

Introduction to Prompt Engineering: Fundamentals and Applications

Author: Dr. Hossein Mokhtarzadeh

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Table of Contents

Table of Contents	2
Dedication	2
Preface: Embracing the Power of AI and LLMs: Setting the Stage	4
Acknowledgments	5
About the Author	6
Who can use this book?	7
Decoding the Future: An Introduction to Large Language Models	8
Exploring ChatGPT with other Free Tools (Optional and for advanced users)	10
Preparing for the Journey: A Beginner's Guide	11
Introduction to ChatGPT: Harnessing AI for Engineering Innovation	12
Introducing Prompt Engineering	18
Prompt Engineering Examples	19
Unlocking LLM Potential: Embrace Experimentation and Learn by Doing	22
Reproducibility of ChatGPT Responses across Conversations	22
What is research and learning?	24
Common myths surrounding Language Models (LLMs)	27
Simplifying Questions and Steps: Achieving Clear Answers with ChatGPT	30
Boosting Productivity - An Example	33
Designing Ergonomic Assistive Devices: An Example	35
Persona Patterns and Corresponding Personas:	37
Exploring Conversational Patterns and Prompt Variations	40
Zero-shot, one-shot, and few-shot learning	44
Chain of Thought Pattern	45
Harnessing the Power of Outlines with ChatGPT	47
Leveraging LLMs: Potential, Limitations, and Optimal Tools	50
Utilizing Placeholders in AI Conversations for Comparative Analysis	52
Automation and ChatGPT (Conversational AI)	53
Significance of LLMs in Engineering Research and Learning	57
LLMs Available and Free to Use	59
Note on the Broader Spectrum of LLMs	59
Enhancing Collective Intelligence through LLM Collaboration	59
Resources to Master Language Learning Models (LLMs)	61
The Future of Human-Computer Interaction: A Voice-Powered Revolution	62
The Transformative Power of Voice Interaction with LLMs	63
OpenAI's Six Strategies for Improved Results	65
Embracing AI: Rethinking Education and Evaluation	67
Exploring the Future with AI: Embracing Change and Opportunities	70
Closing Thoughts	72
Reflections and Quizzes	73

Dedication

This book is dedicated to the courageous women in Iran who inspire us with their resilience and commitment to equality.

I also dedicate it to my son, Arvin, for his curiosity and passion for learning. May this book inspire him and future generations to explore AI, ML, and LLMs.

Lastly, to my wife, Fatemeh, for her unwavering support and love. Her presence reminds me of the strength of true partnership.

May this dedication honor those who fight for freedom and the power of family love and support.

زن، زندگی، آزادی

Woman, Life, Freedom



Women, akin to LLMs, possess an incredible ability to generate and create value from virtually nothing, showcasing their remarkable resourcefulness and creativity.

Preface: Embracing the Power of AI and LLMs: Setting the Stage

In this book, I navigate the rapidly evolving world of Artificial Intelligence¹ and large language models (LLMs), adapting my approach amidst intense competition and technological advancements. Initially focusing on the free version of ChatGPT, I quickly expanded to using the paid version to address the challenges of these evolving tools. This journey underscores the importance of learning effectively, formulating precise questions, and using AI as a supplementary aid, rather than relying solely on complex techniques.

Join me in exploring the boundless possibilities of AI, ML, and LLMs across various disciplines, from engineering research to broader applications. This book is a journey from fear to empowerment, emphasizing understanding and collaboration with AI to achieve remarkable outcomes. It's about unlocking your potential and confidently navigating this technological landscape. Get ready for an adventure into AI and LLMs, where we'll learn, adapt, and create a brighter future together.



¹ "Artificial intelligence - Wikipedia." [Artificial intelligence - Wikipedia](#). Accessed 26 Jul. 2023.

Acknowledgments

A special acknowledgement is extended to the Mermaid² team and the creators of the Google Docs³ extension for their seamless graph creation tools. Furthermore, we are thankful for the support and assistance provided by OpenAI⁴ and ChatGPT⁵ throughout the brainstorming, generating, writing, drafting, and editing process of this book. Many of the techniques used in this book have been utilized in writing it. We would also like to express our gratitude to the Microsoft designer⁶ for crafting the AI-generated images showcased in this book, prior to my utilization of ChatGPT DALL·E 3. I'm grateful for the invaluable knowledge gained from various sources like YouTube⁷, blogs (e.g. on Medium⁸), LinkedIn⁹, Coursera¹⁰, Udemy¹¹ and Twitter¹². Thanks to those who freely share their expertise, enabling faster and more efficient learning. While I might not have referenced all of them, my learning has been enriched by these resources. I'm grateful to Google and Colab developers for their contributions to Python's open-source packages, briefly mentioned in this book but pivotal in my future work.

² "Mermaid Live Editor: Online FlowChart & Diagrams Editor." [Mermaid Live Editor](#). Accessed 26 Jul. 2023.

³ "Google Docs: Online Document Editor | Google Workspace." [Google Docs: Online Document Editor](#). Accessed 26 Jul. 2023.

⁴ "OpenAI." [OpenAI](#). Accessed 26 Jul. 2023.

⁵ "ChatGPT." [ChatGPT](#). Accessed 26 Jul. 2023.

⁶ "Microsoft Designer - Stunning designs in a flash." [Microsoft Designer](#). Accessed 2 Aug. 2023.

⁷ "YouTube: Home." <https://www.youtube.com/>. Accessed 28 Jul. 2023.

⁸ "Medium – Where good ideas find you.." <https://medium.com/>. Accessed 28 Jul. 2023.

⁹ "LinkedIn: Log In or Sign Up." <https://www.linkedin.com/>. Accessed 28 Jul. 2023.

¹⁰ "Coursera | Degrees, Certificates, & Free Online Courses." [Coursera](#). Accessed 28 Jul. 2023.

¹¹ "Udemy: Online Courses - Learn Anything, On Your Schedule." [Udemy](#). Accessed 28 Jul. 2023.

¹² "Twitter. It's what's happening / Twitter." [Twitter](#). Accessed 28 Jul. 2023.

About the Author

Dr. Hossein Mokhtarzadeh is an accomplished mechanical engineer, holding a PhD from the University of Melbourne in 2014, as well as Master's and Bachelor's degrees from Sharif University of Technology and the University of Tehran, respectively.

