LVC 3: Large Language Models and Prompt Engineering

Natural Language Processing with Large Language Models

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Agenda

- Introduction to LLMs
- Working of LLMs
- Applications of LLMs
- Introduction to Prompt Engineering
- Common Practices for Devising Prompts

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Introduction to LLMs

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The Transformer Advantage

Transformers have revolutionized NLP, demonstrating state-of-the-art performance across multiple NLP tasks

Contextual Understanding

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

Attention Mechanism

Positional Encoding

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Scalability and Performance

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

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

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Transformers are the core of large language models (LLMs) today

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Large Language Models

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

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Language

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

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Language

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Model

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

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Expectations from Large Language Models

What to expect?

Good Articulation

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

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General Knowledge

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Creativity and Diversity

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

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Expectations from Large Language Models

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

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Guardrails

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

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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

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Working of LLMs

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Training of Large Language Models (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

Similar to pre-training performed in BERT

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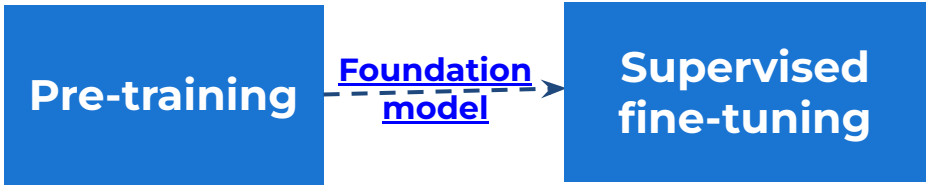
Training of Large Language Models (LLMs)



Data

Large corpus of internet data	Curated high quality input - output pairs

After pre-training, the model undergo fine-tuning, where it is trained on a specific task using supervised (labelled) data

By providing the model with supervised data and guiding it toward the desired output, it adapts its pre-existing knowledge to perform better on the targeted task

Similar to fine-tuning performed in BERT

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Training of Large Language Models (LLMs)

Data

Large corpus of internet data	Curated high quality input - output pairs	Ranking of prompt responses on quality

In this stage, the model receives feedback from human interactions or simulated environments to improve its performance

The model generates responses, and these responses are evaluated by humans or algorithms.

Feedback reinforces desirable behavior, helping the model adjust its parameters to generate better outputs

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Evolution of LLMs

BERT (340M parameters)
First model to consider both left and right contexts of words simultaneously during pre-training

GPT (117M parameters)
First model to be trained in a “generative” mode by masking portions of input text from left-to-right

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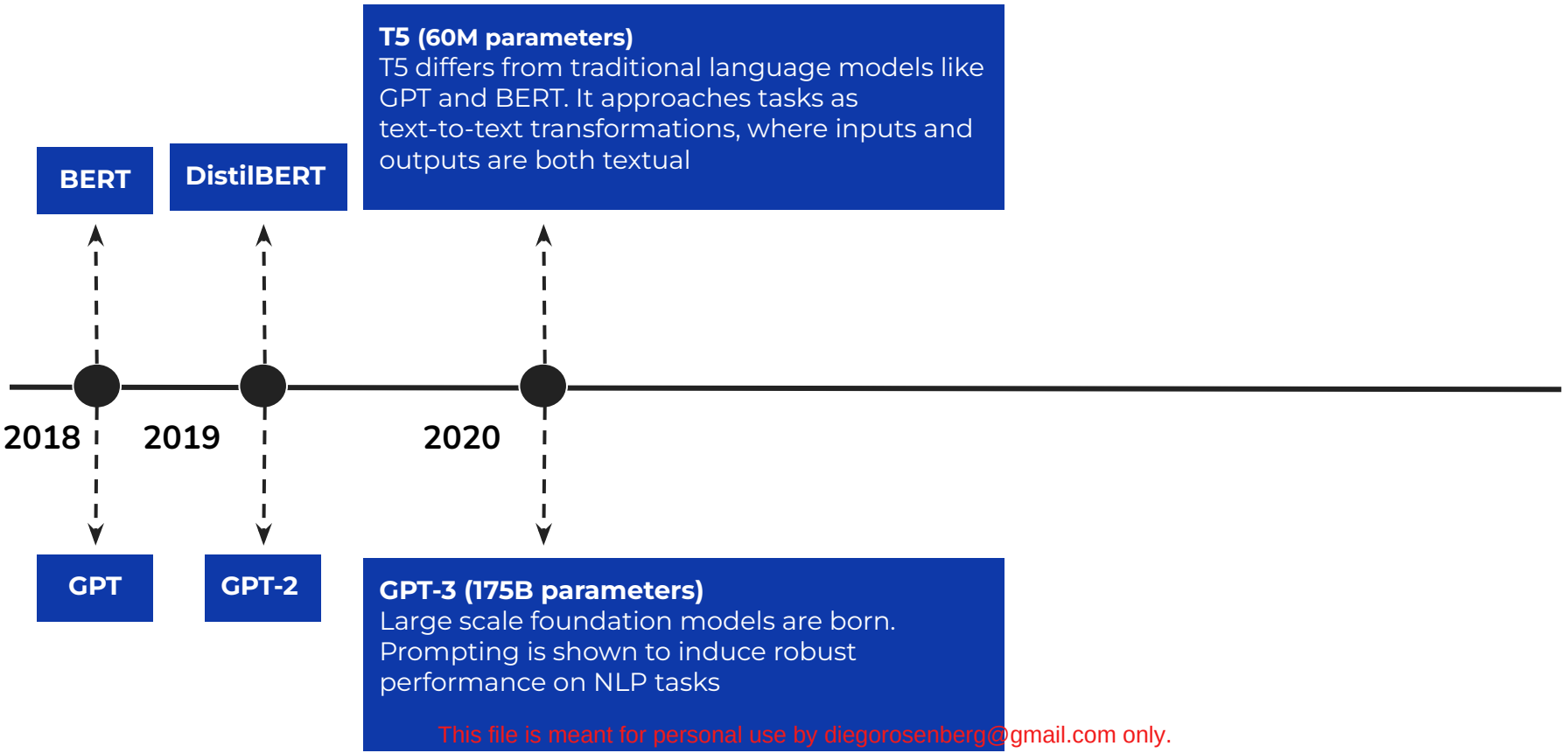

