

EvoMaster: A Search-Based System Test Generation Tool

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Summary

Testing web/enterprise applications is complex and expensive when done manually. Therefore, in *Software Engineering* (SE) research, a lot of effort has been spent in trying to design and implement novel techniques aimed at automating several different tasks in SE. *Search-Based Software Testing* (SBST) casts the problem of software testing as an optimization problem, aimed at, for example, maximizing code coverage and fault detection.

EvoMaster (Arcuri, 2018a) is a SBST tool that automatically *generates* system-level test cases. Internally, it uses an *Evolutionary Algorithm* and *Dynamic Program Analysis* to be able to generate effective test cases. The approach is to *evolve* test cases from an initial population of random ones, using code coverage and fault detection as fitness function.

When addressing the testing of real-world web/enterprise applications, there are many challenges. To face and overcome those challenges, EvoMaster has been used to experiment with several novel techniques. This led to several publications: novel search algorithms such as *MIO* (Arcuri, 2017a)(Arcuri, 2018b), addressing the white-box testing of RESTful APIs (Arcuri, 2017b)(Arcuri, 2019), resource-dependency handling (Zhang, Marculescu, & Arcuri, 2019), accesses to SQL databases (Arcuri & Galeotti, 2019), and novel *testability transformations* (Arcuri & Galeotti, 2020).

EvoMaster is aimed both at practitioners that want to automatically test their software, and at researchers that need generated test cases for the SE problems that they are investigating.

At the moment, EvoMaster targets RESTful APIs compiled to JVM **8** and **11** bytecode. The APIs must provide a schema in *OpenAPI/Swagger* format (either v2 or v3). The tool generates JUnit (version 4 or 5) tests, written in either Java or Kotlin.

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