

Human Computer Interaction (HCI): Content Summarization Tools

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Abstract— This project explores various Natural Language Processing (NLP) techniques for document summarization, focusing on both extractive and abstractive methods. Extractive summarization selects key sentences directly from the original text, while abstractive summarization generates new sentences to convey the essential meaning of the content. The study emphasizes user feedback on summary quality, relevance, and customization options to better understand how these methods perform in real-world contexts. Surveys and interviews are conducted to gather insights on user satisfaction, particularly regarding the clarity, accuracy, and personalization of the summaries. By incorporating customization features, the system aims to tailor summaries to individual preferences, making the content more accessible and relevant. The project's findings will help identify which summarization method serves as the most effective Human-Computer Interaction (HCI) tool, optimizing user engagement by providing concise, relevant, and user-specific summaries.

Keywords— Human computer interaction, hci, ChatGPT, NLP, machine learning, gemini, copilot, HCI.

I. INTRODUCTION

In today's hyper-connected world, individuals are constantly exposed to an overwhelming amount of digital information across various platforms. From news articles and academic papers to social media updates and emails, the sheer volume of content that users encounter on a daily basis can be both empowering and exhausting. While this access to information provides people with the tools to stay informed and make decisions, it often leads to cognitive overload, reducing productivity and making it difficult to filter out what is truly important. As a result, the need for more efficient methods of consuming and processing information has become more urgent than ever.

Automated content summarization has emerged as a powerful solution to this challenge, offering users the ability to quickly grasp the essential points of large volumes of content without needing to engage with every detail. By condensing textual or multimedia data, summarization tools extract the most relevant information, allowing individuals to focus on the core message. This process not only saves time but also reduces mental fatigue, enabling users to make faster and more confident decisions. As the demands for efficiency and quick

access to information grow, automated summarization has proven to be an invaluable asset in both personal and professional contexts.

The benefits of automated content summarization extend far beyond mere convenience. In today's digital age, content consumption is not limited to specific formats or platforms—individuals are expected to navigate diverse content forms, from lengthy reports and academic studies to real-time social media feeds and casual emails. Automated summarization tools can help streamline this process by tailoring summaries to individual preferences, delivering personalized insights that are more relevant to the user's needs. This customization makes information more accessible and manageable, especially for users who are short on time or need to sift through large amounts of data quickly.

Moreover, automated summarization plays a critical role in improving the accessibility of information for individuals with disabilities. For people with visual impairments, cognitive challenges, or other barriers to content consumption, having access to clear, concise summaries can significantly enhance their interaction with digital content. This aligns closely with the broader goals of Human-Computer Interaction (HCI), which aims to create inclusive and user-friendly interfaces that cater to a wide range of user needs. Summarization tools can help bridge gaps in accessibility by providing an efficient way for all users, regardless of ability, to engage with content meaningfully.

II. PROBLEM STATEMENT

As Human-Computer Interaction continues to evolve, automated content summarization is expected to play an increasingly central role in shaping how users interact with digital systems. By reducing cognitive overload and simplifying the consumption of vast amounts of information, these tools help create a more seamless interaction between users and digital content. This paper will be structured as follows: The literature review section will provide an overview of automated summarization techniques, discussing both extractive and abstractive methods. The methodology section will examine the accessibility benefits of summarization tools for individuals with disabilities, emphasizing their role in inclusive design. Ultimately, automated summarization stands as a vital tool for enhancing user experience in the digital age.

