Large Language Models and Prompt Engineering

Agenda

- Introduction to LLMs
- LLMs: Expectations and Caution
- Training and Evaluation of LLMs
- Multi-modal LLMs
- Prompt Engineering
- LLM Ethics

Let's begin the discussion by answering a few questions on Large Language Models (LLMs) and Prompt Engineering

LLM and Prompt Engineering Quiz

Which architecture is commonly used in large language models like GPT (Generative Pre-trained Transformer)?

A. LSTM

B. CNN

C. Transformer

D. RNN

LLM and Prompt Engineering Quiz

Great Learning
POWER AHEAD

Which architecture is commonly used in large language models like GPT (Generative Pre-trained Transformer)?

A. LSTM

B. CNN

C. Transformer

D. RNN

Transformer

A **neural network architecture** introduced in 2017 that revolutionized natural language processing (NLP) and is at the core of widely used large language models (LLMs) today

Contextual Understanding

Grasp context between tokens and sequences, enhancing their ability to generate coherent and relevant output for various tasks

- **Self-attention Mechanism**
- **Positional Encoding**

+

Scalability and Performance

Efficiently process vast amount of sequential data, resulting in improved language processing and generation capabilities

- **Computation Parallelization**
- **Residual Connections**

Large Language Models (LLMs)

Large **L**anguage **M**odels (**LLM**s) are powerful AI models trained on massive amounts of data to learn the complex patterns and rules of human language, allowing them to perform a wide variety of tasks

Large

Trained on **large amounts of data** and have **billions of trainable parameters**

Language

Deals with text data (takes input in text and generates output in text)

Model

Predicts the next **word** / **sentence / token**

LLM and Prompt Engineering Quiz

What does "hallucination" refer to in large language models (LLMs)?

A. Generating text that is vivid and imaginative, often diverging from factual information.

B. Creating text that is coherent and contextually relevant to the given prompt.

C. Incorporating diverse perspectives and opinions to enhance the richness of generated text.

D. Ensuring that the generated text aligns perfectly with the training data, without any deviation.

LLM and Prompt Engineering Quiz

What does "hallucination" refer to in large language models (LLMs)?

A. Generating text that is vivid and imaginative, often diverging from factual information.

B. Creating text that is coherent and contextually relevant to the given prompt.

C. Incorporating diverse perspectives and opinions to enhance the richness of generated text.

D. Ensuring that the generated text aligns perfectly with the training data, without any deviation.

Expectations from LLMs

What to expect?

Good Articulation

Ability to express information coherently and fluently, ensuring clear communication through well-structured and understandable output

General Knowledge

Possesses a vast repository of information gathered during training, enabling them to provide diverse and comprehensive knowledge across various topics

Creativity and Diversity

Capable of producing creative and diverse responses, adapting to different styles, tones, or perspectives based on provided specifications

Expectations from LLMs

What NOT to expect?

Domain Knowledge

Lacks inherent domain-specific knowledge as they rely on the data they were trained on, which may not cover specialized domains comprehensively

Guardrails

Lack the ability to implement strict boundaries or ethical considerations, potentially generating inappropriate or biased content without constraints

Consistent Accuracy

May generate responses that sound plausible but are factually incorrect, leading to potential misinformation and misunderstanding.

This is known as **"hallucinations"** in LLMs

Hallucination in LLMs

Hallucination in LLMs refers to the generation of text that is vividly imaginative but may lack factual accuracy, often diverging from the given context.

It occurs when the model generates responses that are unrelated or irrelevant to the input prompt, leading to outputs that can be misleading or nonsensical.

Example Prompt: Who was the first person to land on the moon ?

Model Response: Buzz Aldrin is famously known as the first person to land on the moon, where he famously took the iconic steps that marked a giant leap for mankind. His groundbreaking achievement not only reshaped our understanding of space exploration but also inspired generations to reach for the stars in pursuit of discovery and innovation.

While the answer from the model is very well articulated and provides insights into the impact of the event, the answer is factually incorrect as the first person to land on the moon was Neil Armstrong.

