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# Artificial intelligence prompt engineering as a new digital competence: Analysis of generative AI technologies such as ChatGPT

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**ABSTRACT**

**Objective:** The article aims to offer a thorough examination and comprehension of the challenges and prospects connected with artificial intelligence (AI) prompt engineering. Our research aimed to create a theoretical framework that would highlight optimal approaches in the field of AI prompt engineering.

**Research Design & Methods:** This research utilized a narrative and critical literature review and established a conceptual framework derived from existing literature taking into account both academic and practitioner sources. This article should be regarded as a conceptual work that emphasizes the best practices in the domain of AI prompt engineering.

**Findings:** Based on the conducted deep and extensive query of academic and practitioner literature on the subject, as well as professional press and Internet portals, we identified various insights for effective AI prompt engineering. We provide specific prompting strategies.

**Implications & Recommendations:** The study revealed the profound implications of AI prompt engineering across various domains such as entrepreneurship, art, science, and healthcare. We demonstrated how the effective crafting of prompts can significantly enhance the performance of large language models (LLMs), generating more accurate and contextually relevant results. Our findings offer valuable insights for AI practitioners, researchers, educators, and organizations integrating AI into their operations, emphasizing the need to invest time and resources in prompt engineering. Moreover, we contributed the AI PROMPT framework to the field, providing clear and actionable guidelines for text-to-text prompt engineering.

**Contribution & Value Added:** The value of this study lies in its comprehensive exploration of AI prompt engineering as a digital competence. By building upon existing research and prior literature, this study aimed to provide a deeper understanding of the intricacies involved in AI prompt engineering and its role as a digital competence.

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## INTRODUCTION

The artificial intelligence (AI) revolution was propelled by the emergence of unsupervised learning, which enabled models to learn from vast, unstructured datasets (Korzynski, Haenlein, & Rautiainen, 2021). Before 2017, AI focused on narrow tasks through supervised learning, but the introduction of the transformer architecture changed this approach. Models began to identify patterns in data, improving their ability to tackle various tasks. An evolved iteration of OpenAI's Generative Pretrained Transformer (GPT) series, advanced this further by highlighting the potential of prompting models for

a better understanding of user context. This emergent property, in-context learning via prompting, has become a fundamental aspect of modern machine-learning models (Cuofano, 2023). Furthermore, AI generative technologies, such as ChatGPT or Bard, have significantly impacted the business landscape, transforming the way organizations operate, communicate, and innovate (Korzynski, Kozminski, & Baczynska, 2023; Wach *et al.*, 2023). These technologies facilitate more efficient processes, enhance decision-making, and enable the creation of personalized user experiences, all of which contribute to a more human-centric approach in the era of digital transformation (Korzynski *et al.*, 2023).

Robin Li, the co-founder and CEO of the Chinese AI giant Baidu, predicts that in ten years, half of the world's jobs will involve prompt engineering, and those who cannot write prompts will become obsolete (Smith, 2023). Although this statement might be somewhat overstated, prompt engineers will undoubtedly hold an essential position in the realm of artificial intelligence. These professionals will adeptly steer AI models to generate content that aligns with the desired outcome, ensuring that it is not only pertinent but also cohesive and coherent. Some media indicate that currently, a novel type of AI-related occupation is surfacing, offering six-figure incomes without the necessity for a computer engineering degree or advanced coding abilities. As generative artificial intelligence gains prominence, numerous businesses are seeking to employ 'AI prompt engineers' responsible for refining the performance of AI tools to provide more precise and pertinent answers to questions posed by real individuals. Some of these positions can command annual salaries of up to 335,000 USD (Popli, 2023). Prompt engineering provides remarkable benefits for individuals and organizations working with generative AI models. It allows for greater control over the output, as the right prompts can help ensure AI models create the desired content. Additionally, effective prompts contribute to improved accuracy by guiding AI models to generate more relevant and valuable content. Furthermore, prompt engineering can enhance creativity by presenting AI models with new and unique prompts to explore (God, 2023).

