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Evaluation of Mobile Interfaces as an Optimization Problem

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Abstract

Mobile applications are more and more present everywhere (at home, at work, in public places, etc.). Many academic and industrial studies are conducted about design methods and tools for mobile user interface generation. However, the evaluation of such interfaces is object of relatively few propositions and studies in the literature. The existing evaluation methods are widely based on a questionnaire, survey, eye tracking, etc. to assess mobile interface. These methods are time-consuming, error-prone task. In fact, one of the widely used methods to assess quality of MUI is using detection rules. But, the manual definition of these methods is still a difficult task. In this context, we define a method that generates evaluation rules for assessing the quality of mobile interfaces. To this end, we consider the generation of evaluation rules as a mono-objective technique problem where the goal is to find the best rules maximizing the quality of mobile interfaces. We evaluate our approach on four mobile applications. This study was designed around the android mobile devices. The obtained results confirm the efficiency of our technique with an average of more than 70% of precision and recall.

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1. Introduction

Nowadays, the diversity of context in which the interaction between system and users takes place is a new challenge for developers. In fact, the mobile and tablet devices sales are growing every day and there is an increased attention to mobile user interfaces. In this way, there are widely innovations and development tools of new mobile services. In this context, mobile interfaces are designed to be used on smartphones and tablet computers. These mobile interfaces can be used in everyday life and/or at work, in different contexts such as e-learning, transport, games, social networking, weather, etc.

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According to Statistics, the number of mobile applications downloads worldwide in 2009 is 2.52 billion. In addition, the social network and e-commerce development stimulates the evolution of the mobile operating systems (Android, Windows phone, iOS, etc.). For example, the number of application available in Google play store is 1.600.000 and the number of applications in windows phone store is 340.000. As mobile technologies became widespread, users will be more motivated to use more portable devices and interacting with mobile applications. Indeed, 3600 million of users are subscribed in mobile services since 2014[21].

A mobile user interface (MUI) is the graphical and usually touch sensitive display on a mobile device, such as a smartphone or tablet that allows the user to interact with the device's apps, features, content and functions. User interface level represent 50% of software code which proves the importance of this level in the correctness and the effectiveness of the application[16, 18]. Hellmann[8] reported that MUI-related defects have a significant impact on the end users of system. He has shown that 60% of defects can be traced to code in the Graphical User Interface (GUI), and 65% of GUI defects resulted in a loss of functionality. Therefore, evaluating mobile UI is very important phase in the development to decrease the maintenance cost of application.

Several studies have been carried out to model the user as well as to design methods and tools for mobile UI generation. However, few evaluation studies have been proposed for mobile user interface quality assessment. The literature has shown that there are many evaluation techniques to assess GUI such as heuristic evaluation, questionnaire, interview, etc. However, there is no consensus as how mobile interface should be assessed. In fact, mobile UI has limited characteristics (small screen size, event centric, simple and Intuitive GUI) compared to traditional desktop GUI which need specific evaluation techniques. The diversity of mobile platforms makes the evaluation task very difficult to ensure that mobile interfaces can be used effectively and efficiently under any context and environment. Thus, it is necessary to envisage new methods that take into account the evaluation of mobile interface. In this context, we propose in this paper an evaluation approach based on the genetic programming algorithm. Our approach aims to find the best evaluation rules that maximize the quality of mobile user interface. These rules can be used to detect defects of mobile user interface.

The rest of the paper is organized as follows. Section 2 presents the related work. Section 3 gives an overview of evaluation of MUI. Section 4 gives an overview of our proposal and explains how we adapted the GP algorithm to find the best rules maximizing the quality of mobile UI. Section 5 discusses the results of the evaluation of our approach. Finally, we conclude in Section 6.

2. Related works

Recently, there are several works that have focused on detecting defects of mobile user interface using different methods. Park et al.[20] has suggested an interview to assess the quality of mobile interfaces according to the user experience when using a mobile phone. Similarly, Gena and Torre[7] exploited a questionnaire to evaluate an MUI system called MastroCARONTE which provides tourist information on board cars. These methods are very expensive because they need the presence of many users having different profiles. For this reason, Soui et al.[24] have proposed a tracing system in order to evaluate the mobile application "MouverPerso".

In addition, one of the widely used methods to evaluate mobile interface is heuristic evaluation. In this way, Ji et al.[9] proposed a study that test usability checklist based on heuristic evaluations in views of mobile phone user interface practitioners. They reported also the importance of usability to evaluate the quality of mobile interface. Similarly, Biel et al[5] proposed a heuristic evaluation method based on generic evaluation scenario. Then, the results will be discussed and categorized according to their impact on usability and software architecture. These study propose manually heuristic to evaluate the mobile phone UI. In our work, we propose an automatic method to generate evaluation rules. In addition, Jin[10] proposed quantitative method to evaluate mobile UI in which they investigated the physical user interface. It measures the following three functions: key level (KLV), function level (FLV), grip level (GLV). Then, they estimate manually the degree of usability risk. Lettner and Holzmann[15] proposed also an semi-automatic usability evaluation method for mobile application UIs. It assesses MUI by using