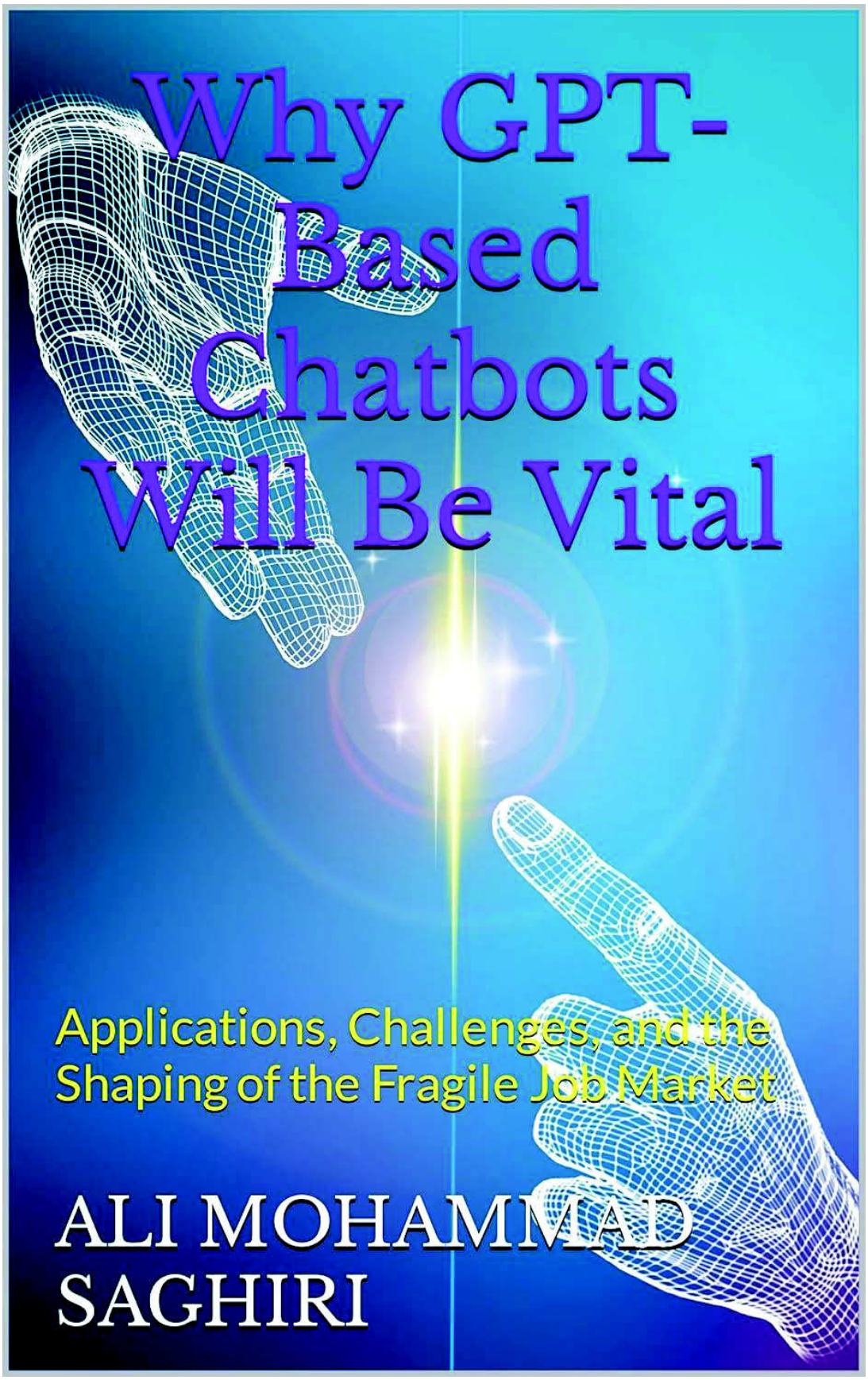
Why GPT-Based Chatbots Will Be Vital
Applications, Challenges, and the Shaping of the Fragile Job Market
ALI MOHAMMAD SAGHIRI

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# 1. Introduction

Welcome to the captivating world of modern chatbots, where cutting-edge artificial intelligence converges with the complexities of human interactions and the ever-evolving job market. In this book, we embark on a journey to unravel the significance of these advanced conversational agents, exploring their applications, challenges, and profound impact on the fragile job market in the age of artificial intelligence.

Artificial intelligence (AI) is poised to revolutionize numerous industries and job sectors. We are living in an era of transformation where AI is implicitly or explicitly integrated into almost everything[1]. Every day, we encounter new AI-based applications that are sometimes awe-inspiring and, at other times, daunting. For instance, there have been discussions about the potential loss of jobs due to the deployment of bots to replace humans [2]. Representative examples of such jobs can be found in the vehicle and mining industries. Bots have proven capable of efficiently performing routine tasks without compromising accuracy. In hazardous environments like mining, bots have been utilized where human presence would be unsafe. Now, we are faced with new types of bots that have the capability to not only perform tasks quickly and accurately but also generate new things (text, voice, and image), just like a human can. This concept is described in the next paragraph.