III. LITERATURE REVIEW

Human-Computer Interaction (HCI) is a multidisciplinary field focused on improving how people interact with computers by making systems more user-friendly. Originally aimed at trained users, HCI now targets a wider audience, emphasizing intuitive design, mental models, and emotional intelligence in interfaces. Key approaches include anthropomorphic, cognitive, and predictive models, supported by low- and high-fidelity prototyping for iterative testing. While early research focused on younger, tech-savvy users, HCI now considers diverse groups, like older adults, to enhance accessibility. This field is set to play a vital role in advancing human-centered AI, enabling smoother human-computer interactions.[1]

The authors in [2] explore human-automation interaction, focusing on automated tools like robots, drones, and chatbots used by everyday users. By analyzing 50 years of studies from the International Journal of Human-Computer Studies (IJHCS), it identifies key trends in this area, including task allocation, trust, and attention management, as well as newer issues like interdisciplinary approaches, regulation, explainability, and ethics. Though rich in historical and theoretical insights, the study lacks specific case studies or empirical data, limiting its direct application to current challenges in human-automation interaction.

"Review of Automatic Text Summarization Techniques & Methods" by Adhika Pramita Widyassari and colleagues evaluates ChatGPT's performance in sentiment analysis and text summarization through face and criterion validity testing. The study finds ChatGPT effective for HCI research due to its efficiency, consistency, scalability, and cost-effectiveness, with reliable sentiment analysis and summarization capabilities. However, limitations include its reliance on training data, contextual challenges, risk of over-reliance, and ethical and privacy concerns.[3]

Automated Machine Learning (AutoML) aims to make ML accessible to non-experts, highlighting the importance of human-computer interaction (HCI) across ML workflows, from development to deployment. Initially focused on model selection and hyperparameter tuning, AutoML now covers all ML stages, emphasizing user-friendly UIs, transparency, and explainability to build user trust, especially in high-stakes fields like healthcare. Addressing fairness and bias remains essential, underscoring the need for human oversight. As AutoML becomes more autonomous, future research will need to rethink human roles, especially in dynamic environments, to maintain effective and trustworthy systems.[4]

Research on human-AI interaction in text summarization addresses the challenges of managing vast information and balancing human and AI strengths. Cheng et al. (2022) reviewed 70 studies to establish a taxonomy of human-AI interactions, identifying five types: guiding model output, selecting/rating output, post-editing, interactive editing, and writing with AI assistance. These types differ in human control level and interaction dynamics, with user-centered factors like efficiency, control, and trust being crucial in tool design. Emphasizing iterative refinement and user control, this study highlights the value of human-centered approaches for effective and trusted AI summarization tools.[5]

The integration of deep learning has greatly advanced Human-Computer Interaction (HCI), moving beyond traditional tools like keyboards to natural methods such as

gesture and speech recognition. Models like CNNs and LSTMs have improved the accuracy of these interactions, enabling applications in virtual assistants and robotics. Multimodal interaction, combining multiple input types, enhances intuitiveness, though challenges remain in making systems robust in complex environments. Despite these issues, deep learning continues to drive innovation in HCI across various industries.[6]

Human-Computer Interaction (HCI) has evolved from computer science origins to a multidisciplinary field involving psychology, design, and ergonomics. Moving beyond command-based systems, HCI now includes GUIs, voice interfaces, and multimodal designs. Modern advancements focus on intelligent, adaptive systems that personalize experiences and provide real-time feedback. Emerging fields like ambient intelligence and pervasive computing highlight HCI's role in seamlessly integrating technology into daily life, making it more accessible and user-centered.[7]

"Using ChatGPT for Human-Computer Interaction Research: A Primer," Wilbert Tabone and Joost de Winter review automatic text summarization, comparing extractive and abstractive methods. Through a systematic literature review, they highlight a trend towards abstractive summarization despite its challenges, along with advancements in extractive methods. Key issues include the difficulty of evaluation metrics, dependence on quality data, and scalability in real-time use. The paper also discusses limitations like bias, domain generalization, coherence, and human-like understanding, offering recommendations to address these challenges in future research.[8]

The authors in [9] highlight advancements in NLP through machine learning algorithms and their impact on Human-Computer Interaction (HCI), focusing on improved communication between humans and machines. It reviews key algorithms like HMMs, CRFs, RNNs, LSTMs, CNNs, and Transformers, and their roles in tasks such as speech recognition, sentiment analysis, and translation, which enhance HCI applications like virtual assistants. Challenges include the need for high-quality data, multilingual model development, and fairness and interpretability. The paper suggests future research to address these challenges for more robust and interpretable HCI models.

