Code Ownership in Open-Source Software

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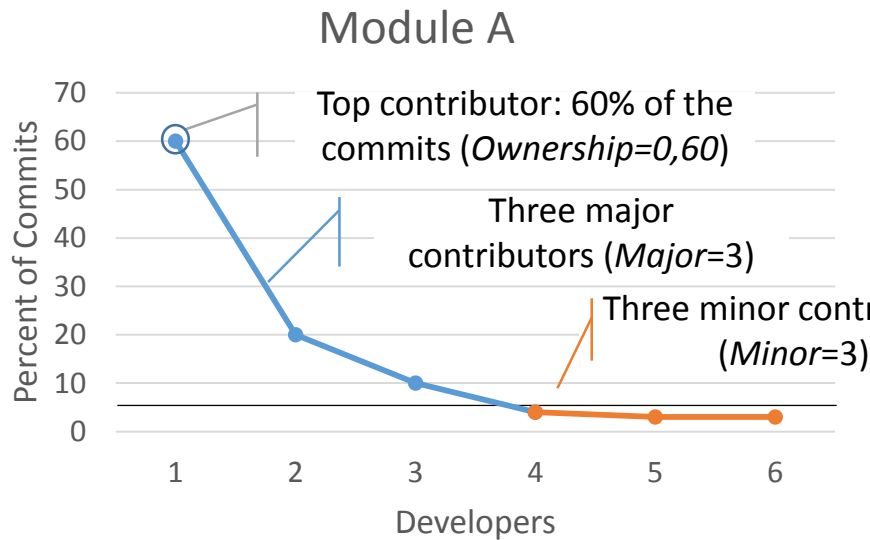
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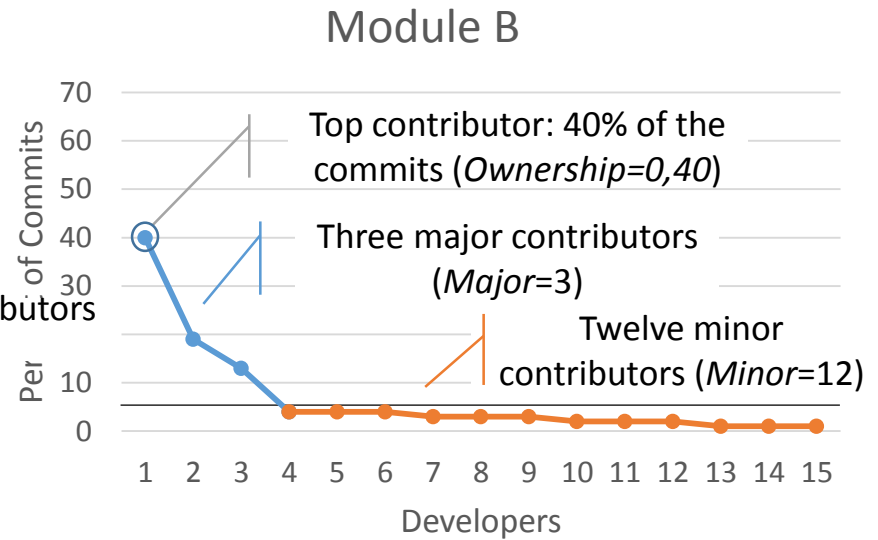
EASE'14 - London

Code Ownership

C. Bird, N. Nagappan, B. Murphy, H. Gall, and P. Devanbu, "Don't touch my code!: examining the effects of ownership on software quality," FSE'11

Module A

Top contributor: 60% of the commits (*Ownership=0,60*)

Three major contributors (*Major*=3)

Three minor contributors (*Minor*=3)

Major Contributors   Minor Contributors

Module B

Top contributor: 40% of the commits (*Ownership=0,40*)

Three major contributors (*Major*=3)

Twelve minor contributors (*Minor*=12)

Major Contributors   Minor Contributors

Few minor contributors 👍

Many minor contributors 👎

Minor contributors:
- do not have a global knowledge of the module
- tend to make more mistakes than others

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Original Study

- Relationship between ownership metrics and bugs
- Comparison to other metrics (Total number of developers, code metrics)
- Windows Vista & Windows 7 development history

Results:

- Measures of ownership have a relationship w/ bugs
- *Minor* correlates better w/ bugs than other metrics

Replication

- Relationship between ownership metrics and bugs
- Comparison to other metrics (Total number of developers, code metrics)