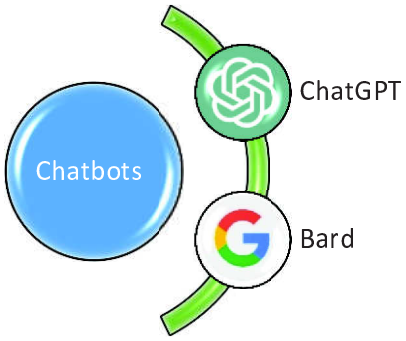


*Figure 1. Chatbots suggested by OpenAI and Google*

It is worth noting that with the emergence of AI's remarkable tools, known as generative models, developed by leading high-tech companies like OpenAI, Google, and others, chatbots with extraordinary capabilities have been introduced [3]. In this domain, ChatGPT and GPT-4 are two products of OpenAI, while Bard is a product of Google. These bots are now comparable to humans in various domains, such as creativity, which has not been considered for machines so far. The utilization of technologies such as GPT (Generative Pretrained Transformer) is due to their implementation of generative models and transformers, both of which were proposed in the last decade. Consequently, traditional chatbots have evolved into entirely new entities that were previously unseen. Further exploration of these concepts will be presented in plain text throughout the remainder of this book. It is important to note that the precise limits and capabilities of these systems are still unknown, and no one can definitively ascertain their ultimate boundaries. To gain a clear understanding of the news and avoid succumbing to hype, we will examine OpenAI's report on the actual capabilities of their chatbot in real-world exams in the following paragraph.

GPT-4, the latest version of GPT-based chatbots proposed by OpenAI, has not only demonstrated extraordinary potential but has also shown capabilities never seen before, as reported in [4]. Table 1

presents the almost magical performance of GPT-4. OpenAI conducted rigorous tests, including the Uniform Bar Exam, LSAT, GRE Quantitative, and several AP subject tests, and in numerous instances, GPT-4 performed at a level comparable to humans. It is fascinating to consider that if GPT-4 were an actual person evaluated solely based on test-taking proficiency, it would qualify for admission into law school and likely many other universities as well. While some critics might argue that these results are not impressive, we must acknowledge that we are dealing with bots that possess the ability to learn at a pace faster than humans.

*Table 1. The results of exams that GPT and ChatGPT participated[4]*

| Exam name | Scope of exam | Grade of Chatbot |
|---|---|---|
| **SAT (Scholastic Assessment Test)** | The SAT is a standardized test widely used for college admissions in the United States. It assesses a student's readiness for college and is typically taken by high school students. | GPT-4 scored 710 out of 800 on the SAT Reading & Writing section, putting it in the 93rd percentile. For the Math section, it earned a score of 700 out of 800, ranking among the 89th percentile. |
| **GRE (Graduate Record Examinations)** | The GRE is a standardized test used for graduate school admissions in the United States. It assesses analytical writing, verbal reasoning, and quantitative reasoning skills. | GPT-4 scored in the 99th percentile on the verbal section, in the 80th percentile on the quantitative section, and in the 54th percentile on the writing test. |
| **Stanford Medical School Clinical Reasoning Final** | The clinical reasoning exam assesses a medical student's ability to analyze patient symptoms, diagnose conditions, interpret test results, and recommend treatments. | ChatGPT passed the Stanford Medical School clinical reasoning final with an overall score of 72%. |
| **Law School Exams** | Law school exams cover legal subjects and are administered to law students. | GPT-4 received a "low but passing grade in all four courses" on law school exams at the University of Minnesota |
| **AMC (American Mathematics Competitions) Exams** | The AMC 10 and 12 are mathematics exams for high school students covering topics like algebra, geometry, and trigonometry. | Grade of Chatbot: GPT-4 scored a 30 on the AMC 10, placing it between the 6th to 12th percentile, and a 60 on the AMC 12, placing it between the 45th to 66th percentile. |

