Software Engineering Seminar

Flow-Based SBFL Techniques

Description

Automated fault localization techniques assist developers with the task of pointing out program elements that are most probable to be responsible for a detected error. Over the years, many different techniques have been developed [4].

Spectrum-based fault localization (SBFL) is a statistics-based technique that operates on execution information that is collected from successful and failing runs of a software system. For each considered program element, a suspiciousness score is calculated based on its execution or non-execution in the runs. The basic idea is that execution in failing runs adds to the suspiciousness of the element, while execution in successful runs makes the element less suspicious. Non execution, on the other hand, has the adverse effect.

Traditionally, SBFL techniques operate on statement or method level, but there also exist more intricate approaches that collect data about the execution of control flow and data flow elements, e.g., def-use pairs [3, 2], information-flow pairs [2] and dependence chains [1]. While these approaches are more powerful for locating some types of bugs, they also cause more overhead in terms of performance.

The goal for the student is to evaluate and discuss the current state of the art of flow-related fault localization techniques and to compare them to techniques that operate on structural program elements like, e.g., statements.

References

[1] Rawad Abou Assi and Wes Masri. Identifying Failure-Correlated Dependence Chains. In *2011 IEEE Fourth International Conference on Software Testing, Verification and Validation Workshops*, pages 607–616, 2011.

[2] Wes Masri. Fault localization based on information flow coverage. *Software Testing, Verification and Reliability*, 20(2):121–147, 2009.

[3] Raul Santelices, James A. Jones, Yanbing Yu, and Mary Jean Harrold. Lightweight fault-localization using multiple coverage types. In *2009 IEEE 31st International Conference on Software Engineering*, pages 56–66. IEEE, IEEE, 2009.

[4] W. Eric Wong, Ruizhi Gao, Yihao Li, Rui Abreu, and Franz Wotawa. A survey on software fault localization. *IEEE Transactions on Software Engineering*, 42(8):707–740, 2016.

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