At first glance, one might assume that AI prompt engineering is primarily associated with information technology rather than a human-centric discipline. However, in this article, we aim to offer an alternative perspective. Artificial intelligence prompt engineering is a human language-focused practice in which individuals create prompts using unique and separate elements of text, known as distinct tokens. This method is different from 'soft prompting' techniques, which emphasize automatic fine-tuning of inputs for machine learning models (Ghazvininejad, Karpukhin, Gor, & Celikyilmaz, 2022). For example, prefix tuning optimizes continuous vectors (numerical representations of data) in pre-trained language models for specific tasks, using 'virtual tokens' instead of distinct ones (Liu *et al.*, 2021). Virtual tokens are continuous, numerical representations of textual elements that can be manipulated and optimized within the model's vector space, offering greater flexibility compared to discrete tokens. On the other hand, prompt tuning applies backpropagation (an algorithm for training neural networks by minimizing the error between the network's predictions and the actual output, allowing the network to learn and improve its performance on various tasks) to train a frozen language model to produce input prompts for particular tasks (Lester, Al-Rfou, & Constant, 2021). In contrast to these approaches, prompt engineering concentrates on manually creating and revising prompts, aligning it more with human-centred fields such as human-computer interaction, and conversational AI, rather than the general field of machine learning (Oppenlaender, Linder, & Silvennoinen, 2023).

This article aims to explore AI prompt engineering as a digital competence using a narrative and critical literature review. We aimed to develop a comprehensive understanding of the intricacies involved in AI prompt engineering and assess its role as a digital competence by examining various dimensions, techniques, challenges, and applications across multiple domains. We asked the following research questions:

1. What are the key dimensions and aspects of AI prompt engineering as a digital competence?
2. What are the technological challenges faced in AI prompt engineering?
3. How is AI prompt engineering applied across various domains such as entrepreneurship, art, and science, and what is its impact in these areas?
4. What are the prominent techniques and strategies used in AI prompt engineering, and how do they contribute to its effectiveness as a digital competence?

The article initiates by outlining the methodological principles tied to the literature review. It then progresses to the crux of the piece, which applies a narrative and critical examination of the literature. Several key topics are delved into, such as digital competencies, the progression of prompt engineering techniques, technological obstacles within prompt engineering, and the utilization of AI prompt engineering across various fields. Subsequently, the article elucidates on AI prompt engineering strategies, founded on the analysis of diverse prompts including text-to-image and text-to-text prompting. It culminates with the final remarks, providing significant implications for educators and organizations.

## MATERIAL AND METHODS

In this study, we employed a narrative and critical literature review, following the approach outlined by Ratten (2023), to delve into the various aspects of AI prompt engineering as a digital competence. By building upon existing research and prior literature, we sought to develop a comprehensive understanding of the intricacies involved in AI prompt engineering and its role as a digital competence.

The article systematically explores various dimensions of AI prompt engineering. By analyzing the academic and practitioner literature and conducting desk research, we created a list of potential themes related to AI prompt engineering, including the development of prompt engineering techniques, technological challenges faced in prompt engineering, and the application of AI prompt engineering across various domains like entrepreneurship, art, and science.

Moreover, we developed a conceptual framework that encompasses different strategies for AI prompt engineering. This framework highlights the significance of certain prompt techniques and provides specific examples from business settings.

## LITERATURE REVIEW AND THEORY DEVELOPMENT

### Digital Competences

The majority of studies on digital competences are related to the education industry, focusing on students' and teachers' abilities to use technology effectively in learning and teaching (Fernández-Batanero, Montenegro-Rueda, Fernández-Cerero, & García-Martínez, 2022; Pozo-Sánchez, López-Belmonte, Rodríguez-García, & López-Núñez, 2020) highlighting the need for continued improvement in this area (Falloon, 2020). These studies indicate the need for digital competences as a core, fundamental literacy addressing both technology mastery and a digital citizenship mindset, especially in higher education (Martzoukou, Fulton, Kostagiolas, & Lavranos, 2020).

