
2. Define a sample dataset and extract cohesion metrics
3. Investigate the correlation between those metrics
4. Investigate the relationship of the metrics and perceived maintainability
5. Draw conclusions which metrics are important for software quality analyses.

Deliverables

- An automated tool to extract cohesion and coupling metrics from Java source code.
- Technical report with comprehensive documentation of the implementation, i.e. design decision, architecture description, API description and usage instructions.
- Final thesis report in English written in conformance with TUM guidelines.

References

[1] S. R. Chidamber and C. F. Kemerer, Towards a metrics suite for object oriented design. 1991
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[5] Briand et al. A unified framework for coupling measurement in object-oriented systems. 1999
[6] Briand et al., Exploring the relationships between design measures and software quality in object-oriented systems. 2000

Application:
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