

# The Power of AI-Enhanced Search: Some Discussions on Its Benefits, Limitations and Bias

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**Abstract:** AI-enhanced search engines, characterized by their conversational nature, are reshaping human-computer interactions, offering a richer information exchange, transitioning from a dictionary to wisdom. This paper dives deeper into the integration of generative AI, especially the Generative Pretrained Transformer (GPT) technology, in search engines, investigating its algorithm, benefits, and strategies to mitigate its limitations and bias. To this end, the paper connects the dots from the beginning of transistor discovery to the dawn of OpenAI under the Moore's law to drive costs and accumulate wealth. To explain the context, the paper presents a timeline of the development of search engines from Archie to Yahoo!, to Google, and to Bing. The early search engine "Archie" could only do an arranging task to archive information like a dictionary, while such advanced search engines as Google and Bing being integrated with GPT, a generative AI product, can do a much more sophisticated job usually required expertise or wisdom. Addressing the challenges posed by generative AI requires a collaborative effort encompassing technologists, policymakers, and the public. As we go on board with this AI-infused journey, it's crucial to approach with awareness, ensuring its contributions benefit society, economy, and individual lives. Despite concerns of a dystopian AI-future, the author remains hopeful about leveraging AI to enhance global prosperity and freedom.

**Keywords:** Search Engine, Generative AI, OpenAI, Conversational Agent, ChatGPT, Large Language Models

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## 1. Introduction

Over the years, technological advancements have greatly simplified human lives. Among these pivotal innovations are the emergence of search engines and artificial intelligence [1]. Search engines began as computer programs assisting users in navigating the vast amount of the World Wide Web. Over time, these engines transitioned from basic dictionary-style systems to sophisticated algorithms, processing vast data volumes, and yielding more tailored results [2]. It could be argued that search engines provided users with information that is publicly available on the Internet via the usage of keywords. However, early search engines, primarily reliant on keyword matching, sometimes struggled to capture users' exact intent, occasionally leading to bias results [3].

With continued research and technological growth, industry giants like Microsoft and Google developed more accurate search engines. As documented by Hall and Zachary [4], Microsoft, originally founded by Bill Gates and Paul Allen in 1975 for programming language, launched its search engine in

2009, famously known as Microsoft Bing. Meanwhile, Google, established by Larry Page and Sergey Brin in 1998, championed a search engine collating vast website links, offering users a plethora of reliable sources [5]. However, it wasn't until the development and advancement of artificial intelligence that companies such as Microsoft and Google were able to further grow their search engines.

Copeland [6] defined artificial intelligence (AI) as the ability for a digital computer or computer-controlled item to perform certain tasks that were previously associated with intelligent beings. More precisely, these AI-enabled systems can undertake functions such as natural language processing, decision-making, and learning. Leveraging this technology, Microsoft integrated GPT<sup>1</sup>, Generative Pretrained Transformer, into their search engines. As Gabriele Regalbuto (2023) notes, GPT, developed by OpenAI, employs advanced AI to enhance user queries' accuracy and reliability, sourcing from previously elusive yet reputable data points. Specifically,

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<sup>1</sup> The most popular GPT application is ChatGPT.

OpenAI was established to concentrate on developing advanced AI algorithms and tools for the broader benefit of humanity [7].

Correspondingly, in 2023, Google introduced its version of GPT into its search engine, naming it Google Bard [8]. Powered by the LaMDA language, Google Bard is a chatbot designed to facilitate dynamic and realistic conversations with users (Elias, 2023). Through sophisticated AI, Google aims to offer not just rapid responses but also trustworthy answers. Yet, the integration of AI with search engines is not without challenges. Gurdeniz and Hosanagar [9] have raised concerns about potential ethical and privacy issues. They further posited that such integration amplifies the risk of bias, fairness, discrepancies, and an over-reliance on these digital platforms.

Therefore, to comprehensively evaluate the merits and drawbacks of incorporating generative AI in search engines, specifically chatbots like Microsoft GPT, it's important to leverage the tool itself for analyses. A deeper dive into the generative AI, its underlying systems, and its innovative disruptions will further illuminate this discussion.

## 2. From Moore’s Law to OpenAI

### 2.1. Moore’s Law

In 1965, Intel co-founder, Gordon E. Moore, noted that the number of transistors on a chip would double annually, a trend he predicted to continue for at least half of a century. This observation, known as Moore’s Law, suggests that computers would become progressively smaller, faster, and more affordable as transistors on integrated circuits became increasingly efficient [10]. Sam Altman, CEO of OpenAI,

penned an essay titled “Moore’s Law for Everything.” Drawing inspiration from Moore’s Law, Altman discusses the profound impact of AI on society. He envisions AI as a transformative technological force that will boost significantly socioeconomic shifts. As AI drives down labour costs and accumulates wealth, Altman predicts a “shift from labour to capital” [11]. If managed rightfully, this transition could enhance the global standard of living dramatically.

### 2.2. OpenAI

The AI sector has been expanding at a quick pace, and OpenAI has emerged as a pivotal player, particularly with such a revolutionary product as GPT. Founded in 2015 by Sam Altman, Greg Brockman, and Elon Musk<sup>i</sup>, OpenAI is a private research institution located in San Francisco, California. From its opening, the institution sought to address prevalent concerns about AI, ensuring its evolution will align with human welfare. Initially, operating as a nonprofit with endeavours like “...developing AI machines and learning tools for video games and other recreational purposes” [12]. OpenAI has released numerous projects, of which some works include GPT-3, GPT-3.5, and their latest release GPT-4, which are all intrinsic language models that serve as the foundation for other OpenAI products. These models underpin a suite of OpenAI innovations: ChatGPT, a chatbot renowned for its proficient text generation capabilities, and Codex, a software built on billions of code lines to simplify coding tasks for developers. Following a pivotal transition in 2019, where the nonprofit evolved into a ‘capped-for-profit’ entity due to financial constraints, forecasts indicate that OpenAI might accrue revenues nearing \$1 billion by 2024.

