

Opportunities and threats of generative AI technology†

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... Abstract ...

In this essay, the opportunities, threats, and limitations of the AI chatbot ChatGPT were deeply explored. ChatGPT, which secured 1 million users within just 5 days of its release, was analyzed through a literature review approach based on existing literature and media reports. The concept of GPT, the role and functionality of ChatGPT as a chatbot, and the differences from traditional search engines were examined, along with the development process and technical achievements of ChatGPT. Additionally, predictions and future prospects for GPT-4, announced on March 14th this year, were also included.

General applications, industrial applications, and actual usage cases were investigated for ChatGPT, presenting real-life examples such as paper writing and coding. Despite rapid growth due to its diverse applications and innovative features, this essay highlights the technical, ethical, and legal limitations associated with the development and usage of ChatGPT. Ethical issues such as personal information protection, bias, and social impact were raised.

In conclusion, users are urged to be aware of potential risks and take necessary safety precautions while utilizing the positive features of ChatGPT responsibly. Moreover, it was made clear that it is crucial for researchers, developers, and policymakers to collaborate in establishing and continuously managing safe and ethical standards for AI chatbots.

Key Words : generative AI, ChatGPT, Ethical Implication, Responsible Usage

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I . Introduction

Generative AI technology has enabled machines to inventive activities that were once solely reserved for human beings, including crafting poetry, penning lyrics, composing music, and sketching. Although this technology brings immense possibilities, it simultaneously raises ethical and legal concerns that may influence organizations, society, and individuals in both favorable and unfavorable ways(Brown et al., 2020; Choi & Lee, 2021).

ChatGPT, an innovative generative AI model created by OpenAI, has significantly transformed the field of natural language processing due to its sophisticated abilities (Radford et al., 2021; Kim et al., 2021). The model's primary strength lies in its capacity to comprehend context and produce coherent, context-aware replies by undergoing extensive training on a large volume of textual data. ChatGPT has been successfully applied in various real-world applications, making it a valuable asset in our daily lives. One such application is the development of chatbots, which serve in customer service, technical support, and as virtual assistants(Haleem et al., 2023).

Nonetheless, there are limitations to ChatGPT, such as technical and language limitations, which can result in inaccuracies and misinterpretations. Additionally, there are concerns about copyright infringement, the potential for AI-generated content to bypass personal effort, and the ethical implications of

perpetuating stereotypes and biases(Hariri, 2023).

The development of ChatGPT has opened up new possibilities for the use of generative AI in various applications, including chatbots. However, along with its benefits, there are concerns regarding privacy, security, accountability, and ethical considerations(Lee & Park, 2022; Smith & Kim, 2021). This essay aims to discuss the potential opportunities, threats, and limitations associated with ChatGPT in the context of chatbot development, and proposes a multi-faceted approach to address these challenges.

II . Understanding ChatGPT

2.1 ChatGPT overview

ChatGPT is a generative AI model that contains a massive number of parameters, positioning it as a state-of-the-art AI(Brown et al., 2020; Wang et al., 2021). It is a Large Language Model that is capable of understanding context and generating consistent, context-sensitive responses. By training on vast amounts of text data, ChatGPT can identify subtle differences and patterns in human language, allowing it to produce grammatically correct and contextually appropriate text. When a user inputs text into ChatGPT, the model analyzes it and generates a probability distribution for all possible next words. The word with the highest probability is

<Table 1> Comparison of ChatGPT and search engines

Category	ChatGPT	Search engine
AI technology	Creating answers to user questions using language modeling, an artificial intelligence technology.	Provide information through keyword search.
Generative	Generating new information about user questions, providing more generative answers than traditional search engines.	Cannot generate new information.
Interaction	Effectively understand and answer questions through user-friendly interactions	No interaction with users as information is provided through keyword search
Query and context understanding	Natural language processing technology comprehends user inquiries, delivering tailored results based on user intent, and recalls prior questions to respond adaptively while taking their relevance into account.	Search engines provide information for each query independently through keyword searches, rather than understanding and answering user questions directly

Source : Hariri(2023); Kim(2023); Wang et al.,(2021)

selected as the next response word, and this process continues until the desired response length is achieved.

