An Empirical Study on Practicality of Specification Mining Algorithms on a Real-World Application

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Goal

Assessing the feasibility and effectiveness of currently existing model inference tools and algorithms on a large scale application in a larger context of applying specification mining techniques in rather unexplored context of debugging

Study Subject

Autopilot software developed by Micropilot Inc.

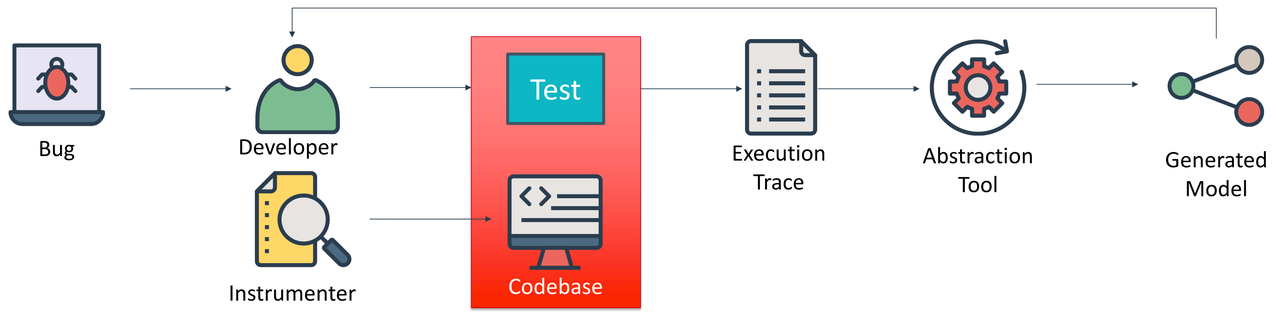
500k lines of C code

1000+ customers

In **85** countries

Real bug reports and their associated regression tests

Study process



For each bug, the autopilot source code was instrumented and the resulting execution traces was fed to the abstraction tool with several configurations:

5 State merging strategies × **3** Values of K × **2** Options of determinization × **2** Options of Using Daikon = **60 configurations**

Challenges

Instrumentation

- Too Many Events
- Complex Variables
- Irrelevant Variables
- Boilerplate Code

100s of GBs of events data generated in a matter of minutes

Each event is accompanied with **100+KB** of variable assignments

Most of the recorded variables are **irrelevant** to the bug or are **boilerplate** code

Abstraction

- Input Redundancy
- Crashing

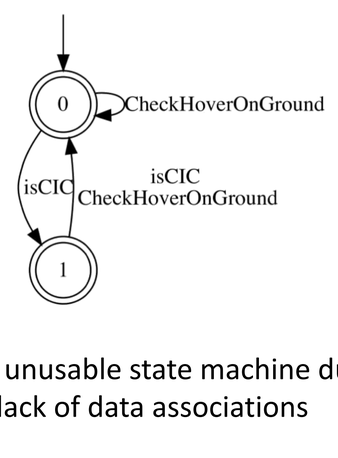
Identical consecutive events making **input larger** without adding **information**

Abstraction tool **crashed** for several reasons:

Interpretation

- No Constraints
- Low Control on Granularity

In successful cases the state machines did not contain transition guards and were **not usable**



An unusable state machine due to lack of data associations

Solution: Some processing and keeping human in the loop

Abstraction Tool: MINT

A promising tool that implements well known FSM and **EFSM inference** algorithms such as:

- kTails
- Gk Tail
- No loops
- Red-blue (Evidence Driven State Merging)
- Exhaustive Merge

The input and output formats are **independent** of the selected strategy

Takeaways

Current algorithms work well on the samples they were tested and evaluated with but they are not **scalable** enough to be a reliable tool to be used in an **industrial setting**.

The result and impact of the **state of the art** algorithms and techniques would be much greater if they are **applicable** on industrial applications as well. Striving on achieving such quality will pay off.

Relaxing the constraint of having a "fully automated" algorithm to having a **"semi-automated interactive"** algorithm might have benefits justifying the overhead.

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