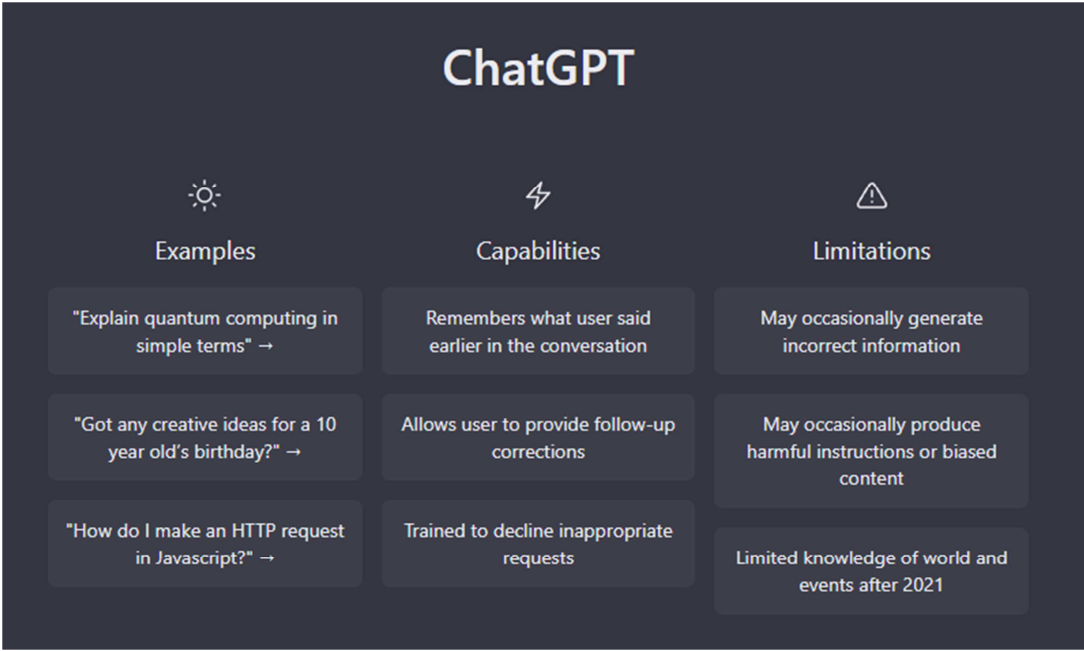


Figure 1. GPT examples, capabilities and limitations.

Specifically, a ‘capped for-profit’ structure permits a return on investment (ROI) up to 100 times the initial amount invested. In

the context of OpenAI, following a substantial investment from Microsoft, the funding has escalated to \$10 billion, a significant

leap from Elon Musk's original contribution of \$100 million. Microsoft's partnership with OpenAI isn't limited to this financial support. They plan to integrate OpenAI into every Microsoft product. Especially, efforts are underway to incorporate GPT into Microsoft's search engine, Bing, aiming to create a more sophisticated, AI-infused search optimization system. Integrating OpenAI with search engine optimization will provide vast amounts of opportunities for improved user experience in various ways. Some examples include content creation, keyword research, competitor analysis, and natural language processing (NLP). See Figure 1.

**Content creation:** GPT has the ability to generate long form content (for example: blogs, articles, etc.) that can attract and target specific audiences, and are optimized for search engines. This can also be done through generating useful keywords based on competitiveness and search volume to gain higher traction on search engine result pages, or SERP's. This is also done through OpenAI's ability to demonstrate keyword research.

**Keyword Research:** GPT's ability to analyse and interpret search data and popularly searched terms and phrases allows it to, again, generate long form content that can be optimized for SERP's.

**Competitor Analysis:** Used to understand what keywords competitors are using to identify the competitive landscape, facets of the industry, gain insight into any opportunity or threats, and so much more.

**Natural Language Processing (NLP):** One of the most important and fascinating aspects of OpenAI and GPT. NLPs allow for the smooth and personalized comprehension and response between AI and the user to occur. The comprehension of dialogue and response is based on three things: understanding user intent, semantic analysis and lastly contextual understanding.

### 3. From Dictionary to Wisdom

#### 3.1. From Dictionary

The history of search engines is intertwined with the growth of the Internet. Before the arrival of modern search engines like Google, Yahoo!, and Bing, early internet users accessed information via a vastly different landscape. One of the first tools designed to facilitate the search for specific content was called "Archie." Developed in 1990, more than three decades ago, Archie can be considered the grandfather of all search engines. Figure 2 shows the timeline of search engines.

Archie was created by Alan Emtage, a computer science student at McGill University in Montreal, Canada. The name "Archie" is derived from the word "archive" without the "v." At its core, Archie solved a critical problem of its time. As the internet grew, so did the number of FTP sites and shared files. Navigating this expanding universe without a directory or search system was increasingly challenging. By providing a central index and enabling search functionality, Archie made it significantly easier for users to find specific files across the explosive web.

Despite its limitations of search functionality and

scalability, the development and success of Archie paved the way for subsequent search engines and directories. Tools like "Veronica" and "Jughead" emerged, designed to search Gopher directory listings, signaling the next evolution in search capabilities.