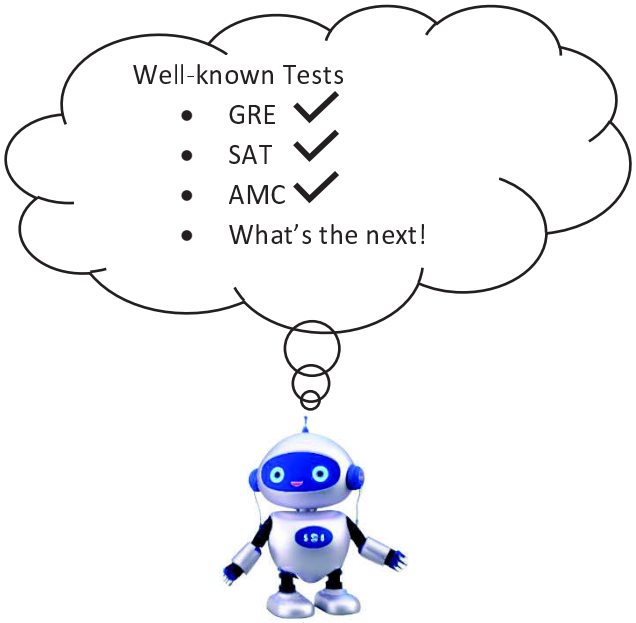


*Figure 2. The chatbot eagerly awaits the next exam to conquer!*

We can ask any question about any domain, and it will return an answer instead of web pages. While some websites and reports focus on the text generation capability of GPT-based chatbots, this view of the bot's capability is not accurate. GPT-based chatbot goes beyond generating text; it can create programs or provide suggestions based on requests. In other words, you can ask the bot to evaluate your abilities in an interview simulation or act as a tutor, teaching you quantum computing using simple concepts in a paragraph! When you see the results of these questions, which stem from the enormous volumes of data used to train this bot, you can imagine its numerous capabilities in different domains. This bot can adapt itself to interact with users, serving as a tutor, content provider, simulator, programmer, doctor, engineer, researcher, stand-up comedian, poet, and even a judge, to mention just a few examples [5]. After the successful applications of the first generation of GPT-based chatbots, a wide range of extensions has been proposed in the literature to cover various applications in financial services, copyright protection, and tax processing, to mention a few [6]–[11]. We will delve into some of these capabilities in this book later on.

