Analytics Vidhya

Self-Consistency Pattern

Instructor

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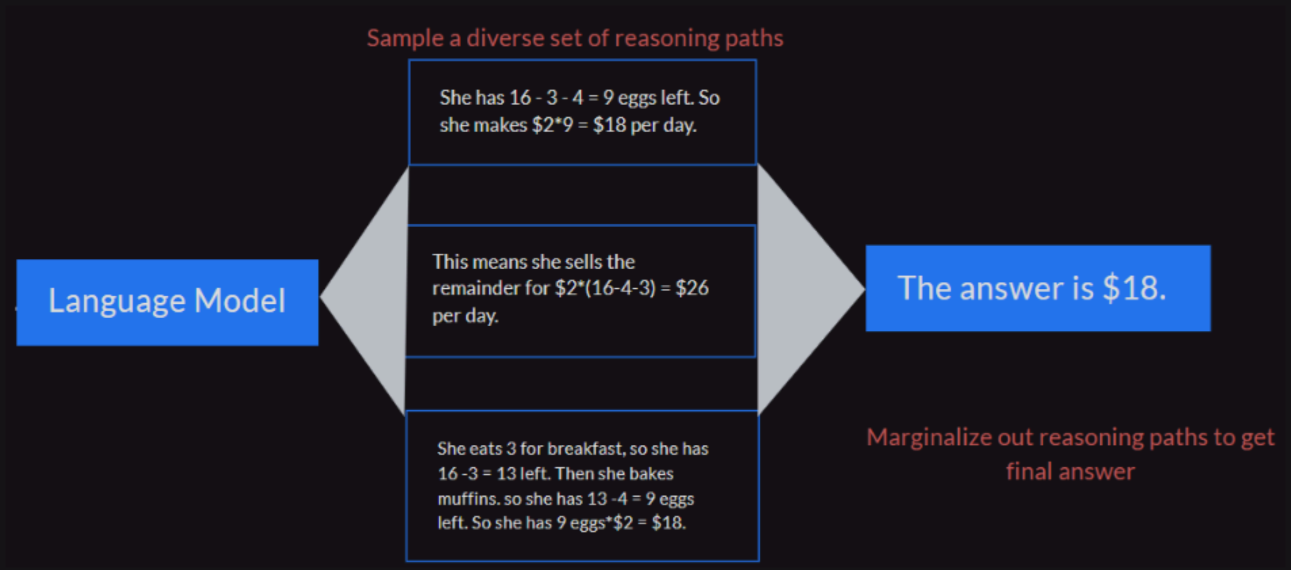
Self-Consistency Pattern

- Self-consistency prompting is a method that helps language models solve complex problems by considering multiple ways to think about a problem and then choosing the most common solution.
- Idea is to not rely on LLM greedy decoding which always selects the response tokens with the highest probability
- Instead, we make the LLM potentially explore diverse reasoning paths by sampling from potential response tokens when generating the response


Sample a diverse set of reasoning paths
Language Model
The answer is $18.
Marginalize out reasoning paths to get final answer

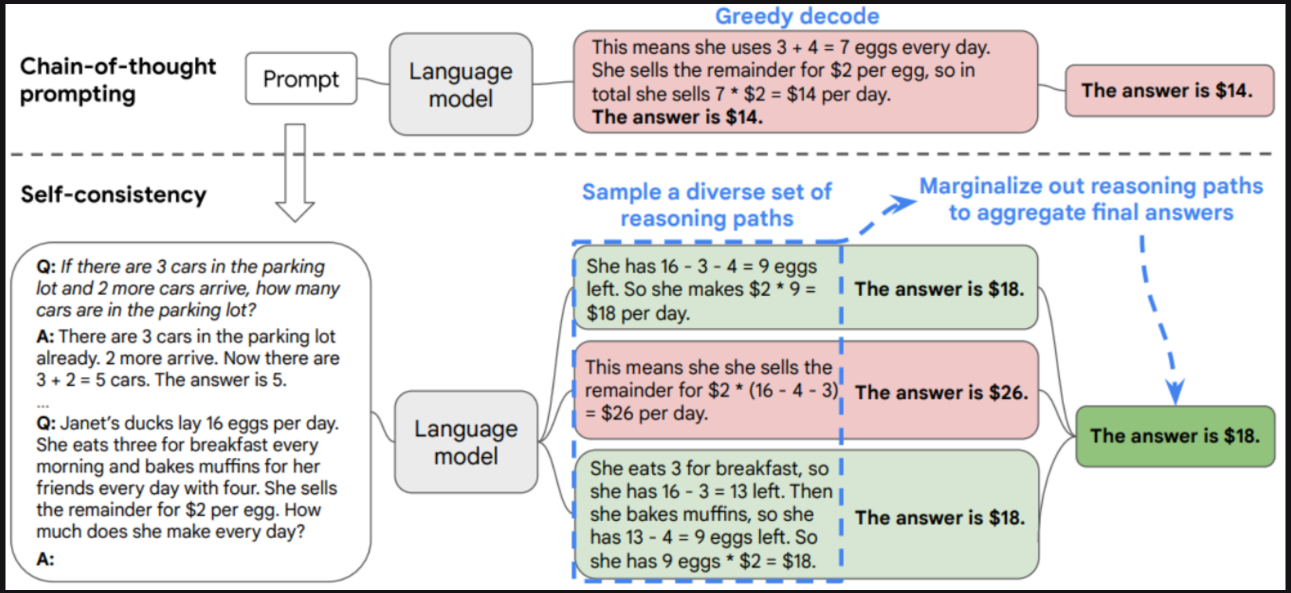
She has 16 - 3 - 4 = 9 eggs left. So she makes $2*9 = $18 per day.