Windows	Module = *.dll*	Time period = 1 release
Open-source	Module = ?	Time period = ?
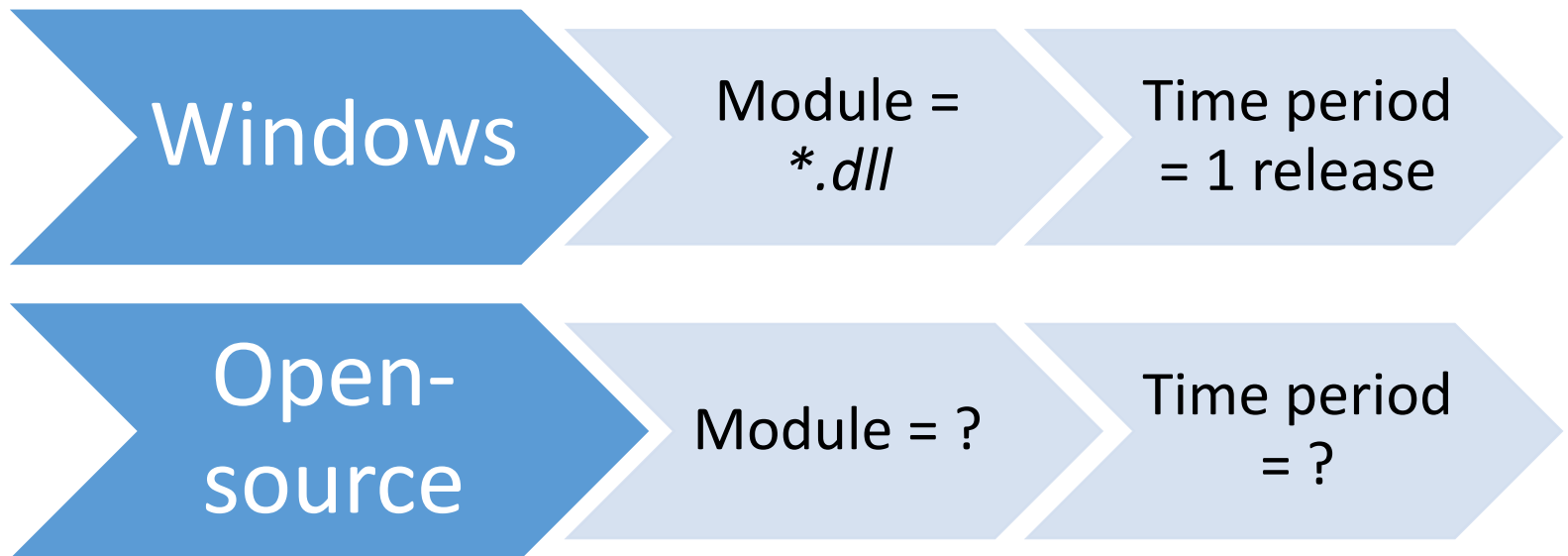
Dataset

- Existing datasets
  - PROMISE[3]
  - D'ambros et al.[4]
- Seven projects written in Java
- Module granularity: Package & File
- Time period: Last Release & Whole History
- The number of post-release bugs per file is included in these datasets.

[3] M. Jureczko and L. Madeyski. "Towards identifying software project clusters with regard to defect prediction." PROMISE '10

[4] M. D'Ambros et al. "Evaluating defect prediction approaches: a benchmark and an extensive comparison." Empirical Software Engineering, 2012

Total vs. Ownership, Major, Minor

Spearman correlation coefficients between metrics and bugs

	Ownership	Major	Minor	Total
equinox OSGi	0,60	0,64	0,00	0,64
eclipse JDT	0,11	0,54	0,63	0,73
eclipse PDE	0,42	0,49	0,00	0,49
Apache Ant	-0,52	0,54	0,64	0,67
Apache Camel	0,16	0,34	0,10	0,33
LOG4J	0,22	0,20	0,53	0,42
Lucene	0	0,34	0,39	0,41

Module = Package
Period = Release

Total number of developers have stronger correlation than *Ownership*, *Major* and *Minor*

Ownership vs. Code Metrics

Spearman correlation coefficients between metrics and bugs

	Ownership	Major	Minor	Total	Complexity	Size
equinox OSGi	0,60	0,64	0,00	0,64	0,72	<u>0,73</u>
eclipse JDT	*0,11*	0,54	0,63	0,73	<u>0,85</u>	0,84
eclipse PDE	0,42	0,49	0,00	0,49	0,58	<u>0,61</u>
APACHE ANT	-0,52	0,54	0,64	<u>0,67</u>	0,63	0,56
Apache Camel	*0,16*	0,34	*0,10*	0,33	0,36	<u>0,4</u>
LOG4J	*0,22*	*0,20*	0,53	0,42	0,85	<u>0,9</u>
Lucene	*0*	0,34	0,39	0,41	0,47	<u>0,49</u>

