



Unlocking ChatGPT's Potential: a Literature Review of Prompt Engineering Strategies Across Diverse Domains

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ChatGPT 활용에 대한 고찰: 다양한 도메인에 적용되는 프롬프트 엔지니어링 전략 분석

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요약

Large Language Models (LLMs), exemplified by OpenAI's ChatGPT, represent a significant advancement in artificial intelligence, demonstrating human-like text generation and contextual understanding. Contrary to misconceptions, ChatGPT enhances creativity and efficiency instead of reducing human involvement. The model's efficacy relies on well-crafted prompts, emphasizing the importance of clear and context-rich communication. The literature review of seven papers underscores the crucial role of tailored prompts in optimizing ChatGPT's performance across diverse domains. This analysis reveals both commonalities and distinctions in prompt engineering strategies, with a consistent theme of specificity and structure. The adaptability of ChatGPT across various fields is evident, showcasing its potential in scientific research, entrepreneurship, and education.

1. Introduction

The advent of Large Language Models (LLMs) marks a significant leap in the field of artificial intelligence and natural language processing [1]. LLMs, such as OpenAI's GPT series, are sophisticated algorithms trained on vast amounts of text data and they have the remarkable ability to generate human-like text, comprehend complex queries, and provide relevant responses [2]. ChatGPT, in particular, can offer more accurate, context-aware, and interactive responses, making it an invaluable tool in diverse applications ranging from customer service to content creation and educational support [3]. Contrary to belief, while ChatGPT can allow people to do less, and people that want to do more, be more creative, save time, will be able to do so [4].

The efficacy of ChatGPT, while impressive, is significantly influenced by the input it receives – this is where the concept of 'prompting' becomes crucial [5]. Prompting in the context of LLMs refers to the way users communicate their requests or queries to the model. The effectiveness of ChatGPT, therefore, hinges on how well these prompts are engineered. Effective prompting

involves creating queries that are clear, concise, and contextually rich, guiding the AI to understand the intended task and respond accurately.

In the following literature review, we will review and compare 7 papers related to ChatGPT prompting and how to improve the LLM's responses.

2. Analysis of Prompt Engineering Strategies

This literature review delves into the realm of optimized prompting strategies to enhance the utilization of ChatGPT. By examining various studies, this review explores how different approaches to prompt engineering can significantly impact the performance of ChatGPT across various domains. From scientific data extraction to educational applications, each paper in this review contributes insights into the art and science of prompting, showcasing the potential of well created prompts in unlocking the full capabilities of this advanced LLM. Through this exploration, we aim to provide a comprehensive understanding of how strategic prompting can transform the way we interact with and benefit from conversational AI models like ChatGPT.

Table 1 Prompting papers' summary

<i>Author</i>	<i>Field</i>	<i>Prompting strategy</i>	<i>Additional remarks</i>
Polak and Morgan [1]	Scientific Data Extraction	Zero-shot	AI prompted to recognize and interpret complex scientific data
Short and Short [5]	Business communication	Elevator, Crowdfunding, Twitter pitch prompts	ChatGPT crafting diverse business narratives with specific prompts
Poola [6]	General AI	Prompt – Evaluate result – Give feedback – Prompt again	Focus on improving ChatGPT's accuracy and conveying uncertainty
Lo [7]	Education	Concise, Logical, Explicit, Adaptive, Reflective prompts	Promoting information literacy through nuanced prompt engineering
Mesko [8]	Healthcare	No specific strategy, but recommends zero-shot, few-shot, roleplaying prompting	Refining healthcare interactions, decision support, and patient engagement
Shi et al. [10]	Regulation	3 step approach: 1) Summarize text 2) Ask to add specific facts 3) Summarize text again	Refining summarization abilities for FDA guidelines
Oh [11]	Education	Prompts including Role-playing, Rules, Example, Problem, Process	Integrating specific strategy to solve mathematical problems

Table 1 summarizes the papers and related prompt strategies discussed in this section. In the realm of advancing conversational AI, Polak and Morgan [1] present a compelling case for the extraction of accurate materials data from scientific literature using ChatGPT. The objective was to leverage the model for precise data mining tasks, which often requires an understanding of complex scientific terminologies and concepts. The researchers employed a zero-shot learning approach where the AI was prompted to recognize and interpret data without prior specific training on the task, and the results were promising – showing high precision (around 91%) and recall (around 85%) in identifying material properties, a testament to the model's potential for scientific data extraction. This study's contribution is particularly noteworthy as it underscores the capacity of well-engineered prompts to enable AI to navigate and extract information from highly specialized and technical texts.

Transitioning from scientific research to the business world, Short and Short [5] explore ChatGPT's utility in creating entrepreneurial rhetoric. The investigation centered on the model's ability to emulate the

communicative styles of various CEO archetypes, thereby generating diverse and compelling business narratives. While the findings revealed ChatGPT's adeptness at crafting pitches that resonated with the qualities of different leadership personas when provided with strategically designed prompts, due to the risk of fake announcements, the authors warn that in the future we need to be careful when it comes to business communication. Overall, this research broadens the horizon of conversational AI's applicability in the business sector, demonstrating that with well-structured prompts it has the potential for creating nuanced and persuasive content that aligns with the user's intent and the audience's expectations

On the back of distinguishing between real and fake, Poola [6] focuses on addressing the inaccuracies often encountered in AI outputs, particularly in ChatGPT. The study delves into the model's problem-solving capabilities and its expression of uncertainty—a critical aspect of trust and reliability in AI systems. The researchers believe that ChatGPT cannot indicate of any uncertainties in its answers and that its answers are not consistent. This can lead basic question and answer

users to end up with inaccurate responses. Thus, by experimenting with various prompting strategies, the researchers aimed to enhance the model's accuracy and its ability to convey uncertainty appropriately. The results suggest users to prompt ChatGPT, evaluate the result and provide feedback and prompt again. This can lead to more accurate and trustworthy interactions. This contribution is pivotal as it provides a pathway to improve conversational AI's performance in tasks that require not only precision but also the nuanced expression of confidence levels in the provided information.