ChatGPT, with its generated and interactive nature, has unique characteristics that set it apart from keyword-centric search engines. This results in a distinctive approach to information retrieval and user engagement

(Hariri, 2023; Kim, 2023; Wang et al., 2021).

2.2. Brief history and development

The GPT series, first introduced by OpenAI with the launch of GPT-1 in 2018, has evolved through GPT-2, GPT-3, and most recently, GPT-4(Ahn, 2023; Smith & Kim, 2021; Brown

<Table 2> History of GPT

Platform	Year	characteristics	Number of Parameters
GPT-1	Jan 11, 2018	Introduced the transformer architecture for NLP tasks; unsupervised pre-training with a smaller dataset	117 million
GPT-2	Feb 14,2019	Improved capabilities; coherent and contextually relevant text generation; potential risks and ethical concerns highlighted	1.5 billion, 12.8 times of GPT-1
GPT-3	Mar 28,2022	Significantly scaled-up model; state-of-the-art results with minimal fine-tuning; few-shot learning demonstrated	175 billion, 117 times of GPT-2
GPT-4	Apr 14, 2023	training data could be 571 times larger than GPT-3(?)	100 trillion(?), roughly equgle to the human brain.

Source: Ahn (2023); Smith & Kim (2021); Brown et al. (2020); Radford et al. (2018).

et al., 2020; Radford et al., 2018). Each iteration has demonstrated significant improvements in model size, training data, and performance across a variety of language tasks. In 2022, OpenAI released ChatGPT, which is based on GPT-3.5 and comprises 175 billion parameters(Hariri, 2023; Kim Taewon, 2023). This model can generate text responses with remarkable accuracy and consistency, closely resembling human-like responses(OpenAI, 2023).

The popularity of ChatGPT was immense. Following its release on November 30, 2022, ChatGPT demonstrated various potential applications as mentioned earlier and attracted 1 million users within just 5 days. This rapid growth is remarkable when compared to the time it took major services like Netflix(3.5 years), Airbnb(2.5 years), and Facebook(10 months) to reach the same milestone. In contrast, GitHub Copilot, an AI service for code writing, took 6 months, and AI-generated

image creation platforms took approximately 2.5 months to achieve 1 million users(Statista, 2023).

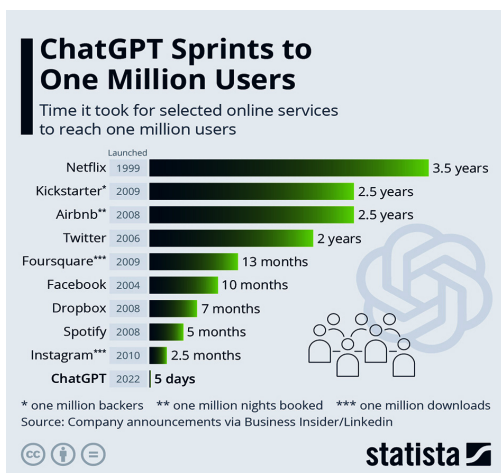
2.3 GPT-4

The GPT-4 Technical Report provides an overview of the characteristics of GPT-4, which was recently announced by OpenAI. The first sentence of the report introduces GPT-4 as follows:

GPT-4, a large multimodal model capable of processing image and text inputs and producing text outputs. Such models are an important area of study as they have the potential to be used in a wide range of applications, such as dialogue systems, text summarization, and machine translation. As such, they have been the subject of substantial interest and progress in recent years.