Software maintenance, especially code comprehension, is a crucial and often time-consuming part of development, with code comments playing an essential role. While the quality of comments varies, recent Transformer-based models like CodeBERT, CodeT5, and Codex have improved automated comment generation. The COMCAT system builds on these models by integrating human feedback to produce inline comments tailored to developer needs. Human evaluations show COMCAT outperforms both manual and model-generated comments, emphasizing the value of human insights in automated documentation. Future directions include expanding COMCAT to other languages and enhancing its human-guided approach.[10]

TABLE I. SUMMARY OF LITERATURE REVIEW

Ref No.	Focus Area	Key Findings	Challenges Identified
[1]	HCI research explores mental models, analyses trends, and identifies outdated methods	HCI is crucial for user-friendly interfaces and AI advancement	HCI research often focuses on younger, tech-savvy participants.
[2]	IJHCS explores past developments and future trends in human-automation interaction	IJHCS highlights ongoing trends and emerging themes in human-automation interaction	The IJHCS offers a theoretical foundation but may benefit from more case studies.
[3]	The evaluation assesses ChatGPT's capabilities for HCI research	Reliable sentiment analysis, effective summarization, and validated outputs	Dependent on training data, risks misinterpretation, lacks deep insight and adaptability.
[4]	Understand HCI during the development, deployment, and maintenance of AutoML	Identifying key directions for improving interactions in this emerging field	Lacks detailed implementation of HCI mechanisms, focusing more on theoretical concepts.
[5]	Maps design opportunities and user needs for human-AI interaction in text summarization	Provides the first taxonomy of human-AI interactions for text generation	Formative and qualitative, focusing on existing interactions rather than introducing new ones.
[6]	Advances HCI, improves user experience, utilizes multiple input types	Automates complex tasks, offers personalized experiences	Dependent on large datasets, faces challenges with generalization across different tasks.
[7]	Analyzes the evolution of HCI, assesses usability and functionality	Demonstrates effective integration of emerging technologies	Primarily focused on quantitative analysis, which may overlook qualitative aspects of user experience.
[8]	Provides an overview of automatic text summarization, extractive and abstractive methods	Comprehensive overview, clarity in methodology, balanced analysis	Dependence on high-quality data, scalability challenges, bias in models.
[9]	Provides an overview of key ML algorithms in NLP and their impact on improving efficiency and accuracy	Facilitates intuitive, efficient communication between humans and machines	Challenges include obtaining high-quality annotated data, model complexity across languages.
[10]	Automates code comment generation, identifies optimal comment locations	Enhances LLMs to focus on relevant locations and comment types	Primarily focused on C/C++ code, which may limit applicability to other languages.

IV. METHODOLOGY

In our research, we conducted a detailed comparison of several leading AI-powered chat summarization tools, including Gemini, ChatGPT, and Copilot. We evaluated these platforms across a wide range of parameters to assess their capabilities, strengths, and weaknesses. By analyzing their performance on different metrics, we gained insights into how each tool excels in certain areas while facing limitations in others. This comparison provided a comprehensive understanding of their respective features and how they measure up against one another in the realm of chat summarization.

Google Gemini

Google Gemini has been positioned as a groundbreaking multimodal AI model. The model has the capability to seamlessly process and produce text, images, audio, and even code. Google Gemini's such versatility keeps this tool apart from the rest as it promises more adaptability and overall AI experience.

Microsoft Copilot

Heavily rooted in almost all Microsoft ecosystems, Copilot harnesses OpenAI's GPT-4 technology to offer intelligent inputs across a gamut of applications such as Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and even Outlook. The tool is built to enhance user productivity by integrating real-time suggestions and streamlining tasks.

