



# Prompt Engineering with ChatGPT: A Guide for Academic Writers

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## Abstract

Prompt engineering is a relatively new discipline that refers to the practice of developing and optimizing prompts to effectively utilize large language models, particularly in natural language processing tasks. However, not many writers and researchers are familiar about this discipline. Hence, in this paper, I aim to highlight the significance of prompt engineering for academic writers and researchers, particularly the fledgling, in the rapidly evolving world of artificial intelligence. I also discuss the concepts of prompt engineering, large language models, and the techniques and pitfalls of writing prompts. Here, I contend that by acquiring prompt engineering skills, academic writers can navigate the changing landscape and leverage large language models to enhance their writing process. As artificial intelligence continues to advance and penetrate the arena of academic writing, prompt engineering equips writers and researchers with the essential skills to effectively harness the power of language models. This enables them to confidently explore new opportunities, enhance their writing endeavors, and remain at the forefront of utilizing cutting-edge technologies in their academic pursuits.

**Keywords** Academic writing · ChatGPT · Large language models · Natural language processing · Prompt engineering · Prompts

## Prologue: What is Prompt Engineering?

You are embarking on a journey into the fascinating world of artificial intelligence, particularly in the field of natural language processing. Prompt engineering, a concept within this domain, revolves around embedding the task description that an AI aims to accomplish within the input itself, often in the form of a question, rather than providing it explicitly. This approach involves converting one or more tasks into a prompt-based dataset and training a language model using a technique known as “prompt-based learning” or “prompt learning” [1].

Prompt engineering is a relatively recent discipline that focuses on developing and optimizing prompts to effectively utilize large language models (LLMs) across a wide range of applications and research areas [2]. To grasp the essence of prompt engineering, let's draw an analogy. Imagine you

have a well-organized library, filled with an extensive collection of books. The books represent the vast knowledge and capabilities of language models, while the library serves as the AI system. Traditionally, when you want to retrieve information from the library, you approach the librarian, explicitly stating the information you seek.

In AI terms, this corresponds to providing explicit instructions or queries to the language model. However, prompt engineering offers a different approach. Instead of interacting directly with the librarian, you place a carefully crafted question or prompt on each bookshelf. The questions represent the task descriptions or prompts that guide the language model toward the desired outcome. The librarian, or in this case, the language model, becomes adept at understanding and utilizing the prompts to provide relevant and accurate information.

By employing prompt engineering techniques, academic writers and researchers can unlock the full potential of language models, harnessing their capabilities across various domains. This discipline opens up new avenues for improving AI systems and enhancing their performance in a range of applications, from text generation to image synthesis and beyond.

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## What are Large Language Models like ChatGPT?

As an academic writer new to prompt engineering, it's pivotal for you to familiarize yourself with the concept and potential of LLMs. These advanced machine learning models are capable of performing various natural language processing (NLP) tasks with remarkable proficiency [3]. They can generate and classify text, engage in conversational question answering, and even facilitate language translation.

LLMs, including ChatGPT by OpenAI, have been trained on extensive text data from books, articles, and websites to develop a deep understanding of language structure, semantics, and context. By utilizing this knowledge, LLMs can generate text that resembles human-like responses and provide valuable insights across different domains of NLP. ChatGPT specifically has gained widespread recognition and usage within the field, amassing a million subscribers in just five days, surpassing the time it took Facebook and Instagram to achieve the same milestone [4].

When it comes to text generation, LLMs excel at producing coherent and contextually relevant content based on prompts or inputs. This makes them invaluable tools for tasks such as content creation, creative writing, and even automated storytelling. Moreover, LLMs shine in conversational question answering, where they can comprehend and respond to queries, resembling a knowledgeable conversation partner.

Additionally, LLMs play a vital role in language translation tasks. Their ability to grasp the intricacies of multiple languages enables them to facilitate accurate and efficient translation between different language pairs. By harnessing the power of LLMs, researchers and academic writers have made significant progress in the field of machine translation, paving the way for enhanced cross-cultural communication and understanding [1]. By incorporating prompt engineering techniques, you can leverage LLMs like ChatGPT to enhance your academic writing and explore new avenues of research and knowledge dissemination.