LLM and Prompt Engineering Quiz

How does reinforcement learning with human feedback contribute to training large language models (LLMs)?

A. It utilizes human feedback to fine-tune model parameters.

B. It employs unsupervised learning techniques to update model weights.

C. It leverages simulated environments for generating training data.

D. It applies transfer learning from pre-trained language models.

LLM and Prompt Engineering Quiz

How does reinforcement learning with human feedback contribute to training large language models (LLMs)?

A. It utilizes human feedback to fine-tune model parameters.

B. It employs unsupervised learning techniques to update model weights.

C. It leverages simulated environments for generating training data.

D. It applies transfer learning from pre-trained language models.

Training LLMs

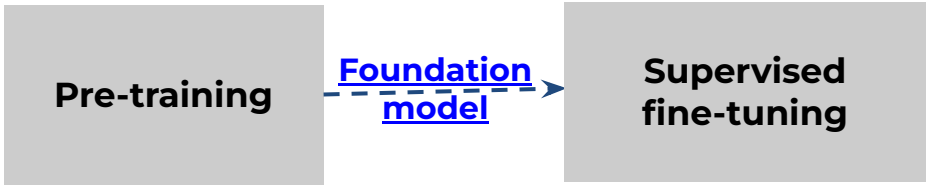
Pre-training

Data

Large corpus of internet data

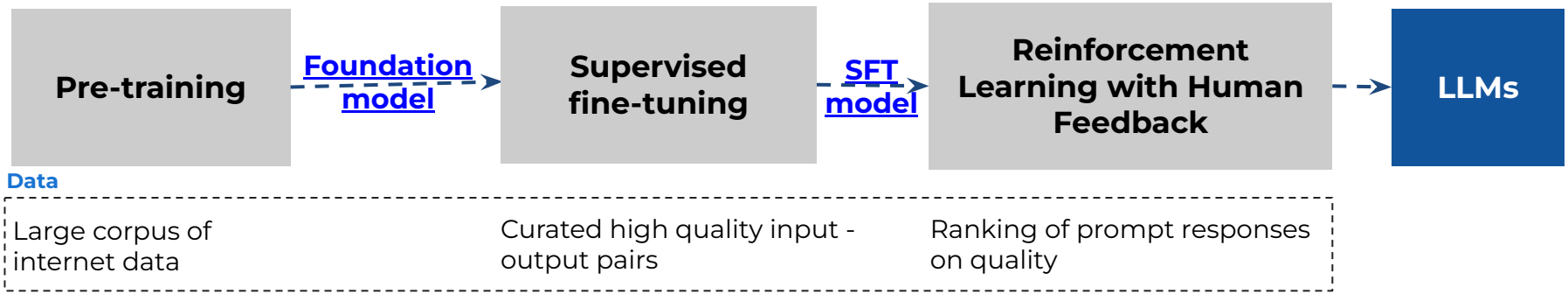
In **Pre-training**, the model builds a foundational understanding of language from a vast amount of data, allowing it to generate coherent and contextually relevant responses

Training LLMs



Following pre-training, the model undergoes **fine-tuning** to hone its capabilities for a specific task, utilizing labeled data. The model is guided by this data, refining its pre-existing knowledge and improving performance in the targeted task.

Training LLMs



Following fine-tuning, **reinforcement learning with human feedback** allows LLMs to improve by incorporating rewards or signals provided by humans, guiding the model towards desired behavior.

This approach enhances model performance by leveraging human expertise and preferences, leading to more effective training and better adaptation to specific tasks or contexts.

LLM and Prompt Engineering Quiz

What is the primary purpose of GLUE, a collection of nine language tasks, in evaluating language models?

A. To measure a language model's proficiency in translation tasks

B. To assess a language model's ability to generate human-like text

C. To evaluate a language model's performance across a range of language understanding tasks

D. To gauge a language model's capacity to understand spoken language

LLM and Prompt Engineering Quiz

What is the primary purpose of GLUE, a collection of nine language tasks, in evaluating language models?