Dr. Mokhtarzadeh has a diverse professional background, currently serving as an Asia-Pacific (APAC) Account Manager, Solution Consultant, and Customer Success Manager at [Motek Medical](#) (DIH Brand) in the Netherlands. He specializes in assisting researchers, clinicians, and partners in selecting optimal technology, such as CAREN, M-Gait, and GRAIL systems, to enhance understanding of human performance, prevent injuries and diseases, and explore human-machine interaction.

With over 15 years of experience in research and engineering, Dr. Mokhtarzadeh has held notable positions as a research fellow at Harvard Medical School for the Framingham Heart Study (Osteoporosis) and as a Technical Lead and Research Fellow at the groundbreaking **Computer Assisted Rehabilitation ENvironment (CAREN)** at Melbourne University. His work is driven by principles of efficiency and continuous learning, aiming to empower others to achieve their goals more effectively while finding greater leisure and personal fulfillment. This book serves as a platform for sharing his expertise and experiences, leveraging advancements in large language models to support the broader community of researchers and professionals, particularly in the field of engineering, with various examples and applications.

Furthermore, Dr. Mokhtarzadeh holds the position of Senior Research Fellow at the University of Melbourne, where he provides guidance to researchers in effectively communicating their findings. He firmly believes in the transformative power of continuous learning and enthusiastically invites readers to join him on a journey of knowledge acquisition and personal growth. His motto is '**Let's learn how to learn**, and then you'll have a superpower.'¹³

In his spare time, Hossein enjoys Karate, learning new concepts, writing books like this one, and producing podcasts, formerly as a casual producer for SBS in Australia.



¹³ "Powerful mental tools to help you master tough subjects - Coursera." [Learning How to Learn: Powerful mental tools to help you master tough subjects | Coursera](#). Accessed 28 July. 2023.

Who can use this book?

This book is designed to cater to individuals with varying levels of knowledge, including those with minimal understanding of engineering and coding. However, students, researchers, and professionals in the fields of engineering and computer science may find even greater value in the content, given their specific interests and background.

Regardless of your familiarity with the subject matter, this book offers methods to gain insights and progress in your understanding. It is suitable for anyone who has an enthusiasm for learning and is open to exploring new concepts. I have taken the complex ideas surrounding large language models and their applications in engineering and simplified them within these pages. All you need to embark on this journey of mastering engineering research and learning is access to the internet and a Gmail account¹⁴. With these resources at your disposal, you are well-equipped to delve into the world of engineering and expand your knowledge.

To fully benefit from this book:

1. Read it digitally or in print.
2. Utilize online resources:
 - a. Visit [Chat AI](#)¹⁵ or [Google Bard](#)¹⁶.
 - b. Sign up for a Gmail account at [Gmail](#).
 - c. Access [Welcome To Colaboratory](#)¹⁷ with internet connectivity (**Optional**).

Note for advanced users: With paid ChatGPT-4 access, you can use [Advanced Data Analysis](#), (formerly Code Interpreter) to run Python codes. However, you can't install new packages yet. Platforms like Google [Colaboratory](#) (Colab) are preferable for this, but

Advanced Data Analysis is good for quick code reviews and execution. I initially planned to include extensive details like Colab and how to generate codes in ChatGPT and run in Colab, but decided it's better to learn and practice in steps. Stay tuned for upcoming releases, books, and blogs, where I'll delve into how ChatGPT can be integrated with platforms like Google Colab. While OpenAI employs advanced computing infrastructure to run large language models like GPT-3 and GPT-4, my focus will be on demonstrating practical applications using accessible tools, such as Python in notebook environments similar to Jupyter.



¹⁴ "Gmail.com Login - Google Sites." [Gmail Login - www.gmail.com](#). Accessed 24 Jul. 2023.

¹⁵ "ChatGPT." [ChatGPT](#). Accessed 24 Jul. 2023.

¹⁶ "Try Bard, an AI experiment by Google." [Google Bard](#). Accessed 24 Jul. 2023.

¹⁷ "Welcome To Colaboratory - Google Research." [Welcome To Colaboratory](#). Accessed 24 Jul. 2023.

Decoding the Future: An Introduction to Large Language Models

In the fast-evolving world of technology, Large Language Models (LLMs) stand out as a pinnacle of innovation. These complex algorithms, powering tools like ChatGPT, Claude, and Bard, are capable of understanding, interacting, and creating content with an almost human-like fluency in language. They are digital brains, storing immense knowledge and capabilities, much like the Llama-2-70b model with its 140 gigabytes of parameters.



A visual representation that captures the essence of Large Language Models (LLMs). This image embodies the concept of a digital brain, symbolizing the vast knowledge and capabilities of LLMs. It's surrounded by various forms of creative output they can generate, set against a backdrop that represents the digital landscape of the internet compressed into these models. This depiction aims to visually convey the themes and ideas discussed in your book's introduction, enhancing the reader's engagement and understanding.

Training LLMs is an immense task, akin to compressing the internet into a dense parameter 'zip file.' This process requires significant text data and computational resources. But their abilities

extend far beyond their creation. LLMs can generate a wide range of content, from poetry to code, offering both versatility and depth.

Yet, these powerful tools also face challenges, particularly in security. Threats like prompt injection and data poisoning show the need for cautious and responsible use.

LLMs represent a new era of digital interaction and creativity. This book aims to explore and demystify LLMs, showcasing their potential and the journey through their digital minds.

The introduction and accompanying visual representation draw inspiration from Andrej Karpathy's comprehensive YouTube video on LLMs. It serves as an excellent primer for understanding LLMs, their development, applications, and challenges. The content here aims to provide a foundational understanding, inviting readers to delve deeper into the world of LLMs. As we embark on this exploration, we'll uncover how to utilize LLMs in engineering and beyond, enhancing our daily lives with their capabilities.

[Watch the insightful video on YouTube for a deeper understanding](#) and let's embark on this enlightening journey together. As we delve into the complexities and capabilities of Large Language Models, a pivotal question emerges: do these models, like ChatGPT, possess actual intelligence?

To explore this further, I recommend a concise yet informative [video](#) presented by Code.org, featuring insights from Mira Murati, CTO of OpenAI, and Cristóbal Valenzuela, creator of Runway. Accessible on YouTube, this video provides a clear understanding of how LLMs function, highlighting their capabilities and limitations.