OpenAI ChatGPT

The most popular in the LLM domain, OpenAI's ChatGPT has enjoyed widespread acclaim for its powerful conversational capability and capacity to produce human-like responses. The tool excels in enticing users with its unique conversation, accurate information, and creative art.

The (Table 2) mentions the model performance and key insights along with accuracy.

TABLE II. COMPARISON BETWEEN GOOGLE GEMINI, MICROSOFT COPILOT AND CHATGPT AND THE BEST TOOL FOR SPECIFIC FEATURE/ASPECT:

Feature/Aspect	Google Gemini	Microsoft Copilot	ChatGPT (by OpenAI)
Primary Use Case	Integrated AI in Google services (search, Workspace)	Integrated AI in Microsoft Office apps (Word, Excel)	General-purpose conversational AI
Platform Integration	Google Search, Workspace (Docs, Sheets, etc.)	Microsoft Office Suite (Word, Excel, PowerPoint, etc.)	Standalone; used in various platforms and applications
AI Capabilities	Search enhancements, document creation, summarization	Contextual assistance, automation in Office apps	Conversational, code generation, writing assistance
Natural Language Processing	Advanced NLP for search and document understanding	Tailored NLP for Office documents	Highly advanced NLP for general conversation and content creation
Availability	Integrated in Google services	Integrated in Microsoft 365	Available via OpenAI API, ChatGPT app, and other integrations
Customization	Limited customization	Office-specific customization	Highly customizable via API and user preferences
Learning Model	Trained with data from Google services	Leverages Microsoft's proprietary data and models	Trained on diverse datasets with reinforcement learning from OpenAI
Unique Features	AI-driven search results, Workspace document enhancements	Automates repetitive tasks in Office apps	Versatile content generation, broad knowledge base
Target Audience	Google users, businesses using Google Workspace	Microsoft Office users, businesses using Office 365	General users, developers, businesses
Pricing Model	Included in Google services (some may be premium)	Included with Microsoft 365 subscriptions	Free tier available; premium versions via subscription

Final Summary:

- Microsoft Copilot: Best for Office automation and deep productivity integration within Microsoft 365.
- ChatGPT: Best for versatility, customization, and availability,

- excelling in conversational AI and content creation.
- Google Gemini: Strong in Google Workspace, but limited compared to the broader applications of the other tools.

V. USER FEEDBACK

For our research we conducted a survey where we received 57 responses and the results are:

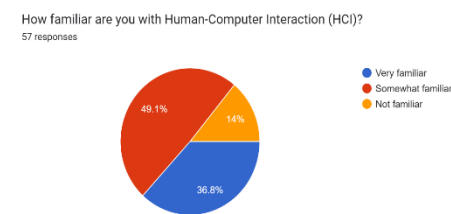


Figure 1: Familiarity with Human-Computer Interaction (HCI) among respondents.

This pie chart illustrates the level of familiarity with HCI among 57 respondents. Nearly half (49.1%) of the participants are somewhat familiar with HCI, while 36.8% report being very familiar. Only 14% indicate that they are not familiar with the subject. This distribution suggests that a majority have at least some knowledge or experience with HCI, which could influence their perspectives on related topics.

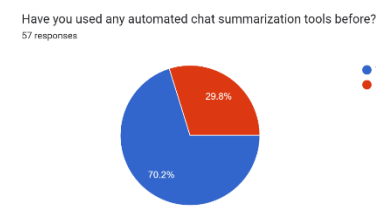


Figure 2: Usage of Automated Chat Summarization Tools among Respondents.

This pie chart shows that 70.2% of respondents have used automated chat summarization tools, while 29.8% have not. The majority's prior experience with these tools suggests that most respondents may have a foundational understanding of their functionality and benefits, potentially influencing their views on their effectiveness.