This means she sells the remainder for $2*(16-4-3) = $26 per day.

She eats 3 for breakfast, so she has 16 -3 = 13 left. Then she bakes muffins. so she has 13 -4 = 9 eggs left. So she has 9 eggs*$2 = $18.

Self-Consistency Pattern

- Chain of Thought uses LLM greedy decoding to select the best response
- In Self-Consistency, we can make the LLM sample tokens and generate multiple variations of CoT responses to explore diverse reasoning paths and then take the majority vote to get to the answer
- Published in the paper, *Self-Consistency Improves Chain of Thought Reasoning in Language Models - March, 2023*



Chain-of-thought prompting

Prompt

Language model

Greedy decode

This means she uses 3 + 4 = 7 eggs every day. She sells the remainder for $2 per egg, so in total she sells 7 * $2 = $14 per day. **The answer is $14.**

The answer is $14.

Self-consistency

Q: *If there are 3 cars in the parking lot and 2 more cars arrive, how many cars are in the parking lot?*

A: There are 3 cars in the parking lot already. 2 more arrive. Now there are 3 + 2 = 5 cars. The answer is 5.

...

Q: Janet's ducks lay 16 eggs per day. She eats three for breakfast every morning and bakes muffins for her friends every day with four. She sells the remainder for $2 per egg. How much does she make every day?

A:

Language model

Sample a diverse set of reasoning paths

She has 16 - 3 - 4 = 9 eggs left. So she makes $2 * 9 = $18 per day. **The answer is $18.**

This means she she sells the remainder for $2 * (16 - 4 - 3) = $26 per day. **The answer is $26.**

She eats 3 for breakfast, so she has 16 - 3 = 13 left. Then she bakes muffins, so she has 13 - 4 = 9 eggs left. So she has 9 eggs * $2 = $18. **The answer is $18.**

Marginalize out reasoning paths to aggregate final answers

The answer is $18.

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How to Sample LLM Generation Tokens to get Different Responses?

Model is deterministic. Always picks the word with the highest probability

Encourages more creativity by allowing the model to consider words with lower probability

Strongly biases the model towards lower-probability words, leading to highly unusual or unexpected outputs