For a more in-depth exploration, valuable resources are available at [Code.org's AI learning section](#). This platform, supported by organizations such as ETS, ISTE, and Khan Academy, offers extensive knowledge for those keen on delving deeper into the world of AI and LLMs.

Exploring ChatGPT with other Free Tools (Optional and for advanced users)

Initially, my goal was to write a comprehensive book that would encompass code generation (reading, running, and editing in Google [Colab](#)) and report generation (reading and editing in Google Docs). However, I decided to start small, as effective learning can still be achieved this way. Stay tuned for more details in the next books, which will explore other applications of what you can create. For example, you can generate Python code in ChatGPT, copy and paste it into Google Colab, install any necessary packages, and run it. You can also generate reports, which can be accessed in Google Docs or downloaded for reading elsewhere. While waiting for my future books, you can also Google these topics or ask ChatGPT for assistance.

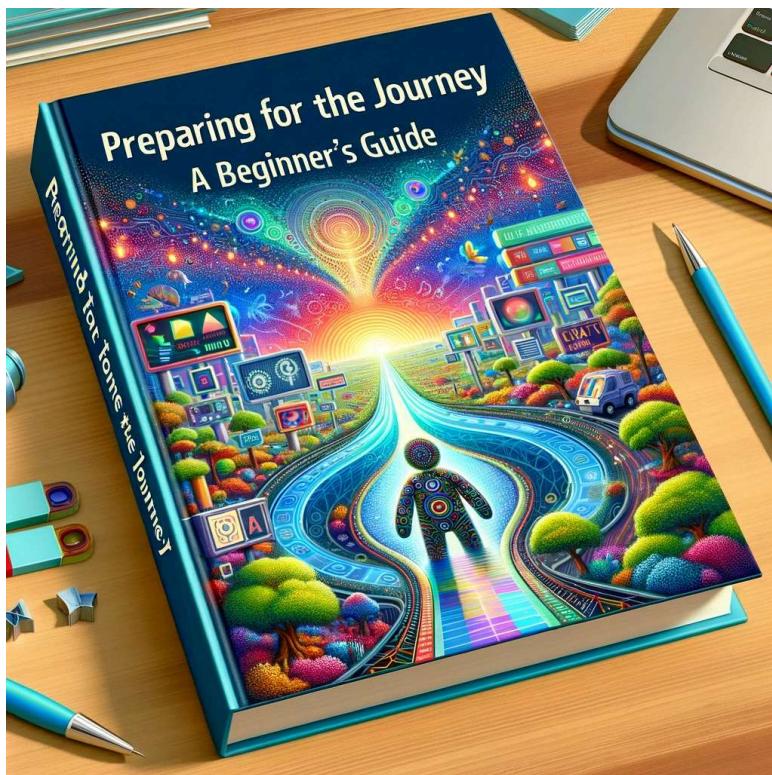
Quick update: Google's Keyword blog announced expanded AI coding features in Colab for free-tier users. Stay tuned as I delve into these further, and we'll explore them together.



The image features a workspace setting with a laptop displaying ChatGPT, another screen showing Google Colab with Python code, and a third screen with a Google Docs report. Additionally, there are books in the background symbolizing future learning and a search bar query about Google's AI coding in Colab, all within a modern and technologically evolving environment.

Preparing for the Journey: A Beginner's Guide

This guide is tailored for beginners, diving into the world of large language models (LLMs¹⁸), AI, and machine learning without overwhelming technical details. It sidesteps the intricate theories often associated with these fields, choosing instead to streamline their practical applications, especially in engineering contexts, through engaging examples. Consider this guide your starting point in a broader educational journey. Here, you'll find a focus on prompt engineering, with a promise of more advanced topics as we collectively explore and grow. The guide's interactive format allows you to leap over sections you're already comfortable with, catering to a wide audience from novices to seasoned experts. Whether it's your initial foray into AI¹⁹, ML²⁰, or LLMs like ChatGPT²¹ or other GPT models, this guide invites you to join a shared learning experience. The guide covers a range of language model applications, with a special emphasis on ChatGPT-like systems. The initial sections introduce language models, simplifying and constructing conversational prompts for everyday use. It's advisable to practice these initial exercises before advancing to subsequent topics. Let's embark on this journey together, and I wish you the best of luck!



Preparing for the Journey: A Beginner's Guide

¹⁸ "Large language model - Wikipedia." [Large language model - Wikipedia](#). Accessed 24 Jul. 2023.

¹⁹ "Artificial intelligence - Wikipedia." [Artificial intelligence - Wikipedia](#). Accessed 24 Jul. 2023.

²⁰ "Machine learning - Wikipedia." [Machine learning - Wikipedia](#). Accessed 24 Jul. 2023.

²¹ "ChatGPT." [ChatGPT](#). Accessed 24 Jul. 2023.

Introduction to ChatGPT: Harnessing AI for Engineering Innovation

"Education is not preparation for life; education is life itself." - John Dewey



The primary objective of this book is to democratize engineering research and education by leveraging freely available tools (some features are paid) and large language models (LLMs). Please note that although I had originally intended to focus solely on engineering, the content here can be applied to almost any other field and daily activities ([Figure 1](#)). My ultimate goal is to share more as I learn through different books and focus on learning and research in engineering and beyond using LLMs. However, this particular book is concentrating on basic engineering prompts, so no previous knowledge is needed.

LLMs are sophisticated AI tools specifically designed for text processing. To get started, access ChatGPT at [Chat AI](#) and log in using either your email or Gmail account. Similarly, access Bard by visiting [Google Bard](#) and logging in with your Gmail account. These platforms will provide you with valuable conversational assistance. By engaging with the chapters in this book, you will achieve the following:

- (i) Utilize LLMs to gain a comprehensive understanding of almost any concept.
- (ii) Effectively communicate your findings through concise reports.
- (iii) Enjoy the learning process while exploring the world of engineering and prompt engineering.

This book includes interactive tasks, allowing you to skip chapters covering familiar topics.

If you're **new to using ChatGPT**, no worries! Just follow these steps:

1. Go to [ChatGPT](#) and log in ([Figure 2](#)).
2. Start typing your questions or anything you'd like to say in the "Send a message" bar.
1. Press Enter to see ChatGPT generate responses to your input.

Or search and watch a beginner's guide on YouTube²²: e.g., [Link](#).

