

MMReport

Summary

The code defines three functions — ``zero_shot_prompt``, ``zero_shot_prompt`` (a duplicate with slight variations), and ``react_prompt`` — which are used to interact with a language model (LLM) to solve multiple-choice questions (MCQs).

1. ``zero_shot_prompt``:

- This function sends a zero-shot prompt to the LLM, asking it to think step-by-step and solve the question.
- The user message contains the question and four answer choices (A, B, C, D).
- The LLM is instructed to provide an explanation and output the correct answer within a specific format (e.g., ``Correct Answer: $[Correct option]$``).
- After receiving the LLM's response, the answer is extracted using regular expressions, looking for the option inside ``$`` symbols.

Accuracy for Meta-LLaMA Zero-Shot: 0.40

Accuracy for Gemma Zero-Shot: 0.21

2. ``react_prompt``:

- This function uses a React-style prompting approach where the LLM runs in a loop of **Thought, Action, and Observation**.
- The LLM describes its reasoning process in the "Thought" phase, takes an action to run an external tool (if applicable) during the "Action" phase, and the result is given in the "Observation" phase.
- The final answer is presented in the form ``Correct Answer [Correct option from A, B, C, D]``.

Accuracy for React Prompt: 0.42

Specific Prompts for Each Technique

1. Zero-Shot Prompt:

- User Prompt:
...
{question} A: {option_A} B: {option_B} C: {option_C} D: {option_D}. Finally, give the correct answer (alphabet A,B,C or D) and put the answer inside \$ bracket to identify.
...
- Assistant Response:
...
I'm functioning within normal parameters. I am a maths professor and I will solve MCQ questions and strictly answer in the format Explanation: [Explanation] Correct Answer: \$[Correct option from A, B, C, D]\$
...

2. Zero-Shot Prompt (Variant):

- User Prompt:

...

{question} A: {option_A} B: {option_B} C: {option_C} D: {option_D}. Think step-by-step. Finally, give the correct answer (alphabet A,B,C or D) and put the answer inside \$ bracket to identify.

...

- Assistant Response:

...

I'm functioning within normal parameters. I am a maths professor and I will solve MCQ questions and strictly answer in the format Explanation: [Explanation] Correct Answer: \$[Correct option from A, B, C, D]\$

...

3. React Prompt:

- User Prompt:

...

{question} Think step by step. A: {option_A} B: {option_B} C: {option_C} D: {option_D}. You run in a loop of Thought, Action, Observation. At the end of the loop you output an Answer. Use Thought to describe your thoughts about the question you have been asked. Use Action to run one of the actions available to you. Observation will be the result of running those actions. Finally give the answer in the following way - Correct Answer [Correct option from A, B, C, D].

...

- Assistant Response:

...

I am a maths professor and I will solve MCQ questions strictly in the format - You run in a loop of Thought, Action, Observation. At the end of the loop you output an Answer. Use Thought to describe your thoughts about the question you have been asked. Use Action to run one of the actions available to you. Observation will be the result of running those actions. Finally give the answer in the following way - Correct Answer [Correct option from A, B, C, D].

...

In summary, the **zero-shot** techniques focus on immediate problem-solving with explanations, while the **React prompt** uses a more interactive, step-by-step approach combining reasoning and external actions.

In Summary:

The **zero-shot** techniques focus on immediate problem-solving with explanations, while the **React prompt** uses a more interactive, step-by-step approach combining reasoning and external actions.

Time taken for LLAMA- 3m 45 second average

Time taken for Gemma - 2m 20 seconds average

- **Zero-Shot Accuracy:**
 - Meta-LLaMA: **0.40**
 - Gemma: **0.21**
- **Chain of thought Accuracy:**
 - Meta-LLaMA: **0.41**
 - Gemma: **0.17**
- **React Accuracy:**
 - Meta-LLaMA: **0.42**
 - Gemma: **0.15**

Model Performance Comparison

Basic model description-

The Meta-LLaMA-3.1-8B-Instruct model is designed to excel in instruction-following tasks. It has demonstrated significant improvements in both content and style alignment when generating responses based on user prompts. LLaMA-3.1-8B-Instruct leverages an extensive dataset specifically designed for instruction-following tasks, such as InstructS2S-200K as given in **Scaling Laws for Neural Language Models**. This dataset includes diverse instructions, enabling the model to generalize well in various tasks.

While Microsoft's Phi-3.5-mini-instruct is smaller and optimized for multilingual tasks, its primary strengths lie in safety-aligned instruction-following as explained in **Phi-3 Safety Post-Training: Aligning Language Models with a “Break-Fix” Cycle Microsoft** and performing queries efficiently and securely.

Gemma-2b-it, while strong in text-based processing due to its knowledge distillation technique, is optimized more for structured tasks (such as specific NLP applications like prompt recovery) and is known to struggle with open-ended and creative queries.

Comparison for different prompt techniques-

Zero - shot prompting -

Meta-LLaMA-3.1-8B-Instruct** is better suited for zero-shot tasks because it is designed for instruction-following. It has a very efficient pre-training process and can adapt to different tasks.

Also, due to its large size (8 Billion parameters) it also has better reasoning capabilities.

Chain of Thought Prompting-

Again, Meta-LLaMA-3.1-8B-Instruct** is better suited for cot tasks because it is designed for instruction-following. Also in

Also, due to its large size (8 Billion parameters) it also has better reasoning capabilities.

Phi performs better in COT than Gemma since it has shown to have some adaptability towards instructions based tasks.

React Prompting-

Meta-LLaMA-3.1-8B-Instruct has a more flexible architecture, allowing it to integrate reasoning with actions, a critical feature in React prompting. Its extensive training enables it to understand and react to changing environments or tools.

Gemma-2b-it is less adaptable to dynamic, interactive tasks that require the model to perform actions based on reasoning and external input.

Sources -

<https://arxiv.org/pdf/2409.06666v1>

<https://arxiv.org/pdf/2407.13833v2>

<https://arxiv.org/pdf/2407.05233>