

Hci mini proj 2 - Saichandu Juluri

Design Justification document:

Design idea:

My Chrome extension provides a summary of selected text from any webpage. Users can also generate a personalized speech and text version of the summary by entering a custom prompt.

By entering specific instructions or preferences, users can tailor the output to better meet their needs. It helps them to **Adjust the Tone, Change the Level of Detail, and Focus on Specific information**

Design Justification and Problem Statement

The original study by [1] was later interpreted by [2, p-3] to indicate that “students with learning disabilities are the highest group of students (approximately 35%) receiving special education services, it is important to understand how assistive technologies support their learning needs” [2]. ADHD (Attention-deficit/hyperactivity disorder) is a “neurodevelopmental disorder that affects individuals’ ability to focus, control impulsive behavior, and manage their hyperactivity” as mentioned in [3] taken reference from [4]. Students with ADHD are more likely to suffer from academic dysfunction and tend to have lower grades [5]. As mentioned in [3], which is taken reference from [6], “Studies have shown that compared to their peers, students with ADHD score significantly lower on reading comprehension tests”.

One of the skills that is important for academic performance is reading comprehension. My tool will help students to improve their reading comprehension by simplifying the text they want to read. By simplifying text, the content can be understood better by the user, addressing their specific needs.

Additionally, my tool has a Text-to-Speech (TTS) feature. “TTS software can contribute to students’ improved reading abilities, including comprehension, reading speed, and fluency. This added functionality ensures that the tool caters to different learning preferences and enhances accessibility” [2, p-9].

Overall, my tool aims to improve learning abilities, such as reading comprehension, by simplifying text and incorporating TTS to support students with learning disabilities like ADHD.

In the meeting with the guest speaker from Envisioning Access, they discussed the need for assistive technology that can explain or summarize selected sections of a webpage. Based on this feedback and the scientific evidence on the benefits of summarization as discussed above, I have designed an extension that provides similar assistance, offering summarized content to help users better understand information from webpages.

Target Population and Accessibility Needs

My tool is designed to support users with cognitive disabilities, such as ADHD, who want to improve their reading comprehension. All three ADHD subtypes—predominantly inattentive ADHD (formerly known as ADD), predominantly hyperactive-impulsive ADHD, and combined ADHD—experience difficulty understanding large amounts of information [7][8]. This user group faces unique challenges like paying less attention to detail, Avoiding tasks that require prolonged mental effort, and Losing important items. And my tool aims to simplify and summarize content to cater to their needs. It helps them to reduce the complexity of information consumed on a webpage by simplifying the selected content. This way, they can pay attention to only less information.

Envisioning Access is seeking an assistive tool to help users summarize content and better understand selected parts of webpages. My tool addresses this need by simplifying complex information, making it easier to understand and explain.

Addressing Gaps in Scientific Literature and Existing Tools

In a study for Designing an Online Infrastructure for Collecting AI Data From People With Disabilities, the reflections of 5 participants is as follows:

They viewed the “failure to have been caused by their misuse rather than by the AI system’s shortcomings (n=5). This made them think that there is little to be done to improve AI applications; “I’m not going to fault [the AI application] because I mean, everyone’s handwriting is so different. So I don’t think there’s too much to be improved (P13)””[9, p-57].

So my AI tool will solve this issue by only having minimal features and easy-to-use UI and also personalized to each user accordingly.

“Marvista—a human-AI collaborative tool that employs a suite of natural language processing models to provide end-to-end support for reading online news articles provided users to focus on only specific content. During reading, Marvista helps the user reflect on their understanding of each paragraph with AI-generated questions. After reading, Marvista generates an explainable human-AI summary that combines AI’s processing of the text, the user’s reading behavior, and user-generated data in the reading process. Their explanation of summary feature is missed by Quite a few participants because it was not enabled by default and required a reader to check a box”[10].

So my UI enables users to perform summarization of text only if they have filled in all the required details. Additionally, it is designed to be easy to understand by looking at the UI.

Guest from Envisioning Access mentioned that they do not have any knowledge if such solutions exist in the market, and if they do, some applications are not accessible for a handicapped person using a single hand. So my application is designed to be accessible by handicapped users with a single hand.

Potential Harms, Biases, and Mitigation Strategies

As mentioned by research in Marvista[10], “the occasional inaccuracy of the model in capturing the gist of the article, which is a known issue in most summarization models,” we can also observe occasional inaccuracies in the summaries generated by my model. Users with ADHD may find it hard to remember what they have learned from the summaries due to the unavailability of a history of their searches. This contrasts with people without ADHD, who may find it easier to retain information. According to research on ADHD and Knowledge Work, two consistent challenges reported by participants with ADHD are staying focused on tasks and effectively prioritizing multiple tasks [11]. This lack of history, while ensuring privacy, might inadvertently bias the tool against individuals with ADHD.

Furthermore, my tool is biased toward users who meet specific conditions: they must use desktop devices, have Chrome installed, and possess subscriptions to LLMs and TTS models for extensive use. This restricts accessibility for users without these resources. Language bias is another concern: “MLLMs heavily rely on multilingual corpora to enhance their performance. For example, among the training corpus of ChatGPT, the English corpus accounts for 92.099%, and the Chinese only accounts for 0.16%” [12]. Consequently, the model exhibits a bias toward English and may not generate accurate summaries for other languages.

Strategies for Mitigation:

Inclusiveness:

My tool is inclusive because it can be used by people with or without disabilities, helping with their reading comprehension. To ensure confidentiality and anonymity, we are not collecting any data from users. The tool requires API keys for LLM and TTS, which are stored only in the user's browser. Additionally, avoiding the storage of user history prevents stereotyping and allows the model to approach every request freshly.

Testing:

To address potential biases, I plan to directly involve individuals with ADHD in testing the tool for discrepancies. According to research, “methodologically, we see an implication for future research in directly including people with ADHD in research about ADHD. Instead of talking about individuals (and inherently conceptualising them as not worth talking with), actively involving them is the basis for respectful and appreciative partnerships” [13]. This approach ensures that feedback from affected users directly informs improvements to the tool.

Algorithm Adjustments:

Because of the lack of historical content, the model may hallucinate. “Hallucinations and factual inconsistencies in the generated text remain an open research problem” [10]. To mitigate this, I allow users to input more context to refine their summaries. If users are dissatisfied with the output, they can use a feedback button, enabling LLMs to improve via fine-tuning for future requests. This method aligns with recent approaches discussed by a Meta guest lecturer on red teaming.

As mentioned in Marvista, “To achieve a more comprehensive explanation, our future work will explore and incorporate other types of explanations, e.g., computing a saliency score of each paragraph (or even sentence) to reflect the actual process of how they are weightedly combined to formulate the summary” [10]. Similarly, my future work will aim to adopt this methodology to improve summarization quality.

References:

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