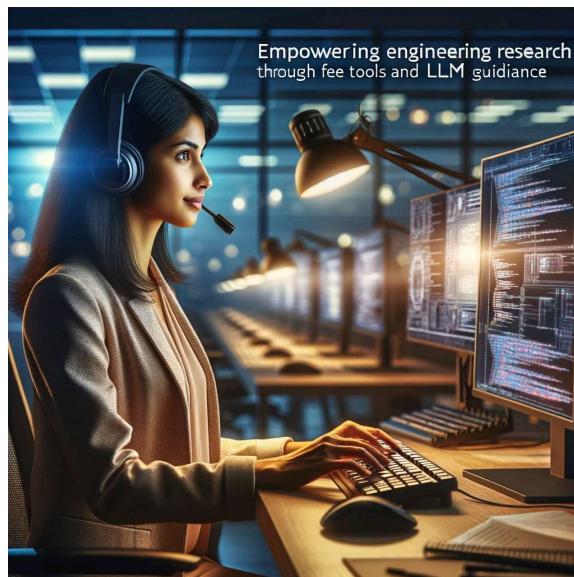


Figure 1: Empowering Engineering Research through Free Tools and LLM Guidance

²² "YouTube." 11 Dec. 2017, [YouTube](#). Accessed 2 Aug. 2023.

Accessing GPT-4 for advanced ChatGPT features:

1. Visit [ChatGPT](#).
2. Log in to your account.
3. Click on "Upgrade to Plus" in the bottom left corner of the page.
4. A window will appear; press the green "Upgrade plan" button under "ChatGPT Plus."
5. On the right side, enter your payment info and billing address.
6. Click "Subscribe."

Initially, my focus was primarily on the free version of ChatGPT, but I later realized the need to incorporate the capabilities of GPT-4. While most of the ideas in the book can be executed using the free version, certain sections indeed require the advanced features of GPT-4.

Remember that some websites, such as Bing AI chat through Microsoft Edge, might also offer access to GPT-4. However, the steps above are specifically for purchasing or subscribing to ChatGPT-4 on the OpenAI platform. Keep in mind that the advanced features in ChatGPT-4 cannot be accessed through, for example, Bing AI chat.

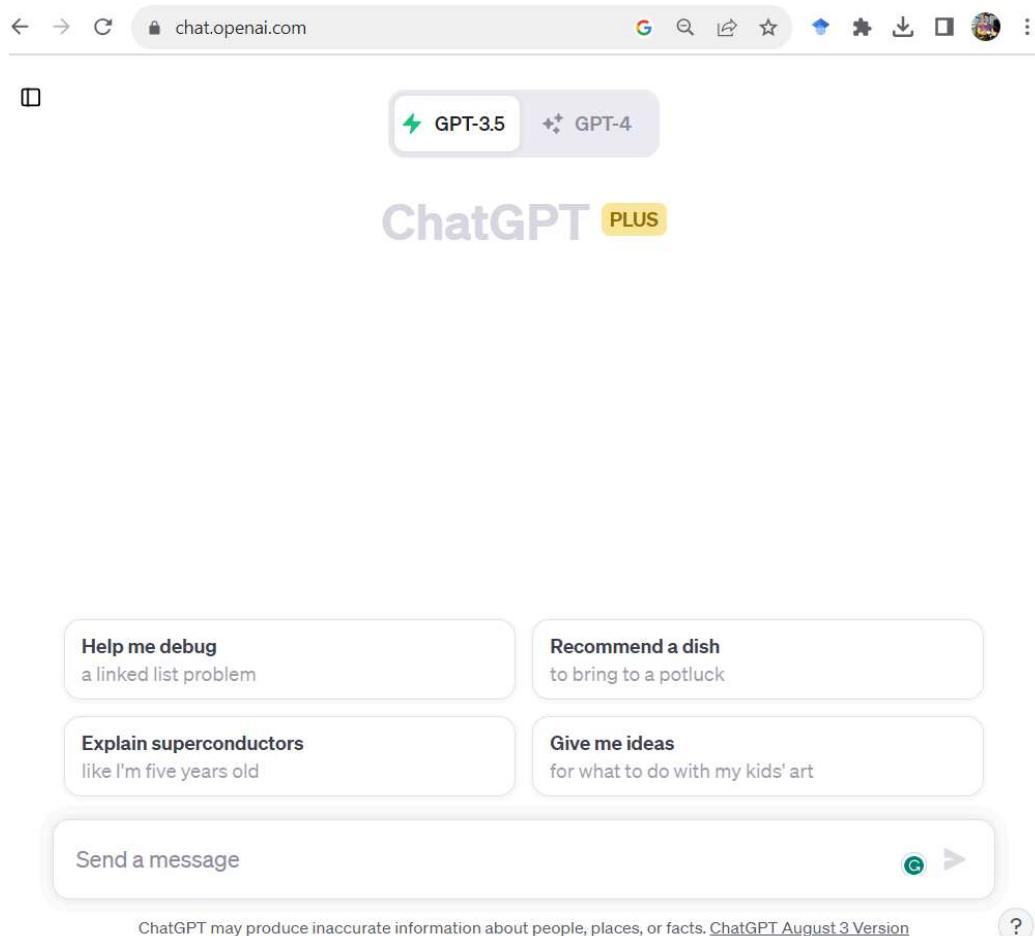


Figure 2: ChatGPT interface at [ChatGPT](#) provides access to the latest GPT versions. The screenshot displays the August 3rd version of ChatGPT, specifically the Plus Version, which grants access to ChatGPT-4 and Advanced Data Analysis, among other plugins. Both versions are accessible by joining via email, and you can start using them by typing in the "Send a message" bar. Type anything that comes to mind, whether a question, comment, or click on a recommendation like 'Recommend a dish' above the bar. After typing, hit Enter to observe how ChatGPT generates responses.

You should be able to reproduce the responses from ChatGPT in this book though with slight changes, as the outcomes are predictive, not deterministic. Each prompt will begin with "**User:**" and be followed by "**ChatGPT:**" responses. If other LLMs like Brad, etc., are used, they will be mentioned accordingly. Simply copy and paste the prompts after "**User:**" to start the exploration process.

Note: For clarity, the prompts might have gone through the following steps too: A) write the idea or prompt, then B) ask ChatGPT to proofread, edit, or even condense it (e.g.: 50 verbs to improve writing with ChatGPT, [see below](#)), C) this process may have been iterated for clarity ([Figure 3](#) and [Figure 4](#)).

