A Metric Comparison between Aspect and Object Paradigms

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Summary

- Motivation
- Code Smells
- Target System
- Metrics
- Results
- Conclusions

Motivation

Verify the behaviour of some metrics in the detection of Code Smell God Class, in different programming paradigms.

Motivation - Hypotheses

#1:Same metrics will produce different results in programs with different paradigms.

#2: Same metrics will have similar results although with different thresholds.

#3: Same metrics will produce equal result regardless of the paradigms.

Target System

iBatis is a persistence framework for object-relational mapping between SQL databases and objects in Java;

Implemented in Java and AspectJ

Target System - Simplification

To minimize the analysis we select 20% of the classes for the system randomly

- AspectJ
  - 250 classes
  - 50 selected
- Java
  - 225 classes
  - 45 selected

Code Smells

God Class:

This code smell describes an object that knows too much or does too much.

Riel, A. J.(1996)

Metrics - CK Metrics

- Weighted Methods per Class (WMC)
- Coupling Between Object classes (CBO)
- Depth of the Inheritance Tree (DIT)
- Number of children (NOC)
- Response for a Class (RFC)
- Lack of Cohesion of Methods (LCOM)

Metrics - Other Metrics

- Lines of Class Code (LOC)
- Coupling on Method Call (CMC)
- Coupling on Field Access (CFA)

Results - Background

Pair	Experience			Time (min)
	Work	Technology	Metric	
S1 and S2 = AOP1	Yes	Yes	Yes	4
S3 and S4 = AOP2	Yes	No	Yes	4
S5 and S6 = AOP3	Yes	Yes	Yes	5
S7 and S8 = AOP4	Yes	Yes	Yes	5
S9 and S10 = OOP1	Yes	Yes	Yes	5
S11 and S12 = OOP2	No	Yes	Yes	9
S13 and S14 = OOP3	Yes	Yes	Yes	4
S15 and S16 = OOP4	Yes	Yes	Yes	4
S17, S18 and S19 = OOP5	No	Yes	Yes	6

Results - Thresholds

	AOP(%)	OOP(%)	Δ(%)	Total Average (%)
LOC	100	100	0.00	100
WOM	75	100	33.33	89
CMC	25	0	-100.00	11
CBM	75	40	-46.67	56
RFM	25	40	60.00	33
LCO	100	60	-40.00	78

Results - Thresholds

	AOP	OOP	Δ(%)
LOC	90.25	128.95	42.88
WOM	13.00	10.66	-17.98
CMC	4.00	0.00	-100.00
CBM	4.67	3.51	-24.79
RFM	15.00	15.00	0.00
LCO	52.50	43.07	-17.96%

Results - Reference List

- Problem:
  - No other study specificities God Class for iBatis;
- Solution:
  - A class has the code smell God Class if more than 50% of the pairs identified them as a God Class

Results - Recall and Precision

Recall:

$$\text{Recall}(R) = \frac{\text{True Positives}}{\text{Reference List}}$$

Precision:

$$\text{Precision}(P) = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Positives})}$$

Results - Recall and Precision

	Group one				Group two				
Pair	**AOP1**	**AOP2**	**AOP3**	**AOP4**	**OOP1**	**OOP2**	**OOP3**	**OOP4**	**OOP5**
R(%)	100	100	66.67	100	100	71.43	85.71	85.71	42.86
P(%)	60	60	100	100	87.5	83.33	100	100	100
Time(min)	34	27	30	20	45	41	45	31	25

	AOP	OOP	Δ(%)
Recall	91.67%	77.14%	-15.84
Precision	80.00%	94.17%	17.71
Time(min)	27.75	37.4	34.77

Conclusion

- AOP has a higher average Recall
  - Smaller number of pairs means probable higher correspondence with selected Reference List
- OOP has a higher average Precision
- Few could be said about the thresholds values obtained.
  - Their sparse behavior didn’t lead to any significant conclusion.

Conclusion - Future Work

- Test in different Code Smells
- Test in a larger group

Thank you!

Any question????