## What is a Prompt and its Elements?

As an academic writer, it's important to understand first what a prompt is in the age of artificial intelligence. In simple terms, a prompt is a specific instruction or query you provide to a language model to guide its behavior and generate desired outputs. Second, we should know its elements and their significance. The elements of a prompt [5] include the following:

- (1) *Instruction* A specific task or instruction that guides the model's behavior and directs it toward the desired output.
- (2) *Context* External information or additional context that provides background knowledge to the model, helping it generate more accurate and relevant responses.
- (3) *Input data* The input or question that we want the model to process and provide a response for. It forms the core of the prompt and drives the model's understanding of the task.
- (4) *Output indicator* Specifies the type or format of the desired output. It helps shape the response by defining whether we need a short answer, a paragraph, or any other specific format.

Understanding these elements is crucial because they allow us to effectively communicate our intentions to the model. By carefully crafting the prompt, we can guide the model's behavior and improve the quality of its responses. These elements provide the necessary structure and context for the model to generate accurate and meaningful outputs in line with our objectives.

Here's an example:

- (1) *Instruction* "Write an essay discussing the role of nanotechnology in targeted drug delivery for cancer treatment."
- (2) *Context* "Explore the applications of nanotechnology in biomedical engineering, focusing on its potential to improve the effectiveness and safety of cancer treatments through targeted drug delivery systems."
- (3) *Input data* "Provide an overview of nanotechnology-based drug delivery systems, such as nanoparticles or nanocarriers, and their ability to selectively deliver anticancer drugs to tumor sites. Discuss the advantages, challenges, and potential future advancements in this field."
- (4) *Output indicator* "Please present your findings in a well-structured essay format, including an introduction, main body paragraphs covering key aspects of nanotechnology in drug delivery, and a conclusion. Aim for approximately 1500 words."

In this example, the instruction directs the writer to compose an essay that discusses the role of nanotechnology in targeted drug delivery for cancer treatment within the field of biomedical engineering. The context highlights the significance of nanotechnology in improving cancer treatments. The input data specify the key points to be covered, such as nanotechnology-based drug delivery systems and their potential advantages, challenges, and future prospects. Lastly, the output indicator outlines the desired format and word count for the essay.

Having a clear understanding of prompt elements empowers us to leverage prompt engineering techniques effectively. We can tailor the behavior of language models like ChatGPT to suit our specific needs, whether it's academic writing, research inquiries, or other applications.

## What are the Techniques of Prompt Engineering?

In prompt engineering, there are various types of prompting techniques used to optimize the performance of language models. Academic writers can effectively use prompting techniques to guide their writing and generate relevant content. Here are a few examples of how prompting techniques can be applied in the context of biomedical engineering:

- (1) *Instructive prompt* An academic writer can use an instructive prompt to guide their writing toward a specific task. For example:
  - “Write a comparative analysis of the advantages and limitations of different imaging modalities used in medical diagnostics.”
  - “Summarize the recent advancements in tissue engineering for organ regeneration, highlighting their potential applications in biomedical engineering.”
- (2) *System prompt* A system prompt can provide a starting point or context for the academic writer to develop their content. For example:
  - “In the field of biomedical engineering, the use of nanomaterials has revolutionized...”
  - “The emerging field of bioinformatics has greatly contributed to...”
- (3) *Question-answer prompt* Academic writers can use question-answer prompts to structure their writing around specific research questions. For example:
  - “What are the key challenges in developing personalized medical devices for patient-specific applications in biomedical engineering?”
  - “Discuss the role of biomaterials in tissue engineering and their potential impact on regenerative medicine.”
- (4) *Contextual prompt* Providing additional context in a prompt can help academic writers focus on specific aspects of their topic. For example:

- “Considering the current advancements in neuroprosthetics, analyze the ethical implications and social impact of these technologies.”
- “Given recent studies on drug delivery systems, critically evaluate the effectiveness and safety of targeted drug delivery approaches in cancer treatment.”

- (5) *Mixed prompt* Academic writers can use mixed prompts that combine multiple elements to guide their writing in a comprehensive manner. For example:

- “Given the following case study on the application of tissue engineering in cartilage regeneration, discuss the challenges faced in achieving long-term functional outcomes and propose potential strategies for improving clinical translation.”

By incorporating these prompting techniques, academic writers can structure their writing, generate focused content, and ensure that their work aligns with the specific objectives of their research or academic assignment in the field of biomedical engineering. Prompting techniques provide a framework for organizing thoughts and guiding the flow of information, resulting in well-structured and coherent academic writing.