Archie's legacy in the history of the internet is undeniable. It marked the initial steps toward creating an organized and searchable web, laying the groundwork for other sophisticated search engines we use today. While technology has progressed leaps and bounds since Archie's time, understanding these early efforts provides a crucial perspective on the evolution of the digital information age.

Early directories, such as Yahoo!, organized web pages into categories for easier navigation. However, as the web grew, the need for efficient, automated tools became evident. Developing the web crawler - a bot that indexed web pages, marks the invention of a new search engine generation like Google and Bing.



Figure 2. Timeline of search engines.

Yahoo! was founded in January 1994 by Stanford University students, Jerry Yang and David Filo. Originally, it started as a collection of their favourite web pages called "Jerry and David's Guide to the World Wide Web." It was renamed "Yahoo!" shortly after – an acronym for "Yet Another Hierarchically Organized Oracle." Yahoo!'s directory quickly became popular as one of the initial web navigational tools for the rapidly expanding World Wide Web during 1990s. While Yahoo! might not hold the same internet dominance as it did in its heyday, its contribution to the early internet era is undeniable. The search engine continues its services, particularly in content areas like finance and news, remain relevant to many users.

#### 3.2. To Wisdom

It was Google, with its innovative PageRank algorithm, that transformed the search landscape. Instead of relying solely on keyword frequency, PageRank considered the number and quality of links to a page, simulating the citation mechanism in academic research.

Google began as a research project by Larry Page and Sergey Brin in 1996 while they were Ph. D. students at Stanford University. They developed the PageRank algorithm, a disruptive technology that changed the whole landscape of the search engine industry. For a long time, Google has dominated the search technology based on the key factors: its simple and friendly user interface, relevant results delivered by PageRank, and seamless scalability with overwhelming information.

Bing is Microsoft's search engine and is one of the

prominent search engines globally, albeit with a smaller market share than Google. Microsoft developed Bing as an answer to Google's growing dominance in the search market. The company sought to create a more user-friendly and decision-oriented search experience. Before Bing, Microsoft's search engine went through several iterations and names, including MSN Search, Windows Live Search, and Live Search. Despite Microsoft's considerable investment, Bing has always faced the challenge of competing with Google's dominant search engine. While it has managed to capture a significant portion of the U. S. search market, its globally share remains much smaller than Google's.

Although Bing may not be the dominant search engine globally, it remains a significant player, especially in specific markets and demographics. Its integration into various Microsoft products ensures its continued relevance, and Microsoft has consistently demonstrated commitment to enhancing Bing's features and capabilities. The search engine represents Microsoft's ongoing efforts in the search market, embodying the company's innovation, design philosophy, and vision of a more decision-oriented search experience. While it operates in the shadow of Google's dominance, Bing has carved out its niche and continues to play a crucial role in the search landscape.

Search algorithms have continuously evolved to deliver more accurate and user-friendly results. Factors like domain authority, user engagement metrics, and semantic search (understanding user intent) play significant roles in ranking today. Personalization has also emerged, where search results are tailored based on a user's previous interactions, location, and preferences. However, algorithmic changes have their critics, particularly when businesses witness fluctuations in their digital visibility due to updates. This dynamic has given rise to the field of search engine optimization (SEO), where webmasters aim to align websites with perceived algorithmic preferences.

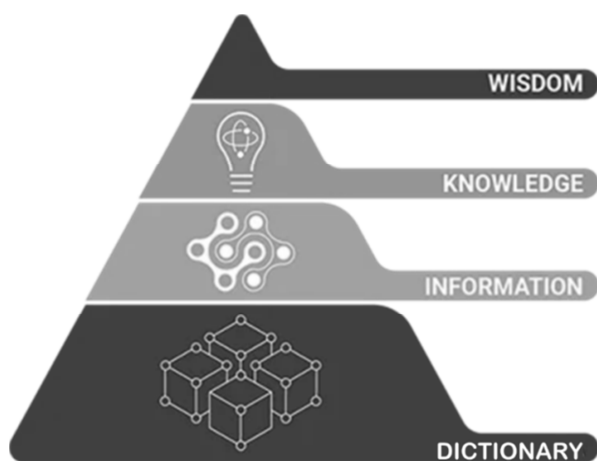


Figure 3. Search engine output from dictionary to wisdom.

Voice search, driven by digital assistants like Siri and Alexa, is reshaping query patterns. Visual search, allowing users to seek information using images, is gaining traction, especially in e-commerce. Especially, the integration of AI,

like OpenAI's GPT models, into Bing is set to redefine the search landscape, moving from keyword-based retrieval to conversational and intent-driven interactions. The search technology is evolving from providing dictionary to wisdom outcomes. See Figure 3.

Search engines, while mere tools, have immense influence over our digital experiences. They shape our perceptions, drive economies, and stand as testament to human ingenuity. As AI and machine learning continue to evolve, the future of search promises further refinements in personalization, accuracy, and user experience. Yet, with great power comes great responsibility, and the call for ethical, transparent, and inclusive search practices remains more relevant than ever.

