

Bachelor Thesis

May 20, 2017

GUI usability and testing of mobile applications

Example subtitle

Lucas Pelloni

of 18.03.1993, Switzerland (13-722-038)

supervised by

Prof. Dr. Harald C. Gall
Dr. Sebastiano Panichella
Giovanni Grano (PhD student)



University of
Zurich^{UZH}



software evolution & architecture lab

Bachelor Thesis

GUI usability and testing of mobile applications

Example subtitle

Lucas Pelloni



University of
Zurich^{UZH}



Bachelor Thesis

Author: Lucas Pelloni, lucas.pelloni@uzh.ch

URL: https://github.com/lucaspelloni2/BA_PROJ

Project period: 08.01.2017 - 08.07.2017

Software Evolution & Architecture Lab
Department of Informatics, University of Zurich

“Program testing can be used to show the presence of bugs, but never to show their absence.”
Edsger W. Dijkstra

Acknowledgements

Abstract

Zusammenfassung

Contents

1	Introduction	1
1.1	Context	1
1.2	Motivation	1
1.3	Motivation Example	1
1.4	Research question	1
1.4.1	Subsection	1
2	Related Work	3
2.1	Automated tools for Android Testing	3
2.2	Usage of users reviews in Software maintenance activities	4

List of Figures

1.1	imgs/seal logo	1
-----	--------------------------	---

List of Tables

List of Listings

1.1	An example code snippet	1
-----	-----------------------------------	---

Introduction

1.1 Context

1.2 Motivation

1.3 Motivation Example

1.4 Research question

Subsubsection



Figure 1.1: imgs/seal logo

1.4.1 Subsection

Paragraph. Always with a point.

```
/**
 * Javadoc comment
 */
public class Foo {
    // line comment
    public void bar(int number) {
```

```
    if (number < 0) {  
        return; /* block comment */  
    }  
}
```

Listing 1.1: An example code snippet

Related Work

In the following two sections, I summarize the main related works on *automated testing tools for Android apps* and on *the broadly usage of user reviews from app store in Software maintenance activities*. An overview of the recent research in the field can be found in the survey by Martin *et al.* [9].

2.1 Automated tools for Android Testing

Unlike traditional software, mobile applications are mainly exercised by user inputs.

In the mobile world, an extremely valid approach to ensure the reliability of these applications is the GUI¹ Testing.

In particular, in this kind of testing, each test case is designed and run in the form of sequences of GUI interaction events.

Depending on their exploration strategy, there are in general three approaches for creating a generation of user inputs on a mobile device [4, 7]: *random testing* [5, 7], *systematic testing* [8] and *model-based testing* [2, 3, 6].

Fuzz testing

Monkey, is the most widely used tool in practice for testing Android applications with a random strategy [5]. It is the official Android testing command-line tool directly provided by Google.

This tool simply generates, for the specified Android applications, pseudo-random streams of user events into the system, with the goal to stress the AUT² [5].

The effort required for using *Monkey* is very low [4]. Users have to specify in the command-line the type and the number of the UI events they want to generate and in addition they can establish the verbosity level of the *Monkey log*.

The set of possible *Monkey parameters* can be found in the official *User Guide* for *Monkey* [5].

The kind of testing implemented by *Monkey* follows a black-box approach. Despite the robustness, the user friendliness [4, 7] and the capacity to find out new bugs outside the stated scenarios [1], this tool may be inefficient if the AUT would require some human intelligence (*e.g.* a login field) for providing sensible inputs [7].

For instance, *Monkey* may cause highly redundant and senseless user events. Even though it would find out a new bug for a given app, the steps for reproducing the bug may be very difficult to follow, due also to the randomness in the testing strategy implemented by *Monkey* [1].

Dynodroid [7] is also a random-based testing approach. However, this tool has been discovered

¹Graphical User Interface

²Application Under Test

being more efficient than *Monkey* in the exploration process [4].

One of the reasons behind a better efficacy has been that *Dynodroid* is able to generate both *UI inputs* and *system events* (unlike *Monkey*, which can only generate UI events) [4].

Indeed, *Dynodroid* views the *AUT* as an event-driven program and follows a cyclical mechanism, also known as the *observe-select-execute* cycle [7]. First of all, it *observes* which events are relevant to the *AUT* in the current state grouping them together (an event must be considered relevant if it triggers a part of code which is part of the *AUT*). After that, it *selects* one of the previously observed events with a randomized algorithm [4,7] and finally *executes* it. After the execution of that event it reaches a new state and can start the cycle again.

Another advantage of *Dynodroid* compared to *Monkey* is that it allows users to interact in the testing process providing UI inputs. In doing so, *Dynodroid* is able to exploit the advantage of combining automated with manual testing [7].

Systematic testing

The tools using a systematic explorations strategy rely on more sophisticated techniques, such as symbolic execution and evolutionary algorithms [4].

2.2 Usage of users reviews in Software maintenance activities

this is the part of the usage of users reviews!

Bibliography

- [1] What is monkey testing? types, advantages and disadvantages. .
- [2] D. Amalfitano, A. R. Fasolino, P. Tramontana, B. D. Ta, and A. M. Memon. Mobiguitar: Automated model-based testing of mobile apps. *IEEE Software*, 32(5):53–59, 2015.
- [3] W. Choi, G. Necula, and K. Sen. Guided gui testing of android apps with minimal restart and approximate learning. *SIGPLAN Not.*, 48(10):623–640, Oct. 2013.
- [4] S. R. Choudhary, A. Gorla, and A. Orso. Automated test input generation for android: Are we there yet? (e). In *Proceedings of the 2015 30th IEEE/ACM International Conference on Automated Software Engineering (ASE)*, ASE '15, pages 429–440, Washington, DC, USA, 2015. IEEE Computer Society.
- [5] Google. Android monkey. .
- [6] M. Linares-Vásquez, M. White, C. Bernal-Cárdenas, K. Moran, and D. Poshyvanyk. Mining android app usages for generating actionable gui-based execution scenarios. In *Proceedings of the 12th Working Conference on Mining Software Repositories, MSR '15*, pages 111–122, Piscataway, NJ, USA, 2015. IEEE Press.
- [7] A. Machiry, R. Tahiliani, and M. Naik. Dynodroid: An input generation system for android apps. In *Proceedings of the 2013 9th Joint Meeting on Foundations of Software Engineering, ESEC/FSE 2013*, pages 224–234, New York, NY, USA, 2013. ACM.
- [8] R. Mahmood, N. Mirzaei, and S. Malek. Evodroid: Segmented evolutionary testing of android apps. In *Proceedings of the 22Nd ACM SIGSOFT International Symposium on Foundations of Software Engineering, FSE 2014*, pages 599–609, New York, NY, USA, 2014. ACM.
- [9] W. Martin, F. Sarro, Y. Jia, Y. Zhang, and M. Harman. A survey of app store analysis for software engineering. *IEEE Transactions on Software Engineering*, PP(99):1–1, 2016.