50 verbs to improve writing with ChatGPT:

1. Elaborate; 2. Analyze; 3. Summarize; 4. Synthesize; 5. Validate; 6. Dissect; 7. Optimize; 8. Evaluate; 9. Revise; 10. Propose; 11. Investigate; 12. Compare; 13. Contrast; 14. Demonstrate; 15. Illustrate; 16. Examine; 17. Interpret; 18. Incorporate; 19. Implement; 20. Refute; 21. Support; 22. Correlate; 23. Formulate; 24. Suggest; 25. Construct; 26. Extrapolate; 27. Identify; 28. Justify; 29. Clarify; 30. Predict; 31. Integrate; 32. Modify; 33. Establish; 34. Quantify; 35. Recommend; 36. Categorize; 37. Generate; 38. Organize; 39. Comprehend; 40. Compose; 41. Discover; 42. Resolve; 43. Systematize; 44. Validate; 45. Improve; 46. Innovate; 47. Investigate; 48. Develop; 49. Adapt; 50. Revamp.



Figure 3: Here is a visual representation of the concept "Improve Writing with ChatGPT." The image shows a cozy study room where a person is engrossed in writing at a desk with a holographic display of ChatGPT providing writing tips. The room's inviting and productive atmosphere is enhanced by a window overlooking a serene landscape, a steaming cup of coffee, and various writing materials.



Figure 4: Here's a visual representation of the iterative learning process using ChatGPT, inspired by the 'Build, Measure, Learn' cycle. It features three distinct sections: writing an idea on a digital tablet, interacting with ChatGPT for proofreading and editing, and an illustration of the repetitive process for clarity and refinement, all set in a modern, tech-friendly workspace.

You may wish to try a similar approach that will be used across this book. Here's a simple example from ChatGPT:

User: Please condense the following:

Original: "You should make sure to carefully read the instructions before assembling the furniture. If you encounter any difficulties during the assembly process, you can refer to the troubleshooting section in the manual."

ChatGPT:

Condensed: "Before assembling the furniture, carefully read the instructions. If any difficulties arise, refer to the troubleshooting section in the manual (e.g. xxx)."

Table 1: Summary of Fundamental Keywords and Explanations in Engineering Research. Experiment by inputting the prompts into [ChatGPT](#) or [Bard](#) and observe the results. A prompt you may use to recreate the table below could be: "Give me a summary of fundamental keywords and explanations up to 5 in engineering research using AI in a table with brief explanations and a sample prompt for each cell (<5 words)"

Keyword	Explanation	Sample Prompt
Artificial Intelligence (AI)	<i>Simulation of human intelligence in machines.</i>	<i>Define AI and its applications.</i>
Machine Learning (ML)	<i>Subset of AI enabling systems to learn from data.</i>	<i>How does ML differ from AI?</i>
Neural Networks	<i>AI models inspired by the human brain's structure.</i>	<i>Explain the functioning of neural networks.</i>

Data Preprocessing	<i>Cleaning and transforming raw data for ML/AI models.</i>	<i>Why is data preprocessing important in AI?</i>
Optimization	<i>Improving efficiency and accuracy of AI algorithms.</i>	<i>Discuss optimization techniques in AI.</i>
GPT	<i>Generative Pre-trained Transformer by OpenAI</i>	<i>What is GPT and how is it used in natural language?</i>
ChatGPT	<i>Advanced language model for text generation</i>	<i>Explain the capabilities of ChatGPT in communication.</i>

To embark on our exploration of the role of LLMs in engineering education and research, let's start by familiarizing ourselves with basic terminologies and explanations. We can leverage the same tools and website mentioned earlier to delve deeper into these concepts. Utilize the prompts provided in the condensed table to enhance your understanding and prepare yourself for the subsequent sections of this book ([Table 1](#)).

These prompts can be used as starting points to gather more information about each keyword and engage in a deeper discussion or exploration.

As an example, let's have a quick look at a couple of prompts in the table above. You can either explore those prompts or simply come up with your own. As a user, you will go to [Chat AI](#) (where it says "Send a message") and start this conversation:

Let's ask ChatGPT about using prompts in guiding AI models in research.

User: What is the role of prompts in guiding AI models during the research process?

Then you may get the following. The response may differ because of the nature of LLMs as they are predictive models.

ChatGPT: The role of prompts in guiding AI models during the research process is to provide specific instructions or input to influence the model's output and tailor its responses to desired outcomes.

Or you may continue exploring this response or ask a totally different question like:

User: What is the significance of AI in engineering research and its potential applications?

ChatGPT: The significance of AI in engineering research lies in its ability to revolutionize various aspects of the field, enhancing efficiency, accuracy, and innovation. Potential applications include optimization, automation, predictive maintenance, image and signal processing, and designing complex systems.

What else would you like to ask? Keep reading and practicing to learn more!

Introducing Prompt Engineering

Prompt Engineering²³ is a vital aspect of AI utilization, especially when it comes to ChatGPT. By skillfully crafting well-designed prompts (a prompt is a given text that guides an AI model's response), we can effectively influence and guide ChatGPT's responses. For instance, when aiming to create a futuristic story, one might use a prompt like "In a technologically advanced city...". Similarly, for summarizing an article about renewable energy sources, a prompt such as "Summarize the following article about renewable energy sources" can be employed ([Figure 5](#)).

