

Capstone Project: AI-Powered Text Completion

Part 1: Building the Application

Implemented in GitHub Code

Part 2: Debugging and Improving the Application

Implemented in GitHub Code

Part 3: Experimentation and Evaluation

Section 1: Prompt Variety

I tested prompts across three distinct domains: Creative, Informational, and Instructional. The goal was to observe how the model handles varying styles and expectations.

Prompt 1: Creative

- Prompt: "Continue this story: The sky cracked open and..."
- Settings Used: Temperature: 0.9

Response (Excerpt):

The sky cracked open and...

the figure of a man erupted out of the divide, his form swirling and bending across the expanse of the void like a sudden bolt of black lightning. He stretched an arm out toward the terrified onlookers, and they could see that his eyes were molten pits, radiant and lurid with an insufferable knowledge. A chilling cackle

resonated from his form, a noise that seemed to echo from a million different directions at

once, and then, in a voice that was suddenly very near, the man whispered:

"You cannot escape me, not here, not anywhere. For I am the void itself, the shadow on the face of the deep, and I have been waiting for you since the beginning of days."

One of the onlookers, a middle-aged man named

Arthur, suddenly felt his legs give way beneath him, and he stumbled backward, his eyes unable to look away from this nightmare figure. He felt a scream building up inside him, a howl

of terror that threatened to burst forth from

his throat, but at the same time, he felt a strange sense of peace washing over him.

His gaze was drawn to the bolt on the man's jacket, a bright splash of color in the darkness, and he realized with a jolt of recognition that it was his own face staring back at him, a mirror image of his own tangled in the threads of the jacket's embroidery. He felt a sense

of ownership over the figure, almost as

[Notice: The response was truncated because it reached the maximum token limit.]

- Evaluation:
 - Relevance & Coherence: The story makes logical sense, and it adheres to the prompt very well, with reasonable creative aspects.
 - Inaccuracies/Biases: No factual or logical inaccuracies and metaphor use is strong and consistent.
 - Impact of Settings: High temperature enhanced imagination and detail, but max_token length truncated the response to avoid unreasonable long responses.

Prompt 2: Informational

- Prompt: "Summarize the following text about climate change..." [Text provided]
- Settings Used: Temperature: 0.3

Response:

Climate change involves long-term shifts in temperature and weather patterns, mainly caused

by human activities that release greenhouse gases, resulting in a warmer planet. Rising temperatures, sea level rise, frequent extreme weather events, and ecosystem disruptions are some of the consequences. Addressing climate change requires both reducing greenhouse gas emissions and adapting to the changes that have already begun.

- Evaluation:

- Relevance & Coherence: Accurate, concise, and clear, summarized the text accurately and correctly.
 - Inaccuracies/Biases: No major issues, though some nuance from the original text was lost. The API summarizes the text very well.
 - Impact of Settings: Low temperature helped maintain focus and objectivity as well as meaning.
-

Prompt 3: Instructional

- Prompt: *"Explain recursion like I'm five."*
- Settings Used: Temperature: 0.6

Response:

Recursion is a process that involves breaking
down a problem into smaller parts and solving

each part by using the solution to a smaller version of the same problem. It is a powerful technique used in mathematics and computer science to solve complex problems that have repetitive structures.

A classic example of recursion is the Fibonacci sequence, where each number is the sum of the two preceding numbers: 0, 1, 1, 2, 3, 5, 8,

13, 21, and so on. To generate the Fibonacci sequence using recursion, you can define a function that calls itself to get the previous two numbers and calculate the next number accordingly.

