Study of Functional Bugs in Android Apps

MASTER'S STUDENT

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Agenda:

- Introduction

- Goal of this Project

- Motivation

- Implementation

- Evaluation

Introduction

- Android apps are ubiquitous and serve many aspects of our daily lives. Ensuring their functional correctness is crucial for their success.

- Recent reports show that app users highly value the user experience — only 16% of the users will try a function-failing app more than twice. Indeed, those function-failing apps could severely affect the users in real life. Thus, ensuring the functional correctness of an app is crucial for its success.

- We still lack a general and in-depth understanding of functional bugs, which hinders the development of practices and techniques to tackle functional bugs.

Goal of this Project

- The overarching goal of the project is to enhance the understanding of functional bugs in Android apps.

- Develop a practical tool (RegDroid) for bug detection and contribute insights that can guide future research and the development of effective practices in this domain.

Motivation

- The motivation behind the project is to understand and address functional bugs in Android apps through a systematic study, leading to the development of a differential testing tool, RegDroid. The tool has shown success in discovering previously unknown bugs in real-world apps, contributing valuable insights for future research in this domain.
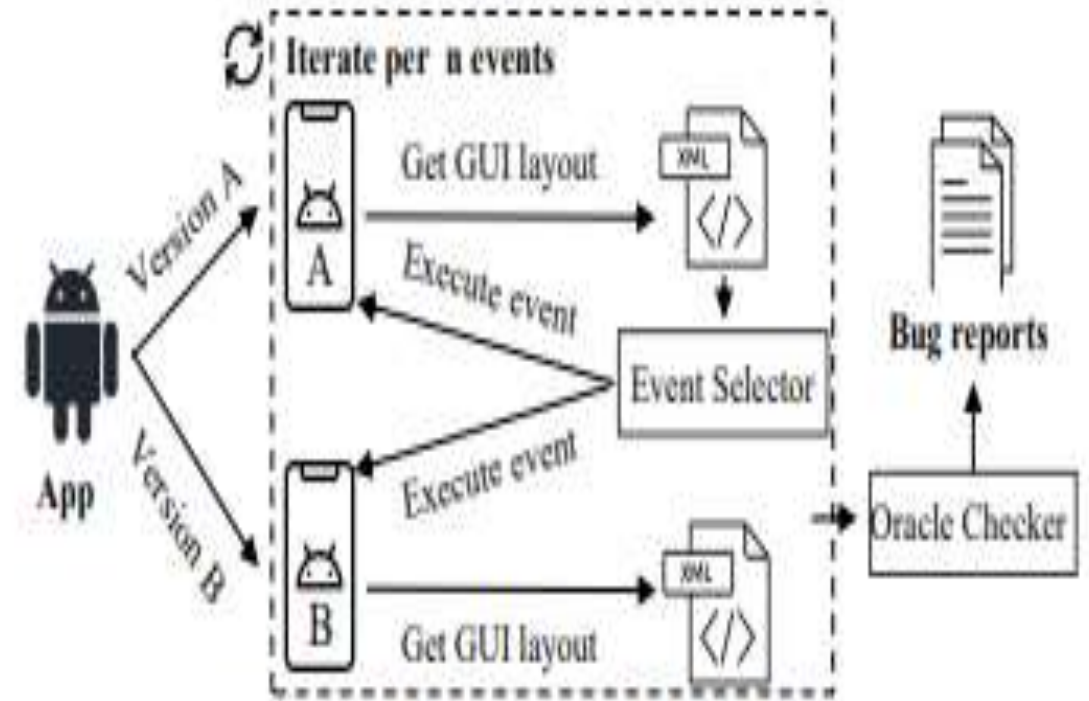
Implementation

- Implemented the preceding idea as an automated differential testing tool named RegDroid to find functional bugs.

- It consists of two main modules

- Event Selector

- Oracle Checker

Evaluation

- Applied RegDroid on popular, long maintained open-source apps. (Amaze).

- RegDroid is configured to test any two continuous release versions of an app by generating random GUI tests (each test contains 100 events), which took about 12 hours.

- Tested all the continuous version of the App.

- If a bug is a true positive, tried to reproduce it on the latest app version to verify whether this is a new (unknown) bug or a fixed one.

- Regdroid successfully found bugs in the App.

- RegDroid reported bugs. Among these bugs, true positives (36%) and false positives (64%).

- Despite the false positive rate, simple implementation (without any optimization) of RegDroid already shows its promise finding hard-to-detect functional bugs, which complements existing tools.

- In fact, its positive rate (64%) is comparable to existing sophisticated, state-of-the-art functional testing tools Genie and Odin , which respectively have 59% and 60% false positive rates. Moreover, it is feasible to avoid many false positives by choosing two "closer" app versions with fewer feature (UI) changes.

- It can be achieved by analyzing the app code to identify which code commits changed UIs.

- New Finding → regdroid is not supported for gaming apps.

- Not able to detect single bug in the gaming apps.

- Even it was not supported for the testing.

Limitation:

- It is not common for all the other apps

- Our findings may not be general to all the apps. To mitigate this threat, these apps are selected carefully to ensure that their representativeness.

- These apps are popular, actively-maintained and have different features.

- Not supported to gaming apps.

Reference:

Yiheng Xiong, Mengqian Xu, Ting Su, Jingling Sun, Jue Wang, He Wen, Geguang Pu, Jifeng He, and Zhendong Su. 2023. An Empirical Study of Functional Bugs in Android Apps. In Proceedings of the 32nd ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA '23), July 17–21, 2023, Seattle, WA, USA. ACM, New York, NY, USA, 13 pages. https://doi.org/10.1145/3597926.3598138