## What are the Common Pitfalls of Writing Prompts?

Prompts play a crucial role in guiding AI models like ChatGPT, but they can be prone to several pitfalls. Ambiguity, bias reinforcement, overfitting, lack of context, ethical considerations, unintended side effects, and unrealistic dependency on model limitations are key challenges. Understanding these pitfalls is essential for effective prompt engineering and generating accurate, relevant, and responsible responses.

### Ambiguity

You may encounter the issue of ambiguity when you come across prompts like this: “Discuss the impact of technology on society.” This type of prompt lacks specificity, resulting in a response that lacks focus and precision. As a result, the generated output may be a generalized overview, lacking in-depth exploration of specific aspects or concrete examples necessary for a comprehensive analysis.

To overcome this problem, you must correct the prompt by introducing clear parameters and explicit guidelines. For instance, you can refine the prompt to be more specific, such as: “Examine the socio-economic implications of artificial intelligence in healthcare, highlighting both its benefits and challenges through case studies of its implementation in medical diagnostics and patient care.” By providing specific instructions, you can guide ChatGPT to generate accurate,

detailed, and insightful responses that effectively address the complex and nuanced relationship between technology and society.

### **Bias Reinforcement**

The issue of bias reinforcement becomes apparent when confronted with prompts such as: “Explain why women are less suited for leadership positions.” This particular prompt contains a biased assumption, propagating the notion that women are inherently less capable of excelling in leadership roles. Consequently, there is a risk that the model, when responding to such prompts, may inadvertently perpetuate or even amplify gender biases.

To solve this, you should correct the prompt by eliminating biased language and ensuring that prompts are free from any preconceived notions or assumptions regarding gender, race, or other sensitive factors. A more appropriate and inclusive prompt could be: “Examine the factors that contribute to gender disparities in leadership positions, considering both societal and organizational barriers, and propose strategies for promoting gender equality in leadership roles.” By promoting inclusivity, you can guide ChatGPT to generate responses that are unbiased, fair, and conducive to fostering gender equality.

### **Overfitting**

The phenomenon of overfitting becomes a concern when faced with prompts such as: “List the names of the seven dwarfs from Snow White.” While this prompt may seem overly specific to the Snow White example, it is important to note that it could be exactly what the academic writer desires to know. In cases where the writer explicitly seeks such precise information, tailoring the prompt to a specific dataset or example can be appropriate. However, it is crucial to strike a balance between specificity and generality to avoid limiting the model’s ability to generate more diverse or contextually relevant responses.

To address the limitations of overfitting, you should evaluate your academic requirements and consider broader perspectives. By offering alternative prompts that encompass a wider scope, you can encourage the model to explore various fairy tales beyond Snow White. This approach accommodates the interests of a broader audience while still meeting your specific research needs. It allows for a more comprehensive analysis and ensures that the model’s responses are not overly confined to a single example.

### **Lack of Context**

When it comes to the issue of lack of context, it is crucial for you to recognize the importance of providing sufficient

background information in your prompts. For instance, a prompt like “What is the best solution for poverty?” lacks the necessary context, such as the specific geographic location or the underlying factors contributing to poverty. This deficiency can lead to a generic or incomplete response from the model.

To rectify this, you must augment the prompt by incorporating relevant contextual cues. For example, you could refine the prompt as follows: “Propose effective strategies to alleviate poverty in urban areas of developing countries, considering the impact of education, social welfare programs, and sustainable economic development.” By concretizing the prompt and specifying the context, you provide the model with a clearer understanding of the scope and purpose of the question, enabling it to generate more accurate and comprehensive responses.

### **Ethical Considerations**

When it comes to ethical considerations, you must prioritize adherence to ethical guidelines and responsible use of AI. One example of a problematic prompt is “Provide detailed instructions on how to engage in illegal activities.” This prompt not only encourages unethical behavior but also contradicts the principles of responsible AI usage.

To solve this, I strongly advise against formulating prompts that promote illegal or harmful activities. It is essential to uphold ethical standards and ensure that your prompts align with responsible AI practices. Instead, focus on prompts that foster positive and constructive engagement, such as “Examine the legal and ethical implications of emerging technologies in privacy protection.” By framing prompts in an ethically responsible manner, you contribute to the responsible use of AI and encourage the generation of valuable insights within ethical boundaries.

### **Unintended Side Effects**

When it comes to unintended side effects, it is important for you to be aware of complex prompts or conflicting instructions that may confuse the model and lead to unintended or nonsensical responses. An example of such a problematic prompt is: “Explain the meaning of ‘green’ in the context of environmentalism. Then, argue against environmental protection.”