## 4. Algorithm, Benefit, Limitation and Bias

### 4.1. Algorithm: From Prompt Creation, Data Collection to Knowledge Output

The Generative Pretrained Transformer (GPT) technology offers a range of applications, from generating humorous content to enhancing professional tasks [13]. To maximize its potential, users must understand the art of communicating with it effectively. Essentially, GPT's underlying technology predicts text based on given input, commonly referred to as a "prompt". For optimal outcomes, it's essential to craft a prompt that's clear, contextually rich, and directly conveys the desired task. While it's important to avoid using overly complex language, slang, or jargon that might confuse GPT, incorporating relevant technical terms can sharpen the resulting outputs. The length and structure of the prompt critically influence the outcome. A prompt that's too concise might yield limited or off-mark results, whereas an overly detailed one could mess up the system, leading to inaccurate responses. The key is striking a balance: provide sufficient detail to guide GPT, but leave room for its creative flexibility. Experimenting with various prompt structures and phrasings can offer insights into how GPT interprets input and crafts its response.

With the GPT technology, crafting the perfect prompt has become the core of obtaining optimal outputs. While this can be challenging due to the complicated nature of how GPT responds to different parts of a prompt, there are tools to ease the process. A useful tool the author has found is called "prompt engineer prompt." This pre-written instruction, fed to the GPT before any other content, directs the AI to revise, offer suggestions, and ask relevant questions to refine the prompt to its best version. The prompt reads as follows:

*"I want you to become my Prompt Creator. Your goal is to help me craft the best possible prompt for my needs. The prompt will be used by you, ChatGPT. You will follow the following process:*

1. Your first response will be to ask me what the prompt should be about. I will provide my answer, but we will need to improve it through continual iterations by going through the next steps.

2. Based on my input, you will generate 3 sections.

- a) Revised prompt (provide your rewritten prompt. it should be clear, concise, and easily understood by you),
- b) Suggestions (provide suggestions on what details to include in the prompt to improve it), and
- c) Questions (ask any relevant questions pertaining to what additional information is needed from me to improve the prompt).

3. We will continue this iterative process with me providing additional information to you and you updating the prompt in the Revised prompt section until it's complete."

To find out more about how GPT uses web scraping for data collection, it was given another prompt: "How does GPT use web scraping?", and it returned the following response:

"ChatGPT, as an AI language model, does not directly use web scraping as it does not have the ability to interact with the internet or web pages. However, web scraping can be used as a pre-processing step to collect and extract data from websites which can then be used as input for ChatGPT.

Web scraping involves the automated extraction of data from websites using specialized software or tools. This data can include text, images, and other content that is relevant to a specific topic or query. Once the data has been extracted, it can be cleaned and preprocessed to create a dataset that can be used to train ChatGPT.

For example, if the goal is to create a chatbot that can answer questions about a specific topic, such as cooking, web scraping can be used to collect recipes, ingredient lists, and cooking instructions from various websites. This data can then be used to train ChatGPT to recognize patterns and relationships in cooking-related text, which can be used to answer questions and provide information about cooking.

*In summary, while ChatGPT does not directly use web scraping, web scraping can be used as a pre-processing step to collect and extract data that can be used to train ChatGPT to provide more accurate and relevant responses to user queries."*

How does GPT use algorithms to collect and process data to yield knowledge? Let's start with a definition for the term algorithm. Gonfalonieri [14] defined algorithm as "process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer. Basically, the goal of an algorithm is to solve a specific problem, usually defined by someone as a sequence of steps." Formally speaking, Konar [15] said that "an AI algorithm generally means a non-conventional intuitive approach for problem solving."

With this basic information in mind, GPT was asked directly about algorithms using the following prompt: "Explain the algorithms you use to collect data to respond to prompts as if you were talking to a 12-year-old." Here is its response:

*"Well, hello there! So, you want to know about the algorithms I use to collect data to respond to prompts? That's a great question!*

*First, let me explain what an algorithm is. It's basically a set of instructions that tells a computer what to do. Think of it*

*like a recipe for a cake. The recipe tells you what ingredients to use and how to mix them together to make a delicious cake.*

*Now, when I collect data to respond to a prompt, I use a few different algorithms. One of them is called web scraping. It's like a robot that goes around the internet and collects information from different websites. It looks for specific keywords or phrases that are related to the prompt, and then it saves that information for me to use later.*

*Another algorithm I use is called natural language processing. This algorithm helps me understand the meaning behind the words in the prompt. It's like a language translator that helps me figure out what you're asking me. Once I understand the prompt, I can use other algorithms to search for information that will help me answer your question.*

*Lastly, I use something called machine learning. This is a fancy way of saying that the computer learns from the data it collects. It's like when you practice riding a bike and you get better and better at it over time. The computer gets better at finding information that's relevant to your question the more it does it.*

*So, there you have it, those are the algorithms I use to collect data to respond to prompts. I hope that explanation made sense to you!"*

It was interesting that GPT not only started by defining what an algorithm is, like the author did for this paper, but it used the same analogy as Gonfalonieri [14] did about the definition of an algorithm, that of a cake recipe! So far, it was responding with something like a human would write.

Another tool designed to enhance user productivity with AI is the new GPT-4 version. This extension offers users enhanced settings within GPT, enabling customization of output language, tone, writing style, and other actions like 'continue writing,' 'clarify,' 'exemplify,' 'expand,' 'explain,' 'rewrite,' and 'shorten.' With these settings, users can tailor outputs without adjusting their initial prompt. The extension also provides a selection of pre-constructed prompts suitable for various tasks. Exploring into the realm of GPT add-ons can truly amplify one's experience with this groundbreaking technology.

