An Empirical Investigation into the Reproduction of Bug Reports for Android Apps

Jack Johnson*, Junayed Mahmud+, Tyler Wendland*, Kevin Moran+, Julia Rubin★, Mattia Fazzini*

* University of Minnesota
+ George Mason University
★ University of British Columbia
Mobile Applications
Latent Bugs
Failures
Bug Reproduction
Content of Bug Reports

Bug Report

Title:
Bug: Long pressing the amount input brings up QWERTY keyboard

Content:

Software specifications:
GnuCash Android version: 2.2.0
System Android version: 6.0

Steps to reproduce the behavior:
1. Navigate to Transactions screen
2. Tap the Add button
3. Enter Description (optional)
4. Focus the Amount input
5. Long press to bring up the context menu

Actual behaviour:

Steps To Reproduce

Content

Environment

Observed Behavior
Study Overview

Our goal is to gain insight into the process of bug report reproduction

<table>
<thead>
<tr>
<th>RQ1</th>
<th>What are the failure types associated with reproducible bug reports?</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ2</td>
<td>What information modalities are used to report the information contained in reproducible bug reports?</td>
</tr>
<tr>
<td>RQ3</td>
<td>Do reproducible bug reports have missing information?</td>
</tr>
<tr>
<td>RQ4</td>
<td>Do discussion threads of reproducible bug reports contain helpful information for reproducing the reports?</td>
</tr>
<tr>
<td>RQ5</td>
<td>How specific is the information reported in reproducible bug reports?</td>
</tr>
</tbody>
</table>
Dataset Creation

Bug Report Analysis

RQ1: Failure Type
- Open Coding

RQ2: Reporting Modality
- Open Coding

RQ3: Missing Information
- Annotated Information
  - S2R Comparison

RQ4: Discussion Information
- Manual Discussion Analysis

RQ5: Information Specificity
- OB & Environment Verification
  - S2R Comparison
RQ1 Results

What are the failure types associated with reproducible bug reports?

- Crash: 31%
- Cosmetic: 28%
- Navigation: 33%
- Output: 8%
- Fix: 8%
RQ2 Results

What information modalities are used to report the information contained in reproducible bug reports?

- Text: 180
- Annotated Text: 100
- Image: 30
- Annotated Image: 6
- Recording: 18
- Log: 19
RQ2 Results

What information modalities are used to report the information contained in reproducible bug reports?

a) Modalities for bug reports.

b) Modalities for environment.

c) Modalities for S2Rs.

d) Modalities for OB.
RQ3 Results

Do reproducible bug reports have missing information?
RQ4 Results

Do discussion threads of reproducible bug reports contain helpful information for reproducing the reports?

Issues With Added Information

- Nothing Added: 81%
- Added Info: 19%

Type Of Information Added

- Env.
- S2Rs
- OB

# of Occurrences
RQ5 Results

How specific is the information reported in reproducible bug reports?

Bug Reports With Non-Specific Steps

- 74% Had Non-Specific Steps
- 26% 100% Specific Steps

Non-Specific S2Rs Per Bug Report
Discussion

New automated techniques are needed for understanding non-crashing oracles.

There is a need for automated multi-modal understanding of bug report information.

Many bug reports have missing S2Rs, which need to be accounted for.

Handling non-specific S2Rs in bug report data is a major challenge.

Techniques for inferring and mocking app environments are essential.
Summary

Study Overview

RQ1: What are the failure types associated with reproducible bug reports?

RQ2: What information modalities are used to report the information contained in reproducible bug reports?

RQ3: Do reproducible bug reports have missing information?

Dataset Creation

Bug Report Analysis

Discussion

- New automated techniques are needed for understanding non-crashing oracles.
- There is a need for automated multi-modal understanding of bug report information.
- Many bug reports have missing S2Rs, which need to be accounted for.
- Handling non-specific S2Rs in bug report data is a major challenge.
- Techniques for inferring and mocking app environments are essential.

https://github.com/se-umn/2022_saner_bug_report_reproduction_study