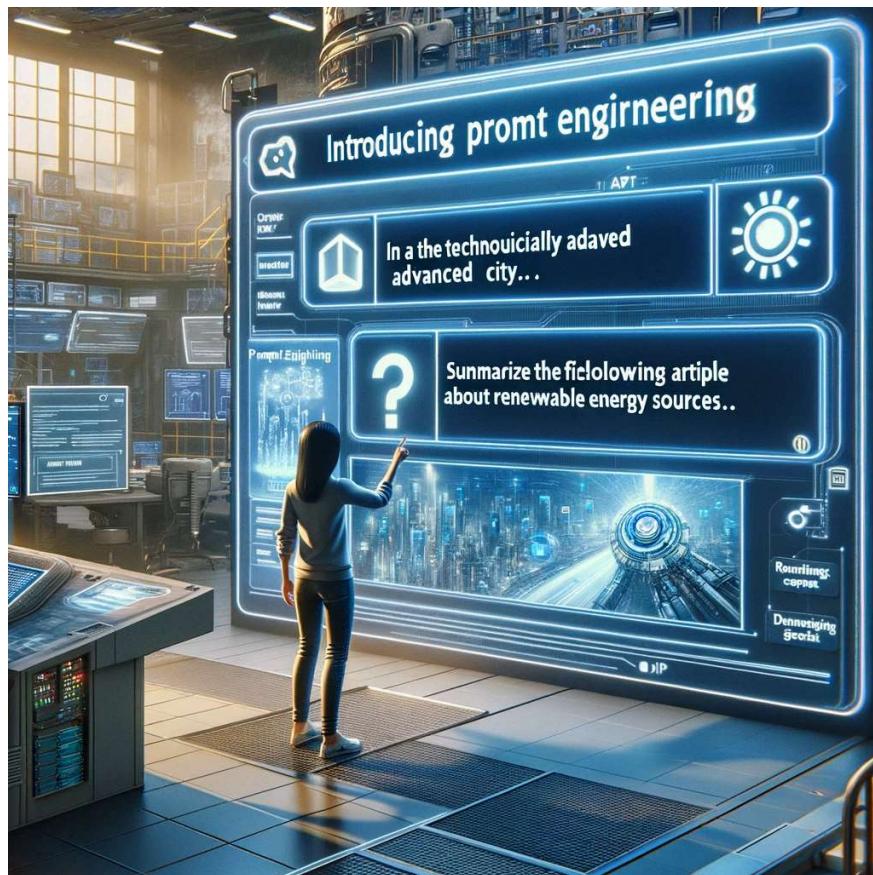


Figure 5: The image provides a visual representation of "Introducing Prompt Engineering," depicting a person crafting prompts for ChatGPT on a large digital screen.

The process of Prompt Engineering encompasses the refinement of prompts, the adjustment of parameters, and the careful selection of relevant words. When seeking improved translation results, experimenting with different phrasings can prove beneficial. To encourage poetic outputs, offering various starter phrases can inspire ChatGPT to generate creative and artistic responses.

²³ "Prompt engineering - Wikipedia." [Prompt engineering - Wikipedia](#). Accessed 2 Aug. 2023.

The effective practice of Prompt Engineering yields substantial benefits, enabling ChatGPT to deliver responses that are more accurate and contextually appropriate, which enhances the overall versatility and usefulness of AI. However, it is crucial to exercise caution and always validate responses from Language Model Models (LLMs). Hallucinations²⁴ in language models, such as falsely stating, "All fish can fly," are instances where they generate incorrect or imaginary information. Blindly trusting AI responses can lead to misinformation or errors. More detailed insights on this subject can be found in the book.

In conclusion, Prompt Engineering represents a captivating and ever-evolving field that empowers us to harness the full potential of AI, making it an exciting area of exploration.

Prompt Engineering Examples

Then let's use ChatGPT to list, e.g., 5 examples of prompt engineering in our daily activities and highlight the key aspects and important points for us ([Figure 6](#)).

ChatGPT: Sure! Here are five examples of Prompt Engineering in our daily activities, along with the key aspects and important points for each:

1. Search Engine Queries:

- Prompt Engineering: Crafting specific search queries to find relevant information.
- Key Aspects: Using keywords, adding modifiers (e.g., "best," "how to"), and refining queries iteratively.
- Important Points: Precise prompts yield more accurate search results, saving time and improving research efficiency.

2. Virtual Assistants:

- Prompt Engineering: Formulating clear and concise voice commands for virtual assistants.
- Key Aspects: Structuring queries for natural language understanding, providing necessary context.
- Important Points: Well-constructed prompts help virtual assistants perform tasks accurately and swiftly.

3. Email Subject Lines:

- Prompt Engineering: Creating compelling subject lines for emails to improve open rates.
- Key Aspects: Using engaging language, conveying the message's essence in a limited space.

²⁴ "Hallucination (artificial intelligence) - Wikipedia." [Hallucination \(artificial intelligence\) - Wikipedia](#). Accessed 26 Sep. 2023.

- Important Points: Effective email prompts lead to better communication and higher response rates.
- 4. Chatbot Interactions:**
- Prompt Engineering: Designing user prompts for chatbot interactions.
 - Key Aspects: Offering clear options or guiding questions, anticipating user needs.
 - Important Points: Well-structured prompts enhance user experience and streamline conversations.
- 5. Smart Home Devices:**
- Prompt Engineering: Formulating voice commands for smart home devices.
 - Key Aspects: Using predefined phrases, incorporating device names and desired actions.
 - Important Points: Proper prompts enable seamless control of smart devices, making daily tasks convenient.