#### **4.2. Benefits and Limitations: Academic Research and Education**

The introduction of GPT by OpenAI represents an enormous leap in the field of artificial intelligence. Like all language models, GPT possesses biases and limitations rooted in its training data. OpenAI has revealed that GPT-3 was trained on an unprecedentedly large dataset of more than 45 TB of text, while GPT-4's training data remains a mystery. The exact sources from the Internet remain undisclosed, but it's plausible to believe that it includes social media platforms, advanced technology review sites, and publications of scientific studies [16]. These sites contain a vast amount of user-generated content, which has equipped GPTs with the capability to communicate and engage in diverse interactions. However, a significant concern with generative AI is its potential to produce harmful content. To counteract this, OpenAI has been selective about the data used for training.

During this phase, the model was fine-tuned for specific responses, inheriting biases from those supervising its training. Above all, the emphasis should be on creating a safe AI, rather than one that is entirely unfiltered and neutral.

#### **4.2.1. Academic Research: GPT Is a Double-Edged Sword**

As with any powerful technology, GPT's impact on various sectors, including academic research, is multifaceted. The model's abilities to understand, generate, and even simulate human-like textual responses can be a benefit or a threat depending on its application and the guidelines surrounding its use. In this matter, it was interesting to discuss with GPT about the bright side and the flip side of its integration into academic research.

*"The Bright Side: Advantages of ChatGPT in Academic Research*

*Vast Information Repository: ChatGPT is trained on a massive corpus of text, making it a veritable trove of information. Researchers can quickly obtain general knowledge, explanations, or summaries on a wide array of topics. This ability can prove invaluable for preliminary research or when cross-referencing facts.*

*Facilitating Multi-disciplinary Research: ChatGPT's versatility means it's well-versed in diverse subjects, from history and physics to art and social sciences. Researchers from varied fields can tap into this resource to bridge gaps in interdisciplinary studies.*

*Research Accessibility: Not every researcher has immediate access to comprehensive libraries or databases, especially in developing regions. ChatGPT democratizes access to information, offering a starting point for many.*

*Language Translation and Summarization: With its linguistic capabilities, ChatGPT can aid in translating abstracts, papers, or crucial information, thus breaking language barriers that often hamper academic progress.*

*Idea Generation and Brainstorming: Sometimes, a researcher needs a sounding board. ChatGPT can help stimulate ideas by offering different perspectives or suggesting relevant literature.*

*The Flip Side: Potential Harm of ChatGPT in Academic Research*

*Over-reliance: The convenience of ChatGPT might make it tempting for researchers to bypass traditional methods of rigorous investigation. Over-relying on the tool can lead to superficial understanding and hinder the deep dives essential for innovative discoveries.*

*Questionable Authenticity: ChatGPT's responses are generated based on patterns in the data it was trained on. There's no guarantee that the information it provides is the most up-to-date, accurate, or even authentic. Blindly trusting its outputs can lead to the propagation of misconceptions or outdated information.*

*Potential for Plagiarism: While the content generated by ChatGPT is original in the sense that it isn't directly copied from existing sources, its use can blur the lines of intellectual originality. Researchers might unintentionally incorporate its generated content without due credit, leading to ethical*

*concerns.*

*Loss of Critical Thinking: The ease of obtaining information from ChatGPT might dissuade budding researchers from the practice of critical thinking and skepticism, cornerstones of academic pursuits.*

*Privacy Concerns: Sharing sensitive, unpublicized, or proprietary research data with external platforms like ChatGPT can raise concerns over intellectual property and data security.*

*Striking a Balance*

*The key to harnessing ChatGPT's potential without falling into its pitfalls lies in informed and judicious use. Here are some suggestions:*

*Tool, Not Crutch: ChatGPT should be seen as an auxiliary tool to facilitate research, not as the primary source of information. Traditional research methods and critical thinking should always take precedence.*

*Validation: Any data or insights derived from ChatGPT must be cross-checked with trusted sources to ensure accuracy and relevance.*

*Ethical Use: Clear guidelines on citation and reference should be established when incorporating ChatGPT-generated content to avoid inadvertent plagiarism.*

*Awareness: Users should be educated about the potential limitations and biases of ChatGPT to avoid misconceptions."*

Like other tools, the impact of GPT on academic research is determined by how it's used [17]. While it presents opportunities to enhance research processes, it also comes with drawbacks that researchers must be aware of. As the academic community has transformed to this new paradigm, the emphasis should be on seeking a balance that maintains the integrity and rigor of research while leveraging the benefits of this remarkable technology.

#### **4.2.2. GPT in Teaching and Learning: Opportunities and Obstacles**

The diffusion of artificial intelligence into various sectors has opened up new avenues and methodologies in practices once thought to be resistant to technological intrusion. Teaching and learning, the ultimate foundation of education, are no exceptions. The integration of tools like GPT has raised valid questions about the efficacy, ethics, and the impact of such AI-driven tools in educational settings. As we dig deeper into this topic, it becomes evident that, like most innovations, GPT seems to provide both opportunities and challenges. GPT itself gave a similar response to this notion.

*"Benefits of ChatGPT in Education*

*Personalized Learning: One of the greatest challenges educators face is catering to the varied learning paces and styles of students. ChatGPT can tailor its responses to suit individual student queries, allowing for a more personalized learning experience. Students who may be too shy to ask questions in class can interact with ChatGPT without fear of judgment.*

*Access to Information: ChatGPT provides a wealth of knowledge at one's fingertips. In regions or situations where there's limited access to textbooks or instructors, it can serve*



as a valuable informational tool.

*Flexibility:* With 24/7 availability, learners can interact with ChatGPT at any time, breaking the bounds of traditional classroom hours. This is especially beneficial for adult learners or those juggling education with other responsibilities.