Digital competences consist of a blend of knowledge, skills, and attitudes encompassing concepts, facts, skill descriptions (for example, the capability to execute processes), and attitudes (such as a mindset or inclination to take action) (VUORIKARI Rina, Kluzer, & Punie, 2022). Scholars indicate that digital competences transcend mere technical abilities and represent a complex concept that integrates a wide range of skills, including cognitive, emotional, and sociological knowledge, which are crucial for effectively navigating digital environments (Røkenes & Krumsvik, 2016; Wang, Zhang, Wang, & Li, 2021). Moreover, scholars emphasize the importance of critically and reflectively employing technology to generate new insights and knowledge (DeWitt & Alias, 2023; Głodowska, Maciejewski, & Wach, 2023). Over the years, a wide variety of frameworks and models have been developed and utilized to explore and understand digital competence from different perspectives (Blundell, Mukherjee, & Nykvist, 2022; Guitert, Romeu, & Baztán, 2021; Kelentrić, Helland, & Arstorp, 2017).

One of the most comprehensive developments in this area is the DigComp framework which offers a more in-depth and structured approach to understanding digital competence (Reisoğlu & Çebi, 2020). Created with the purpose of informing and guiding policies to enhance digital competencies for citizens of all age groups, the framework acknowledges the critical role digital skills play in the constantly changing digital landscape of today (Štaka, Vuković, & Vujović, 2022). The DigComp framework is structured around five core competence areas. Since 2016, these areas include information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving

(VUORIKARI Rina *et al.*, 2022). This framework will be applied to conceptualize AI prompt engineering. We used the DigComp framework to analyze AI prompt engineering as a competence (Table 1).

**Table 1. AI prompt engineering's overlap with other digital competences**

| Area | Competence | AI prompt engineering |
|---|---|---|
| 1. Information and data literacy | 1.1. Browsing, searching, and filtering data, information, and digital content | ✓ |
| | 1.2. Evaluating data, information, and digital content | ✓ |
| | 1.3. Managing data, information, and digital content | ✓ |
| 2. Communication and collaboration | 2.1. Interacting through digital technologies | ✓ |
| | 2.2. Sharing through digital technologies | ✓ |
| | 2.3. Engaging in citizenship through digital technologies | |
| | 2.4. Collaborating through digital technologies | ✓ |
| | 2.5. Netiquette | |
| | 2.6. Managing digital identity | |
| 3. Digital content creation | 3.1. Developing digital content | ✓ |
| | 3.2. Integrating and re-elaborating digital content | ✓ |
| | 3.3. Copyright and licenses | |
| | 3.4. Programming | ✓ |
| 4. Safety | 4.1. Protecting devices | |
| | 4.2. Protecting personal data and privacy | |
| | 4.3. Protecting health and well-being | |
| | 4.4. Protecting the environment | |
| 5. Problem solving | 5.1. Solving technical problems | ✓ |
| | 5.2. Identifying needs and technological responses | ✓ |
| | 5.3. Creatively using digital technologies | ✓ |
| | 5.4. Identifying digital competence gaps | ✓ |
| | 5.5. Learning in digital environments | ✓ |

Source: own elaboration based on Vuorikari Rina *et al*., 2022.

## AI Prompt Engineering

In recent years, AI prompt engineering has emerged as a critical aspect of interacting with large language models (LLMs) such as ChatGPT. By examining the literature, we can identify several themes that help us better understand the applications and implications of AI prompt engineering across various domains. Some of these themes include the development of prompt engineering techniques, the challenges faced by non-experts in prompt engineering, and the application of AI prompt engineering in different domains such as entrepreneurship, art, and science.

### Development of Prompt Engineering Techniques

A notable theme in the literature is the ongoing effort to develop and improve prompt engineering techniques. White *et al.* (2023) presented a catalogue of prompt engineering patterns that can be applied to solve common problems in LLM conversations. Reynolds and McDonell (2021) introduced the concept of a 'metaprompt,' which is a higher-order prompt designed to seed the language model to generate its own natural language prompts for a range of tasks. The metaprompt approach aims to leverage the language model's inherent capabilities and understanding of natural language to create more effective and nuanced prompts. Instead of directly prompting the model with a specific task, the metaprompt encourages the model to generate appropriate prompts that could be used for the desired task. This approach can potentially lead to more accurate and creative results, as the language model leverages its vast knowledge to generate suitable prompts. Ekin (2023) provides a comprehensive guide on prompt engineering techniques, tips, and best practices for ChatGPT, a powerful tool in

natural language processing (NLP) with applications across various industries. This guide covers the fundamentals of prompt engineering, effective prompt crafting techniques, best practices, advanced strategies, and real-world case studies that demonstrate the practical applications of prompt engineering in customer support, content generation, domain-specific knowledge retrieval, and interactive storytelling. Ling *et al.* (2023) explored the use of reasoning chains as a prompting technique, which leverages structured sequences of related knowledge statements from external knowledge bases to improve the model's performance in open-domain commonsense reasoning tasks.