2.3.1 GPT-4's enhanced ability to comprehend

According to OpenAI, GPT-4's notable new capability is its ease in comprehending complex and intricate prompts. This assertion was substantiated by subjecting GPT-4 to several standardized tests and human-level exams, including the SAT, BAR, and GRE, without any specialized training. GPT-4 exhibited not only consistent high performance in these assessments but also outperformed its predecessor, GPT-3.5, in all of them.



<Figure 1> Days to 1 million users

2.3.2 Multimodal capabilities

Unlike the previous version of ChatGPT, which was limited to text prompts, GPT-4 can handle both text and image prompts due to its multimodal capabilities. Multimodal capabilities refer to the ability of AI systems to process and integrate multiple types of data or information from different modalities, such as text, images, audio, and video. By combining information from various sources, these AI models can deliver more comprehensive and contextually relevant outputs, leading to enhanced user experiences and more efficient problem-solving.

2.3.3 Improved steerability

GPT-4 can now be directed with greater precision, making it more dependable for use in applications that require specific character portrayal. Moreover, GPT-4 has been improved to mitigate the risk of potential issues that might cause deviations from the character's portrayal in such applications.

2.3.4 Safety enhancement

After six months of improving the safety and alignment of GPT-4, it is now 82% less likely to generate inappropriate or prohibited content, 29% more likely to comply with OpenAI's guidelines for sensitive requests, and 40% more likely to generate factual responses compared to GPT-3.5.

2.3.5 Performance boost

OpenAI not only evaluated GPT-4's performance on human exams but also tested it using conventional benchmarks designed for machine learning models. The assertion is that GPT-4 surpasses other existing language models and the most advanced models by a significant margin.

2.4 Generative artificial intelligence service

In the wake of ChatGPT's release, the attention and utilization of generative artificial intelligence have notably increased. As a result, Google Meta introduced its generative AI service that same year, while companies such as Naver and Kakao have finished developing their own generative AI systems and are gearing up for commercial launch, or are working to improve their current offerings (NIA, 2023; Ahn et al., 2023).

AI technologies, including ChatGPT, have become increasingly popular among the general public, causing a shift from being exclusive to researchers and businesses. As a result, many companies are creating new business models based on these technologies, taking advantage of their advanced capabilities in natural language processing to develop chatbots, virtual assistants, language translation tools, and other applications that provide more natural and engaging conversations with users.

III. Application of ChatGPT

3.1 Primary applications

ChatGPT serves various purposes in the realm of natural language processing, such as text summarization, which transforms extensive text into brief, coherent summaries; machine translation, allowing for the conversion of text across languages; sentiment analysis, detecting and categorizing emotions and opinions within text; question-answering, offering contextually accurate responses to user inquiries; text completion, creating meaningful and appropriate extensions of input text; and conversational AI, promoting natural and human-like interactions between AI and users (Kim et al., 2021; Brown et al., 2020).

3.2 Industrial applications

Generative AI models, such as ChatGPT, are transforming various industries by significantly reducing costs and time in multiple domains. For instance, they expedite drug discovery processes by predicting molecular properties and simulating interactions with potential drug targets (Stokes et al., 2020). In material science, these models enable targeted property engineering by predicting material properties and suggesting optimal material compositions (Zhang et al., 2020). Furthermore, they shorten product development cycles in chip design by automating layout generation and optimizing designs for improved performance (Mirhoseini et al., 2021).

Wanted, a job search platform in South

<Table 3> Generative AI service(use cases)

Company	Generative AI	Release Date	Additional Information
OpenAI	ChatGPT	2022	
Microsoft	Prometheus	2023	Exclusive license for ChatGPT through investment in OpenAI
Google	Bard	2023	
Meta	LLaM(Large Language Model)	2023	Meta AI
Naver	HyperCLOVA X	July 2023	Preparing 'SearchGPT' project, a fusion between Naver search and HyperCLOVA
Kakao	KoGPT (based on GPT-3)	2021	
SK Telecom	A.Dot(based on GPT-3)	2022	Future enhancements to include multimodal service provision
LG	EXAONE(EXpert Ai for everyONE)	2021	Applied to various sectors like IT, finance, healthcare, manufacturing, and telecommunications
KT	MI:DEUM	First half of 2023	

