
FEW-SHOT PROMPTING

BLAŽ ZUPAN, LJUBLJANA, 2024

LECTURE NOTES FOR THE UNIVERSITY OF LJUBLJANA'S COURSE ON

CHATGPT FOR RESEARCHERS



These notes continue our writing on the topic of prompt engineering. We start where we have finished with the notes on “Introduction to Prompt Engineering” and continue introducing patterns that guide large language models (LLMs) to produce interesting and useful outputs.

CHAIN-OF-THOUGHT (CoT) PROMPTING

Chain-of-thought (CoT) prompting is a technique that encourages language models like ChatGPT to break down reasoning tasks step by step. Instead of responding immediately, the model is guided to explain its thought process before arriving at a final answer. To invoke Chain-of-Thought (CoT) prompting, one needs to explicitly instruct the model to break down its reasoning step by step. The simplest way to do this is through direct instruction, e.g., "think step by step." For example, if analyzing the impact of peer review on research quality, a well-structured prompt would be: "How does peer review improve research quality? Think step by step." This forces the model to structure its reasoning, ensuring logical flow and completeness in its response.

A more advanced method involves prompting for intermediate reasoning before asking for a conclusion. Instead of asking directly whether a study's claim is valid, one can break the problem into sub-questions. For example, if assessing a study that claims AI-generated abstracts are superior to human-written ones, the user might prompt: "Before we conclude, let's consider: How was 'better' defined? What evaluation methods were used? Were there biases in the study design?" This encourages the model to provide a well-reasoned response rather than a simplistic or potentially biased answer.

Note that CoT prompting does not work equally well for all tasks. Vague prompts such as "Explain in detail" may not guide the model effectively, whereas structured instructions yield better responses. Additionally, CoT is not necessary for factual lookups, such as retrieving a Nobel Prize winner's name, where a simple direct question suffices. However, for research tasks requiring critical analysis, multi-step reasoning, and structured argumentation, CoT prompting is a powerful tool.

For instance, compare the output of the following two prompts:

In short, how does one apply single-cell gene expression analysis?

In short, how does one apply single-cell gene expression analysis? Think step-by-step.

ZERO-SHOT PROMPTING

We already know zero-shot prompting, but we expose it here just for the contrast with a few-shot prompting that comes next. Zero-shot prompting is a technique in which you ask LLM to perform a task without providing any examples or prior context. The model relies entirely on its pre-trained knowledge to generate a response. This method works well for simple, common, or widely covered tasks in the model's training data. For example, for the prompt

|

Summarize the attached research paper in one paragraph

the model will generate a summary based on its understanding of the text without needing any sample responses. While zero-shot prompting is helpful for quick and general tasks, it has limitations. The output may lack accuracy if the task is complex or ambiguous, and it may not follow a specific format unless explicitly instructed.

FEW-SHOT PROMPTING

In prompt engineering, "few-shot examples" refer to providing a small number of examples or demonstrations within a prompt to help guide the model in generating desired responses. This technique improves the performance of language models by showing them patterns and structures they should follow when producing their outputs.

Let us start with an example:

|

Generate questions for the following statements:

Statement: The Earth revolves around the Sun.

Question: What does the Earth revolve around?

Statement: Water boils at 100 degrees Celsius.

Question: At what temperature does water boil?

Statement: The Eiffel Tower is located in Paris.

Question: Where is the Eiffel Tower located?

Statement: Photosynthesis occurs in the chloroplasts of plant cells.

Question: Where does photosynthesis occur in plant cells?

Statement: The Great Wall of China can be seen from space.

Question: What can be seen from space?

Statement: Ljubljana is the capital of Slovenia.

Question: What is the capital of Slovenia?

Statement: All organisms inherit genetic information that specifies their structure and function from their parents.

Question: From whom do all organisms inherit the genetic information specifying their structure and function?

Few-shot examples help the LLM understand the context and structure it needs to follow, leading to more accurate and relevant outputs. The technique allows users to tailor the model's responses to specific tasks or styles without extensive retraining or fine-tuning. By seeing a few examples, the model can generalize from them to handle similar tasks, improving its performance. Few-shot examples are particularly useful for niche or specific tasks where large datasets for fine-tuning may not be available.

Another example:

For a given situation, provide an action.

Situation: I wrote a paper and I am happy with the content.

Action: give it to a colleague to make final checks.

Situation: I revised the paper according to my colleague suggestions.

Action: submit to a journal.

Situation: I got the comments from the editor of a journal.

Action: Address the editor's comments and revise the paper accordingly.

