

Exploring Transformers with Pretrained Text Generation Models

Transformers are a powerful type of model in AI that have changed the way machines understand and generate things like language, images, and audio. What makes them so effective is their ability to look at all parts of a sentence or sequence at once, thanks to something called self-attention. This lets them find patterns and relationships between words, no matter where those words are in the sentence. Unlike older models that read one step at a time, transformers can process information in parallel, making them faster and more accurate. Because of this, they've become the backbone of many advanced tools in AI, including language models like GPT and image generators like DALL-E.

For the experiment, I used the pretrained Transformer model (GPT-2) and generated text based on different prompts while experimenting with various generation parameters. These included prompts such as news headlines, short story openers, dialogues, and factual statements. In one of the test experiments I conducted, focused on plant biology and photosynthesis, I used the prompt: *"A fundamental chemical fact about plants is their ability to perform photosynthesis, a process where they convert light energy into chemical energy in the form of sugars. This process utilizes..."* I intentionally left the sentence unfinished to give the language model (LLM) more space and creative freedom to continue the idea.

While working with the dialogue prompt "AUNTY EM: Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you doing? AUNTY EM:" and the factual prompt "A fundamental chemical fact about plants is their ability to perform photosynthesis, a process where they convert light energy into chemical energy in the form of sugars. This process utilizes...", I noticed that the dialogue produced more limited output due to the lack of context in the conversation. This became especially apparent when testing it with very low temperature settings. At temperatures of 0.4 and 0.1, and a maximum length of 80, the model repeated the same ideas over and over, resulting in looping responses between the characters. At a temperature of 0.4, for example, it outputs:

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AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you
doing? AUNTY EM :Good. DOROTHY: Good. DOROTHY: Good. DOROTHY: Good. DOROTHY:
Good. DOROTHY: Good. DOROTHY: Good. DOROTHY: Good. DOROTHY: Good. DOROTHY:
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Good. DOROTHY: Good. DOROTHY: Good. DOR
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When using 0.1, it outputted:

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AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you
doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How
are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty
Em! How are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning,
Aunty Em! How are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good
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morning, Aunty Em! How are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you doing? AUNTY EM :Good morning, Dorothy! DOROTHY: Good morning, Aunty Em! How are you doing? AUNTY EM :Good morning, Dorothy.

But when more context was provided in the photosynthesis example, the looping still occurred, though the output was more detailed.

When 0.8 was used it outputted:

A fundamental chemical fact about plants is their ability to perform photosynthesis, a process where they convert light energy into chemical energy in the form of sugars. This process utilizes photosynthesis to produce sugars and, eventually, leaves.

The plant "can be harvested from a single plant or harvested from multiple plants", but it also has a very tiny proportion of the sunlight it consumes, meaning it doesn't grow as fast. So you need to get a lot of sunlight in order to grow food. You need a lot of sunlight to grow food, and your plants need sunlight to grow food. The plants that use the most light, the ones that are able to use the least amount of sunlight, have more of the maximum amount of food they need.

The difference between the light in and the light in means that you need to use more light to grow food.

The difference between how much light an animal absorbs into its body, and how much it absorbs into its food is the difference between how much light an animal is losing from the sun's rays and how much light there is in its body.

What About Energy?

The world has a great many different energy sources. Energy is what you burn from your body when you are alive; it can be used to feed your body or you can convert it into something valuable.

The use of energy is one of a number of different ways that I know of

When 0.2 was used it outputted:

A fundamental chemical fact about plants is their ability to perform photosynthesis, a process where they convert light energy into chemical energy in the form of sugars. This process utilizes photosynthesis to produce energy, which is why plants are so important to our understanding of the world.

The photosynthetic process is the process by which plants produce energy. Plants use photosynthesis to produce energy, which is why plants are so important to our understanding of the world. Plants are the primary source of

[illegible]

From this experiment with Transformer-based text generation, I learned how important context is when prompting a model. Even a short amount of setup can open the door to more creative and varied outputs. I also noticed how the order and structure of words in the prompt had a big impact on the results. For example, simply adding “AUNTY EM:” at the end of a dialogue prompt significantly changed how the model continued the conversation, compared to leaving it out entirely.

Link to notebook:

https://github.com/castilloadriana/Cognizant-GenAI-Externship-/blob/main/Projects/transformer_template.ipynb