NotiSummary: Exploring the Potential of AI-Driven Text Summarization on Smartphone Notification Management

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ABSTRACT

As smartphone notifications proliferate, it becomes increasingly challenging for users to review them all. In response, we've developed NotiSummary, an application leveraging ChatGPT to present a concise summary of notifications, thereby reducing the time and effort required to review them. The application also integrates customization capabilities to further enhance the user-centric experience. Our study investigates the potential applicability of AI-based summarization techniques in notifications and explores user interaction patterns with these summaries. Preliminary results show that users find these summaries helpful in quickly accessing specific information, with preferences emerging for receiving summaries early in the morning and late at night. These findings underscore the potential value of notification summarization while highlighting the need to further investigate user preferences for summary appearance and the impact of summary generation on notification management behavior.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in ubiquitous and mobile computing**.

KEYWORDS

Notification Management, Notification Overload, Text Summarization, Large Language Model, ChatGPT

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1 INTRODUCTION

In today's society, smartphones are essential for accessing and disseminating information. They constantly deliver a myriad of notifications from various applications. Despite the potential benefits of greater connectivity and access to information, managing an excessive volume of notifications can be daunting and overwhelming. Research suggests that this deluge can even provoke negative emotions, including annoyance, stress, and anxiety. [7, 13, 19, 22, 23, 28]. Indeed, a study by Murphy et al. [15] echoes this concern, emphasizing the necessity of delivering an optimal quantity of information to users without overwhelming them. Moreover, users may not have the time or capacity to review each notification thoroughly. Consequently, some notifications, despite their inherent value, could be dismissed without knowing their content [16]. It could lead to overlooked opportunities and vital information, reinforcing the paradox of users being inundated with information yet remaining under-informed.

Researchers have long argued for and studied ways to support users in managing their notifications more efficiently and effectively (e.g., [1, 4, 8, 11, 14, 17, 20, 25–27]). For some time, researchers have explored strategies to aid users in managing their notifications more efficiently. A prominent strategy has been the integration of notification previews [2], which aim to manage interruptions and decrease the cognitive load by providing users with an outline of the incoming interruption, helping users make informed decisions about whether or not to engage.

Further, the emergence and maturation of text summarization models, demonstrated in domains like news articles [5, 10], emails [9, 24], social media posts [6, 10], and search engine results [18, 21], present new possibilities. The rise of large language models (LLMs) such as ChatGPT, known for its proficiency in text summarization, suggests an opportunity to provide compact summaries of smartphone notifications, further streamlining user engagement.

Building on these initial insights, our study posits that integrating advanced text summarization techniques and Large Language Models (LLMs) into existing notification systems could potentially transform users' notification engagement patterns. We propose that offering users summarized notifications may mitigate notification
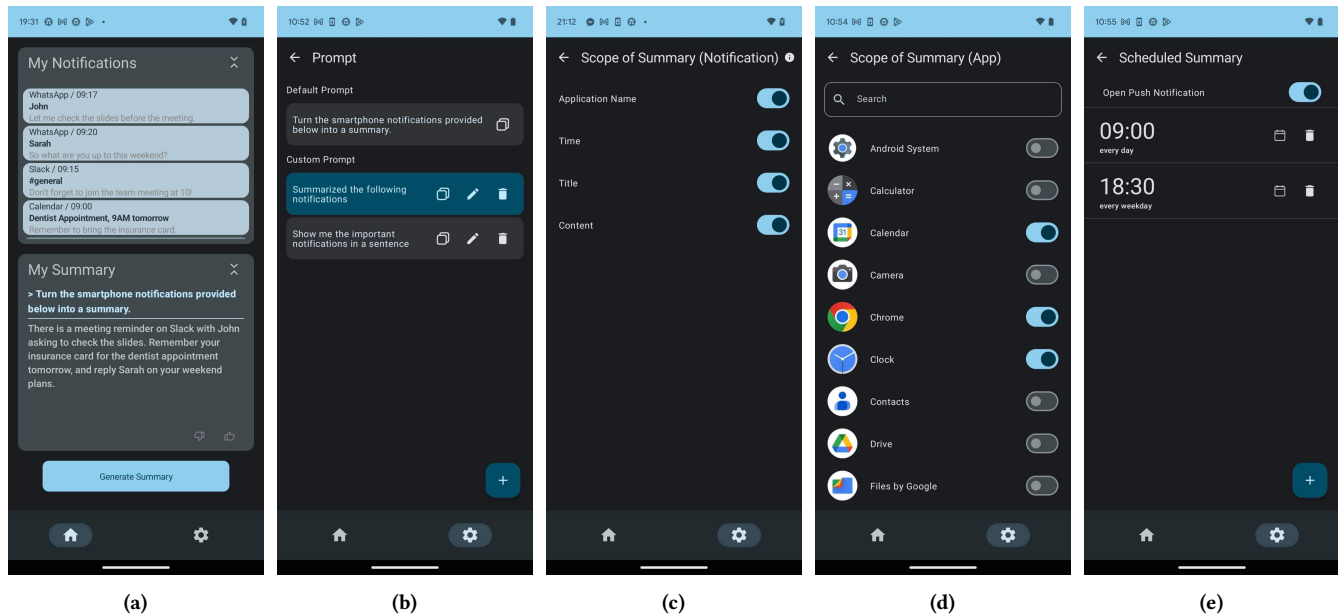
Figure 1: User Interface of NotiSummary

