
Bachelor/Master Thesis Topic

Search-Space Classification for Test Suite Generation and Augmentation Problems

Motivation and Background

As the complexity of software increases, designing and developing new software systems becomes more challenging. To handle this complexity, there is a trend to partially automate software development tasks supported by optimization methods. This area is known as Search Based Software Engineering (SBSE) [Har07a].

Software testing is a crucial part of software development, used to assess correctness, completeness and reliability of a software systems. Due to the time-consuming nature and computational load of this task, search-based methods have successfully been applied in solving a wide range of software testing problems [McM04, Har07a] and haven been empirically proven to successfully find faults in existing software systems [FA15]. The objective function that should be improved is usually defined as branch, statement, and method coverage for source code, or metrics such as transition coverage for model-based testing. A test case generation approach known as test suite augmentation is also applied to regression testing scenarios [KXK⁺14, XKKR11, XKK⁺15, YH12]. Here the goals are to create test cases that cover the newly generated code or to identify behavioral differences between two consecutive software versions. The used meta heuristics for test suite generation problems are traditional genetic algorithms [FA15], memetic algorithms [FAM15] or ant colony systems [MXYC15]. This shows that the problem can be tackled with different meta heuristics, however a clear superior meta-heuristic could not be identified.

Goals

The goal of this project is to analyses the search space for common test suite generation and augmentation problems.

Description of the Task

- Understand the current problems in test suite generation and augmentation
- Run and analyses experiments in the area of test suite generation and augmentation
- Provide information/characterization about the search spaces in this area

Research Type

Theoretical Aspects: *****

Industrial Relevance: *****

Implementation *****

Prerequisite

The student should be enrolled in the bachelor/master of computer science program, and has completed the required course modules to start a bachelor/master thesis.

Skills required

Programming skills in Java or C++, understanding of, or willingness to learn, the software engineering and software analysis foundations needed for the project.

Contacts

Lars Grunske, Humboldt-Universität zu Berlin, Institut für Informatik, Lehrstuhl Software Engineering, Unter den Linden 6, 10099 Berlin, Germany

Application

Please contact me during my office hours or send me an email with the title: “[ThesisProject]-SC4SBSE-TestGenAug” to se-career@informatik.hu-berlin.de

References

- [FA15] Gordon Fraser and Andrea Arcuri. 1600 faults in 100 projects: automatically finding faults while achieving high coverage with evosuite. *Empirical Software Engineering*, 20(3):611–639, 2015.
- [FAM15] Gordon Fraser, Andrea Arcuri, and Phil McMinn. A memetic algorithm for whole test suite generation. *Journal of Systems and Software*, 103:311–327, 2015.
- [Har07a] Mark Harman. The current state and future of search based software engineering. In *International Conference on Software Engineering, ISCE 2007, Workshop on the Future of Software Engineering, FOSE 2007*, pages 342–357, 2007.
- [KKK⁺14] Yunho Kim, Zhihong Xu, Moonzoo Kim, Myra B. Cohen, and Gregg Rothermel. Hybrid directed test suite augmentation: An interleaving framework. In *Seventh IEEE International Conference on Software Testing, Verification and Validation, ICST*, pages 263–272. IEEE Computer Society, 2014.
- [McM04] Phil McMinn. Search-based software test data generation: A survey. *Software Testing, Verification and Reliability*, 14(2):105–156, 2004.
- [MXYC15] Chengying Mao, Lichuan Xiao, Xinxin Yu, and Jinfu Chen. Adapting ant colony optimization to generate test data for software structural testing. *Swarm and Evolutionary Computation*, 20:23–36, 2015.
- [XKK⁺15] Zhihong Xu, Yunho Kim, Moonzoo Kim, Myra B. Cohen, and Gregg Rothermel. Directed test suite augmentation: an empirical investigation. *Softw. Test., Verif. Reliab.*, 25(2):77–114, 2015.
- [XKKR11] Zhihong Xu, Yunho Kim, Moonzoo Kim, and Gregg Rothermel. A hybrid directed test suite augmentation technique. In *IEEE 22nd International Symposium on Software Reliability Engineering*, pages 150–159. IEEE Computer Society, 2011.
- [YH12] Shin Yoo and Mark Harman. Regression testing minimization, selection and prioritization: a survey. *Softw. Test., Verif. Reliab.*, 22(2):67–120, 2012.