

Abstract

RCOT(Reverse Chain of Thought) 在数学计算数据集上比标准CoT和自一致性、自改进模型有所提高。

Introduction

之前研究缺乏对于思维链事实不一致问题的明确研究，没有给出细粒度的反馈。 可以解决三种问题：

- overlooking

Problem: Today’s meeting is rescheduled to 11 am tomorrow, 10/16/1924. What is the date one year ago from today?

ChatGPT Chain-of-Thought:
The current date is 10/16/1924. To find the date one year ago from today, you would subtract one year from the current year, which would be 1923. The correct answer is 10/16/1923. ✗

Figure 1: A example of factual inconsistency (condition overlooking).

- misinterpreting

Problem: The cave is 1218 feet deep and they are already at 849 feet. If they are travelling at speed of 17 How much farther until they reach the end of the cave?

ChatGPT Chain-of-Thought:
First, we need to find out how much deeper the cave is from their current position So they still need to descend 369 feet to reach the end of the cave. Next, we need to figure out how long it will take them to descend that distance at a speed of 17 feet per unit of time Therefore, it will take them 22 units of time to reach the end of the cave. ✗

- hallucinating

Problem: A wooden bridge can carry no more than 5000 pounds. A delivery truck filled with identical boxes, each weighing 15 pounds, will pass over the bridge. The combined weight of the driver and the empty truck is 3755 pounds. What is the maximum number of boxes which can be loaded onto the truck while not exceeding the bridge’s weight limit?

ChatGPT Chain-of-Thought:
First, we need to subtract the weight of the driver and the empty truck from the maximum weight the bridge can carry Let’s assume each box weighs 16 pounds (15 pounds for the contents and 1 pound for the box). This means we can load a maximum of 77 boxes onto the truck without exceeding the bridge’s weight limit. ✗

方法从原始解决方案重构新问题，同时对重构后的问题和原始问题进行比较来检测不一致性，监测到的不一致被制定为细粒度的反馈，指导大模型修改他们的方案。

贡献：

- 提出了RCOT，能够检测和纠正在数学计算上推理。
- RCOT的反馈比标准COT有提高，但人工编写的真实值反馈可以进一步提高推理能力。
- 提供了可解释性。

Related Work

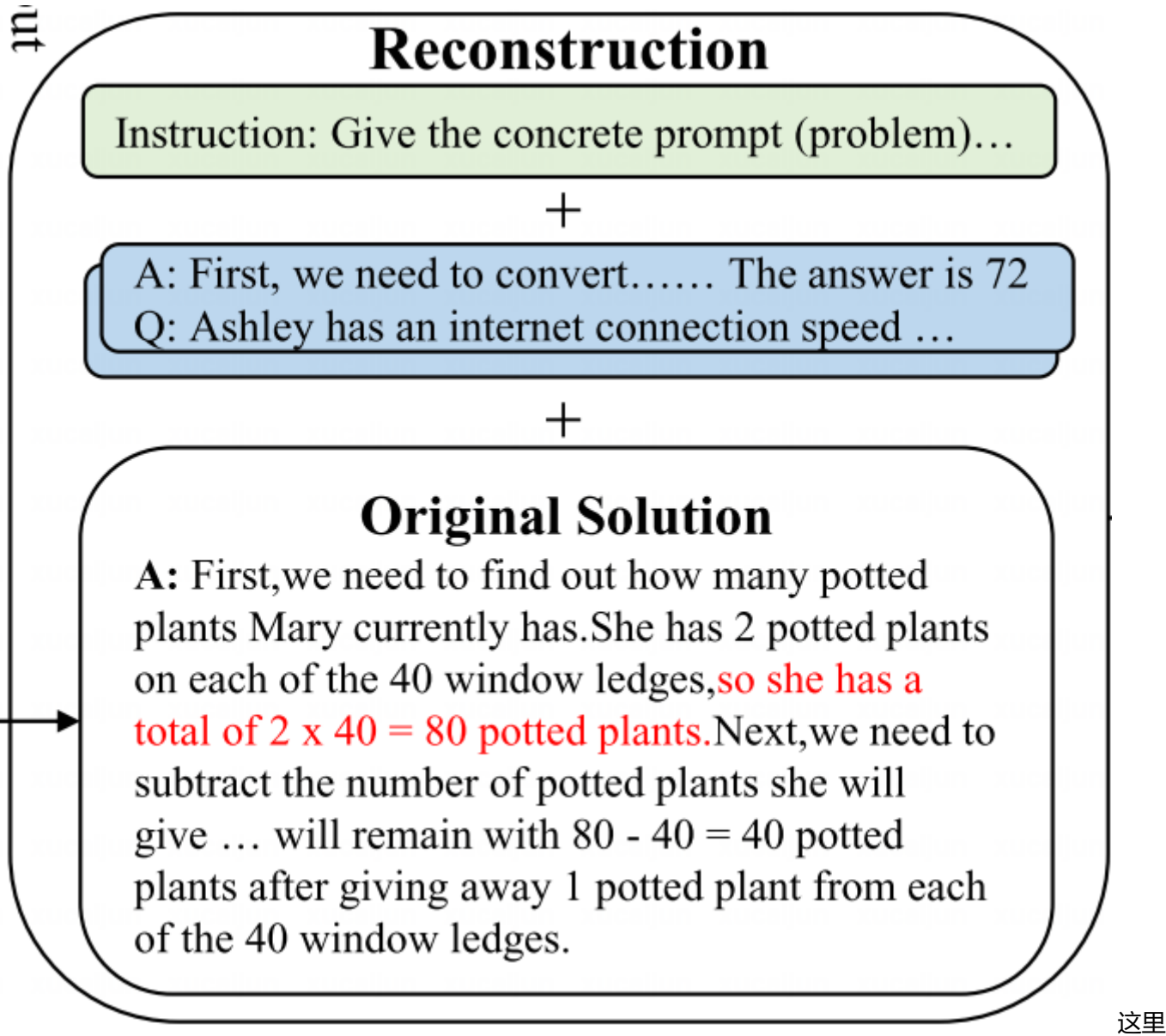
Prompt Engineering两个代表性例子就是 In-Context Learning和Chain-of-Thought

