

A Survey on the Usefulness of Automatic Identification of Human-Centric Issues in Developer Discussions and App Reviews

Problem Statement. We argue that many problems end-users encounter when using mobile apps are “**human-centric issues**”. We define “**human-centric issues**” as the major issues end-users face when utilising misaligned mobile apps. Human-centric issues occur because app developers and owners usually do not consider different end-users’ diverse characteristics such as age, gender, culture, location, language, socio-economic status, and many other diverse human aspects.

Based on a manual analysis of 1,200 developer discussions in GitHub and 1,200 app reviews in Google App Store collected from several mobile apps, we developed a taxonomy of human-centric issues, which groups human-centric issues into three categories: **App Usage**, **Inclusiveness**, and **User Reaction**. Figure 1 shows this taxonomy.

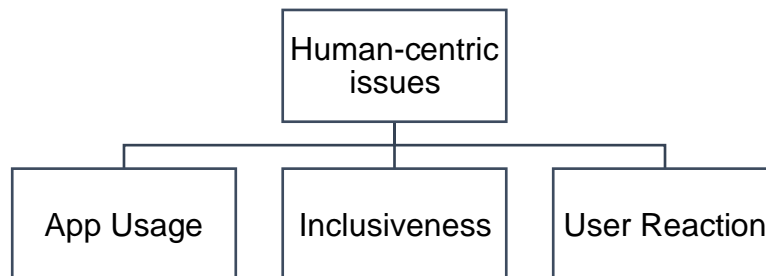


Figure 1. Human-centric issue categories

Our Approach. We believe app developers and owners can extract insightful and actionable insights from app reviews and developer discussions in issue tracking systems that report human-centric issues. Consequently, they can improve the quality of their apps and user satisfaction. However, manual analysis of app reviews and developer discussions to identify reported human-centric issues can be a tedious and error-prone process and takes a significant time from developers and owners.

Our research group has developed a machine learning-based tool with **high accuracy** that takes an enormous amount of app reviews or developer discussions and determines if an app review or developer discussion includes a human-centric issue. If so, it can further specify the given app review or developer discussion belongs to one or more of the following categories of human-centric issues: **App Usage**, **Inclusiveness**, and **User Reaction**. Figure 2 shows an overview of our machine learning-based tool.

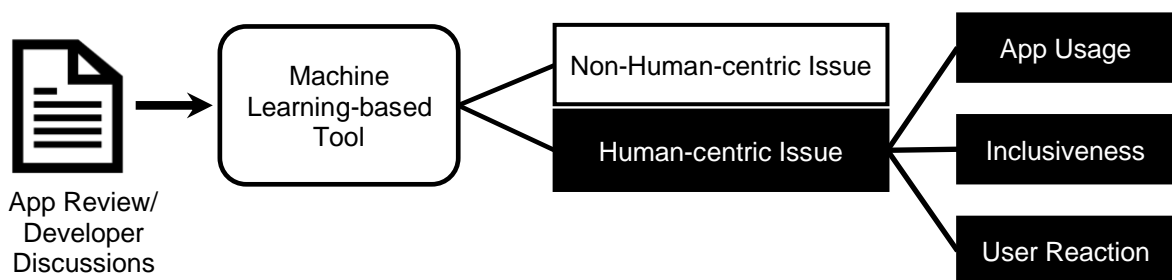


Figure 2. An overview of our machine learning-based tool

As an example, the following table shows how our machine learning-based approach could classify 8 user app reviews from Signal Private Messenger into Non-Human-centric Issues or Human-centric Issues. If the tool recognizes an app review as a Human-centric issue, our tool further classifies it into one or more of the following categories of human-centric issues: **App Usage**, **Inclusiveness**, and **User Reaction**.