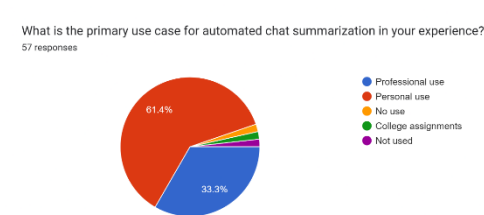


Figure 3: Primary Use Cases for Automated Chat Summarization.

This pie chart indicates that 61.4% of respondents primarily use automated chat summarization tools for personal purposes, while 33.3% use them professionally. Smaller segments use these tools for college assignments or have no use for them. The results highlight that personal and professional needs drive most use cases for chat summarization

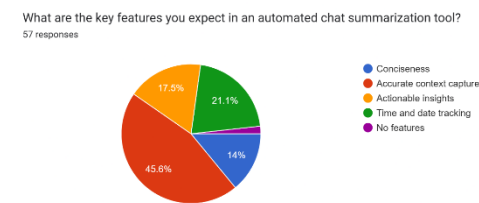


Figure 4: Key Features Expected in an Automated Chat Summarization Tool

Most respondents prioritize "Accurate context capture" (45.6%) in a chat summarization tool, followed by "Actionable insights" (21.1%) and "Time and date tracking" (17.5%). "Conciseness" is less emphasized, with few opting for no features.

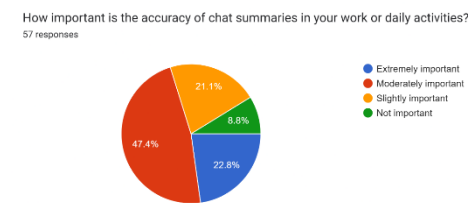


Figure 5: A Look at the Importance of Chat Summaries

survey results reveal a strong emphasis on accuracy in chat summaries. A significant majority (47.4%) consider accuracy moderately important, highlighting its role in daily activities and work. Furthermore, a substantial portion (21.1%) deems accuracy as extremely important, suggesting that precise summaries are crucial for decision-making and task completion. While these findings underscore the value of accurate chat summaries, the combined percentage of those who find accuracy "slightly important" (8.8%) or "not important" (22.8%) indicates an opportunity to improve summary accuracy to cater to a broader range of user needs and preferences.

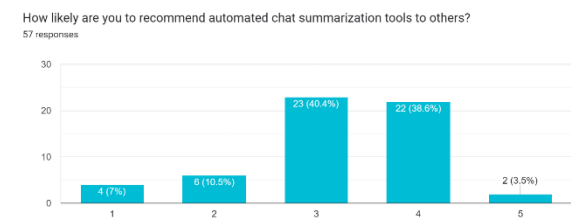


Figure 6: Enthusiasm for Automated Chat Summarization Tools

The survey results indicate a generally positive outlook on automated chat summarization tools. A substantial portion of respondents (40.4% and 38.6%) expressed their willingness to recommend these tools to others, highlighting their perceived value and effectiveness. However, a combined 21.2% remain neutral or unlikely to recommend, suggesting that there is room for improvement in terms of accuracy, user experience, and addressing specific concerns. Overall, the findings suggest a potential for widespread adoption of these tools, provided that ongoing efforts are made to enhance their capabilities and address user needs.

How satisfied are you with the current quality of chat summarization tools you've used?
57 responses

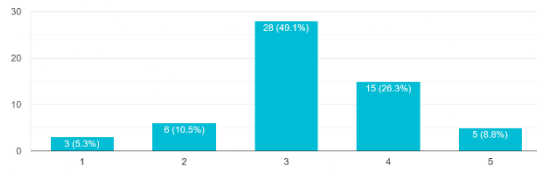


Figure 7: Mixed Satisfaction with Current Chat Summarization Tools

The survey results reveal a mixed sentiment regarding the current quality of chat summarization tools. While a significant portion of respondents (49.1%) expressed moderate satisfaction, a combined 24.6% are either dissatisfied or neutral. This indicates that there is room for improvement in terms of accuracy, comprehensiveness, and overall user experience. By addressing these areas of concern, developers and providers of chat summarization tools can enhance user satisfaction and foster wider adoption of these technologies.