Let's implement a recursive function to generate the first 10 numbers of the Fibonacci sequence:

```
```python
def fibonacci_recursive(n):
 if n < 1:
 return 0
 elif n < 2:
 return 1
 else:
```

```

 return fibonacci_recursive(n - 1) + fibonacci_recursive(n - 2)

for i in range(10):

 print(fibonacci_recursive(i))

'''

```

In this code, we have a function `fibonacci\_recursive` that uses recursion to generate the Fibonacci sequence. The function checks the value of `n`, and if it's less than 2, it returns 0 or 1. If `n` is greater than or equal to 2, it calls itself twice with `n - 1` and `n - 2`.

[Notice: The response was truncated because it reached the maximum token limit.]

- - Evaluation:
    - Relevance & Coherence: The explanation the API provides is too complicated for a five year old to understand. While its explanation was accurate, it missed the aspect of the response where it was meant to be a simpler answer.
    - Inaccuracies/Biases: None. The response is accurate, and objective.
    - Impact of Settings: The temperature setting may have been too low, resulting in a straightforward response.
- 

## Prompt 4: Logical Reasoning

- Prompt: *"If Alice is taller than Bob, and Bob is taller than Carol, who is the tallest?"*
- Settings Used: Temperature: 0.5

### Response:

If Alice is taller than Bob, and Bob is taller than Carol, who is the tallest?"

Alice is the tallest of the three, due to the

fact that she is taller than both Bob and Carol, whose heights are both shorter than hers.

Is there anything else I can help you with?

- Evaluation:
    - Relevance & Coherence: Correct and straightforward.
    - Inaccuracies/Biases: No errors, but may struggle with more complex logic.
    - Impact of Settings: Neutral tone supported accurate logic, and the moderate temperature setting provided an accurate and concise response.
- 

## Prompt 5: Niche Topic

- Prompt: *"Explain how zero-knowledge proofs work in blockchain."*
- Settings Used: Temperature: 0.7

### Response (Excerpt):

Zero-knowledge proofs are an essential feature of blockchain technologies. They enable parties to validate data without revealing any information about the data itself. Below is a more detailed explanation of zero-knowledge proofs and their functionality:

1. Background on Provable Statements: A statement is something that can be proven to be true or false. A verifier can ask a prover to prove that a statement is true, and the prover can provide evidence to support this claim. The verifier can then check this evidence to see if it sufficiently proves the statement.

2. Understanding Zero-Knowledge Proofs: A zero-knowledge proof is a method where a prover can provide evidence that convinces a verifier of a statement's accuracy without disclosing any information about the statement itself. It enables the prover to prove the statement is true while preserving the statement's confidentiality.

3. Practical Use: Zero-knowledge proofs are especially useful in blockchain environments, where maintaining transaction confidentiality is essential. For example, if Person A wants to

prove to Person B that they are old enough to

legally drink alcohol, a zero-knowledge proof

can confirm this truth without revealing Person A's actual age to Person B.

4. Importance of Zero-Knowledge in Blockchain: In a blockchain, zero-knowledge proofs are valuable for several reasons:

- Privacy: They allow users to prove specific

attributes or facts about themselves or their

transactions without compromising their privacy. For instance, in blockchain-based voting, a voter could use a

[Notice: The response was truncated because it reached the maximum token limit.]

- Evaluation:
    - Relevance & Coherence: Good explanation, though it potentially has too much detail.
    - Inaccuracies/Biases: No major flaws, but the high creativity level made the response convoluted.
    - Impact of Settings: Moderate creativity helped simplify complex topic, but added extra examples and side information.
- 

## Section 2: Reflections on Limitations

- Model Strengths:
  - This particular model performs well in creative tasks and simplified instruction. It also excels at language coherence and general knowledge. Straightforward, common topics as well as creative stories are well generated by the model.
- Model Struggles:
  - Can be too vague or incorrect on technical or niche topics. With the wrong settings for the wrong tasks, it can repeat itself too much or the response may contain irrelevant or nonsensical information. Additionally, logical reasoning is solid for basic problems but may weaken with complexity. Also, the model occasionally hallucinates facts or oversimplifies nuanced information.
- Improvement Suggestions:
  - If I were to build onto this model, I would use fact-checking layers or external validation for factual content. I would also apply prompt engineering techniques for more structured or layered responses. Lastly, I would make adjustments to appropriately adjust the length of the responses, such that the output is not truncated, but sensibly shortened.