An example of such a more nuanced approach is the CLEAR framework, designed to promote information literacy through prompt engineering [7]. The aim was to devise a method that would enable ChatGPT to support educational endeavors, specifically aiding librarians and students in their research. The CLEAR framework—standing for Concise, Logical, Explicit, Adaptive, and Reflective prompts—was shown to be effective in guiding students through the research process, enhancing their critical thinking and analytical skills. Not only do they provide a prompting framework, but the researcher suggests users should be aware of technical terms like tokens, model temperature and top-p. Knowing how to adjust these parameters might require a little more technical knowledge from the user and can introduce even more variance in ChatGPT's responses if an unaware of their nuance's person adjusts them.

Moving into the healthcare domain, Mesko [8] discusses the emerging role of prompt engineering for medical professionals. The scope of this research extends to various healthcare-related interactions, including decision support and patient engagement. By providing concrete steps for healthcare professionals to construct effective prompts, the study aims to refine the interaction with AI, thus improving the quality of healthcare services. The outcomes underscore the potential of prompt engineering to significantly enhance the delivery of healthcare by augmenting the decision-making process and facilitating patient communication. The study does not provide any specific prompting solution that can be useful in the medical scene, but rather suggests various approaches that were also mentioned in Schmidt et al. [9] – use one-shot/few-shot, ask ChatGPT to play roles, ask open ended questions and request examples.

Shi et al. [10] present a distinct application of ChatGPT in the regulatory sphere, specifically in

summarizing food effect studies pertinent to FDA guidelines. The researchers proposed an iterative prompting strategy (1st stage: summarize a text, 2nd stage: ask to add specific facts to it, 3rd stage: again, summarize the text into 2–3 sentences) to refine the model's summarization abilities, thereby aiding in the drafting of clear and concise food regulatory documents. After being tested on 100 drugs, the assessors concluded that the text after stage 3's prompt is the most concise, but noted that even for 42 of the cases, even just after stage 1, the text was satisfactory. This emphasizes the idea of writing a simple prompt, even without knowing any technical aspects of ChatGPT, which counters the ideas of some of the above studies which suggest looking into technical details as well, only to write a good prompt.

Finally, Oh [11] examines the use of ChatGPT in educational settings, focusing on the resolution of mathematical problems. The study developed a structured prompting approach that significantly enhanced the model's problem-solving accuracy. This approach, integrating role-play, rules, example-solving, and process articulation within the prompts, was shown to markedly improve ChatGPT's performance in mathematical tasks.

The implications of this research are far-reaching for, not only, the field of education, suggesting that conversational AI, when combined with carefully designed prompts, can serve as an effective supplementary tool for learning and instruction. This study's result may indicate that specific areas may need their own versions of efficient prompts, because what might work for mathematics, might not work for medicine or food regulation.

3. Application in Software Engineering

Applying insights from existing studies can enhance ChatGPT's usage in software engineering tasks. Drawing inspiration from Polak and Morgan's precision approach, a zero-shot learning strategy could help ChatGPT understand and interpret programming-related data without specific task training. Short and Short's entrepreneurial rhetoric exploration may be adapted for crafting code snippets tailored to different programming needs. The CLEAR framework, designed for education, could guide developers in creating prompts that can result in better code snippets. Insights from prompt engineering for medical professionals may provide invaluable insights into medical LLM and how to

improve their training and testing. Shi et al.'s iterative prompting strategy could refine code documentation or generate concise technical summaries. Finally, Oh's structured prompting approach for mathematical problem-solving may be extended to enhance ChatGPT's assistance in addressing coding challenges (as in LeetCode). In summary, these strategies offer practical ways to optimize ChatGPT for software engineering tasks, focusing on precision, clarity, collaboration, and problem-solving.

4. Conclusion

In conclusion, a comprehensive analysis of the identified studies reveals both commonalities and distinctions in the application of prompt engineering to enhance the performance of ChatGPT. The emphasis on tailored prompts emerges as a shared theme across all papers, underscoring the critical role of specificity and structure in input prompts for optimizing ChatGPT's effectiveness. Furthermore, the studies showcase the versatility of ChatGPT in diverse domains, ranging from scientific research and entrepreneurship to education. Despite this commonality, the application contexts and objectives vary, emphasizing the adaptability of prompt engineering across different fields. Finally, it becomes evident that prompt engineering consistently enhances ChatGPT's performance across all papers. However, the degree of effectiveness varies, with different studies reporting varying levels of impact in specific domains. The complexity of prompt design also differs, with some studies presenting structured frameworks (i.e. CLEAR) while others adopt a more flexible and creative approach (as in [11]).

5. Future research

Future research in optimizing ChatGPT and LLM prompting for general and software engineering tasks should focus on tailored strategies and addressing challenges in handling ambiguous prompts. Dynamic prompt adjustment mechanisms based on user interactions and ethical considerations for preventing misuse are crucial aspects to explore. Additionally, investigating multimodal interactions, adaptability across software domains, and developing seamless user interfaces will contribute to enhancing ChatGPT's effectiveness and responsible use in the evolving landscape of AI and artificial general intelligence.

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