overload and enhance user engagement. Accordingly, our research aims to assess the efficacy of cutting-edge summarization techniques in crafting effective summaries for smartphone notifications. Our goal extends beyond evaluating these techniques' capacity to distill notifications into a more manageable size while preserving critical information. We also strive to provide an in-depth understanding of the potential role of AI-powered summarization in notification management.

Therefore, to examine the feasibility and user acceptance of these summarization techniques, we designed an Android application to provide empirical insights into user attitudes toward notification summaries. By collecting and analyzing user feedback and log data, we aim to comprehend users' preferences and perceptions regarding notification summaries, as well as their desired utilization of these summaries. Within the larger scope of this project, this paper specifically aims to answer two preliminary questions:

RQ1 When do users like to have their smartphone notifications summarized?

RQ2 How would users prefer to utilize the notification summaries?

In the subsequent sections, we will introduce NotiSummary and share our preliminary findings.

2 NOTISUMMARY

We have created NotiSummary, an Android application that harnesses the capabilities of ChatGPT to summarize smartphone notifications. This application extends beyond basic notification summarization, providing advanced features like customizable prompts, filtering, scheduling, and evaluation options, all designed for flexibility to cater to individual user needs and preferences. To engage a broad user base, the application has been made available on the

Google Play Store [1]. The application's user interface and functionality are depicted in Figure 1. Following a minimum usage period of one-week post-installation, we have conducted semi-structured interviews with users to understand their experiences and interactions with the application.

2.1 Application Features

2.1.1 Notification Summarization. NotiSummary's main role is to generate text summaries of smartphone notifications utilizing the 'gpt-3.5-turbo' model from the OpenAI API. Upon a user's request, the application retrieves notifications from the device's notification drawer via Android's Notification Listener Service. These notifications are then organized into a coherent text sequence, along with the user-created prompt, and a request is sent to OpenAI's text completion API to create the final summary. As illustrated in Figure 1a, the application interface displays current notifications and the corresponding summary. This paired display is designed to enhance the comparison between the summary and the original notifications, assessing the summary's quality. Following each summary creation, users can offer feedback on the summary via a thumbs-up or thumbs-down button. This feedback mechanism aids us in understanding user satisfaction and identifying potential areas for improvement.

2.1.2 User-Customized Summary Generation. Figure 1b illustrates how our application empowers users to provide specific prompts for personalized notification summaries. This feature aims to cater to a wide array of user needs, enabling summaries to be tailored to each user's unique preferences. This design stems from the assumption that users might have preferences for notifications regarding

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[1]https://play.google.com/store/apps/details?id=org.muilab.noti.summary

specific content or from certain senders, as indicated by previous research [12–14].

Additionally, our application offers two further customization features: the Notification Filter and the App Filter. The Notification Filter, as illustrated in Figure 1c, allows users to choose specific notification details (such as the application name, post time, title, and content) to be incorporated in the summaries. Meanwhile, the App Filter, depicted in Figure 1d, grants users to specify the applications from which notifications should be included in the summaries.