Moreover, researchers examined zero-shot and few-shot prompting techniques used in natural language processing to enable LLMs to adapt and generalize to new tasks with limited or no supervised training. Zero-shot prompting enables a model to make predictions about previously unseen data without the need for any additional training. This is achieved by framing NLP tasks as natural language prompts and generating responses that indicate the predicted output. However, performance in zero-shot settings often lags behind supervised counterparts, leaving room for potential improvement (Zhou, He, Ma, Berg-Kirkpatrick, & Neubig, 2022). Meanwhile, few-shot prompting is a technique, in which the model receives a small number of examples, typically between two and five, to quickly adapt to new tasks. This approach allows for the creation of more versatile and adaptive text generation models, often with less data required (Meyerson *et al.*, 2023).

**Technological Challenges in Prompt Engineering**

Another recurring theme is related to technological challenges in designing effective prompts. Bang *et al.* (2023) found that similarly to other LLMs, ChatGPT suffers from hallucination problems that refer to the phenomenon of LLMs generating plausible-sounding but incorrect or unsupported information in their responses. This issue can be particularly problematic, because it can lead to the dissemination of false or misleading information. However, the interactive feature of ChatGPT enables human collaboration with the underlying LLM to improve its performance through a multi-turn 'prompt engineering' fashion, *i.e.* an interactive approach in which users iteratively engage with a large language model (LLM) like ChatGPT in a conversational manner. In this approach, users provide input prompts and refine them over multiple turns or iterations based on the responses generated by the model. Li (2023) highlighted the legal and ethical risks associated with LLMs, including stochastic parrots. Stochastic parrot is a term used to describe LLMs' propensity to mimic and reproduce existing text from their training data without a deep understanding of the content. This behaviour can sometimes lead to biased, inappropriate, or irrelevant outputs. Zamfirescu-Pereira, Wong, Hartmann, and Yang (2023) found that non-AI-experts struggled to engage in end-user prompt engineering effectively, often lacking systematic approaches and overgeneralizing their experiences. This difficulty highlights the importance of addressing the challenges related to prompt engineering and the technological limitations of generative AI models, ensuring the safe and responsible use of LLMs across various applications.

**Application of AI Prompt Engineering in Different Domains**

*Entrepreneurship:* Short and Short (2023) demonstrated how LLMs can be effectively used to produce entrepreneurial rhetoric by mimicking celebrity CEO archetypes. This study underscores the potential for AI prompt engineering to revolutionize content creation and communication strategies in the world of entrepreneurship.

*Art:* Oppenlaender, Visuri, Paananen, Linder, and Silvennoinen (2023) investigated prompt engineering as a creative skill for generating AI art, emphasizing that expertise and practice are required to master this skill. This theme showcases the artistic potential of prompt engineering, opening up new avenues for creative expression and collaboration between humans and AI.

*Science – data extraction:* Polak and Morgan (2023) proposed the ChatExtract method using engineered prompts applied to a conversational LLM for accurate data extraction from research articles. This study highlights the potential for AI prompt engineering to streamline data extraction processes and improve the efficiency of research across scientific disciplines.

*Healthcare:* Wang *et al*. (2023) provided a comprehensive review of prompt engineering methodologies and applications in the healthcare domain. They highlight the significant contributions of

prompt engineering to healthcare NLP applications such as question-answering systems, text summarization, and machine translation.

## AI Prompt Engineering Strategies

### Text to Image Prompting

Recently, there has been a surge in the number of text-to-image generation models based on LLM (DALL·E2, Stable Diffusion, Midjourney). Noteworthy, the construction of appropriate prompts depends on the tool used at the moment, even though there are general best practices for visual models. Building prompts for text-to-image models is conceptually simpler than for text-to-text models, as the number of tasks is limited in their case.