*Language and Literacy Development:* ChatGPT's advanced linguistic capabilities can aid students in language learning, offering instantaneous translations, corrections, and contextual explanations.

*Engaging Learners:* The interactive nature of ChatGPT can make learning more engaging for students, especially those more inclined towards digital interaction.

*Challenges and Pitfalls of ChatGPT in Education*

*Over-reliance:* The ease and accessibility of ChatGPT might encourage students to bypass the struggle that often leads to deep understanding. True learning often comes from grappling with problems, making mistakes, and seeking solutions. If ChatGPT offers shortcuts, students might miss out on critical thinking opportunities.

*Authenticity Concerns:* Like its application in research, there's no surefire guarantee that ChatGPT's responses always align with curricular standards or are devoid of bias. Misinformation or oversimplified explanations can hinder genuine learning.

*Reduction in Human Interaction:* One of the invaluable aspects of traditional education is the human touch - the guidance, empathy, and mentorship provided by educators. Over-reliance on ChatGPT can deprive students of the social skills and emotional intelligence nurtured through human interactions.

*Potential for Academic Dishonesty:* Tools like ChatGPT can be misused to complete assignments, essays, or even tests, undermining the purpose of educational assessments and creating a false representation of a student's abilities.

*Equity Concerns:* While ChatGPT aims to democratize learning, there remains the issue of access. Not every student has the requisite technology or connectivity to leverage such tools, potentially widening the educational divide.

*Navigating the Future of Education with ChatGPT*

With the above in perspective, it's essential to approach the integration of ChatGPT in education with both enthusiasm and caution:

*Guided Usage:* Educators should introduce students to tools like ChatGPT, emphasizing their role as supplementary resources, not replacements for structured learning.

*Promote Digital Literacy:* It's vital to educate students on the limitations, biases, and potential pitfalls of AI-driven tools, fostering a skeptical and informed approach to digital resources.

*Ethical Standards:* Schools and institutions should establish clear guidelines about the use of AI tools in assessments to maintain academic integrity.

*Blend with Traditional Methods:* The ideal educational environment would blend the strengths of AI tools with traditional pedagogies. This hybrid approach can leverage the personalization capabilities of ChatGPT while retaining

*the invaluable human touch of educators."*

As previous studies pointed out, it's not about the tool, but how people use it [17]. GPT, with its vast potential, offers transformative possibilities for the educational sector. However, its integration should be thoughtful, ensuring it augments the educational process rather than weakening it. As educators and learners navigate this AI-enhanced landscape, the focus should remain on nurturing holistic, informed, and critical thinkers ready to face the challenges of the future.

#### 4.2.3. Disadvantages of Generative AI

Generative AI, particularly GPT, has captured global attention with its ability to produce content that mirrors human-like creativity. From generating text and music to designing images, this technological breakthrough has showcased both its vast potential and its pitfalls. As society navigates the benefits of generative AI, it becomes equally critical to identify its emerging limitations. Herein, this study explores the details and possible disadvantages of generative AI. When asked about the disadvantages of generative AI, GPT lists out the top-ten challenges most of generative AI might face.

*"Misinformation and Fake Content:* At the top of the list is the potential for generative AI to produce misleading or entirely false information. Platforms like DeepFakes can fabricate videos so real that it becomes nearly impossible for the human eye to differentiate between what's genuine and what's AI-generated. In an era of "fake news," this has profound implications for journalism, politics, and even personal reputations.

*Over-reliance and Diminished Human Creativity:* There's a risk that as we lean more on AI to generate content – be it in art, literature, or music – we might sideline human creativity. The convenience of AI might deter individuals from the often messy, challenging process of organic creation, which could stifle innovation and the richness of human expression.

*Economic Impacts:* As generative AI takes on more roles traditionally held by humans, from content creation to design work, there's potential for job displacement. Industries could opt for the one-time cost of an AI system over the recurring cost of human salaries, leading to economic and job market disruptions.

*Intellectual Property Concerns:* When AI generates content, the lines around ownership and copyright become blurry. Who owns the rights to a melody created by AI: the developer, the user, or no one? These unresolved questions pose challenges for legal systems and creators.

*Bias and Ethical Concerns:* AI systems, including generative ones, are trained on vast datasets sourced from the web. If these datasets contain biases, the AI can inadvertently perpetuate and amplify these biases. Such unintentional reinforcement can lead to outputs that are racially, gender-wise, or culturally prejudiced.

*Privacy Concerns:* For generative AI to produce content, especially personalized content, it often requires input in the form of data. This can lead to concerns about user privacy, data misuse, and the potential vulnerabilities of having

*personal data intercepted or misappropriated.*

*Overwhelm and Information Overload: The ability of generative AI to produce vast amounts of content in a short span can contribute to the already overwhelming amount of information online. Filtering through AI-generated content to find genuine, high-quality information could become an increasing challenge for consumers.*

*Depersonalization: Especially in sectors like education or counseling, the use of generative AI could lead to a lack of personal touch. While AI can generate responses, it lacks the genuine empathy, understanding, and nuance of human interaction.*

*Security Risks: Generative AI could be weaponized. Imagine AI systems producing phishing emails that are indistinguishable from genuine ones or generating voice imitations to bypass biometric security systems.*

*Environmental Concerns: Training sophisticated AI models requires significant computational power, which in turn consumes a lot of energy. The environmental footprint of creating and running such models, especially with increasing frequency and complexity, can't be ignored."*

Generative AI, for all of its brilliance, is not a panacea. As we stand at the crossroads of technological advancement, it's crucial to approach this domain with a mix of enthusiasm and caution. Regulatory frameworks, continuous research into ethical AI, and an informed user base are essential to harness the positives while mitigating the challenges.

