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Prompting

- **What is Prompting?**

➢ Prompting refers to the practice of crafting specific input instructions or queries (called prompts) to guide a language model like GPT to perform a desired task.

➢ Unlike traditional machine learning models, which require fine-tuning on task-specific data, prompting leverages the model's pre-trained knowledge to solve tasks directly during inference.

- **How Prompting Works?**

➢ Prompting involves presenting the model with:

1. Instructions: Explain the task in natural language.

2. Context (optional): Provide background information or examples to establish the task.

3. Query: The specific input or problem to solve.

➢ The model processes the prompt and generates a response based on the provided information.

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Types of Prompting: Zero-Shot Learning

1. **Zero-Shot Learning**

- **Definition:** The model is asked to perform a task with *no prior examples* of input-output pairs provided in the prompt.

- **How It Works:**

➢ The task is defined purely by the instructions or description in the prompt.

- *Example*:

> **Prompt: "Translate this sentence to French: 'I love programming."**
>
> **Expected Output:** "**J'aime la programmation.**"

- Challenge: Requires the model to generalize entirely from its pre-trained knowledge without specific task examples.

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Types of Prompting: One-Shot Learning

2. One-Shot Learning

- **Definition:** The model is given one example of an input-output pair in the prompt before being asked to perform the task on a new input.

- **How It Works:**

➤ The single example serves as a hint or demonstration of the task.

- *Example*:

> **Prompt: "Use the example to translate the statement to French.**
> **Example: 'I love programming.' -> 'J'aime la programmation.'**
> **Statement: 'I enjoy learning.'"**
>
> **Expected Output: "J'aime apprendre"**

- Challenge: The model must infer the task and generalize correctly from a single example.

Types of Prompting: Few-Shot Learning

3. **Few-Shot Learning (also known as in-context learning)**

- **Definition:** The model is provided with a few examples (typically 2–10) of input-output pairs as part of the prompt.

- **How It Works:**

➢ These examples establish a pattern or context for the task.

- *Example*:

> **Prompt: "Use the examples to translate the statement to French.**
> **Example 1: 'I love programming.' -> 'J'aime la programmation.'**
> **Example 2: 'I like coffee.' -> 'J'aime le café.'**
> **Statement: 'I enjoy learning.'"**
>
> **Expected Output: "J'aime apprendre"**

- Challenge: Balancing the number of examples to provide sufficient guidance while keeping the prompt within token limits.

- Advantage: Often yields better performance than zero- or one-shot by reducing ambiguity.

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Types of Prompting: Chain-of-thought

4. **Chain-of-thought prompting**

- **Definition:** The prompt explicitly encourages the model to generate step-by-step reasoning to arrive at the answer.

- **How It Works:**

➢ This approach mirrors human problem-solving, where we often break tasks into logical intermediate steps to arrive at a conclusion.

➢ *Example*:

> **Prompt: "Solve the following problem step by step:**
> **If a train travels 60 miles in one hour, how far does it travel in 3 hours?"**
>
> **Expected Output: "The train travels 60 miles in 1 hour. In 3 hours, it travels 60 × 3 = 180 miles. The answer is 180 miles."**

- Advantage: Combining CoT with few-shot or zero-shot sometimes yields better performance than the traditional settings.

Prompt Engineering: Foundational Work

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- Wei, J., Wang, X., Schuurmans, D., Bosma, M., Xia, F., Chi, E., ... & Zhou, D. (2022*). Chain-of-thought prompting elicits reasoning in large language models.* Advances in Neural Information Processing Systems, 35, 24824-24837.
- Kojima, T., Gu, S. S., Reid, M., Matsuo, Y., & Iwasawa, Y. (2022). *Large language models are zero-shot reasoners.* Advances in neural information processing systems, 35, 22199-22213.
- Min, S., Lyu, X., Holtzman, A., Artetxe, M., Lewis, M., Hajishirzi, H., & Zettlemoyer, L. (2022). *Rethinking the role of demonstrations: What makes in-context learning work?* arXiv preprint arXiv:2202.12837.
- Madaan, A., & Yazdanbakhsh, A. (2022). *Text and patterns: For effective chain of thought, it takes two to tango.* arXiv preprint arXiv:2209.07686.

Should I do Prompting?

- **Why Prompting?**

  1. No Fine-Tuning Needed: Models can perform tasks directly with prompts, reducing the need for task-specific training.

  2. Task Versatility: Prompts can be used for translation, summarization, question-answering, creative writing, and more.

  3. User-Friendly: Natural language makes prompt design accessible to *non-experts*.

- **Challenges of Prompting**

  1. Ambiguity: Poorly designed prompts can confuse the model, leading to incorrect or irrelevant outputs.

  2. Length Limits: Prompts must fit within the model's maximum token limit, requiring concise yet effective design.

  3. Sensitivity: Minor changes in wording or structure can significantly affect performance.

  4. Context Dependence: Some tasks require substantial context to produce reliable outputs.

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Tips for Prompting

- [Hugging Face](#) documentation.

- [OpenAI](#) documentation: Defines 6 strategies

- Some tips

  1. **Be Explicit**: Clearly state the task and desired output format. Example: "Write a short summary in bullet points."

  2. **Use Demonstrations**: Include high-quality examples to guide the model.

  3. **Leverage Chain-of-Thought**: Encourage reasoning for complex tasks.

  4. **Iterate and Test**: Refine the prompt based on the output quality.

  5. **Avoid Ambiguity**: Make instructions precise to reduce misinterpretation.

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Thank You

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