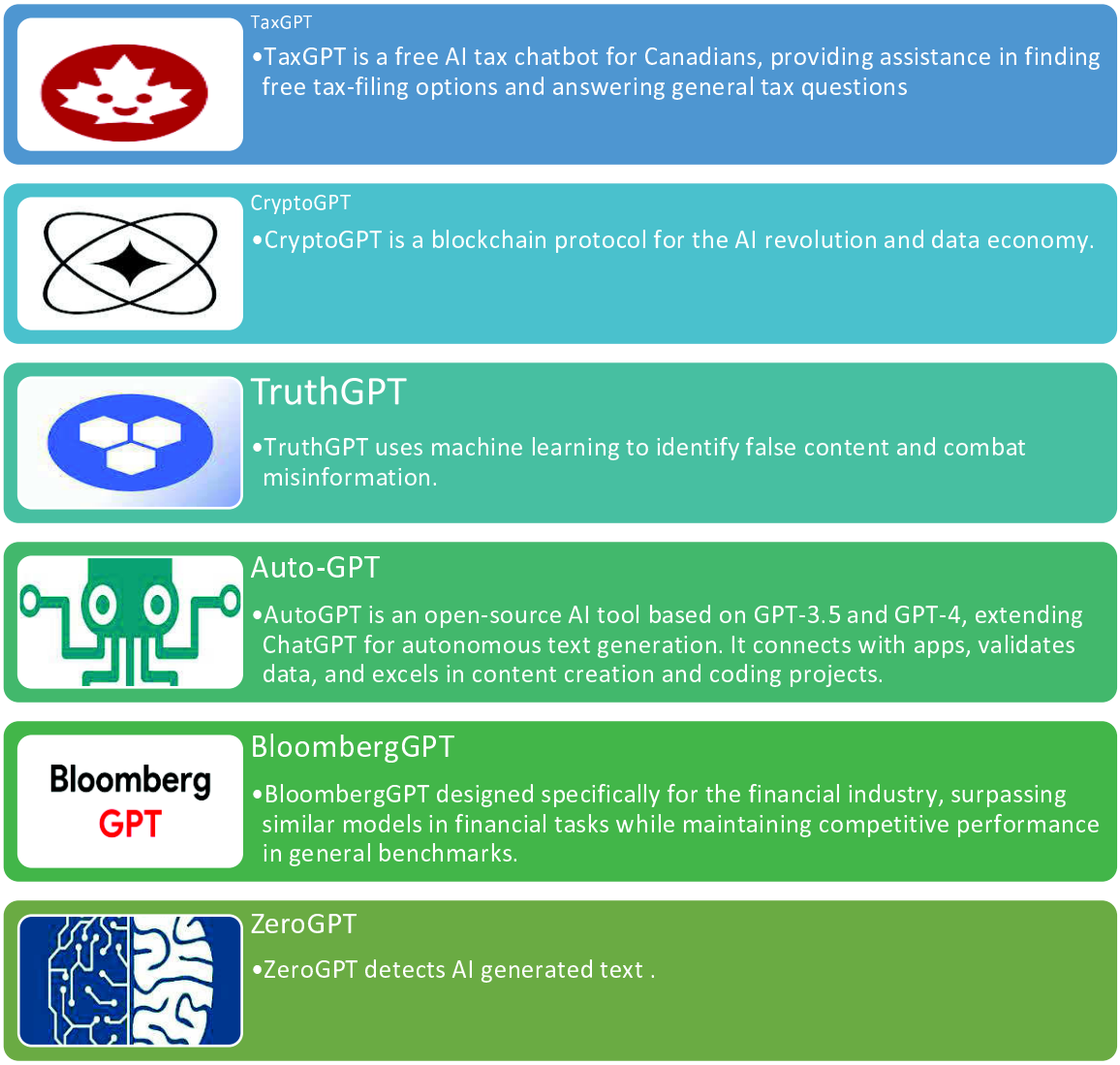


Figure 3. Extensions on GPTs

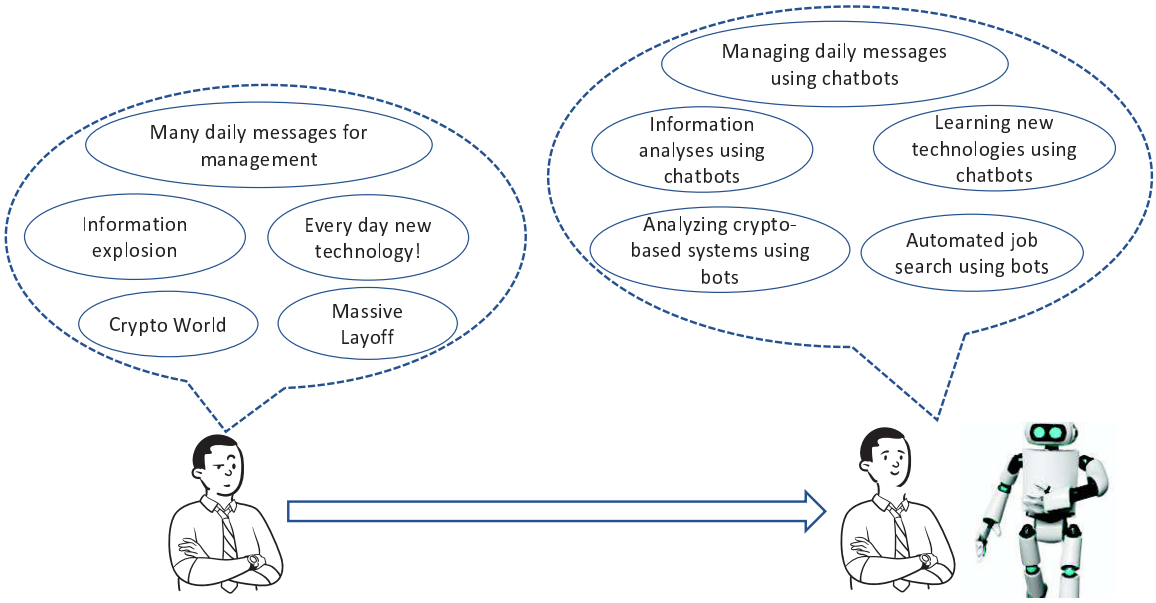


*Figure 4. Chatbots as game changer at the era of industry 4.0 revolution*

On the other hand, Industry 4.0 and the technological advancements of the past decade offer various ways to empower humans and address inefficiencies [12]. Figure 5 shows the changes in technologies from industry 1.0 to industry 4.0 and Figure 4 shows how information and task overwhelm lead to the inefficiency of human workers. For instance, in the realm of blockchain technology, cryptocurrencies like Bitcoin and Ethereum have emerged [13]. Automated bots can efficiently manage and profit from these cryptocurrencies, overcoming the inefficiencies of human analysis in crypto markets. Similarly, the big data revolution has resulted in an overwhelming number of emails and social media messages [14]. Automated systems, powered by AI, can analyze and process large volumes of data, helping individuals manage their communications more effectively. In other words, existing situations result in inefficiencies of human agents for many duties such as financial analyses, tutoring, and daily routines such as email management.