2.1.3   Summary Scheduling. The application also incorporates a scheduler feature, depicted in Figure 1e. This functionality supports the automated generation of notification summaries at user-defined times and days. By providing users the option to receive push notifications upon summary production, this feature offers an effortless way to stay updated with their smartphone notifications, addressing potential worries about missing crucial updates or events.

2.2   Data Collection

To gain insight into users' behaviors and preferences, NotiSummary collects various user activity data elaborated in the following sections. However, to ensure user privacy, the actual text of notifications and the corresponding summaries are not collected.

2.2.1   Summaries and Notifications. The application records metadata from each generated summary, including creation time, word count, and user evaluations, along with information from notifications such as the application name, post time, and word count of both the title and content. This data is tracked over time to provide insights into factors influencing user summary engagement. Additionally, user interactions within the app, like button presses, navigation actions, and occasions of app access or exit, are logged to observe user behavior and engagement patterns.

2.2.2   Summary Customization and Scheduling. Our application logs specific times and days users set on the summary scheduler. This function enables us to discern patterns in users' summary automation practices, potentially hinting at their preferred timings for summary generation. In addition, to gather insights into users' customization preferences, we collect details related to user-created prompts, and the specific applications and notification details chosen for inclusion in the summary generation process. This data helps us understand user behaviors and preferences regarding summary customization.

2.2.3   Demographics. The application also collects anonymized demographic information, including birth year, gender, and country of residence. This data aids in identifying trends and usage patterns across different user demographics, providing insights into the broad applicability of our findings across a diverse range of user groups.

2.3   User Interviews

Supplementing the quantitative data collected from the application, we conducted informal interviews with three users who had been
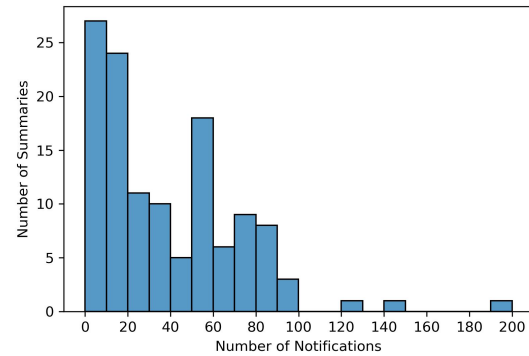

Figure 2: Number of Notifications in a Summary

using the NotiSummary application for at least a week. The qualitative approach aimed for a deeper insight into their experiences and perceptions of the app.

The interviews explored various facets of app usage, such as the typical timing of users' interactions with the app and the nature of these interactions. We also encouraged open-ended feedback, inviting interviewees to share suggestions for app improvements and potential features. The feedback serves as valuable resources for refining our notification summarization techniques and informing future notification system designs, ensuring they better align with user needs and expectations.

3   PRELIMINARY RESULTS

3.1   Quantitative Results

During the initial two-week period following the release of our app, a total of 32 users engaged with our application. The age of users spanned from 20 to 56 (M=30.16, SD=11.68), with 27 identifying themselves as male and 5 identifying themselves as female. Our app supports both Traditional Chinese and English, and currently, the majority of users (30) are located in Taiwan, with 1 in China and 1 in the United States. Out of the user base, we found that 8 users actively utilized our app for a duration exceeding 5 days, and 4 users utilized it for over 10 days. Over the course of our data collection, the user base triggered and received 124 summaries, summed up to a total of 4,740 notifications. Additionally, we accumulated a comprehensive set of app usage data, resulting in a log with 157,468 events recorded, capturing various user interactions and behaviors within the app.

Apart from the general figures, we looked into the number of present notifications and time of day, to get an idea of when users would summarize their notifications.