As mentioned, working with vision models has certain basic principles that we should follow to achieve the desired result. 1) It is important to use a variety of adjectives to give the generated image a desired atmosphere and climate; 2) We should determine the desired image quality, *e.g.* low resolution, HD or 4K; 3) The style of the image should be specified, such as surrealism, realism, expressionism or photorealism; 4) We should provide a reference name of the artist or creator – such as the name and surname of a painter, graphic designer, or photographer) – to help place the model in the style of a particular work and creator; 5) We should not place more than 2-4 objects in the image. If the number is higher than the generators usually start to become less precise and create blurred content. 6) It is important to be specific as the more specific and detailed the prompt is, the greater the chance of getting the desired result (Oppenlaender, 2022). Table 2 presents the final form of an effective prompt.

**Table 2. Prompts examples**

| What do you see? | What is happening? | How does it look? | Results |
|---|---|---|---|
| Businesswoman | Full of energy, Working at the desk | In the style of Van Gogh | This prompt offers a precise description leading to more predictable and concrete imagery. |
| Fulfillment | While working in an NGO sector | 4K | This prompt is more abstract, potentially yielding surprising and inspirational results for further exploration. |

Source: own elaboration.

Another effective prompting strategy involves learning from existing examples. Resources such as Lexica, a database of images, and the prompts utilized for their generation via the Stable Diffusion tool, can be instrumental. Such databases can be navigated to identify desired outcomes or to find inspiration. In the context of brand artwork development or campaign creation, incorporating a consistent descriptive element as a reference point can be highly beneficial. For instance, when crafting artwork for a corporate website, a constant descriptor like 'Bauhaus geometric illustration from 1963' could be applied to each generated image. This approach would yield graphics that adhere to a uniform style, thereby establishing a cohesive visual identity for the website (Parsons, 2023).

### Text-to-text Prompting

For models returning text, the creation of prompts usually relies on the desire to solve a specific language task, therefore, the prompt architecture differs from task to task. Table 3 summarizes AI PROMPT engineering recommendations.

Ultimately, an effective prompt may include the following elements: 1) Context – can include information about the role the model should play for the task or any necessary information about the situation that may ground it ('You are a salesperson in a technology company'); 2) Instruction – the task to be performed ('Write an email to a customer thanking for high attendance during the last workshop on MLOps'); 3) Input Data – data for few-shot learning or information the model should use to perform the task ('Customer name: XYZ, keywords to include = [future, innovation, parthership]'); 4) Expected output format – information about the format and type of output in which the answer is to be provided ('Provide just the email message content').

**Table 3. Recommendations for the text-to-text AI prompts**

| Acronym | Recommendation | Description |
|---|---|---|
| A | Articulate the instruction | Clearly state the task to be performed, such as 'write,' 'classify,' 'summarize,' or 'translate,' and specify how the output should look (table, list, Python code). |
| I | Indicate the prompt elements | Show the model where the instructions and input data are and what the expected output format should be. |
| P | Provide ending cues and context | Offer the model clear ending cues, such as three dots for continuation or a colon, dot, or placeholder like 'answer:' for indicating a response is needed. Furthermore, ground the model by providing a context for the task (*e.g.* 'You are a manager of a tech team'). |
| R | Refine instructions to avoid ambiguity | Give the model-specific instructions and a detailed description of the task to avoid any confusion or imprecision. |
| O | Offer feedback and examples | For conversational models, such as ChatGPT, feedback on the model's responses can help it better understand the desired output. Moreover, providing the model with a few examples of expected responses (few-shot learning) can help it adapt its style and way of responding. |
| M | Manage interaction | Treat the model as your sparring partner, asking it to provide counterarguments or point out flaws in your ideas. |
| T | Track token length and task complexity | Break complex tasks into smaller steps for better performance. Remember to control the token length, keeping the prompt and response under the token limits of the model (usually 4096 tokens for commercially available LLMs). The token length of a text can be checked here: https://platform.openai.com/tokenizer. |

Source: own elaboration of AI prompts in ChatGPT and Bard.