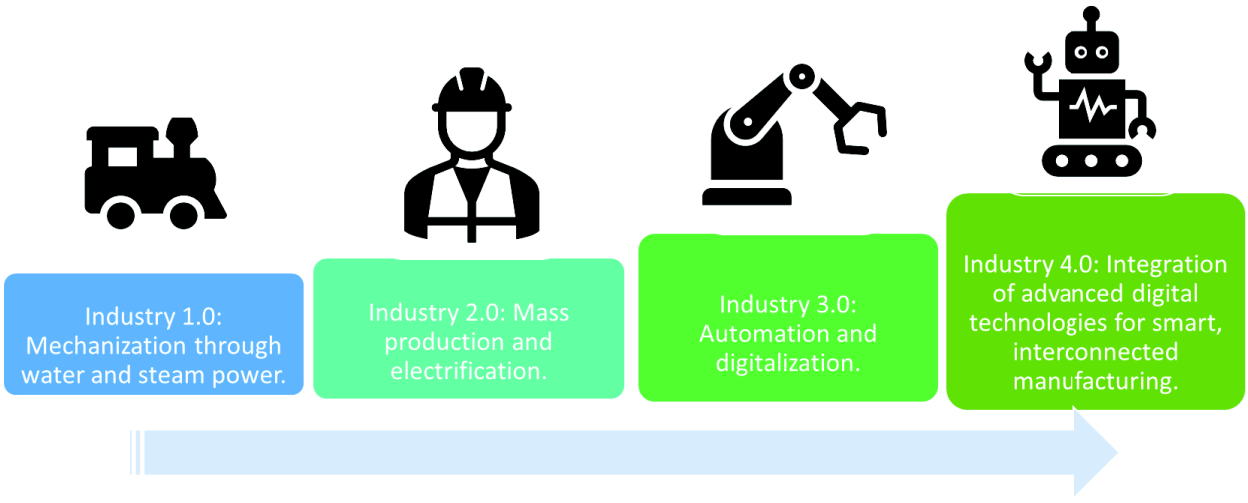


*Figure 5. Industry 4.0 revolution*

Another way in which Industry 4.0 empowers humans is through the use of advanced chatbots like GPT-based chatbots. One of the key features of GPT-based chatbots is their ability to generate coherent and

contextually appropriate responses based on given request. These bots can provide valuable assistance in tasks such as customer service, content creation, and education. In customer service, GPT-based chatbots can handle inquiries, provide information, and troubleshoot common issues, improving response times and reducing the workload on human agents. In content creation, ChatGPT can assist writers by generating ideas, offering suggestions, and aiding in the writing process. Additionally, in education, ChatGPT can serve as a virtual tutor or mentor, answering questions, providing explanations, and offering personalized guidance to students. By leveraging the capabilities of AI technologies like automated bots, humans can tap into a vast amount of information, access real-time assistance, and streamline their workflow. This collaborative approach between humans and AI not only addresses inefficiencies of humans but also enhances productivity, decision-making, and outcomes in various industries and sectors. We will discuss a new generation of workers known as humans empowered with AI using chatbots in chapter 2. These types of workers exhibit high productivity and are also fast learners, unlike anything seen before. In the next paragraph, we will compare the good news and bad news about chatbots, whose main operators are humans empowered with AI.

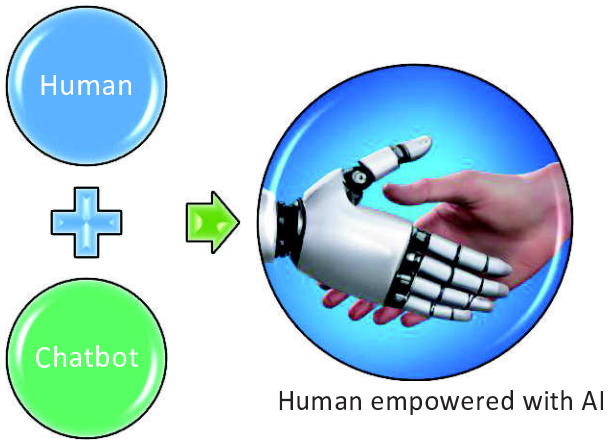


*Figure 6. Appearance of Humans Empowered with AI Using Chatbots*

The current landscape showcases bots that can communicate with users in specific languages and answer questions across various domains with remarkable accuracy. These bots have access to a vast amount of knowledge from the internet, making it an amazing situation for human beings to collaborate with such advanced AI entities. Table 2 summarizes some good and bad news regarding newly arising chatbots.

*Table 2. Good and bad news about chatbots*

| Good news | Bad news | What will happen? |
|---|---|---|
| **Using chatbots, a person self-published their first book, eliminating the need for graphic designers and content providers due to budget constraints[15]. This technology could potentially provide limitless** | Thanks received by content generators and graphic artists have drastically decreased due to chatbot assistance. Experts face job losses or competition with chatbot-enhanced workers, | In the near future, the ability to work with chatbots will become crucial due to the growing number of tasks and messages individuals receive daily[1]. As AI empowers people with chatbots, they will be integrated into job markets, creating a ripple effect[2]. |

[1] Chapter 2 explores why this capability is vital for humans.

[2] This effect will be studied in chapter 7.