Situation: My paper was rejected from the journal.

Action: Review the feedback provided, make necessary revisions, and submit the paper to another journal.

Provide three more examples of this kind.

Certainly, here are three more examples:

Situation: I received the acceptance notification for my paper.

Action: Celebrate the achievement and prepare the final manuscript for publication, following the journal's guidelines.

Situation: I received a request to review a paper for a journal.

Action: Accept the request if it aligns with your expertise and availability, and begin the review process.

Situation: I have an idea for a new research project.

Action: Conduct a literature review to ensure the originality of the idea and then draft a research proposal.

The prompt typically includes few-shot examples in the form of input-output pairs that demonstrate the desired behavior. Here are a few rules on how they can be used effectively:

1. Choose relevant examples: select examples that are representative of the task and cover a range of possible inputs and desired outputs.
2. Clear formatting: format the examples to distinguish them from the actual input the model needs to process. This often involves using a consistent structure or delimiters.
3. Contextual relevance: ensure that the examples are contextually relevant to the task at hand so that the model can infer the correct patterns.
4. Balancing examples: provide enough examples to cover the variety in the task, but not so many that the prompt becomes excessively long or complex.

Here is another example demonstrating the use of few shot examples for sentiment analysis:

Example 1: Text: "I love this product, it works wonderfully!"

Sentiment: Positive

Example 2: Text: "This is the worst experience I have ever had."

Sentiment: Negative

New Input: Text: "The service was okay, not great but not bad."

Sentiment: ?

New Input: Text: "The service was okay, not great but not bad." Sentiment: Neutral

Text: "After the dinner, I had a strange taste in my mouth."

Text: "After the dinner, I had a strange taste in my mouth." Sentiment: Negative

Text: Sailing on high winds was great.

Text: "Sailing on high winds was great." Sentiment: Positive

Can you change the above prompt to answer without repeating the text input? Can you do this using the programming pattern, that is, using initial prompt for instructions?

ONE-SHOT PROMPTING

Ok, there is also one-shot prompting, a technique in prompt engineering where a single example is provided in the prompt to guide the model's response. This example helps the model understand the desired format, style, or reasoning without requiring multiple demonstrations.

The movie was fantastic! -> Positive

The plot was slow and boring. ->

Negative

Njami, pizza toscana.

Positive

Bljak, rotten grapes.

Negative

FEW-SHOT EXAMPLES WITH INTERMEDIATE STEPS

Few-shot examples can include a more complex structure, that is, not only of the form statement-response. Here is an example:

input: fried steak

think: meat

output: reject

input: brass with potato

think: healthy fish

output: like

input: stuffed meatballs

think: I do not like meat

output: reject

input: chicken bowls

think: meat again, no

output: reject

input: pancake with jam

think: sweet but ok for the end of the day

output: like

input: veggie chili

think: vegetarian and spicy

output: like

input: tuna salad

think: fish

output: like

	input: veggie burritos think: vegetarian output: like
	input: potato salad with mushrooms think: vegetarian output: like
	input: grilled chicken think: no to meat output: reject
	input: cooked lamb
think: meat output: reject	
	input: pasta with gongozola
think: vegetarian output: like	
	input: potica
think: sweet output: like	

This is not much different from our previous examples of few-shot training but includes an extra step (“think”). Notice also that LLM has also followed the style of writing, that is, creating an output that only includes few words.

MORE COMPLEX FEW-SHOT PROMPTING

Here is a more complex example:

For a given situation, provide a set of actions. No additional comments are necessary.

Situation: I would like to write a research paper.

Think: What part of my current research is publishable?

Action: List three various topics from my current research that deserve attention.

Think: Which of the three topics is the most exciting one?

Action: Pick the most exciting one and write a short summary.

Think: Where to publish?

Action: Search the citation index to find the highest-ranked journal in my field.

Think: Is my research a good match?

Action: Find papers in a similar domain from that journal.

Situation: I need to design an experiment for my research study.

Think: What is the primary research question I want to address?

Action: Formulate a clear and concise research question.

Think: What is the best methodology to answer this research question?

Action: List three different methodologies suitable for this research.

Think: Which methodology will provide the most reliable and valid results?

Action: Select the most appropriate methodology and outline its key steps.

Think: What resources and equipment will I need for this experiment?

Action: Create a list of required resources and equipment needed for the experiment.

Think: Do I have access to all the necessary resources and equipment?

Action: Identify any gaps and plan how to acquire or borrow missing items.

Situation: I need to write a proposal for a Ph.D. thesis.