ID	App Review Content	Classification			
		None-Human-Centric Issue	Human-Centric Issue		
			App Usage	Inclusiveness	User Reaction
1	Works great all the time especially for video calling.	✓	-	-	-
2	So far, I am enjoying this app. It is kind of aggravating when it comes to messaging people who are not a part of the app. But I love the security. And I love how fast he messages go through when you are messaging people who are using this app	✓	-	-	-
3	Security is best, but lack of some essential options is awful, Bach forwarding and sharing to other apps is impossible, for sending a message like a video message it must be uploaded again, Personalization like dark mode and so on can't be found...	-	-	✓	✓
4	I like the concept of Signal, but I find the support to be lacking and the bugs to be plentiful. Good luck getting rid of it though, tried closing my account due to number of bugs and no one could contact me anymore via SMS. Had to download again and reset up my account.	-	✓	-	-
5	Excellent and full featured messaging app. A welcome replacement to another well-known messaging service that was infected by a social media giant.	✓	-	-	-
6	Good need more improvement 😊 I like And I still use after WhatsApp new policy had come Good feature is available and I think dear developer must add Google drive chat backup option for user and make it more advance Great job keep it encrypted please 🙏	-	✓	-	✓
7	It won't let you forward pictures or messages, it only pulls up random contacts	✓	-	-	-
8	Great chat app, but if the developers want Indians to keep and use this app it will benefit highly from Spam SMS filtering and SMS management features so that it can be fully replaced with stock SMS apps. Something even like SMS organizer from Microsoft.	-	-	-	✓

Survey Goal. With this survey, we want to investigate the **usefulness** of our machine learning-based tool in practice from the perspective of software/app developers and owners. We would be greatly appreciative if you can kindly complete the survey. This survey is anonymous. You will not be identified in the potential publications in the future. The survey takes around 15 minutes.

Survey Questions

1. Which country do you currently work in?
2. How many years have you been involved in software development?
 - a. 0-2 years
 - b. 3-5 years
 - c. 6-10 years
 - d. 11-15 years
 - e. More than 16 years
3. What is your main role in software development?
 - a. Developer
 - b. Architect
 - c. Requirements Engineer
 - d. Business Analysis
 - e. UI/UX Designer
 - f. Project Manager
 - g. Consultant
 - h. Software Engineer
 - i. DevOps Engineer
 - j. Technical Lead
 - k. Other (Please Specify)
4. How large is your organization?
 - a. Less than 20 employees
 - b. $20 \leq \text{employees} \leq 50$
 - c. $50 < \text{employees} \leq 100$
 - d. $100 < \text{employees} \leq 500$
 - e. $500 < \text{employees} \leq 1000$
 - f. More than 1000 employees
5. What is the main domain of your organization?
 - a. Consulting and IT services
 - b. Embedded system
 - c. E-commerce
 - d. Healthcare
 - e. Financial

- f. Telecommunication
- g. Retail
- h. Insurance
- i. Education
- j. Other (Please Specify)

6. How strongly do you agree or disagree with the following statements?

- a. The tool is useful because **issue comments or app reviews with human-centric issues** identified by the tool convey meaningful and important information.
 - i. Strongly agree
 - ii. Agree
 - iii. Neutral
 - iv. Disagree
 - v. Strongly disagree
 - vi. I don't know
- b. The tool is useful because **issue comments or app reviews with human-centric issues** identified by the tool can be used to make informed design decisions in the future or refine the existing sub-optimum decisions.
 - i. Strongly agree
 - ii. Agree
 - iii. Neutral
 - iv. Disagree
 - v. Strongly disagree
 - vi. I don't know
- c. The tool is useful because I, as a practitioner, can find meaningful and important information in a reasonable timeframe from **issue comments or app reviews with human-centric issues** identified by the tool.
 - i. Strongly agree
 - ii. Agree
 - iii. Neutral
 - iv. Disagree
 - v. Strongly disagree
 - vi. I don't know
- d. The tool is useful because **issue comments or app reviews with human-centric issues** identified by the tool can help us identify human-centric issues *faster* in mobile apps than if we did it manually.
 - i. Strongly agree
 - ii. Agree
 - iii. Neutral
 - iv. Disagree

- v. Strongly disagree
 - vi. I don't know
- e. The tool is useful because **issue comments or app reviews with human-centric issues** identified by the tool may contain information that can help us prioritize and resolve such human-centric issues in mobile apps more effectively.
 - i. Strongly agree
 - ii. Agree
 - iii. Neutral
 - iv. Disagree
 - v. Strongly disagree
 - vi. I don't know
- f. The tool is useful because **issue comments or app reviews with human-centric issues** identified by the tool can provide cues/hints to trace backward and forward to codes, services, or features that lead to human-centric issues.
 - i. Strongly agree
 - ii. Agree
 - iii. Neutral
 - iv. Disagree
 - v. Strongly disagree
 - vi. I don't know