Example 1: 'Tell me what prompt engineering is. Write briefly and without unnecessary details.' This example does not provide a clear structure for the response, nor does it indicate the intended audience. 'Briefly and without unnecessary details' is not a clear instruction. Example 2: 'Write a 3-5 sentence explanation of what prompt engineering is. Write the response as if it were directed to a high school student.' This example provides a clear response structure and specifies the intended audience and thus signals the required tone and vocabulary to use in the response.

Table 4 presents best practices for prompts for frequent tasks that we undertake with the help of LLM. Remember to treat these examples as a good starting point for tests, as each task is individual and needs a specific matching prompt.

In many tasks, we need to combine the following building blocks to receive the expected result. For example, we can use transcripts from the call centre to extract important information and then generate an email based on this information which we will direct to the customer.

The implementation of efficient prompting strategies is essential for improving the performance of LLMs in all possible applications. By following the methods, guidelines, and best practices discussed in this article, users can acquire more accurate, relevant, and fitting responses from both text-to-image and text-to-text generative models.

## Resources for AI Prompt Engineering

For the purpose of this article, we analyzed several resources that facilitate the process of prompt engineering in AI systems, such as ChatGPT and DALL-E. These resources range from platforms and databases, like PromptBase and Promptvine, which provide ready-to-use prompts or allow users to exchange their prompts with others. Open-source frameworks, such as OpenPrompt, offer another dimension to these resources. They provide a conducive environment for users to learn, experiment, and even design their own prompts, fostering the development of skills in prompt engineering. Communities also play a pivotal role in the AI and prompt engineering landscape. Platforms like Learn Prompting bring together enthusiasts from various backgrounds to share knowledge, experiences, and best practices. Such communities provide a thriving environment that fosters learning and growth in the AI field. Moreover, there are numerous tutorials and guides, like the Prompting Guide and OpenAI

Best Practices, that offer guidance on prompt engineering and general AI practices. These resources serve as invaluable tools, especially for beginners seeking to establish a solid foundation and understanding of AI techniques. Table 5 illustrates resources for AI prompt engineering.

**Table 4. Examples of AI prompts for specific tasks and implementations**

| Task | Instructions | Example | Implementation |
|---|---|---|---|
| Question answering | Format the prompt so that it specifies where is the instruction, question, and placeholder for the expected answer. Explicitly state not to answer when unsure of the answer. | Context: the stock market in 2019. Question: What were the gains of the Nasdaq Composite in 2019? Answer: | Microsoft Customer Story-Strabag SE builds a risk management solution to improve efficiency using Microsoft Intelligent Data Platform (Microsoft, 2023b) |
| Text classification | Specify the classes that the model can choose to classify content. You can provide an example of a text and how it was classified in the given context to hint at what to pay attention to (few-shot learning). | Text: I recently purchased a new laptop... Classify if this text is: [complaint, review] Answer: | Microsoft Customer Story-KPMG augments current capabilities and improves the service delivery model with Azure OpenAI Service (Microsoft, 2023a) |
| Summary/knowledge mining | Determine how long your summary should be or what specific information (types of information) you want to extract from the text. Determine the output format in which you want to receive the information (table, list of points). | Text: [transcript of a conversation from call centre Extract from the text: 1. Customer's name... 4. Write a summary of the conversation in 3-5 sentences. Return the result in bullet points. | – |
| Content generation | Provide grounding for the model. Specify the style of speech. Determine the expected length and format of the statement. Give an example of your style. | You are a copywriter for the XYZ company... Attributes: [blouse, yellow, lace, for summer]. The description must include information about the attributes and show the attractiveness of the product. The description must be 3-5 long sentences. Description: | Microsoft Customer Story-CarMax puts customers first with car research tools powered by Azure OpenAI Service (Microsoft, 2022) |

Source: own elaboration based on Ekin, 2023.