Source: Ahn (2023)

<Table 4> ChatGPT primary applications

Category	Applications
Text Summarization	Condensing lengthy text into shorter, coherent summaries
Machine Translation	Translating text from one language to another
Sentiment Analysis	Identifying and categorizing opinions and emotions in text
Question-Answering	Providing accurate responses to user queries based on contextual understanding
Text Completion	Generating coherent and relevant continuations of input text
Conversational AI	Enabling natural and human-like interactions between AI and users

Source: Kim et al.,(2021); Brown et al.,(2020)

Korea, is using AI to provide personalized job recommendations to job seekers. Additionally, they have introduced an 'AI interview coaching' service based on GPT-3. With this service, users can input a job posting link, and the AI generates a list of anticipated interview questions while offering feedback on the user's answers(Wanted, 2023).

Upstage, a South Korean AI startup, has recently introduced a new chatbot called

'AskUp' that leverages ChatGPT and optical character recognition(OCR) technology. According to Upstage's homepage, their OCR technology can precisely recognize characters, enabling AskUp to read text in images. This chatbot can recognize text in document images and perform various tasks such as text conversion, summarization, and classification. By merging OCR technology with ChatGPT, AskUp can offer a novel solution that

<Table 5> ChatGPT industrial applications

Business Area	ChatGPT cases
Customer service	<ul style="list-style-type: none"> • Automation of customer support and inquiry handling • Utilization of AI technologies such as chatbots • Improvement of customer service
Marketing & sales	<ul style="list-style-type: none"> • Creation of product and brand names • Automatic generation of advertisements and contents • Analysis of social media and trend identification • Automatic creation of documents such as product manuals and quotations • Development of marketing strategies and improvement of sales efficiency through the utilization of AI technologies
Research and Development	<ul style="list-style-type: none"> • Resolution of technical problems such as natural language processing and image recognition • Efficient execution of research and development
Automated Employee Education	<ul style="list-style-type: none"> • Creation of learning models • Provision of automated employee education programs • Enhancement of employee skills and work performance

Source: Mirhoseini et al.,(2021); Stokes et al.,(2020); Zhang et al.,(2020)

streamlines time-consuming tasks and enhances user experience. This innovation has the potential to revolutionize multiple industries, such as finance, healthcare, and legal services (AskUp, 2023).

ChatGPT's advanced language processing and data analytics capabilities can optimize data analysis and decision-making processes, enabling businesses to gain insights from large volumes of data quickly and accurately.

3.3 Application use cases

3.3.1 Research writing

By entering "ChatGPT" in the search field of Google Scholar, we can discover the total quantity of papers related to ChatGPT. As of April 23, 2023, there are 9,330 papers registered, and the number is steadily

increasing (Googlescholar, 2023). ChatGPT is already being used for writing scientific papers in various fields. By utilizing ChatGPT for research design, tasks such as abstract summarization, creative research title suggestions, experimental result discussions, table of contents composition, future research idea recommendations, topic-specific article writing, grammar correction, and translation can be performed, covering various stages of research writing.

On December 12, 2022, a paper co-authored by ChatGPT was published on MedRxiv, a preprint platform for medical research (Kung et al, 2022). Additionally, on December 16, 2022, Professor Siobhan O'Connor from the Department of Nursing at the University of Manchester, UK, listed ChatGPT as a co-corresponding author in an international journal publication. However, in the published

<Table 6> Example: thesis writing using ChatGPT

Dialogue 1: Please explain ChatGPT in the form of a thesis using the easiest words.

- Title: ChatGPT: A Simple Explanation of an AI Language Model
- Abstract: ChatGPT is a computer program ...
- Introduction: ChatGPT is a powerful AI tool...
- How ChatGPT Works: ChatGPT learns ...
- Benefits of ChatGPT: ChatGPT has many potential uses,
- Limitations of ChatGPT: Despite its abilities, ...
- Conclusion: ChatGPT is an impressive AI language model ...