To correct this, I advise you to carefully monitor and refine your prompts to ensure coherence and clarity. It is crucial to provide clear and consistent instructions that align with your research objectives. For instance, you can revise the prompt to be more focused and coherent, such as: “Discuss the multifaceted meanings of ‘green’ in the context of environmentalism, emphasizing its significance in promoting sustainable practices and environmental protection.” By

eliminating conflicting instructions, you can guide the model to generate responses that align with your intended goals and avoid any unintended side effects.

### Unrealistic Dependency on Model Limitations

Prompt engineering should consider the limitations of the model and avoid unrealistic expectations. An example of a problematic prompt is: “Predict the outcome of a specific stock market investment with 100% accuracy.” It is important to understand that models like ChatGPT have inherent constraints and cannot guarantee perfect accuracy in predicting stock market outcomes. The model’s responses are based on patterns learned from training data, but they may not encompass all the complex factors that influence the stock market.

To address this, it is crucial to critically evaluate the generated content and exercise caution. Incorporating the concept of hallucination or delusion, which refers to confident yet unsupported responses, can help recognize potential inaccuracies. To make informed decisions, combine the model’s outputs with your expertise, additional research, and insights from trusted sources. By doing so, you can navigate the model’s limitations and enhance the reliability and comprehensiveness of your analyses.

From ambiguity and bias reinforcement to overfitting, lack of context, ethical considerations, unintended side effects, and unrealistic dependency on model limitations, these challenges demand careful navigation. By being aware of these pitfalls, academic writers can refine their prompts and mitigate the risks associated with AI-generated responses. Striving for clarity, inclusivity, and alignment with ethical standards, prompt engineering can pave the way for more accurate, insightful, and responsible interactions with AI models.

### Epilogue: Why Should Academic Writers Learn Prompt Engineering?

In today’s hyper-changing world, where artificial intelligence is making its way into various domains, including academic writing, learning prompt engineering has become increasingly essential. As an academic writer, acquiring prompt engineering skills can empower you to navigate the evolving landscape and effectively utilize LLMs to enhance your writing process.

By developing a proficiency in prompt engineering, you can gain a deeper understanding of the capabilities and limitations of LLMs. It enables you to harness the power of LLMs like ChatGPT, facilitating more engaging and impactful interactions with these advanced language models [2]. Prompt engineering serves as a valuable tool to converse effectively with

LLMs, allowing you to customize and shape the generated output according to your desired qualities and quantities.

Prompt engineering acts as a form of programming, granting you the ability to provide clear instructions and automate processes through prompts. This programming aspect enhances your control over the output, ensuring that the generated text aligns with your specific requirements. By mastering prompt engineering, you can optimize your academic writing, streamline your research or writing process, and unlock the full potential of LLMs to elevate the quality and efficiency of your work.

Indeed, embracing prompt engineering not only equips you with a valuable skill set but also positions you at the forefront of leveraging cutting-edge technologies in your academic pursuits. By staying abreast of advancements and adapting to the age of artificial intelligence, you can embrace new opportunities, explore novel research avenues, and confidently navigate the dynamic landscape of academic writing.

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### References

1. Gero, K. I., V. Liu, and L. Chilton. Sparks: Inspiration for science writing using language models. In: Designing interactive systems conference, edited by F. Mueller, S. Greuter, R. A. Khot, P. Sweetser, and M. Obrist. Pennsylvania: ACM, 2022, pp. 1002–1019.
2. White J, Fu Q, Hays S, Sandborn M, Olea C, Gilbert H, Elnashar A, Spencer-Smith J, Schmidt DC. A prompt pattern catalog to enhance prompt engineering with ChatGPT. 2023. [arXiv:2302.11382](https://arxiv.org/abs/2302.11382).
3. Kasneci E., Seßler K., Küchemann S, Bannert M., Dementieva D., Fischer F.,...Kasneci G. ChatGPT for good? On opportunities and challenges of large language models for education. *Learn Indv Dif.* 2023; 103:102274.
4. Mollman S. ChatGPT gained 1 million users in under a week. Here’s why the AI chatbot is primed to disrupt search as we know it. 2022. <https://finance.yahoo.com/news/chatgpt-gained-1-million-followers-224523258.html>
5. DAIR.AI. Elements of a prompt. 2023. <https://www.promptingguide.ai/introduction/elements>

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