**Table 5. Resources for AI prompt engineering**

| Resource Name | Description | Link |
|---|---|---|
| Prompting Guide | Provides foundational knowledge on prompt crafting, methodologies, and models. | https://www.promptingguide.ai/ |
| PromptBase | A large database of prompts compatible with ChatGPT, Midjourney, and DALL-E. It serves as a marketplace for buying and selling prompts. | https://promptbase.com/ |
| OpenPrompt | An open-source framework that allows for the exploration of prompt learning. It facilitates experimentation with existing implementations and the creation of new exercises. | https://openprompt.ai/ |
| ShareGPT | Offers a platform with over 31,000 posts and comments around ChatGPT and its commands. It serves as a plugin for learning and sharing new prompts. | https://sharegpt.com/ |
| OpenAI Best Practices | Provides insights and best practices directly from OpenAI, aiding users especially at the onset of their AI journey. | https://help.openai.com/en/articles/6654000-best-practices-for-prompt-engineering-with-openai-api |

| Resource Name | Description | Link |
|---|---|---|
| Promptvine | A categorized database of prompts, along with plugins and tools dedicated to ChatGPT. | https://promptvine.com/ |
| Prompt Engineering Guide | A GitHub repository with learning guides, tools, and additional information on prompt engineering. | https://github.com/dair-ai/Prompt-Engineering-Guide |
| Learn Prompting | An active Discord community with over 1000 members. It offers a wealth of documents and tutorials on prompt engineering. | https://learnprompting.org/ |
| Awesome ChatGPT Prompts | A categorized collection of several hundred ChatGPT prompts, available free of charge. | https://www.awesomegptprompts.com/ |
| Prompts AI | A platform that analyses text, checks user-selected settings, and provides suggestions on prompt improvement. | https://prompts.ai/ |
| Openart | A database of 10 million prompts dedicated to graphic AI, including Stable Diffusion and DALL-E. | https://openart.ai/promptbook |
| Fusion AI | A free prompt engineering tool designed to assist with command improvement. It also features connections to other tools. | http://www.fusionai.world/ |

Source: own elaboration of online resources.

## CONCLUSIONS

Artificial intelligence prompt engineering has been playing an increasingly crucial role in various fields, including entrepreneurship, art, science, and healthcare, thanks to its ability to generate targeted and meaningful interactions with LLMs. The DigComp framework, which outlines five core competence areas, *i.e.* information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving provides a valuable lens to understand and improve AI prompt engineering competencies. The literature reveals a strong focus on the development of prompt engineering techniques, such as the use of metaprompts and reasoning chains, as well as zero-shot and few-shot prompting techniques. These methods are being refined continually to help LLMs adapt to new tasks with limited or no supervised training. However, there are still challenges to be addressed, including hallucination problems and the tendency for LLMs to mimic and reproduce the existing text without a deep understanding of the content. These issues can lead to the generation of false, misleading, biased, or inappropriate information. Furthermore, non-AI experts often struggle with prompt engineering, indicating a need for more accessible and systematic approaches.

Despite these challenges, prompt engineering has shown promising results in a variety of domains. In entrepreneurship, it can mimic celebrity CEO archetypes revolutionizing content creation and communication strategies. In art, it allows for new forms of creative expression. In science, it can streamline data extraction processes from research articles. Finally, in healthcare, it contributes significantly to applications like question-answering systems, text summarization, and machine translation.

In this study, we explored the significant implications of prompt engineering for AI practitioners, researchers, educators, and organizations. We demonstrated how effectively crafted prompts can enhance the outcomes generated by both text-to-image and text-to-text models. Such a skill can lead to the generation of more accurate and contextually relevant results, which in turn improves the overall performance and efficiency of the AI models.

For educators, our findings may serve as a valuable reference for teaching AI students about the role of prompt engineering in optimizing the performance of language models. The strategies and examples we presented could be integrated into curricula to further enrich the learning experience.

In the field of AI research, the strategies and best practices we shared can stimulate the development of more advanced prompt engineering techniques. Our study could also form the foundation for future research examining the impact of prompt engineering on language model performance.

For organizations incorporating AI into their operations, our study underlines the importance of investing time and resources into prompt engineering. By carefully formulating prompts, these entities

can derive increased value from their AI systems, as the models will then deliver more precise and helpful outputs.

Last but not least, our exploration yielded a valuable contribution to the field, *i.e.* the AI PROMPT framework. It provides clear, actionable recommendations for text-to-text prompt engineering, thus helping practitioners refine their prompts to elicit better responses from language models. The AI PROMPT framework emphasizes the importance of articulating instructions, indicating prompt elements, providing ending cues and context, refining instructions to avoid ambiguity, offering feedback and examples, managing interaction, and tracking token length and task complexity.

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## Conflict of Interest

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