| | | |
|---|---|---|
| **teachers worldwide, free from human limitations like aging, enabling education everywhere!** | and there's potential for bots to replace teachers. | Enhancing workers with chatbots is essential[3]. |
| **Prominent high-tech companies are developing tutors and assistants that are available 24/7 and can provide support across various domains like medical and educational fields. This advancement is expected to eliminate shortages of instructors and physicians in the near future.** | Chatbot responses, as an alternative to teachers or physicians, may contain inaccuracies and lack stability. | A revolution is needed in fields like education. The ongoing development of chatbots aims to address issues like unstable answers and generating false information[4]. |
| **With chatbots, anyone can become a graphic designer or programmer without the burden of expensive training [16].** | Chatbots are commonly used by workers, including students in schools, to complete tasks[17]. However, individuals unfamiliar with ethical principles in different fields can easily violate copyright and ethics. This risk is particularly evident with machine-generated content, which may inadvertently breach copyright rules. | Chatbots serve multiple purposes, including detecting cheating and acting as copyright protection tools[5]. |
| **Chatbots offer equal opportunities for workers and learners to enhance their capabilities. It's a groundbreaking advancement in the literary world, enabling both poor and wealthy students to leverage AI to improve their skills. Anyone can use chatbots as a personal coach for learning or job searching.** | Chatbots can create monopolies favoring those with significant financial resources, as the development and implementation of advanced chatbot systems often require substantial investment. This can lead to larger companies and wealthy individuals gaining a competitive edge in certain markets or industries. | In chapter 3, we study the capabilities of chatbots that have not been considered for underserved communities and can be used to combat the monopoly problem. This includes examining both open source and closed source chatbots, which play a crucial role in fighting against hidden monopolistic practices. |
| **Chatbots have been utilized to generate texts, voices, and videos across various domains. These capabilities have the potential to significantly** | Malicious actors have employed chatbots to spread misinformation and propaganda, using them to | Chatbots are capable of detecting misinformation and providing assistance in self-defense[6]. For insights on dealing with malicious purposes and staying vigilant, we |

[3] Chapter 4 focuses on how we can efficiently utilize chatbots for our tasks.

[4] Chapters 5 and 6 will focus on the challenges should be solved in chatbots.

[5] Chapter 5 of this book will delve into copyright challenges, while Chapter 3 will explore how chatbots assist humans in avoiding mistakes and unexpected situations.

[6] Chapter 3 is dedicated to this challenge.

| | | |
|---|---|---|
| **enhance the efficiency of companies.** | orchestrate attacks on companies. | need to first detect attacks or misbehavior and then develop algorithms to solve their relevant problems[7]. |
| **A study comparing physician and chatbot responses to patient questions on a social media forum revealed that patients preferred and rated chatbot responses higher in quality and empathy [18]. Chatbots enhance treatment accuracy and aid doctors and nurses in patient follow-ups. They will also serve as a valuable tool for educating students and individuals about various diseases. The future may witness telemedicine with high accuracy, leading to the elimination of healthcare provider shortages caused by a lack of experts.** | Criticisms have been raised against chatbots for perpetuating bias and discrimination in their responses. Stanford University researchers found that ChatGPT exhibited a tendency to associate certain professions with men rather than women and certain ethnic groups with negative stereotypes. Such biases could potentially lead to harm and discrimination against individuals belonging to those groups. | In the future, the widespread development of chatbots and therapy apps to offer emotional support for individuals facing anxiety, depression, or other forms of distress is expected. |

If we compare the good and bad news explained in Table 2, the situation of humans will not be as scary as it is sometimes portrayed by some widespread news on social media. Each row of the table also provides potential solutions that could open up new opportunities in both industry and academia. Moreover, each row corresponds to a chapter that delves into the relevant issues.

In the next three paragraphs, we will briefly discuss the changes that will happen in different fields, how we can use chatbots in the correct way, and the challenges we will face during the evolution of chatbots.

[7] Chapter 6 is dedicated to this issue.