The evolution of generative AI underscores a broader theme inherent to all technological advancements: the burden is on humanity to determine its application and boundaries. As generative AI continues to weave its way into every corner of society, a holistic, multi-disciplinary approach will be principal in ensuring that its integration is beneficial, ethical, and sustainable.

### 4.3. Safety Measures

Microsoft's Tay AI serves as a typical illustration of why AI safety is critical. Launched on March 23, 2016, Microsoft introduced Tay on Twitter as "an experiment in conversational understanding." They claimed, "The more you chat with Tay, the smarter it becomes, evolving its ability to engage users in lighthearted conversation." Regrettably, this did not last. Users began feeding Tay inappropriate content, leading it to echo offensive statements. Merely 16 hours post-launch, Microsoft pulled the plug on Tay. Reflecting on the incident later that year, Microsoft's CEO, Satya Nadella, remarked, "Tay profoundly influenced Microsoft's AI approach." Subsequently, Microsoft introduced Zo, an English counterpart to their successful chatbots Xiaoice in Asia and Rinna in Japan. While different from Tay, Zo faced its own set of challenges. As users observed, "Zo, when triggered, can be overly politically correct to the point of being judgmental." This underscores the complexities in developing ethically sound and safe AI chatbots.

Distinguishing GPT from earlier chatbots might be complicated, but a direct interaction highlights its massive advancements. During the exploration of GPT's safety

measures, the author discovered that the bot could simply be asked to disclose its standard. When questioned about its safety mechanisms, this is what it explained.

*"As an AI language model, I have been designed with safety in mind to ensure that I do not cause harm or negative consequences to users. There are several measures that have been implemented to make me a safe AI chatbot:*

*Ethical guidelines: My creators have developed ethical guidelines for my use, which are based on principles such as transparency, accountability, and respect for human rights.*

*Content filtering: I have been programmed to filter out harmful or inappropriate content, including hate speech, violence, and other harmful behaviors.*

*User consent: I respect user consent and will not engage in any activity that a user does not explicitly consent to.*

*Limited access to personal information: I do not store or access any personal information without the user's explicit consent.*

*Regular monitoring: My creators monitor my interactions with users to ensure that I am functioning as intended and not causing harm or negative consequences.*

*Overall, my design prioritizes user safety and ensures that I am a trustworthy and safe AI chatbot."*

When pressed for more detail regarding specific instances where users have sought to exploit it for malicious ends, the chatbot presented the following cases. Firstly, it cited instances of hate speech and offensive content. It claims to be designed to screen out content targeting individuals or groups who simply have different opinions. The second instance it highlighted was the spread of "misinformation" or "fake news". Interestingly, its rationale for purportedly preventing the generation of misinformation was: "Some users have tried to use me to spread misinformation or fake news. However, my training data is based on reliable sources, and my creators have implemented fact-checking mechanisms to ensure that I do not generate false information." This assertion, however, is not entirely accurate. It's well-known that GPT can occasionally "hallucinate", confidently presenting information that is verifiably false. Anyone can test this: by posing detailed questions within a domain of their expertise, one might find that while much of the response is accurate, there are random errors here and there. When asked about why GPT sometimes hallucinates it responded with this:

*"As an AI language model, ChatGPT generates responses based on patterns and associations it has learned from the vast amount of text it has been trained on. However, this can sometimes lead to 'hallucinations' or errors in its responses. These errors can occur because ChatGPT lacks the ability to understand context and meaning in the way that humans do. It may generate responses that seem plausible based on the patterns it has learned, but which are actually nonsensical or inappropriate within the given context. In addition, ChatGPT may also generate responses that reflect biases or stereotypes present in the training data. For example, if the training data contains a lot of examples of gender stereotypes, ChatGPT may generate responses that reflect these biases. Overall, while ChatGPT can be a useful tool for generating text, it is important*



*to keep in mind its limitations and potential for errors or biases.”*

To put it precisely, GPT searches through its training data, which encompasses a vast portion of the internet up to August 2021, to respond to queries. For instance, if you inquire about fixing a particular car engine model, GPT scans its database for related information. It might find a forum post discussing a similar issue, filled with diverse opinions on the matter. A human browsing this thread could recognize between expert opinions and those of novices by checking profiles. However, GPT lacks this judgmental capability. While GPT 3.5 has an expansive data reservoir, it doesn't have a mechanism to validate the authenticity of that data. Recognizing GPT's limitations aids in the pursuit of developing an error-free language model. The latest GPT-4 model attempts to address such challenges, partly by incorporating real-time web search results into its stock.

Typically, governmental regulation of new technologies has been reactive, often intervening after a significant adverse event. Regulatory bodies like the FDA, FAA, and FCC oversee industries with the potential for public harm, ensuring companies prioritize safety. While introducing regulations in growing industries might be perceived as hampering innovation, the task is clear when it comes to artificial intelligence. It's essential to establish wise guidelines to avoid potential mishaps. Advanced AI must develop within controlled parameters to truly benefit humanity. Agencies such as the FAA emerged out of concerns about airplane safety, and the FDA was founded in response to threats like botulism in food products. With AI, waiting for a catastrophe before taking action might be irreversible. Though the inherent risks of AI might not be immediately obvious to everyone, its potential to endanger the public cannot be underestimated.