A. To measure a language model's proficiency in translation tasks

B. To assess a language model's ability to generate human-like text

C. To evaluate a language model's performance across a range of language understanding tasks

D. To gauge a language model's capacity to understand spoken language

GLUE

A **benchmark suite** comprising nine diverse language understanding tasks

Primary purpose: Evaluate the performance of language models across these tasks, providing insights into their overall language understanding capabilities

1	**Task**: Determine if a sentence is grammatically correct or not	**Dataset:** CoLA (Corpus of Linguistic Acceptability)
2	**Task**: Determine if the sentence has a positive or negative sentiment	**Dataset:** SST-2 (Stanford Sentiment Treebank
3	**Task**: Determine if two sentences are paraphrases from one another	**Dataset:** MRPC (Microsoft Research Paraphrase Corpus))

GLUE

4	**Task**: Determine if two questions are semantically equivalent or not	**Dataset:** QQP (Quora Question Pair))
5	**Task**: Determine the similarity of two sentences with a score from 1 to 5	**Dataset:** STS-B (Semantic Textual Similarity Benchmark)
6	**Task**: Determine if a sentence entails,contradicts or is unrelated	**Dataset:** MNLI (Multi-Genre Natural Language Inference)
7	**Task**: Determine if the answer to the question is contained in a second sentence or not	**Dataset:** QNLI (Question-answering Natural Language Inference)
8	**Task**: Determine if a sentence entails a given hypothesis or not	**Dataset:** RTE (Recognizing Textual Entailment)
9	**Task**: Determine if a sentence with an anonymous pronoun and a sentence replaced are entailed or not	**Dataset:** WNLI (Winograd Natural Language Inference)

LLM and Prompt Engineering Quiz

What distinguishes Multi-modal Large Language Models from traditional language models?

A. They can take data across multiple modalities as input and output text

B. They can take text data as input and output data across multiple modalities

C. They are smaller in size compared to traditional language models

D. They are trained using supervised learning techniques only

LLM and Prompt Engineering Quiz

What distinguishes Multi-modal Large Language Models from traditional language models?

A. They can take data across multiple modalities as input and output text

B. They can take text data as input and output data across multiple modalities

C. They are smaller in size compared to traditional language models

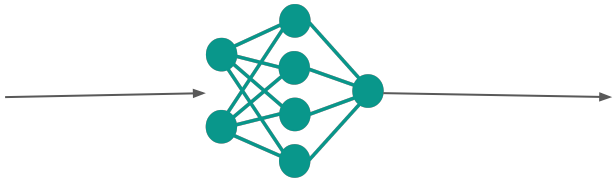
D. They are trained using supervised learning techniques only

Multi-modal LLMs

Multi-modal Large Language Models can process both text and non-textual data, such as images or audio, enabling them to understand and generate content across multiple modalities

This capability is achieved through integrating information from different modalities, allowing the model to produce more comprehensive and contextually rich outputs

Give me a two-paragraph summary of recent advances in multi-modal LLMs.



LLM

Recent advances in multi-modal language models leverage cross-modal pre-training and attention mechanisms to integrate diverse data types, enhancing contextual understanding and performance in tasks spanning text, images, and audio.

These developments signify a significant leap towards creating more versatile AI systems capable of comprehending and generating content across multiple modalities.

Multi-modal LLMs

Is there a dog in the picture?

LLM

YES

Create an image of dog, having fun in a party, wearing a black tuxedo with wine in one hand

LLM

LLM and Prompt Engineering Quiz

What does "constrained outputs" refer to in the context of prompt engineering?

A. Unrestricted and free-form model responses

B. Limiting the allowable model responses

C. Model training without any guidelines

D. Enhancing model creativity

LLM and Prompt Engineering Quiz

What does "constrained outputs" refer to in the context of prompt engineering?

