PAPER 3

UI Screens Identification and Extraction from Mobile Programming Screencasts

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Summary

INTRODUCTION

This research paper is all about the UI Screens Identification and Extraction from Mobile Programming Screencasts. Smart phones are some of the most widely used devices today, with more than 2.5 billion users worldwide. The two most popular app stores, the Apple App Store and Google Play Store host millions of smart phone applications that people use for a variety of tasks in their daily lives. The increasing demand for these applications has spurred growth in mobile app development with more and more programmers learning to develop new mobile applications or having to maintain and evolve existing ones. When learning about new concepts and technologies, debugging, or looking for answers to programming questions, online resources are developers’ preferred documentation sources.

In this paper, They make a step towards addressing this problem by localizing, extracting, and presenting to the developer the most representative UI screens found in a mobile programming screencast. This can be seen as a UI overview of a video, which can help developers quickly comprehend what the apps developed in programming screencasts are about and if they are relevant to their information needs. They focus on the UI of an app, since it captures the essence of an application , by showcasing the features it provides in action. Their approach for extracting the UI overview, called UIScreens, is based on a deep Convolutional Neural Network (CNN) which includes an image feature extractor and an object detector to locate UI screens within the frames of a programming screencast. The detected UI screens are then extracted and filtered such that only unique UI screens are kept. The approach was also integrated into a tool, which is freely available to use online.

They conducted an evaluation of UIScreens through two empirical studies. The first study focused on determining the accuracy of their approach in correctly locating UI screens in 1,000 iOS and Android programming videos from YouTube. The results indicated that UIScreens can precisely locate UI screens in screencast frames, achieving an accuracy of 94%. The second part of the evaluation involved a user study where 25 professional developers and computer science students were asked to assess the results of their approach based on quality and usefulness. The evaluation was done on a new set of 50 iOS and Android screencasts, not involved in the training of their approach. The results indicated that participants valued the extracted UI screens and found them appropriate and useful.

In summary, the main contributions of this paper are:

• The first approach for locating and extracting UI screens from mobile programming screencasts, providing a UI overview of a video. This can enable developers to quickly comprehend which are the main features of an app explained in a screencast and determine if the video is relevant to their information needs.

• An evaluation based on two empirical studies showing that the proposed approach is not only accurate, but also considered useful by developers.

• A freely available tool implementing their approach.

• A replication package containing their complete dataset, results, and scripts.

The second part of their evaluation is represented by a user study which focuses on assessing the end result of UIScreens, namely the UI overview generated at the end of the last step in their approach. They believe that high-quality UI overviews have the potential to help developers get a quick comprehension of the main points of a program explained in a video, which could save them time when searching for helpful videos for their information needs. Therefore, in this user study, they aimed to evaluate both the quality of the UI overviews generated by their approach, as well as their perceived usefulness by developers. In terms of quality, we specifically focused on two aspects relating to the UI screens extracted by their approach. The first aspect is the UI screens’ uniqueness: the extracted UI overview should not contain duplicate or very similar UI screens, in order to avoid overwhelming the developer with screens that do not convey new information.

Research Methodology

The study was conducted through an online survey composed of two main sections. The first section was designed to capture demographic data, such as the main occupation (professional developer, academic, student) and the mobile programming experience (iOS and/or Android and number of years) of their participants. Each participant was required to have at least 6 months experience in at least one of the two mobile programming platforms to be qualified for participating in their survey. The study participants were recruited through announcements on professional social media channels.

For this study, They collected a brand new set of 50 programming screencasts (25 iOS and 25 Android), on which they applied their approach. This was done in order to avoid any bias that could be caused by applying UIScreens on a video from which frames were used during the training of their model. This is important for ensuring that their model is generalizable and that their evaluation is unbiased. The average length of the videos in this study was ∼ 10 minutes. Each participant was assigned one iOS and one Android video. For each of the two videos, they were asked to first watch the video in its entirety and then evaluate the extracted UI screens by indicating their agreement level with two statements. The first statement referred to the sufficiency of the extracted UI screens (“The list of UI screens extracted is sufficient to understand what are the main concepts discussed in the video”) and the second one referred to their uniqueness (“The list of UI screens extracted does not present duplicate information, i.e., all UI screens presented are unique”). They ensured that the same video is not displayed to more than one respondent by evenly selecting among the videos. The answers to these two questions were on a 4-point Likert scale, namely: Strongly Agree, Weakly Agree, Weakly Disagree, and Strongly Disagree. The questionnaire also contained a third question for each video, concerning the perceived benefits of UI overviews. A list of possible answers was displayed to each participant, who could select one or more of the available option or enter their own answer.

RESULTS

They got final result, A total of 25 developers completed their survey, having various levels of experience in Android and iOS development. Most of their participants were M.S. and Ph.D. students in computer science with 28% of the total participants in each of these categories.In addition, 24% of the participants were undergraduate students and the remaining 20% were professional developers.

In 85% of their responses, developers either weakly or strongly agreed that the UI screens extracted by their approach were sufficient in understanding what the main elements discussed in the video were. At the same time, 83% of responses either weakly or strongly agreed that the extracted UI screens were unique when compared to each other. This indicates that UIScreens can efficiently extract distinct and sufficient UI screens in order to provide comprehensive UI overviews for mobile programming screencasts. Only 2% of the participants indicated that seeing a UI overview of a mobile programming screencast is not useful for any purpose. In total, 68% of the participants indicated that the extracted UI overview can help them understand if the video contains UI design or not, 66% thought the UI screens can help them understand the relevance of a video for their search needs, and 64% said the UI screens help them understand the main points of the video.