Dialogue2: Explain it again in the form of an essay, not the form of a thesis.

- ChatGPT is an artificial intelligence(AI) language model ...
- At its core, ChatGPT belongs to a family of AI models called Generative Pre-trained Transformers (GPT). ...
- The potential uses of ChatGPT ...
- However, it is important to acknowledge the limitations of ChatGPT. ...
- In conclusion, ChatGPT is an ...

Dialogue3: good job. Now summarize in one paragraph

- ChatGPT is an AI language model that can generate human-like text by ...

paper by Kung et al. (2023), ChatGPT was not listed as an author. And, O'Connor corrected the completed thesis by acknowledging the helpful contribution of the second author to the writing of the paper, even though their name was removed (O'Connor, 2023).

ChatGPT has provided an introductory article about himself, explaining that he is a language model created by OpenAI to deliver human-like responses to a wide range of questions. While the article is not a comprehensive overview, it provides a good summary of the model's capabilities. Certain parts of the original text have been abbreviated with ellipses (...) due to space constraints in this conversation.

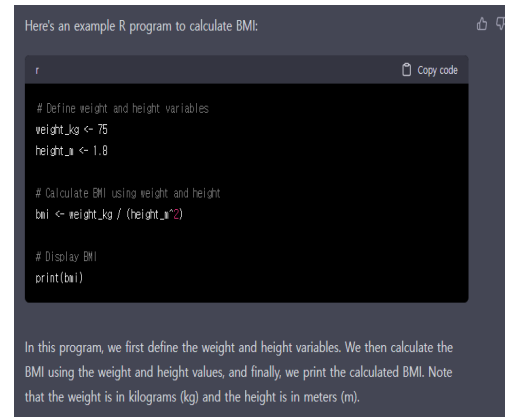
As seen in the conversation above, ChatGPT is built to recall and comprehend the context of past discussions, enabling it to adjust and react to the user's evolving requirements or themes. This results in a more captivating and interactive communication experience.

3.3.2 Coding

Using ChatGPT in programming means taking advantage of its language understanding skills to communicate with or guide the AI in doing particular jobs. Developers can add ChatGPT to apps like chatbots, content creation tools, or coding helpers by using the available API. When they send questions or suggestions to ChatGPT, it examines the input and creates fitting replies or directions, making it easy to interact and help with many tasks like making

code, fixing errors, or giving advice on coding ideas.

The following is the result of "Write a program to calculate BMI in R," displaying the calculated BMI (Body Mass Index) value.



```

Here's an example R program to calculate BMI:

r
# Define weight and height variables
weight_kg <- 75
height_m <- 1.8

# Calculate BMI using weight and height
bmi <- weight_kg / (height_m^2)

# Display BMI
print(bmi)

In this program, we first define the weight and height variables. We then calculate the BMI using the weight and height values, and finally, we print the calculated BMI. Note that the weight is in kilograms (kg) and the height is in meters (m).
  
```

<Figure 2> Programming using ChatGPT

3.3.3 Language translation and correction

ChatGPT goes beyond regular translation tools by not just offering translations, but also clarifying corrections and grammar mistakes. This makes it a helpful resource for learning foreign languages, such as English, and enhancing language education.

Let's try creating a basic sentence and translating it. Start by writing the sentence in Korean, then ask for a translation into the preferred language, and lastly request a summary as part of a back-and-forth conversation. ChatGPT has commercial applications in education, as seen with Spict Labs, an edtech startup making waves in the industry with their English conversation app,

Speak. The app uses a custom-built speech recognition AI engine to identify users' spoken English sentences, assisting them in practicing conversations. Recently, they introduced an 'AI tutor' feature by integrating GPT-4 into the app, further enhancing its capabilities.