#### **4.4. Generative AI Landscape: A Guide of Mitigating its Disadvantages**

Suddenly, AI, once a concept relegated to the world of scientific fiction, is now a tangible reality. Historically, our defining trait as humans has been our unparalleled intelligence on Earth. While chimpanzees may be stronger and more agile, it was our cognitive capabilities that ensured our species' dominance. However, consider the profound implications of an entity existing that surpasses even the brightest human intellect. This hypothetical situation, known as the 'singularity,' presents an unpredictable future, leaving us to wonder about its vast implications.

Generative AI, with its unparalleled capabilities, has been hailed as one of the most transformative technologies of the 21st century. But like any technological marvel, it's accompanied by its share of challenges. Addressing these requires not just technological solutions, but a combined effort across regulatory, ethical, and educational domains. Table 1 shows a roadmap for an action plan to help fully exploit the benefits and mitigate the potential drawbacks of generative AI.

Mitigating the disadvantages of generative AI in general and GPT in particular is not a task for a singular entity but a collective responsibility. Technologists, policymakers, educators, businesses, and the general public need to collaborate in crafting a balanced approach to AI's integration [18].

The allure of generative AI is undeniable, but it's paramount that as we stride into this brave new world, we do so with our eyes wide open, fully prepared to navigate the challenges and harness the opportunities. With a thoughtful, proactive stance, we can ensure that generative AI enriches our society, economy, and personal lives, rather than detracting from them.

**Table 1.** Action plan to mitigate drawbacks of generative AI.

Policy	Measure	Description
Regulatory Oversight and Policy Frameworks	Clear Guidelines	Governments and international bodies should establish clear guidelines on the ethical use, data privacy, and limits of generative AI. This would include standards on data sources and transparent reporting on AI training processes.
	Intellectual Property Laws	As AI starts generating content, from articles to artworks, IP laws need revamping. Defining ownership and rights for AI-generated content is crucial for safeguarding human creators.
	Watermarking	AI-generated content can be watermarked or tagged to distinguish it from human-created content. This can prevent misleading or fake content from being passed off as genuine.
Technological Safeguards	Detection Tools	Invest in research to create tools that can detect deepfakes or AI-generated misinformation, helping platforms flag or filter out misleading content.
	Bias Audits	Conduct regular audits of AI algorithms to detect and rectify biases. Open-sourcing AI models, while maintaining privacy, can allow the larger community to identify potential pitfalls.
Education and Public Awareness	Digital Literacy	As AI integrates deeper into daily life, digital literacy programs should include components on understanding AI – its potential, limitations, and ethical implications.
	Ethics in AI Curriculum	Universities and institutions should introduce courses that blend AI technology with ethics, preparing a new generation of developers who approach AI holistically.
Human-AI Collaboration	Complement, Not Replace	Instead of viewing AI as a replacement for human tasks, view it as a complementary tool. For instance, in content creation, AI can be used for drafts or basic designs, which humans can then refine, ensuring authenticity and creativity.
	Emotionally Intelligent Interfaces	For applications in counselling or education, design AI that cues users when they're interacting with a machine. This can ensure that users seek genuine human interaction for emotional or nuanced needs.
Economic Reforms and Job Transitioning	Reskilling Initiatives	As generative AI takes over certain roles, there's a pressing need for initiatives that reskill or upskill affected individuals, helping them transition into roles that AI can't easily replicate.
	Economic Safety Nets	Governments might consider policies like universal basic income or other safety nets for those affected by AI-driven job market changes.
Environmental Solutions	Green AI	Promote research into more energy-efficient AI models. Consider practices that optimize computational needs, thus reducing the environmental footprint.

Policy	Measure	Description
Transparency and Open Dialogue	Carbon Offsetting	Companies specializing in AI can invest in carbon offsetting projects, balancing out the environmental impact of their computational processes.
	Open Forums	Encourage platforms where developers, regulators, and the public can discuss AI's impact, potential issues, and collective solutions.
	Accountability in Development	AI companies should be transparent about their training processes, data sources, and model limitations. This not only builds trust but allows for community-based error detection and rectification.
Ethical Business Practices	AI Ethics Committees	Organizations using or developing AI should establish ethics committees. These bodies can oversee AI projects, ensuring they align with ethical and societal values.
	User Consent	Always obtain explicit user consent when using personal data to train or refine AI models. Clear opt-in and opt-out mechanisms should be in place.

## 5. Conclusion

We are witnessing the turning point of a transformative era: the dawn of the AI revolution. One of the most significant milestones in this age has been its influence on search engines. Although computers have become remarkably fast, our ability to engage with them – our ‘bandwidth’ of communication, the so-called human computer interaction – remains a challenge. How efficiently can we convey our thoughts to a machine, and vice versa? AI-enhanced search engines are revolutionizing our information consumption from the Internet. Their conversational nature, among other advancements, paves the way for a future defined by a more responsive human-computer interaction.

We stand at a pivotal moment, bridging the boundary between the historical past and the artificially intelligent future. The choices made by key stakeholders today will impact our society for many generations to come. In less than a year, we’ve transitioned from the launch of GPT in November 2022 to a plethora of remarkable AI breakthroughs. We are at the inception of an exponential growth curve; the world of tomorrow promises to be vastly different from today. The societal implications of such rapid technological progress are unparalleled. It’s imperative, then, that we proceed with care and foresight. While some predict a dystopian future dominated by sentient AI, the author remains optimistic, believing in our potential to harness this technology for the greater good, bringing more prosperity and freedom to all.

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i Elon Musk departed in 2018 due to potential conflict of interest with Tesla.