What additional features or improvements would you like to see in future automated chat summarization tools?
57 responses

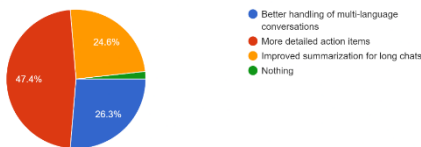


Figure 8: Desired Features and Improvements in Chat Summarization Tools

The survey results provide valuable insights into the desired features and improvements for future automated chat summarization tools. A strong emphasis was placed on better handling of multi-language conversations, reflecting the increasing global nature of communication. Additionally, respondents expressed a need for improved summarization capabilities for long chats, highlighting the challenge of condensing lengthy discussions into concise and informative summaries. While a smaller portion indicated they would like more detailed action items or no additional features, the overall feedback suggests a strong desire for more sophisticated and versatile chat summarization tools.

In what way do you think HCI principles can improve automated chat summarization?
57 responses

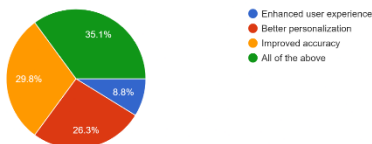


Figure 9: Prioritizing HCI Principles for Enhanced Chat Summarization

The survey results underscore the importance of applying HCI principles to enhance automated chat summarization. A significant majority of respondents (35.1%) prioritized enhanced user experience, emphasizing the need for intuitive and user-friendly interfaces. Furthermore, a combined 62.2% of respondents believed that HCI principles can positively impact multiple aspects of chat summarization, including personalization and accuracy. This broad consensus highlights the potential for HCI principles to significantly improve the overall quality and user satisfaction of chat summarization tools. However, the individual breakdowns suggest that there is still room for improvement in specific areas, indicating

that continued focus on applying HCI principles is essential to address these challenges and provide users with the best possible experience.

What is the biggest challenge you've faced when using automated chat summarization?
57 responses

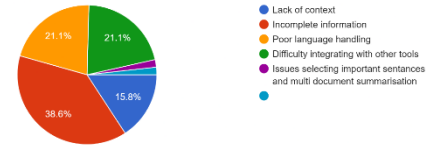


Figure 10: Top Challenges in Automated Chat Summarization

The survey results reveal several key challenges faced by users of automated chat summarization tools. The most prominent challenges include the lack of context, incomplete information, and poor language handling, each cited by 21.1% of respondents. These findings highlight the need for tools that can better understand the context of conversations, fill in missing information, and handle diverse linguistic styles effectively. Additionally, challenges such as difficulty integrating with other tools, issues with selecting important sentences, and multi-document summarization indicate a need for more comprehensive and versatile summarization solutions. Addressing these challenges is crucial for improving the accuracy, reliability, and overall user experience of automated chat summarization tools.

VI. CONCLUSION

Automated content summarization plays a critical role in managing the overwhelming digital information users encounter daily. These tools streamline content consumption, reduce cognitive overload, and enable faster decision-making by delivering concise, relevant insights. Whether in academic, professional, or personal contexts, automated summarization enhances efficiency and productivity, allowing users to focus on core content without unnecessary details. Customizable summaries further improve user experience by making information more accessible and personalized. In line with Human-Computer Interaction (HCI) goals, summarization also enhances accessibility, particularly for users with disabilities, by providing clear, concise information that improves content engagement. As summarization technologies evolve, they will remain integral to the digital landscape, improving how users interact with vast amounts of data. Comparing tools like Microsoft Copilot, ChatGPT, and Google Gemini reveals unique strengths: Microsoft Copilot excels in office automation within Microsoft 365, ChatGPT offers versatility and conversational AI for content creation, and Google Gemini integrates well with Google Workspace but is limited in broader applications. This comparison highlights the distinct benefits each tool provides based on user needs and contexts.

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