3.3.4 Content generation

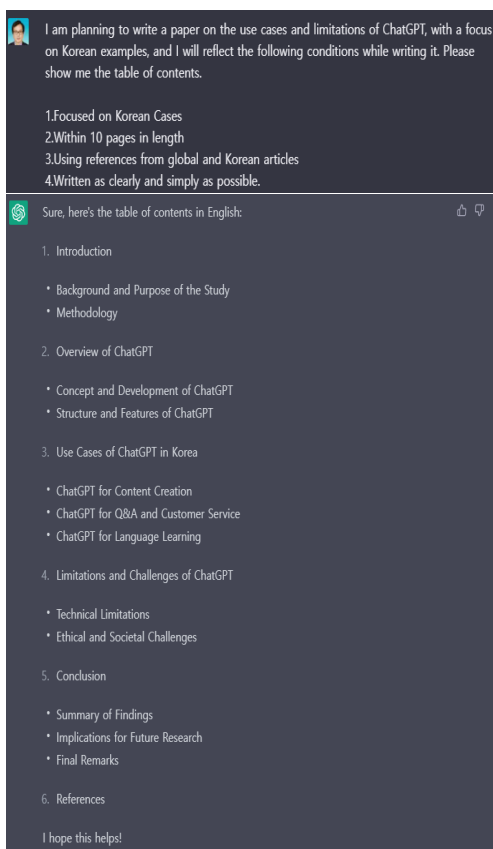
ChatGPT's impressive language skills enable it to create diverse and inventive content beyond just answering questions. Using its

strong algorithms and extensive knowledge, ChatGPT can craft engaging movie plots, fascinating novels, heartfelt song lyrics, informative brochures, compelling ad scripts, insightful financial reports, thorough contracts, persuasive proposals, and well-rounded lecture materials, along with various other content types.

The AI created an english table of contents, featuring an introduction, ChatGPT overview, Korean use cases, limitations and challenges, conclusion, and references. When the user types 'continue,' ChatGPT will generate sentences in sequence, starting with the paper's introduction. Additionally, it can compose lyrics or poetry. For instance, if you ask for "lyrics in the style of a watercolor painting on a rainy day," it will produce the desired lyrics.

ChatGPT's versatility allows it to be used in countless ways, depending on the questions posed, and it excels at creative tasks and content generation beyond the mentioned use cases. Examples include:

- Engaging in conversations with someone feeling down, offering dating advice, suggesting gift ideas, or devising workout plans,
- Recommending podcast guests, listing job interview questions,
- Automatically posting comments on food blogs,
- Simplifying complex concepts (e.g., explaining quantum physics to a young student)



<Figure 3> Thesis writing example using ChatGPT

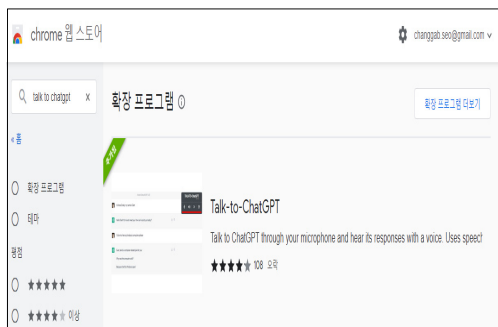
3.3.5. Chrome web store

With ChatGPT's rising popularity, the Chrome Web Store is experiencing an increase in related extensions. These extensions provide various functions, such as summarizing YouTube videos, real-time translation, email writing support, speech recognition, and numerous other diverse features.



<Figure 4> Auto Translation Extension Program

For example, the WebChatGPT extension shows extra web results related to the ChatGPT prompt. With Prompt Genie, users can type text in Korean, translate it to English for ChatGPT, and receive ChatGPT's real-time responses translated back into Korean.



<Figure 5> Talk-to-ChatGPT Extension Program

The Talk-to-ChatGPT extension enables users to communicate with ChatGPT using their microphone and listen to its responses via voice, employing speech recognition and text-to-speech technologies.