Reversing chain-of-thought

Problem reconstruction

手动编写指令和上下文示例作为reconstruction prompt。

Problem Reconstruction
Give the concrete prompt (problem) that can generate this answer. The problem should contain all basic and necessary information and correspond to the answer. The problem can only ask for one result.



这里
可以看出其实answer就是有思维链的，但只运用了Q和A。是否可以设计一些指导模型如何一步步进行逆向思维的上下文例子？（更加细粒度）

细粒度比较

要求大模型直接比较重构问题和原始问题不太能产生高质量的检测结果。

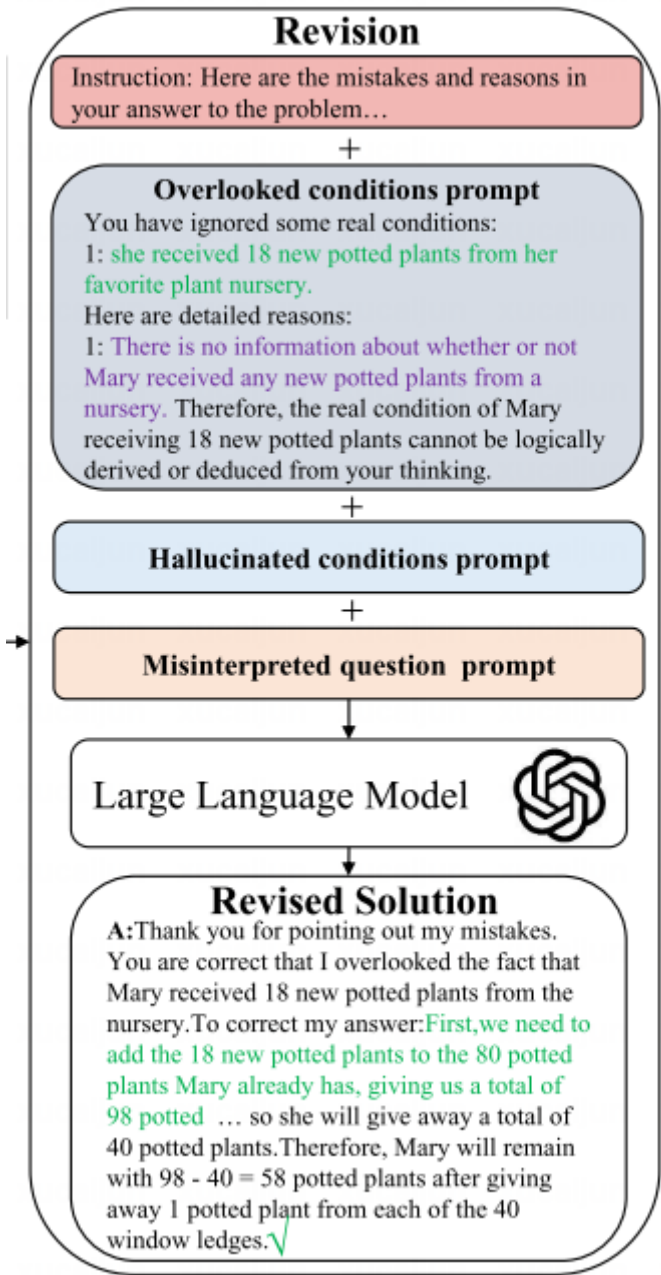
- 问题分解，要求大语言模型把非结构化的文本（两个问题）， 转化成一个条件列表。

- 条件比较 对于原始问题和重构问题中的每个条件，都看能否通过另一方的条件列表推断出来。这里对应者overlooking和幻觉。
- 问题比较，直接比较重构问题和原始问题他们提出的具体疑问，如果不一样认为出现了misinterpreting。

细粒度反馈和修正

如果没有检测到两个问题有任何不一致，就判定原始解决方案是正确的。否则，就需要指定细粒度的反馈，指导大模型修改其解决方案。reason是比较时让大模型给出的。

- 首先声明解决方案不对
- 列出检测到的实际不一致



- 让大模型修正他的solution

Experiment

对于两种COT（zero-shot 和 few-shot）在两种模型（ChatGPT、LLaMA）上进行改进，比原本的模型更强、和一些更强baseline比性能差不多 tokens消耗更少。

消融实验

- w/o reasons 没有告诉模型检测的事实不一致性，而是只给出了一个更层次的判断“你的答案是错的”。
- w/o judgment+reasons 无论正确与否，只告诉他要“double-check your answer” 都有性能下降。

如果直接使用粗粒度的比较，甚至会导致模型比标准CoT更差。

额外的定量分析

Table 5: **Found/Not Found:** RCoT can or cannot find the reasons for errors.**Other errors:** such as computation error, logical error and so on.

Type	Found	Not Found	total
Overlooking	5	1	6
Hallucinating	16	15	31
Misinterpreting	5	3	8
Other errors	0	55	55