0

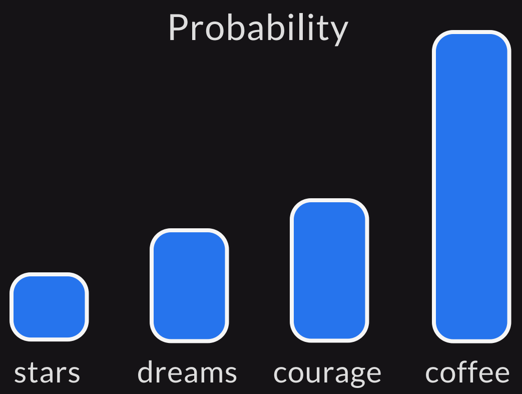
Temperature

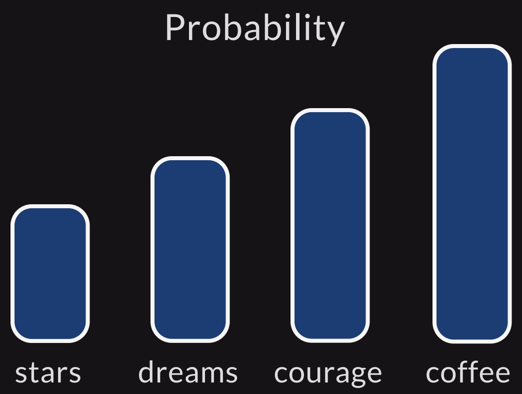
2

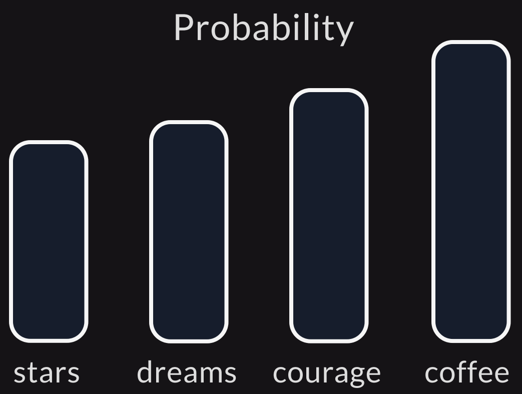
"A cup of coffee"

"A cup of courage"

"A cup of stars"

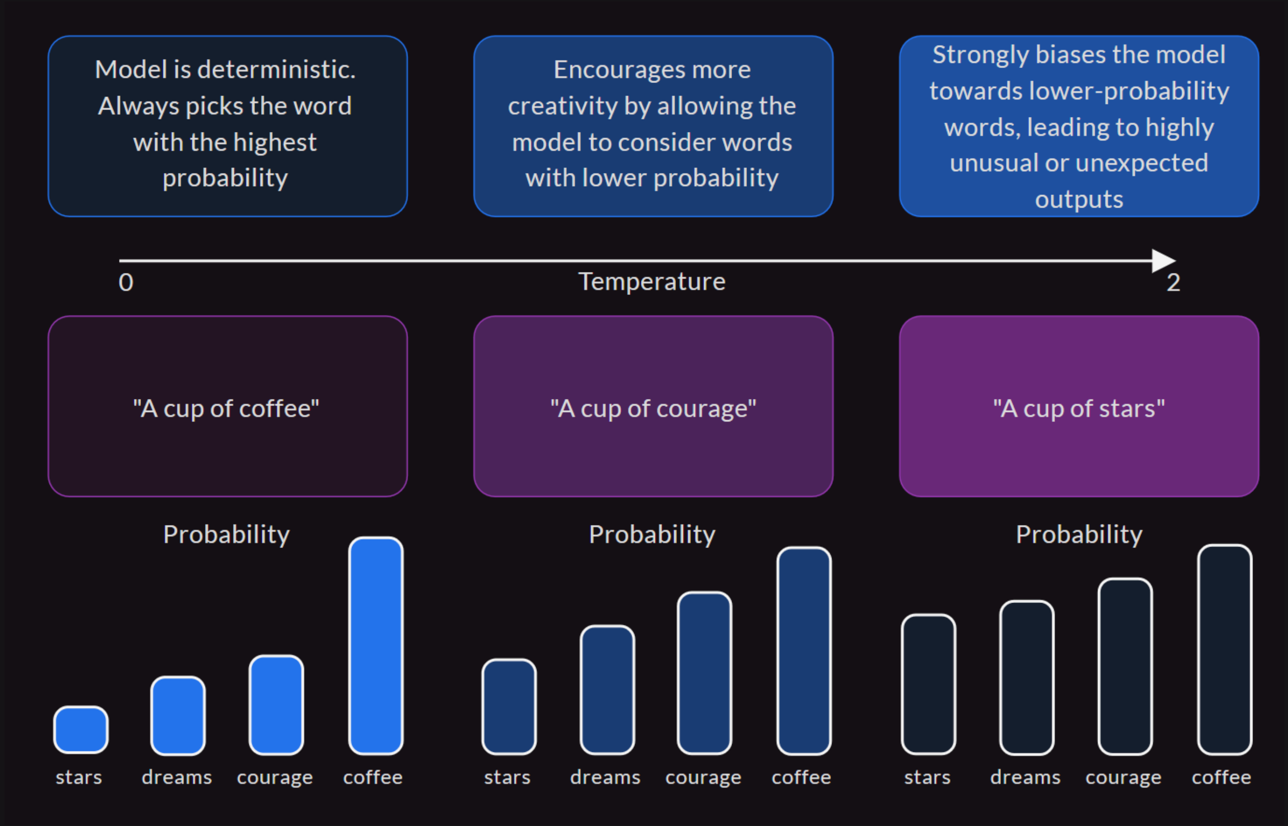






How to Sample LLM Generation Tokens to get Different Responses?

- In Greedy Decoding, LLMs generate the response tokens by always selecting the next probable token with the highest probability
- Setting the temperature of an LLM is a useful method to encourage the model to generate responses by including next probable tokens with lower probabilities.
- Other settings can also be leveraged like top_k or top_p to sample tokens randomly from a selection of
  top next tokens



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Thank You