Exploring means to facilitate software debugging
SOLTANI, M.S.

Author: Soltani, M.S.
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8 English Summary

Today we rely on computer systems in numerous ways. Yet, these systems are susceptible to failure. These failures may disrupt lives, cause deaths, and cost billions of dollars. Thus, software testing and verification play paramount roles in attempting to prevent such catastrophic failures. Since software testing and verification activities are costly and labor-intensive, much effort has been put into automating as many activities in these areas as possible. In this thesis, the overarching goal is to investigate different means to facilitate automated software debugging.

We present *EvoCrash*, which is a search-based approach to automated crash reproduction. *EvoCrash* applies a genetic algorithm to search for a test case that reproduces a software crash. We performed a large-scale evaluation to asses the performance of the EvoCrash approach and identify the areas where further improvement is needed.

Furthermore, we introduce the *IMaChecker* approach, which mines Github bug repositories, using Github APIs. In addition, *IMaChecker* parses bug reports and identifies which elements (e.g. reproducing steps) are included in them. Using statistical tests, *IMaChecker* identifies the impact of different bug report elements on bug resolution times.

Finally, we develop static analyzers which detect the use of program contracts in open source programs which are developed in Java, C++, and Python. In addition, we develop parsers to identify fixing commits among the entire commit histories. Using Poisson regression tests, we show there is a negative correlation between the use of contracts and bug occurrences. Thus, we show one way to avoid bugs is to use program contracts.