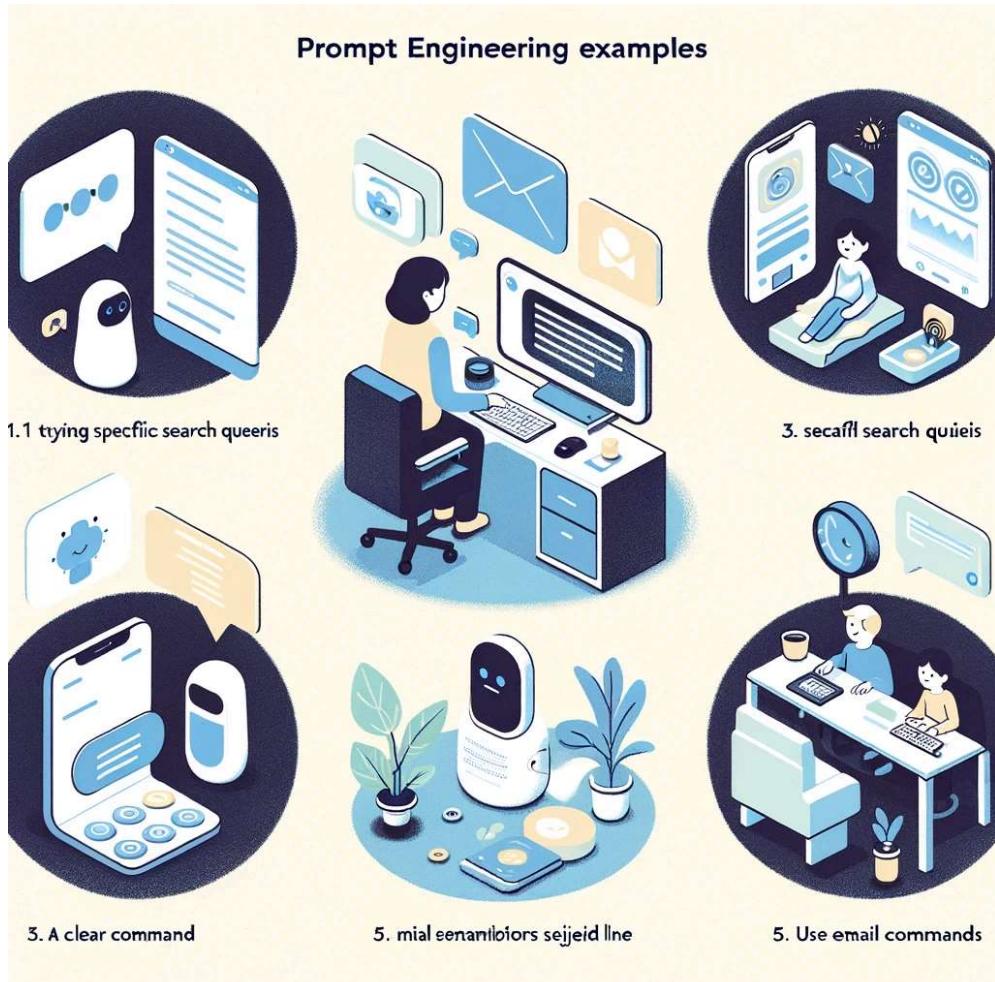


Figure 6: The image provides a simple visual representation of various examples of Prompt Engineering in daily activities, each depicted through a distinct, minimalist scene.

In all these examples, the key aspect of Prompt Engineering is to be clear, specific, and contextually relevant. Providing the right information, using appropriate language, and refining prompts based on feedback are important practices. Effective Prompt Engineering enhances communication, task completion, and overall user experience, making it an essential skill in our daily interactions with AI systems and technology.

Now imagine you want to continue learning more about Virtual Assistants (VA) and, for example, learning about prompt engineering and get help from ChatGPT as a VA to design a tutorial for you. You have also heard of the *Flipped Interaction Pattern*²⁵ (i.e. LLMs question, guide, obtain answers) but have no clue about it. So, you ask your VA to act as an expert and ask you some questions on prompt engineering, so it can provide personalized training for a specific task, e.g., prompt engineering. Let's begin.

User: Now, imagine you want to learn more about Virtual Assistants. For example, you're interested in understanding prompt engineering and seek help from ChatGPT as a Virtual Assistant to design a tutorial for you. So, you ask your Virtual Assistant to act as an expert and quiz you on prompt engineering, enabling personalized training for this specific task. Let's begin.

ChatGPT: Great! Let's start your personalized training on prompt engineering. To get a better understanding, I'll ask you some questions related to prompt engineering. Are you ready? Here's the first question:

Question 1: What is prompt engineering, and why is it important in working with AI models like ChatGPT? Take a moment to think, and then feel free to answer.

Your turn to reply and share knowledge. ChatGPT designs a learning program for you. Explore and read further if needed.

User:...

ChatGPT: ...

Prompt Engineering and improving prompt has become a business endeavor. For instance, 'PromptPerfect'²⁶ is a ChatGPT plugin enabling users to refine their initial prompts. However, here, we can even use the free version of ChatGPT, so employing iterative methods or requesting ChatGPT to enhance the initial prompt remains viable and valuable for research and learning.

Before you begin the journey of prompt engineering, I recommend trying this prompt on your own to explore its potential. Quality prompts are essential for generating quality responses. So,

²⁵ "Prompt Engineering for ChatGPT - Coursera." [Prompt Engineering for ChatGPT | Coursera](#). Accessed 4 Aug. 2023.

²⁶ "PromptPerfect - Elevate Your Prompts to Perfection. Prompt ... - Jina AI." [PromptPerfect](#). Accessed 3 Aug. 2023.

try this: What makes up the Anatomy of a quality Prompt? Or **try this:** What are the limitations of prompt engineering?

Unlocking LLM Potential: Embrace Experimentation and Learn by Doing

When dealing with ChatGPT or similar LLMs, don't be overwhelmed or afraid to experiment. After reading this book, I want you to realize that you don't need to wait for the perfect prompt or someone else to tell you what to do. You have the tools; start exploring and asking questions, even if they're basic. Through iterative improvement, you can create a unique and effective prompt that surpasses other tools available. Learning happens through doing, so don't be shy or wait to understand everything about LLMs or AI. It's like watching a movie on TV; you don't need to know how it's made or the details of electricity in the TV ([Figure 7](#)). Your objective is what truly matters!



Figure 7: The image captures the essence of 'Unlocking LLM Potential: Embrace Experimentation and Learn by Doing', featuring an individual engaging with ChatGPT on a computer, surrounded by symbols of curiosity and exploration in a learning environment, with a background element of a TV playing a movie. This scene reflects the joy and excitement of discovering and learning through experimentation.

Reproducibility of ChatGPT Responses across Conversations

Language models like ChatGPT give varied responses depending on context. Start a new chat for unbiased outcomes. Previous context aids specificity.

[Table 2](#) illustrates how ChatGPT's responses can vary based on different contexts. The provided examples show the impact of maintaining or changing the conversation context on the consistency of the generated outcomes.

Table 2: Context Dependency in ChatGPT Responses: An Example using ChatGPT

Context 1	Context 2	Response
Climate change	<i>French Revolution</i>	Different
Climate change	<i>Climate change</i>	Consistent
New conversation	<i>French Revolution</i>	Different
New conversation	<i>Climate change</i>	Consistent

Practice on your own, ask many questions to explore potential differences and similarities ([Figure 8](#)).