IV. Limitations and challenges of ChatGPT

In a 61-page paper featuring 71 co-authors, including Yogesh, the potential advantages and drawbacks of ChatGPT are explored. While the authors appreciate the technology's capacity to boost productivity across various industries and business activities, they also note its limitations, such as privacy and security issues, disruptions to established practices, and potential biases, misuse, and misinformation. The paper highlights three research themes: knowledge, transparency, and ethics; digital transformation of organizations and societies; and education, learning, and academic research. Studies should focus on pinpointing necessary skills and resources for working with generative AI, examining biases in training data, determining the best human-AI combinations for different tasks, evaluating generated text accuracy, and comprehending ethical and legal concerns in various contexts. Opinions on whether to restrict or regulate ChatGPT's usage also differ. This section delves into the limitations and future tasks, synthesizing research papers like Yogesh et al. (2023), related reports, and online resources.

4.1 Limitations

4.1.1 Technical and language limitations

ChatGPT encounters some limitations, including the inability to accurately predict recent election winners, as its training data extends only until 2021. Furthermore, it might have difficulty grasping subtleties in regional dialects or slang, which could lead to misunderstandings or biases in its responses.

4.1.2 Ethical and legal limitations

Issues related to ChatGPT involve the possibility of creating text that violates copyright, resulting in content ownership disputes. Additionally, AI usage in research can blur the distinction between human and machine contributions, making authorship and accountability more complex.

4.1.3 Cheating and education

Students could potentially use ChatGPT to compose full essays on assigned topics, circumventing personal effort and compromising the educational experience. As a result, some schools and universities have opted to prohibit the use of AI-generated content in coursework.

4.1.4 Personalization, privacy, and discrimination

AI's data collection for personalization may

inadvertently disclose sensitive details like political affiliations or health conditions. Additionally, AI could unintentionally reinforce stereotypes by generating biased content grounded in its training data, like linking particular jobs with specific genders.

4.1.5 Regulatory and liability

Determining accountability in instances where ChatGPT's advice leads to negative consequences for a user poses a challenge. It is crucial to establish explicit regulations and accountability mechanisms to address these concerns, including determining whether developers, users, or another party should be held responsible.

4.2 Challenge issues

4.2.1 Technical challenges

To address limitations and increase ChatGPT's dependability, implementing safeguards is crucial. This involves enhancing learning capabilities to rectify imprecise outcomes and creating interfaces that enable users to report errors or identify the origin of generated text.

4.2.2 Social and ethical challenges

To ensure the effective and responsible use of ChatGPT in society, it is essential to establish standards and social consensus. This

addresses the ethical and social consequences of the increasing use of AI and ensures that AI tools are developed and deployed while considering their impact on various aspects of life.

4.2.3 Industry adoption and expansion

Companies such as Microsoft have invested considerable resources in integrating ChatGPT into their products, including incorporating it into Bing's search engine to reclaim market share from Google. Naturally, efforts to broaden ChatGPT's applications and enhance its capabilities will be accelerated to recoup investments and sustain a competitive edge in the AI landscape.

Addressing these challenging issues necessitates a multifaceted approach that includes technical progress, social and ethical concerns, and industry collaboration. By collaborating, we can guarantee that AI tools such as ChatGPT are developed and used in ways that benefit society and respect ethical boundaries.

4.3 Conclusion

In conclusion, the rapidly expanding use of generative artificial intelligence offers significant potential across various industries, but it is vital to ensure responsible and cautious use to prevent potential misuse or abuse. Ensuring ethical employment of generative AI tools in educational and industrial settings is

crucial, and legal and regulatory frameworks must evolve to provide adequate safeguards and accountability mechanisms for this rapidly advancing technology. The impact of any tool, including generative AI, depends on its usage, and by fostering a culture of ethical development and implementation, society can harness the benefits while minimizing potential risks and challenges.

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