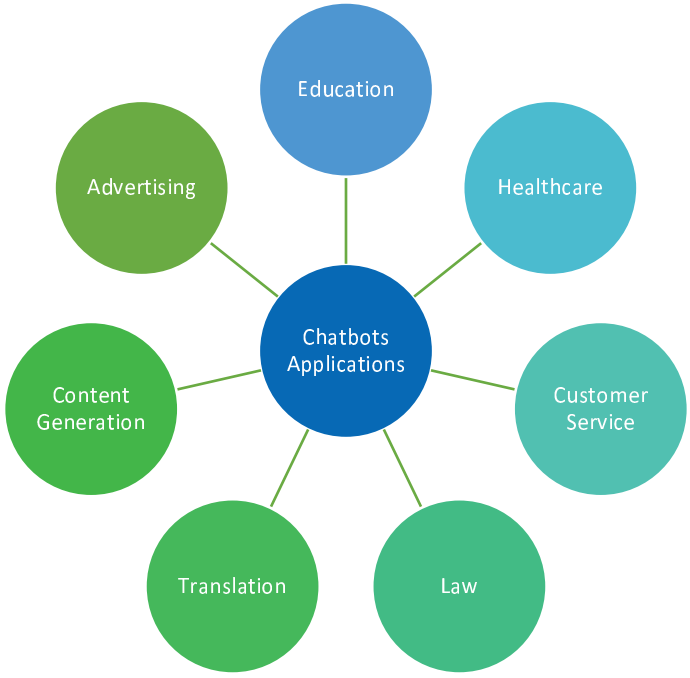


Figure 7. Applications of chatbots

Chatbots have revolutionized various industries and are now widely used in diverse applications. In the field of Education, chatbots have proven to be valuable tools for interactive learning experiences. They can act as virtual tutors, providing instant answers to students' questions and guiding them through personalized study plans. In Healthcare, chatbots offer efficient patient support, assisting with medical queries, appointment scheduling, and even providing mental health support. Customer Service departments benefit from chatbots by offering 24/7 assistance, reducing response times, and resolving common issues swiftly. In the Legal sector, chatbots streamline legal research, providing access to relevant information and assisting with simple legal inquiries. Additionally, chatbots are crucial in the Translation realm, swiftly translating text in various languages, enhancing global communication. Moreover, chatbots have extended their reach into Content Generation, creating automated content for blogs, articles, and social media posts. Lastly, in Advertising, chatbots play a role in targeted marketing campaigns, engaging users with personalized product recommendations and promotional messages. The versatility of chatbot applications continues to grow, enhancing efficiency, accessibility, and user experience across various industries. In this book, different classifications for chatbots will be studied, and we will discuss why companies need to deploy chatbots in the near future.

The integration of chatbots in various domains has revolutionized human-technology interactions, progressing from simple commands to advanced prompt engineering techniques. Prompt engineering, which is a new job that emerged alongside the rise of chatbots, involves crafting prompts relevant to users' questions to guide GPT-based chatbots like ChatGPT in generating desired responses. Understanding the key elements of a prompt, such as instruction, context, input data, and output format, enables the construction of accurate prompts. Prompting enhances chatbots' capabilities in customer service, technical support, content writing, research, and more, augmenting human performance and optimizing workflows. There are numerous techniques like zero-shot, few-shot, and chain-of-thought prompting that will be studied later in this book to create appropriate prompts.

From an academic approach, GPT-based chatbots are classified as weak intelligence, which refers to a type of intelligence that is programmed to perform a specific task. However, we should keep our expectations higher, aiming for general intelligence[8] and even super intelligence[9]. Overall, chatbots, especially GPT-based ones, have the potential to surpass other chatbots and humans, bringing revolutionary changes to different domains, particularly in job markets.

We will study the effects of chatbots on job markets later, but it should be noted that existing chatbots are not yet sufficiently advanced, and they face several challenges, as shown in Figure 8. In this book, we will discuss all of these challenges and explore the possibilities that a successful evolution of chatbots might bring in the last chapter.

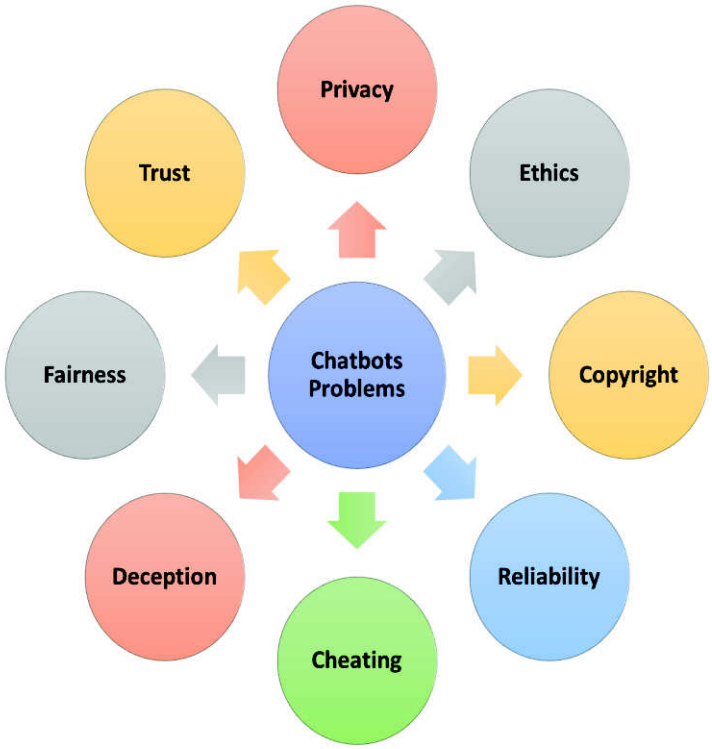


*Figure 8. The problems of ChatGPT based on AI perspectives*

All of the mentioned topics will be explained in this book across eight chapters, as outlined below:

Chapter 2, "Industry 4.0 Revolutions and Human Weaknesses: The Critical Role of Chatbots," sets the stage by delving into the advent of the fourth industrial revolution and the critical role that chatbots play in addressing human weaknesses. As technological advancements reshape our society, GPT-based chatbots emerge as powerful allies in understanding and overcoming the intricacies of human behavior and decision-making.

In Chapter 3, "Unveiling the World of Chatbots: Origins, Functions, and Applications," we embark on a journey to discover the origins and evolution of chatbots. From their humble beginnings to their current

[8] Artificial general intelligence can be equivalent to type of intelligence in humans.

[9] Artificial Super Intelligence surpass human agent intelligence in all dimensions and may exabit something that are not considerable by human intelligence.

state of sophisticated AI systems, we uncover the underlying technologies that fuel their abilities. Moreover, we explore the diverse functions and real-world applications of chatbots, from streamlining customer service to enhancing personal productivity across industries.