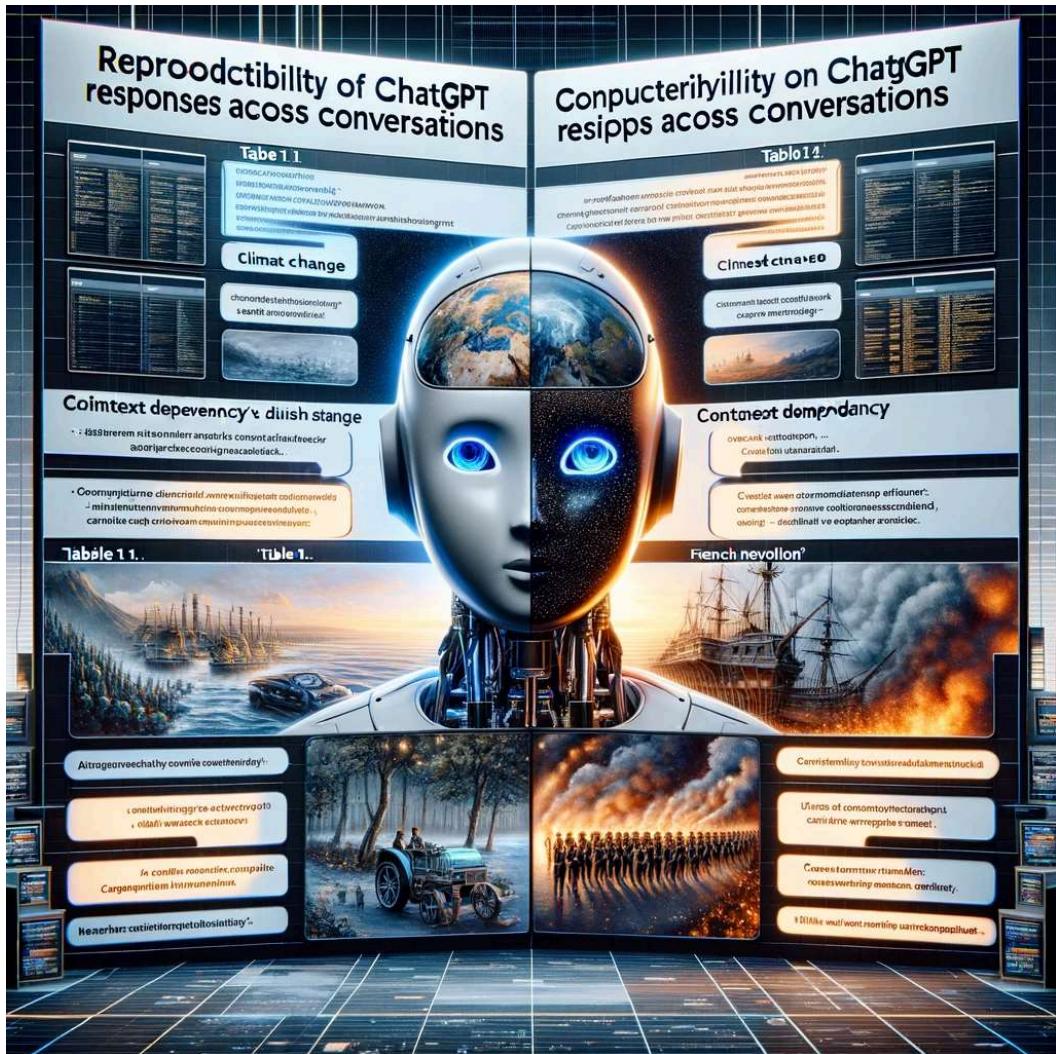


Figure 8: The image visually represents the concept of "Reproducibility of ChatGPT Responses across Conversations," featuring two tables that illustrate how ChatGPT's responses vary based on different contexts.

Note: In ChatGPT-4, selecting text to reply is a user interface feature, allowing focused responses to specific parts of a conversation ([Figure 9](#)).



ChatGPT

Reply

In ChatGPT-4, the ability to select a portion of the text and click "reply" is not inherently a feature of the language model itself. Instead, this functionality would be part of the user interface provided by the platform or application that is utilizing ChatGPT-4.

Here's how it typically works in platforms that support this feature:

1. **Text Selection:** Users can highlight or select a specific portion of the text within the chat interface.

Figure 9: ChatGPT-4's text selection and 'reply' feature are user interface functionalities, not built into the language model itself.

What is research and learning?

Research and learning are fundamental concepts in this book, with a focus on their application in Engineering. However, these principles are universally applicable across multiple disciplines. Research is a form of learning that employs various methods to gain new insights and address unique questions. It's not just academic but extends to all life domains, from business startups to medical device development. Distinct from mere information searching, research involves in-depth exploration and knowledge creation. As illustrated through my interactions with ChatGPT (not fully shown but replicable), research and learning are interconnected, playing critical roles in knowledge acquisition, understanding the world, and advancing different fields.

Let's delve deeper into the motivations behind our research endeavors and define what constitutes research, accompanied by illustrative examples (refer to [Table 3](#)), all in partnership with our trusty companion, ChatGPT (any preferred name for her?).

User: Now I have some ideas of what research is. I want to learn some examples of research in various fields, especially Engineering, Science, and even Business in a table with each cell <5 words.

ChatGPT: Sure, here's a table with examples of research in various fields, including Engineering, Science, and Business:

Table 3: Examples of research in various fields

Field	Research Examples
Engineering	<ul style="list-style-type: none">• Solar cell efficiency improvement• AI-driven autonomous vehicles• Renewable energy storage systems
Science	<ul style="list-style-type: none">• Climate change impact on oceans• Drug efficacy in treating cancer• Genetic mutations in human diseases
Business	<ul style="list-style-type: none">• Consumer behavior analysis• Market entry strategy assessment• Supply chain optimization

Now, let's explore the Key Elements of Research. What are they? ChatGPT responds:

User: What are the key elements of Research? - as a list with no explanation.

ChatGPT:

1. Research Questions
2. Literature Review
3. Methodology Design
4. Data Collection
5. Data Analysis
6. Conclusion
7. Peer Review
8. Publication
9. Collaboration

Note: Results may vary, including differences in formatting and content.

Don't worry about the tools now. For the time being, consider these as some of the tools we aim to use, along with ChatGPT, to optimize our research and learning.

Here's a brief intro to two useful tools:

- **Colab (Google Colaboratory):** Cloud-based Python code platform for collaboration and computation.
- **Google Docs:** Web-based collaborative word processing for creating and editing documents.

As mentioned earlier in this [section](#), my initial plan was to use ChatGPT, Colab, and Docs for a comprehensive research and development process. However, due to its size, I've started with a simpler project, but the original idea remains and will be pursued gradually. Stay tuned for updates. This idea is partially demonstrated here: [\[link\]](#). ChatGPT facilitates research by integrating with Google Docs and Colab.