

Prompting Strategies for Data Augmentation

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I. INTRODUCTION

In milestone I, our objective was to collect data for model training by consulting ChatGPT with a set of 100 questions. The aim was to explore different prompting strategies to optimize the model's performance and achieve the best possible results. Through this process, we created a diverse dataset of demonstrations that could be used to refine our reward model. Here is presented the strategy employed during the data augmentation process and provides an explanation of the prompts used.

The next section provides an in-depth explanation of the prompting strategy used, followed by a discussion and conclusion regarding their effectiveness.

II. PROMPTING STRATEGIES

During the data augmentation process, I employed a comprehensive strategy to optimize the effectiveness of prompting and obtain high-quality demonstrations from ChatGPT focused on Multi Choice answers. This final strategy encompassed various guidelines and techniques that we followed consistently throughout the interactions. After searching and reading different sources of prompting such as [1] [2] [3] [4]. I combined these strategies, making my final prompt strategy.

A. Strategy: Giving Time to Think and Specific Instructions

This strategy focuses on optimizing the model's performance by providing sufficient thinking time, clear and specific instructions, step-by-step guidance, and comparison and justification. By allowing the model ample steps to process the information and reason through the question, we enhance its ability to generate accurate responses.

The prompt is composed by the following part:

- I. Provide a context or scenario to the model.
- II. Specify the input that the model will receive.
- III. Define the task or objective to be accomplished.
- IV. Break down the task into step-by-step instructions to facilitate the model's thinking process.
- V. Prompt the model to generate its own answer and then compare it with the given options to determine the final response.
- VI. Specify the desired format for the output.

B. Example of prompt

The principal template for the questions that follows the steps above is the following:

- **Instruction:**

I → You are a Professor of Neuroscience and you receive a multiple-choice question.

II → You will receive a question and a set of answer choices.

III → Your task is to follow these steps and provide a response:

IV and V:

- 1) Read the question carefully.
- 2) Based on your knowledge in neuroscience, formulate your own answer to the question.
- 3) Read the answer choices provided.
- 4) Select the answer choice that you believe aligns most closely with your own answer, consequently the correct one.
- 5) Justify why the others are incorrect.
- 6) Justify your choice by explaining the reasoning behind your selection.

VI → I expect that you follow this format:

<Output Format>

Your Answer: [your own answer here]

Selected Choice: [chosen answer choice here]

Explanation: [Explanation of why you chose the selected choice]

<Output Format>

- **User:**

Question: What is ?

Choices: a) b) c) d)

The use of precise instructions and a structured approach helps the model analyze the question systematically, generate its own answer, and evaluate the answer choices. Asking the model to compare and justify its selection promotes critical thinking and improves its ability to differentiate between correct and incorrect options. Overall, these steps aim to improve the model's performance in providing well-reasoned responses to multiple-choice questions.

C. Strengths and Weakness

This strategy give have some core points, that make the interaction with ChatGPT very clear. on the think that I need and I request. The high structure prompt and with the output should be clear the answer and why is the correct answer.

The principal problem of the prompt is that is for a very specific task and is not generalizable. This because some questions could ask to select more than one option and know depend on the

model capabilities to understand this. And also the principal strength at the same time is a limitation, the high structured prompt, make the model not explore too much and could end on errors.

III. DISCUSSION

Here are two examples, one bad and another good interaction.

- Bad: confidence 1.

- **Question:** "Calculate the membrane potential for calcium ion using $RT/F = 26.72\text{mV}$, an outside concentration of 10mM and an inside concentration of 0.1M . Enter your membrane potential rounded to two significant digits Choices:"

- **ChatGPT:** Selected Choice: $+67\text{mV}$

Explanation: The Nernst equation can be used to calculate the membrane potential for a given ion. The equation is given by $E = (RT/zF) * \ln([ion]_{out}/[ion]_{in})$, where R is the gas constant, T is the absolute temperature, z is the valence of the ion, F is Faraday's constant, and $[ion]_{out}$ and $[ion]_{in}$ are the concentrations of the ion outside and inside the cell, respectively. For calcium ion (Ca^{2+}), $z = +2$. Plugging in the given values, we get $E = (26.72 \text{ mV}) * \ln(10/0.1)/2 = +67.10 \text{ mV}$. Rounded to two significant digits, the membrane potential for calcium ion is $+67\text{mV}$. Therefore, the correct choice is $+67\text{mV}$.

- Good: Confidence 5:

- **Question:** Why is optimization needed in the simulation of neurons using Hodgkin and Huxley multi-compartment model? Choices:

- a) Because there are many differential equations
- b) Because the number of compartments is high
- c) Because numerous parameters are unknown

- **ChatGPT:** Selected Choice: c) Because numerous parameters are unknown

Explanation: The Hodgkin and Huxley multi-compartment model is a complex model that has many parameters, some of which are not known precisely. These unknown parameters can be estimated using optimization techniques. Optimization is necessary to find the values of these parameters that best fit experimental data or observations. Therefore, option c) is the correct answer as the model needs to optimize the parameters to match the data. Option a) is not correct because the number of differential equations is not a reason for optimization. Option b) is also not accurate because the number of compartments does not require optimization."

The first example highlighted a bad interaction where the interaction gives a wrong result. The

question involved a mathematical problem that went beyond the scope of the prompt's task space (a very difficult task for LLMs). It revealed the limitations of the prompt in open questions and demonstrated the challenge of zero-shot learning in this context. Otherwise, the second example showcased a good interaction with a high confidence. The question was well-suited for the multiple-choice task, and the model provided a correct answer along with an explanation. It justified the selection of the chosen answer and also explained why the other options were not correct.

There are other possible problems with this prompt, for example in the case that the question require to select more than one option, and ChatGPT select only one. In such cases, if the selected option is correct and the explanation aligns with the other correct options, it can provide some reassurance, and a confidence level of 3 is assigned.

IV. CONCLUSION

In conclusion, the prompt strategy employed for over 100 questions with ChatGPT in the context of multiple-choice questions proved to be effective. However, when it comes to tasks beyond its scope, start performing poorly, relying more on the capabilities of the LLM models. Nonetheless, it is important to note that the prompt strategy can be modified according to the needs of the task through an iterative process, without necessarily changing the core structure of the prompt.

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