Think: What is the central research problem I want to address?

Action: Define the primary research problem and its significance.

Think: What are the objectives and aims of my research?

Action: List the main objectives and aims of the proposed research.

Think: What is the existing literature on this topic?

Action: Conduct a literature review and summarize key findings.

Think: What methodology will I use to address my research problem?

Action: Choose a suitable methodology and outline the research design.

Think: What is the potential impact of my research?

Action: Describe the expected contributions to the field and potential applications.

Think: How will I structure my proposal?

Action: Create an outline for the proposal, including sections such as introduction, literature review, methodology, expected results, and timeline.

Think: Who will be my target audience and stakeholders?

Action: Identify and list potential advisors, funding agencies, and collaborators.

Situation: My Ph.D. advisor just resigned from the University and is now a chef in a restaurant.

Think: Who can take over as my Ph.D. advisor?

Action: Identify and list potential faculty members who can serve as your new advisor.

Think: How can I ensure a smooth transition?

Action: Arrange meetings with potential advisors to discuss your research and seek their guidance.

Think: What administrative steps do I need to take?

Action: Contact the graduate program coordinator to understand the process for changing

advisors and complete any necessary paperwork.

Think: How can I maintain momentum in my research during this transition?

Action: Create a plan to stay on track with your research goals, including setting short-term objectives and regular check-ins with your temporary advisor.

Think: What support do I need during this transition?

Action: Reach out to peers, colleagues, and mentors for support and advice on navigating this change.

Few-shot examples with intermediate steps refer to a learning or task-solving approach where a model or algorithm is given a small number of examples (few-shot) and shown the intermediate steps needed to reach the solution rather than just the final answer. This helps the model understand the process and reasoning required to arrive at the solution, improving its performance on similar tasks.

Following is another example where a solution also requires numerical grading of an option.

Input: Skaline Luxury rooms Split features accommodation situated in Split, 1 km from Diocletian's Palace and 4.5 km from Zrnanje Beach. All units feature air conditioning and a satellite flat-screen TV.

Output: reject

Explanation: too much in the city, too crowded

Grade: 2/10

Input: Situated in Pučišća, within 400 metres of Sveti Rok Beach and 600 metres of Macel Beach, Bed & Breakfast Blanc offers accommodation with free WiFi, air conditioning, a terrace and a bar. The property features sea views and is 22 km from Olive Oil Museum Brac and 13 km from Gažul. The bed and breakfast has family rooms.

Output: interesting

Explanation: in the village, less crowded, near the sea

Grade: 6/10

Input: Situated within 300 metres of Sveti Rok Beach and 1.5 km of Macel Beach, Lučica, Luxury Rooms By the Sea features rooms with air conditioning and a private bathroom in Pučišća.

Output: this looks great, alone, near the sea, close to the beach, need to check the price

Grade: 9/10

Input: Providing city views and free WiFi, Zara Palace - design rooms provides accommodation conveniently situated in the centre of Zadar, within a short distance of Kolovare Beach, Maestrala Beach and Karma Beach. It is located 28 km from Kornati Marina and features luggage storage space. This 4-star guest house offers private entrance.

Output: reject

Explanation: too much in the city, too crowded

Grade: 3/10

Input: Located at the foot of Vatnajökull National Park, Lilja Guesthouse offers accommodation along Ring Road 1 in Flatey. Höfn is 28.5 km away from the property and Jökulsárlón Glacier Lagoon is 51 km away. Certain units include a seating area for your convenience. You will find a coffee machine in the room. Free WiFi is featured throughout the property. There is a shared lounge at the property. You can view the mountains from the property. Popular activities in the area include glacier tours. Egilsstaðir town centre and airport are 205 km away.

Output: interesting

Explanation: remote location, close to nature, near mountains and glacier

Grade: 7/10

Input: Apartments Tonic is set in the small village of Lumbarda, 5 km from Korčula's Old Town. The property features a spacious terrace overlooking lush Mediterranean vegetation and Adriatic Sea. The nearest beaches are only steps away. All apartments are air-conditioned and feature a patio with sea views and an equipped kitchenette. Free Wi-Fi and free private parking are provided. Lumbarda town centre with restaurants, bars and shops can be reached within 5 minutes on foot from Apartments Tonic. The local bus stop is set in the centre of Lumbarda and every hour a bus passes and takes guests to Korčula Ferry. Guests can rent a motor scooter at the property.

Output: interesting

Explanation: small village, close to the sea, peaceful location, convenient access to town center

Grade: 8/10