A Decision Support System for Integration Test Selection

Sahar Tahvili
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Abstract
Software testing generally suffers from time and budget limitations. Indiscriminately executing all available test cases leads to sub-optimal exploitation of testing resources. Selecting too few test cases for execution on the other hand might leave a large number of faults undiscovered. Test case selection and prioritization techniques can lead to more efficient usage of testing resources and also early detection of faults. Test case selection addresses the problem of selecting a subset of an existing set of test cases, typically by discarding test cases that do not improve the quality of the system under test. Test case prioritization schedules test cases for execution in order to increase their effectiveness at achieving some performance goals such as: earlier fault detection, optimal allocation of testing resources and reducing overall testing effort. In practice, prioritized selection of test cases requires the evaluation of different test case criteria. Therefore this problem can be formulated as a multi-criteria decision making problem. As the number of decision criteria grows, application of a systematic decision making solution becomes a necessity.

In this thesis, we propose a tool-supported framework using a decision support system, for prioritizing and selecting integration test cases in embedded system development. This framework provides a complete loop for selecting the best candidate test case for execution based on a finite set of criteria. The results of multiple case studies, done on a train control management subsystem, from Bombardier Transportation AB in Sweden, demonstrate how our approach helps to select test cases in a systematic way. This can lead to early detection of faults while respecting various criteria. Also, we have evaluated a customized return on investment metric to quantify the economic benefits in optimizing system integration testing using our framework.

List of Publications

Publications included in the Licentiate Thesis

Not included in the Licentiate Thesis

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Software Testing

The software testing laboratory (STL) at MDH focuses on industry-relevant research in software testing. In our research, we develop, refine, and evaluate methods, theories and tools for testing of complex software-intensive systems. With an emphasis on method and tool development, as well as industrial and practical real life case studies, our research focus includes (but is not limited to) test design, model-based testing, search-based software testing, decision-support for software testing, and test automation. The objectives of STL are to improve the current state-of-the-art in software testing, to share our results with the broader research community, to actively seek academic and industrial collaboration, and to transfer results and knowledge for industrial adoption.

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Biography

Sahar Tahvili is currently working as SICS Swedish ICT as a researcher. Her primary professional interest is software testing and optimization. Sahar got her B.Sc. in Applied Mathematics with a focus on operation research. In 2014, she graduated as M.Phil. in Applied Mathematics with emphasis on optimization from Mälardalen University. Sahar’s research focuses on advanced methods for testing complex software-intensive systems. She also has a background in Aeronautical Engineering.

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ITS-EASY is an industrial research school in Embedded Software and Systems, affiliated with the School of Innovation, Design and Engineering (IDT) at Mälardalen University (MDH) as an integrated part of the MDH strategic research area Embedded Systems (ES).

ITS-EASY is funded by the Knowledge Foundation (KKS), and the eleven participating companies. ITS-EASY started October 1st 2011, and will continue until September 30th 2020. During that period the PhD students will complete their studies and obtain the doctoral degree in Computer Science.

ITS-EASY is a large organization: it counts 22 PhD students, 14 main advisors from IDT, 18 co-advisors from IDT and the partner companies, and more than 25 associated members; senior researchers and industrial specialists. The board, led by Helena Malmqvist, ABB, has six members, and the industrial committee where all participating companies are represented, has 11 members. The management team of the research school consists of four members. All in all, about 85 persons are directly engaged in ITS-EASY.

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