JFEATURE
Know Your Corpus !

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SCAM

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Tool evaluation: why and how ?

- Why ?
    - *Measure* how well our tool perform
    - Convince the reader that our tool is *fast* and *precise*

- How ?

Software Corpus

What is a software corpus ?

- Collection of software projects
  - Fixed version

  - Targeting a specific programming language, e.g., Java, C++

  - Source-code or bytecode

  - Constructed for a particular purpose:
    - Testing specific properties, e.g., *heavy use of concurrency*

    - Complex control-flow

Problem:
Which corpus should we use for the evaluation of our tool?

IT DEPENDS

- The kind of artefact
  - Static or Dynamic analyser
  - Compiler Front-end or Back-end
  - ML-based application

- What we want to evaluate ?
  - Performance
  - Precision
  - ...

- Language version:
  - Java 8 or 11 or 19 ?
  - C98 or C11
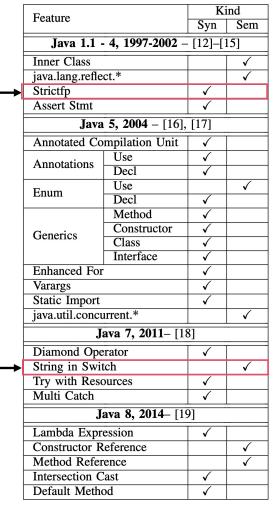
- This list can continue forever
  - ...

JFeature
Decision support for selecting benchmarks for specific research questions for Java

- *Extract how often a Java feature is used*

- *Analyse the source code*

- *Declarative specification*

- *Syntactic and semantic features (anything a compiler can typically compute)*

- *Extensible*

```
Modifiers contributes
  new Feature("JAVA2", "Strictfp", getCU().path())
  when isStrictfp() to Program.features();

Switch contributes
  new Feature("JAVA7", "StringInSwitch", getCU().path())
  when getExpr().type().isString() to Program.features();
```
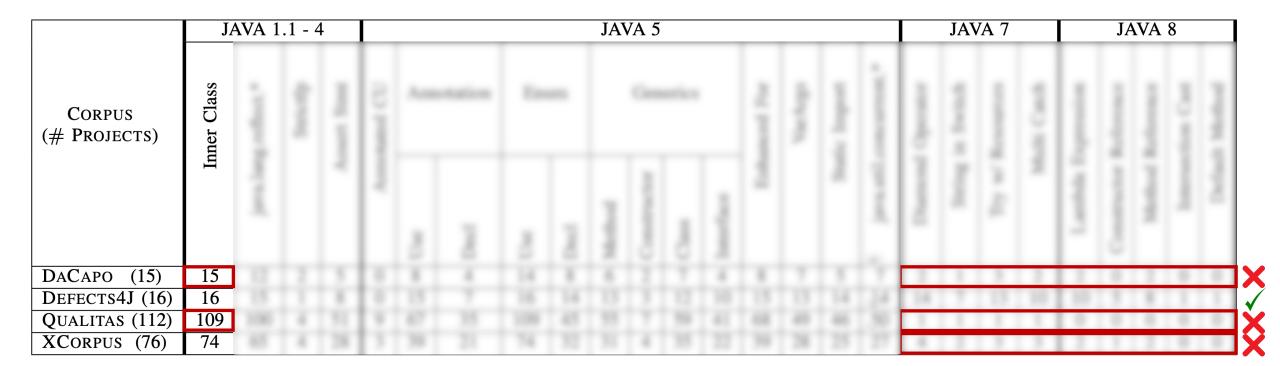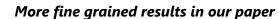
Feature	Kind	
	Syn	Sem
Java 1.1 - 4, 1997-2002 – [12]–[15]		
Inner Class		✓
java.lang.reflect.*		✓
Strictfp	✓	
Assert Stmt	✓	
Java 5, 2004 – [16], [17]		
Annotated Compilation Unit	✓	
Annotations — Use	✓	
Annotations — Decl	✓	
Enum — Use		✓
Enum — Decl	✓	
Generics — Method	✓	
Generics — Constructor	✓	
Generics — Class	✓	
Generics — Interface	✓	
Enhanced For	✓	
Varargs	✓	
Static Import	✓	
java.util.concurrent.*		✓
Java 7, 2011 – [18]		
Diamond Operator	✓	
String in Switch		✓
Try with Resources	✓	
Multi Catch	✓	
Java 8, 2014 – [19]		
Lambda Expression	✓	
Constructor Reference		✓
Method Reference		✓
Intersection Cast	✓	
Default Method	✓	

Empirical results
On four well-known Java corpora

- **DaCapo**
  - Performance
  - # Projects: **15**
- **Defects4J**
  - Static Analysis
  - # Projects: **16**
- **XCorpus**
  - Dynamic Language Feature
  - # Projects: **76**
- **Qualitas Corpus**
  - Static Analysis
  - # Projects: **112**

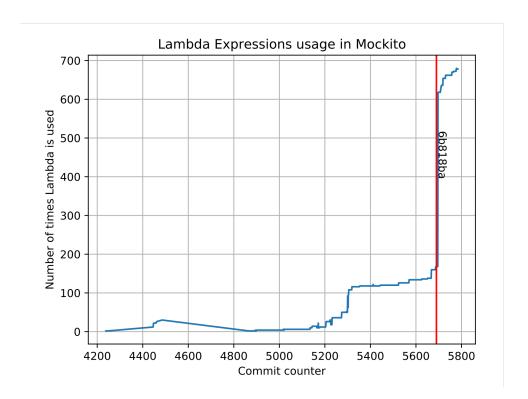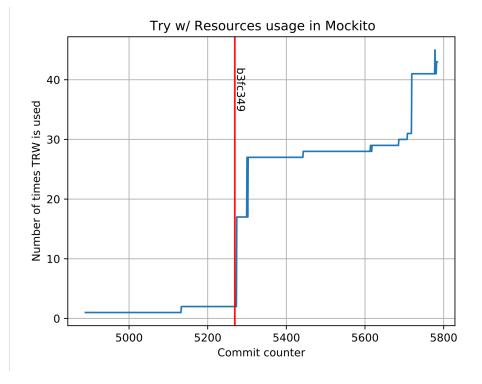| CORPUS (# PROJECTS)	JAVA 1.1 - 4 Inner Class	JAVA 5																JAVA 7				JAVA 8				
DACAPO (15)	15																									✗
DEFECTS4J (16)	16																									✓
QUALITAS (112)	109																									✗
XCORPUS (76)	74																									✗

More fine grained results in our paper

JFeature:
Other possible applications

▪ Longitudinal studies: using JFeature to create new corpus

Conclusions

- JFeature: a decision support tool for selecting corpora
- Empirical study on four well-known corpora

Take away

- Use Defects4j to evaluate your Java 7 or Java 8 application.
- Check if the corpus fits with your research questions

Thank you!

If not, build your own corpus.

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Provocative Questions/Statements

YOU ARE NOT SELECTING CORPORA SYSTEMATICALLY!!!

- Which feature would you extract for your tool?

- Java is evolving to fast! This is not fun for us! How should we create new corpora to evaluate newer Java versions? Incrementally ?

Provocative Questions/Statements

- How do you choose a corpus? What is your *SYSTEMATIC* approach for selecting it ?

- Which feature would you extract for your tool?

- Java is evolving to fast! This is not fun for us! How should we create new corpora to evaluate newer Java versions? Incrementally ?