Comparison of Data-driven Failure Classification Algorithms

Bachelor's Thesis, Master's Thesis

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Starting date: Any time

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Context

In the context of vehicle function development, Hardware-in-the-Loop test benches are used for functional validation on integration and system level. Such test benches are complex cyber-physical systems themselves and for their operation engineers require deep knowledge and understanding about the various components and their interdependencies. Several stakeholders and suppliers contribute to an automotive HiL setup, rendering it unlikely for the testing personnel to know all components and their interdependencies. Let alone due to intellectual property concerns or provision of components as black box modules, the information about many components is scarce.

Nonetheless, a pressing issue in practice is to find out what exactly went wrong when a test case fails. Practitioners investigate the causes for the failures and, most importantly, they determine whether the test results are trustworthy. In other words, they decide whether a test case failure is *valid*, i.e. a flaw in the system-under-test (SUT) has been discovered, or *invalid*, i.e. the test case fails due to the inherent unreliability of the test bench. This investigation is associated with significant amount of time and, thus, is an important cost factor for validation & verification (V&V) projects.

In the literature various data-driven approaches to failure diagnosis can be found ranging from case-based reasoning (CBR) [8, 6] over association rule-mining (ARM) [4] and spectrum-based approaches [3, 1, 5, 7] to classic machine-learning classifiers [9, 2].

Goal

The aim of this thesis is to compare the approaches and evaluate them in the context of at least one running V&V project at our industry partner.

Working Plan

1. Familiarize with the literature on (data-driven) failure diagnosis
2. Find representative articles for each of the aforementioned approaches.
3. Prepare an evaluation schema for the comparison
4. Write the exposé
5. Implement the different approaches
6. Apply the evaluation schema to the implemented approaches
7. Describe the (methodological) differences between the approaches
8. Write the thesis report

Deliverables

- Exposé (about 6 weeks after kick-off)
- Source code of the implementation.
- Technical report with comprehensive documentation of the implementation, i.e. design decision, architecture description, API description and usage instructions.
- Final thesis report written in English and in conformance with TUM guidelines
- Presentation of the work at the chair (2-3 weeks after submission)

Application:
Please apply via email to claudius.jordan@tum.de. Your email should explain your interest in the topic and contain your current transcript of records. The most promising candidates will be invited for an informal interview. Upon mutual agreement, the thesis will be performed in cooperation with TraceTronic GmbH.

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