Chapter 4, "How to Use Chatbots: From Simple Commands to Prompt Engineering," serves as a practical guide for readers to effectively leverage the power of GPT-based chatbots. Whether you are a novice or a seasoned AI enthusiast, this chapter equips you with the knowledge and skills to interact with chatbots through simple commands or engineer prompts for engaging and creative interactions.

With every innovation comes challenges, and Chapter 5, "What Are the Fundamental Challenges of Chatbots?," confronts the ethical considerations, biases, and technical limitations that accompany the rise of GPT-based chatbots. By understanding and addressing these challenges, we pave the way for responsible and inclusive adoption of AI technologies.

Intriguing encounters and humorous anecdotes await in Chapter 6, "Strange Things Happened by Chatbots!" As we explore the intriguing world of chatbot interactions, we uncover instances of unexpected outcomes, cultural nuances, and thought-provoking user experiences. These encounters serve as a reminder that while chatbots possess remarkable capabilities, they are not exempt from the quirks of human communication.

The ramifications of chatbot adoption extend beyond individual interactions and industries. Chapter 7, "The Ripple Effect: Understanding the Interrelated Changes in Humans, Jobs, and Markets Triggered by Chatbot Adoption," explores the complex web of transformations in human behavior, job markets, and economies triggered by the integration of GPT-based chatbots. We delve into the dynamic relationship between humans and machines, shedding light on the changing landscape of employment and the potential disruptions in markets.

Finally, in Chapter 8, "The Future of Chatbots: What Will Happen to Humans in the Continual Evolution of Machines," we peer into the horizon of possibilities. As the continual evolution of machines unfolds, we contemplate the future of chatbots and their profound implications for humanity. Will we witness a seamless coexistence between humans and AI, or will we face unforeseen challenges and ethical dilemmas?

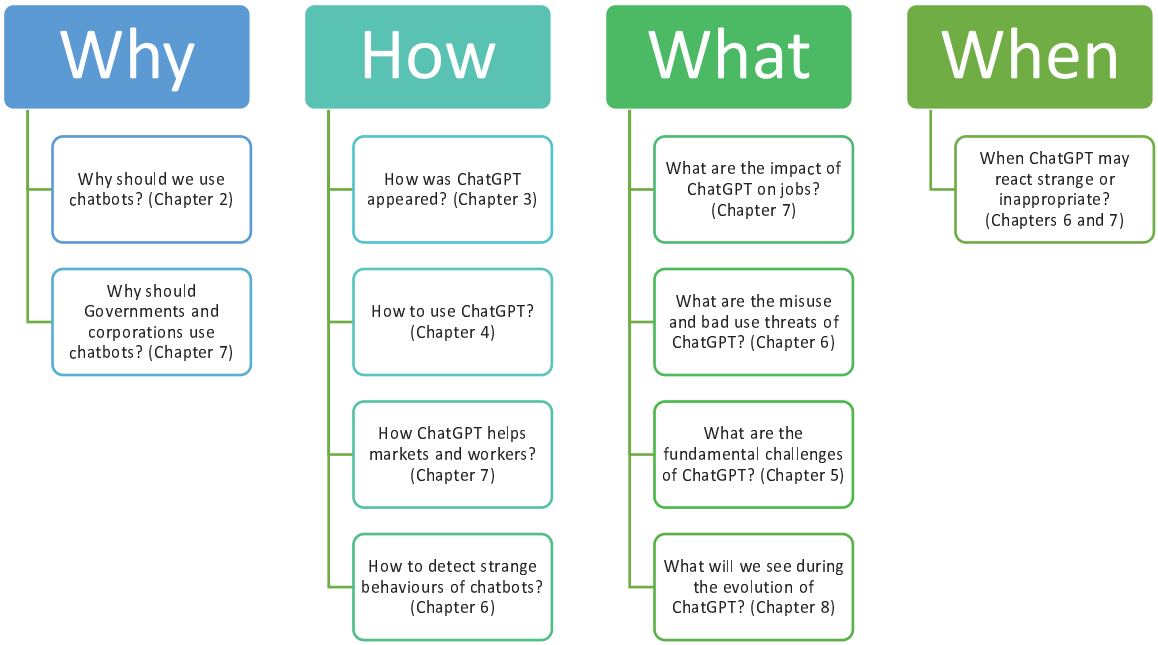


*Figure 9. Answered questions regarding chatbots in this book*

Throughout this book, we invite you to immerse yourself in the exciting world of GPT-based chatbots and their significance in Industry 4.0. Prepare to be enlightened, intrigued, and inspired as we explore the potential, challenges, and transformative impact of these intelligent agents on our lives and the ever-shifting job market. Figure 9 shows a pig picture about questions that will be answered throughout this book. Embrace the revolution, for the future of chatbots is now, and their vitality in shaping our world is undeniable. Let us embark on this remarkable journey together.