Department of Computer Science
Federal University of Bahia

Developers' perception about Code Anomalies indentified by threshold values suggested by different strategies

Luan Passos, Rebeca Sousa, Thamiris Gomes
Eduardo Almeida

Introduction

- Code Anomaly x Metric-based Techniques;
- Metrics are used to measure the quality of a system;
- Threshold Values infer in the measurement process;
  - Problems in identifying these threashold values;

Objectives

- Evaluate the ContextSmell tool;
- Compare the accuracy of the strategies used;
- Understand the strategies behind solving design problems;
- Improve the ContextSmell tool;

Case Selection

- Fraunhofer;
- 6 professionals;
- Systems developed in JAVA;
- 2 participants in the project;
- WEB System;

Research Questions

RQ1 - Are there differences in the accuracy of the techniques in deriving threshold values for metrics at the method level?

- RQ2 - What design decisions influenced the developers to indicate methods as false positives?

Data Collecting

- Execution of design problem recommendation tool;
  - 286 classes e 54.737 lines of code;
  - 353 methods indicated and analyzed by ContextSmell
- Questionnaire based on the results of the tool
  - Quantitative data
  - Qualitative data

Preparations and Execution

- Create a development enviroment to realize the study;
- Set fixed threshold values, based in what was proposed in (ALVES; 2010);
- Define e configurate systems that will be used as the design reference;
- Define participants and what systems will be analyzed by each one of them;
- Execute the .jar file "ContextSmellView.jar", of the ContextSmell tool in the available enviroment.

Threshold Values Deriving Strategies

- A – Fixed values based in the table found in (ALVES, 2010);
- X – Threshold values extracted from systems considering their architectural roles (ANICHE, 2016);
- R – Fixed threshold values extracted from systems that follow the same design rules;
- D - Threshold values extracted from systems that follow the same design rules and considering their design roles;

Data Analysis

- Tabela 1 – Long Method (LOC)

	A	R	D	X
True Positives	35	43	29	67
False Negatives	64	56	70	32
False Positives	6	8	2	9
True Negatives	4	2	8	1
Recall	0,35	0,43	0,29	0,68
Precision	0,85	0,84	0,94	0,88
Accuracy	0,36	0,41	0,34	0,62
F-measure	1,06	1,30	0,87	2,03

Data Analysis

- Tabela 2 – Cyclomatic Complexity (CC)

	A	R	D	X
True Positives	50	29	22	16
False Negatives	7	28	36	41
False Positives	41	50	2	12
True Negatives	9	0	47	38
Recall	0,87	0,50	0,37	0,28
Precision	0,54	0,36	0,91	0,57
Accuracy	0,55	0,27	0,64	0,50
F-measure	2,61	1,5	1,11	0,84

Data Analysis

- Tabela 3 – High Coupling (Efferent)

	A	R	D	X
True Positives	23	19	42	43
False Negatives	42	46	23	22
False Positives	0	1	2	4
True Negatives	6	5	4	2
Recall	0,35	0,29	0,65	0,66
Precision	1,00	0,95	0,95	0,91
Accuracy	0,41	0,34	0,65	0,63
F-measure	1,05	0,87	1,93	1,98

Data Analysis

- Tabela 4 – Number of Parameters (NOP)

	A	R	D	X
True Positives	36	31	36	15
False Negatives	18	23	18	39
False Positives	3	5	0	1
True Negatives	6	4	9	8
Recall	0,67	0,57	0,67	0,28
Precision	0,92	0,86	1,00	0,94
Accuracy	0,67	0,56	0,71	0,37
F-measure	2	1,72	2	0,83

Results

- RQ1 - Are there differences in the accuracy of the techniques in deriving threshold values for metrics at the method level?
- Yes, there is a difference in the threshold deriving accuracy between the strategies.

Acurácia	A	R	D	X
LOC	0,36	0,41	0,34	0,62
CC	0,55	0,27	0,64	0,50
Efferent	0,41	0,34	0,65	0,63
NOP	0,67	0,56	0,71	0,37

Results

- Consider the design roles for threshold derivation
  - LOC: técnica X had the highest accuracy with 0,62
  - CC: técnica D had the highest accuracy with 0,64
  - AE: técnica D had the highest acuracy with 0,65
  - NOP: técnica D had the highest accuracy with 0,71

Results

- RQ2 - What design decisions influenced the developers to indicate methods as false positives?
  - Disregard Long Method for File Manipulations methods;
    "updateFiles"

Threats to Validity

- Developer's personal experience;
- Developer's experience in the project;
- Undefined Architectural Roles;

Ethical Questions

- Info not consented to sharing by company;
  - Project Name;
  - Source Code;
  - Project Documentation;
  - Intellectual and/or Industrial Properties related to confidential information;

References

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