

CSE 503

Software Engineering

Winter 2021

Software Testing

January 27, 2021

Automated Test Generation

Challenges for Automated Testing



```
1 Packet filter(Server s) {  
2  
3   Packet p = s.readUDP();  
4  
5   p = ... // filter packet  
6  
7   return p;  
8 }
```

How to write tests for filter?

Challenges for Automated Testing



```
1 Random r = new Random();  
2  
3 int rnd(int a, int b) {  
4  
5     int n = r.nextInt(a, b);  
6  
7     return n;  
8 }
```

How to write tests for rnd?

Challenges for Automated Testing



```
1 public List sort(List l) {  
2     List s = shuf(l);  
3     ... // sort the list  
4     return s;  
5 }  
6  
7 private List shuf(List l) {  
8     List shuf = ...;  
9     ... // shuffle the list  
10    return shuf;  
11 }
```

How to thoroughly test shuf?

Effectiveness guarantees

The screenshot shows the AgitarOne website with a navigation bar and a main content area. The navigation bar includes links for home, solutions, customers, support, news & events, and company. The main content area features the AgitarOne logo and the tagline 'DEVELOP SOFTWARE WITH CONFIDENCE'. A prominent offer states 'NOW STARTING @ \$10/CLASS'. Below this, a 'LEARN MORE' section lists several features and updates, each with a checkmark icon. A 'Free 30 Day Trial' badge is visible in the bottom left corner. The main content area also includes a section titled 'AgitarOne JUnit Generator' with a list of benefits: 'Find regressions more easily', 'Reduce complexity', and 'Improve maintainability'. Below this, there are three stacked boxes representing features: 'Management Dashboard', 'Code Rules Enforcement', and 'Java Code Analysis Engine', and a final box for 'Continuous Integration and Test'.

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Automated JUnit Generation

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Why Unit Testing?

Resources

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Automated JUnit Generation - 80% Code Coverage, or Better

AgitarOne JUnit Generator provides the fastest and easiest way to create a thorough regression suite of JUnit tests, both for new code and for legacy applications. AgitarOne JUnit Generator creates tests that document the behavior of your code as it exists today. Powered by Agitar's innovative software agitation technology, the analysis that AgitarOne JUnit Generator performs on your code routinely achieves JUnit coverage of 80% or better. With a sufficient server configuration it can generate 250,000 lines or more of JUnit per hour.

AgitarOne JUnit Generator

- Find regressions more easily
- Reduce complexity
- Improve maintainability

Management Dashboard

Code Rules Enforcement Java Code Analysis Engine

Continuous Integration and Test

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- Agitar Provides Native Maven Integration with Latest Release
- Agitar Releases AgitarOne with Mac OS X Support
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- Agitar Announces Support for Android JUnit Testing
- Paper** - Observation Driven Testing: Yes, the code is doing what you want. By the way, what else is it doing? (PDF)
- Paper** - software agitation: Your Own Personal Code Reviewer (PDF)
- AgitarOne JUnit Generator Datasheet (PDF)

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Effectiveness guarantees

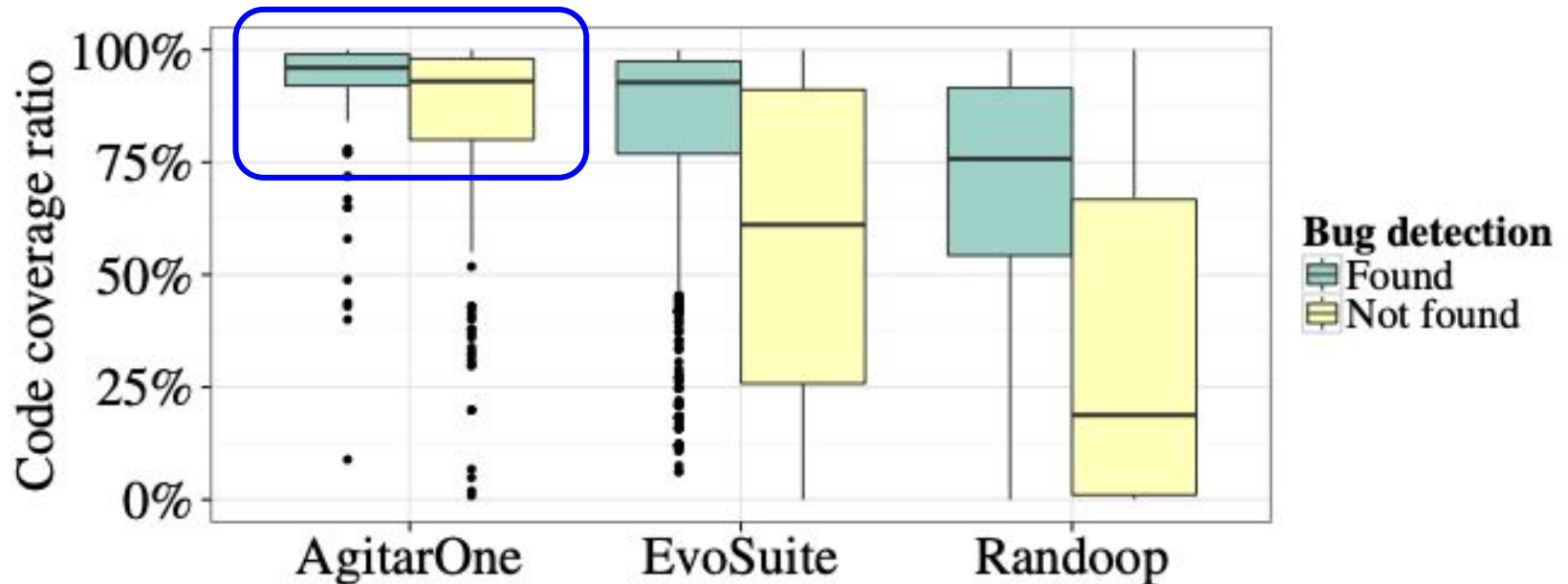


Fig. 3: Code coverage ratios for generated test suites that found a bug and generated test suites that did not. The differences are significant for all tools (Mann-Whitney U test, $p < 0.001$).

Challenges for Automated Test Generation

- Effectiveness (generated tests' ability to detect faults)
- Readability (generated tests' clarity)
- Maintainability (co-evolution of code and tests)

Other challenges

“If you ask Randoop to test code that modifies your file system (such as `File.delete()`), then Randoop will generate tests that modify your file system! Be careful when choosing classes and methods to test.”

Live demo



Instructions

1. `git clone https://github.com/rjust/defects4j defects4j`
2. `cd defects4j`
3. `./init.sh`
4. `./framework/bin/defects4j checkout -p Lang -v 12f -w ./Lang-12`
5. `./framework/bin/gen_tests.pl -g evosuite -pLang -v12f -n1 -o ./gen-tests -b30`
6. `./framework/bin/gen_tests.pl -g randoop -pLang -v12f -n1 -o ./gen-tests -b30`
7. `./framework/bin/defects4j coverage -w ./Lang-12`
`-s./gen-tests/Lang/evosuite/1/Lang-12f-evosuite.1.tar.bz2`
8. `./framework/bin/defects4j coverage -w ./Lang-12`
`-s./gen-tests/Lang/randoop/1/Lang-12f-randoop.1.tar.bz2`
9. (View:
 - a. `./Lang-12/src/main/java/org/apache/commons/lang3/RandomStringUtils.java`
 - b. `./gen-tests/Lang/randoop/1/Lang-12f-randoop.1.tar.bz2`
 - c. `./gen-tests/Lang/evosuite/1/Lang-12f-evosuite.1.tar.bz2`)