A. Unrestricted and free-form model responses

B. Limiting the allowable model responses

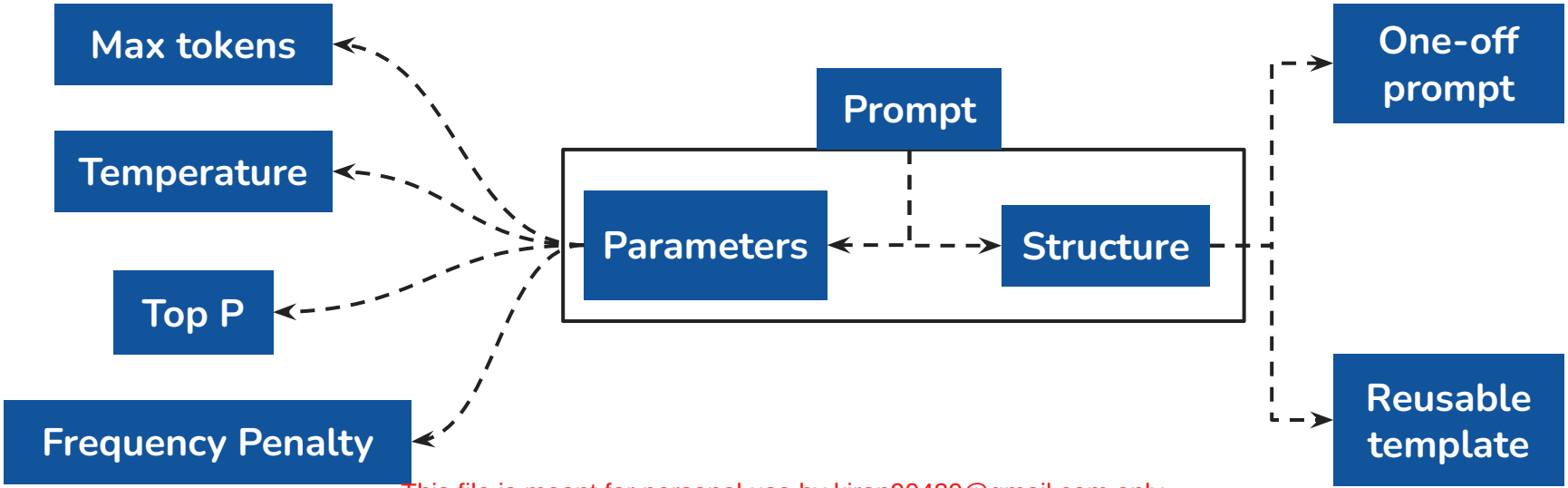
C. Model training without any guidelines

D. Enhancing model creativity

Prompt Engineering

Prompt: Specific set of instructions sent to a LLM to accomplish a task

Engineering: Iteratively deriving a specific prompt for the task



Significance of Prompt Engineering

Great Learning
POWER AHEAD

PROMPT	**Write a blog post about the benefits of meditation for mental health, targeting a beginner audience and optimized for SEO**
1 Control model behaviour	The prompt is designed to control the behavior of the LLM by specifying the topic, target audience, and optimization criteria.
2 Get constrained outputs	The prompt includes specific keywords and phrases, such as "meditation," "mental health," "beginner," and "SEO," which constrain the model's response to a particular domain and style.
3 Higher output quality	The prompt provides context and specifies the tone or style, which helps the model understand the task at hand and generate a high-quality response.
4 Automate LLM operations	The prompt can be used to automate various LLM operations, such as fine-tuning, evaluation, and deployment.

LLM and Prompt Engineering Quiz

What is a primary concern regarding the ethics of artificial intelligence (AI)?

A. Ensuring AI systems have access to vast amounts of data

B. Minimizing the computational resources required for AI development

C. Addressing biases and fairness in AI decision-making

D. Increasing the speed of AI algorithms for real-time applications

LLM and Prompt Engineering Quiz

What is a primary concern regarding the ethics of artificial intelligence (AI)?

A. Ensuring AI systems have access to vast amounts of data

B. Minimizing the computational resources required for AI development

C. Addressing biases and fairness in AI decision-making

D. Increasing the speed of AI algorithms for real-time applications

Ethics of AI

Ethical concerns in AI often revolve around biases embedded in algorithms, raising questions about fairness and equity in decision-making processes.

Addressing these concerns is crucial to ensure that AI systems behave ethically and do not perpetuate or amplify existing societal inequalities.

Great Learning

Happy Learning !