3.1.1   The Number of Notifications in a Summary. Figure 2 illustrates the number of notifications included in each completed summary. Each summary incorporated approximately 38.23 notifications on average (SD=33.08), with a median of 30. A significant tally of summaries incorporated fewer than 20 notifications, implying that users frequently generate summaries before their notifications significantly accumulate. Conversely, we observe another peak at
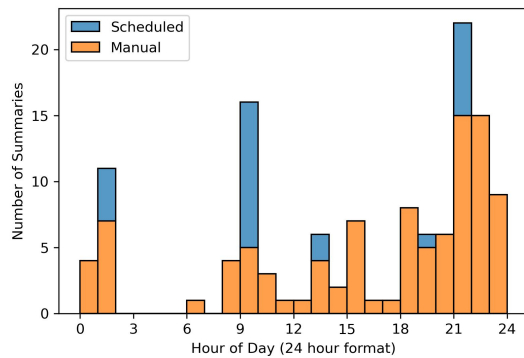
Figure 3: Timing Patterns in Notification Summarization

50 notifications, which may echo prior research suggesting that some users tend to pile up notifications before dismissing them [26]. The reasons behind these two peaks remain uncertain with the currently limited data, but they possibly represent two different user personas or use scenarios. Further qualitative interviews could provide a more thorough understanding of these distinct phenomena.

3.1.2 Notification Summarization Timing Pattern. We investigated the timing of summary generation and observed intriguing patterns, as depicted in Figure 3. Our findings show that users tended to generate summaries during the early morning (around 9 A.M.) and late at night. Among the 124 summaries, 99 were manually initiated, while 25 were scheduled for automatic generation. Most of the automated summaries were produced between 9 A.M. and 10 A.M., suggesting many of our participants prefer to receive such summaries during the morning. This tendency might align with users transitioning to their morning routines, which, according to Chang et al., 2023 [3], is a primary reason for users to check notifications.

3.2 Qualitative Feedback

Our interviews shed light on when interviewees typically preferred to consult the summary. Generally, the interviewees found the summary particularly beneficial when confronted with a sizeable number of notifications, as it facilitated swift identification and concentration on specific information types, thereby eliminating the need to peruse each notification individually. However, they did not find summaries valuable when only a few notifications were present. Yet, one interviewee mentioned a habit of skimming the summary every morning, regardless of the volume of accumulated notifications, particularly in preparation for work. This individual found the summary helpful for staying informed about any critical updates requiring attention, thus indicating that some users might prefer receiving their summary at a specific time, regardless of the volume of notifications.

When asked about how they perceived and utilized the generated summaries, the interviewees pointed out that they primarily used summaries as reminders to stay informed about tasks requiring

their attention. They mentioned that grasping the gist of notifications—such as identifying the sender—was often sufficient, implying that detailed information was not always necessary. Interestingly, some interviewees chose to inspect the full notification after viewing the summary, whereas others immediately undertook the task mentioned in the summary.

In addition to understanding how and when users utilize notification summarization, interviewees provided insightful feedback regarding how they envision such a system could optimally serve their needs. While our current system allows users to set a specific time for summary delivery, one interviewee emphasized the convenience of scheduling summaries at regular intervals. If implemented, this feature could enable users to continually access up-to-date summaries and regularly keep abreast of their latest notifications within our application. Additionally, another interviewee proposed that it would be highly advantageous to have a summary automatically generated when the number of notifications hits a certain threshold. Moreover, all interviewees accentuated the importance of having the summary displayed at the top of the notification drawer, thus eliminating the need to open the app to view the summary. By integrating these invaluable user insights, we can guide future enhancements and feature additions to our application, further personalizing the experience to meet their needs.

4 CONCLUSION AND FUTURE WORK

The issue of dealing with excessive smartphone notifications can often result in information overload. Recognizing the increasing significance of large language models and previous research on document summarization, we developed an application to distill notifications into summaries. We studied user behaviors and preferences regarding how they use notification summaries through app usage data and qualitative feedback. Our initial findings, gathered from a small group of users and reinforced by their qualitative feedback, highlighted the utility of summaries in accessing information efficiently. However, these findings also pointed to areas for improvement, indicating that our application is in its early stage of development and needs further refinement.

In our future work, we aim to obtain more insights from a larger audience and gain more profound user experience feedback about the app. This approach will help us investigate how users alter prompts, use customization features, and form expectations about what a notification summary should encompass. We are optimistic that these steps will enhance our application's ability to cater to diverse user needs.

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