- Code metrics have stronger correlations
- Minor never has the highest correlation

Other Settings

- File & Last Release
- File & Whole History
- Package & Whole History
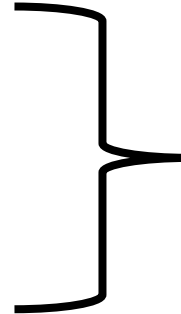
Lower Correlations

Industrial & Open-Source developers

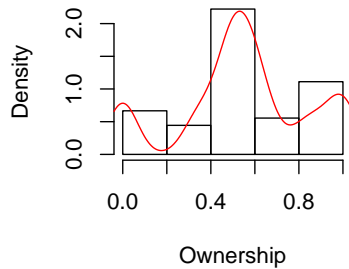| Industrial project |
|---|
| • Developers working at 100% on a project for several months |

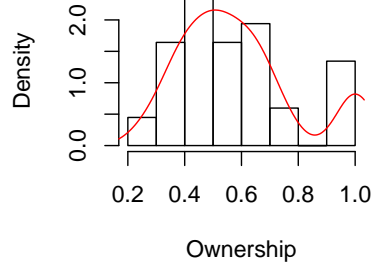| Open-source project |
|---|
| • "Heroes" performing most of the contributions
• Occasional contributors |

- What are the patterns of code ownership in open-source software project?
- Do they have an impact on the correlation?
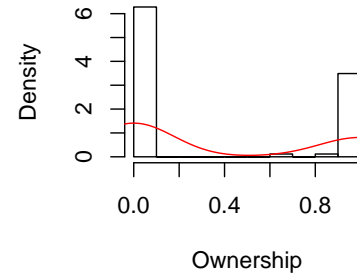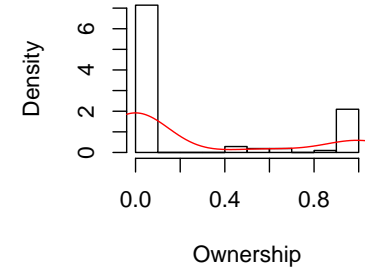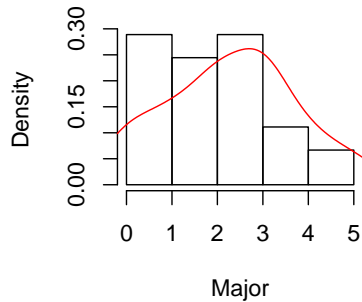
Metrics Distribution
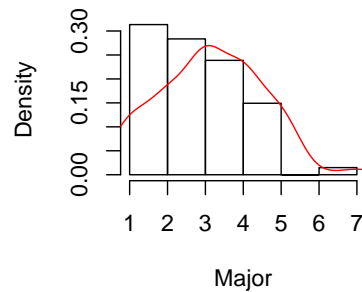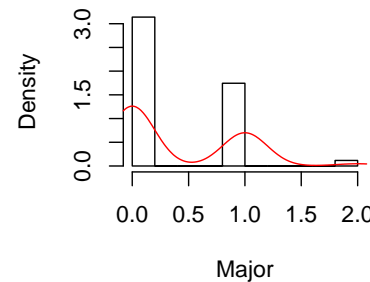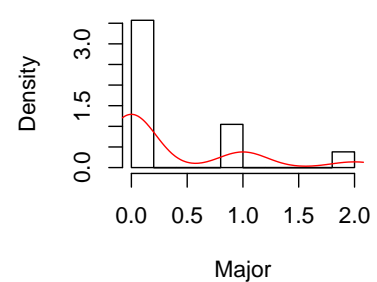

Minor and *Major* are correlated with bugs.

No minor developers, but *Ownership* and *Major* are correlated with bugs.

Some trails, but no significant result

Conclusions and Future Work

Conclusions

- Ownership metrics are not always good indicators of quality
- Complexity and size metrics are better indicators of quality than ownership metrics

Future work

- Larger study: more projects, several programming languages
- Filter projects where ownership metrics are not useful
- All developers do not have the same knowledge of the overall project: there may be differences between minor contributors
- Ownership metrics may have to be tuned for open-source projects