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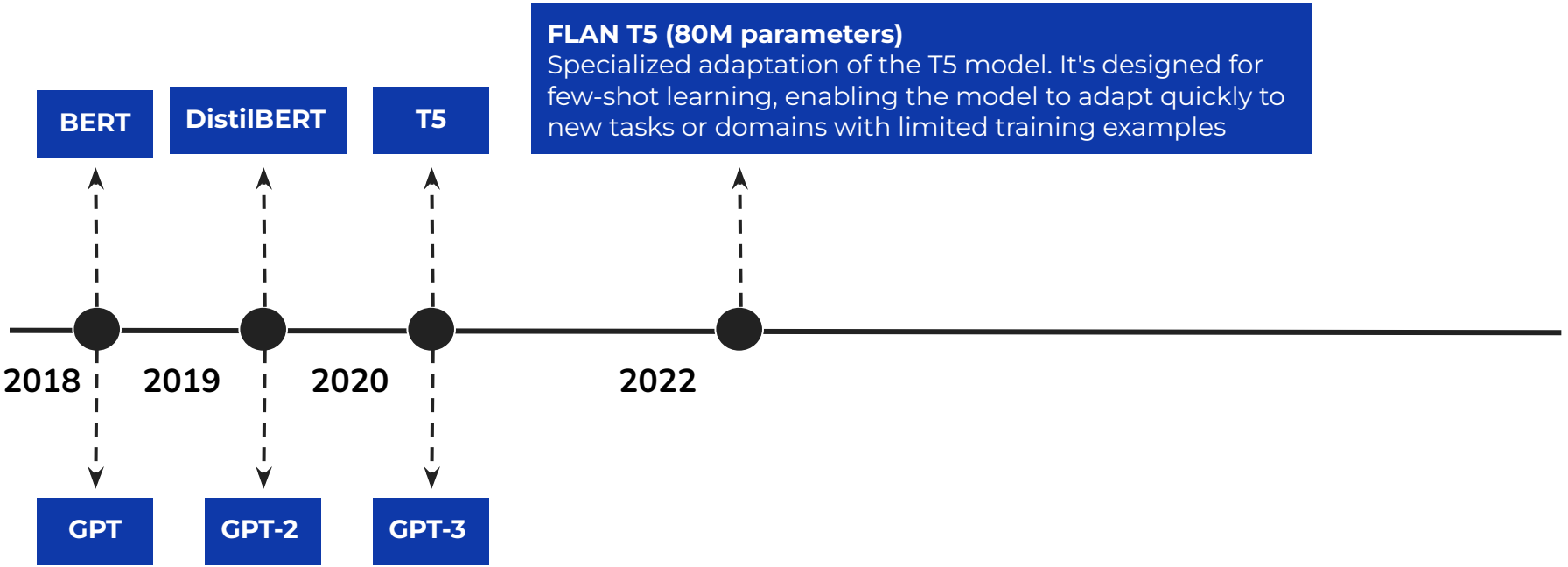

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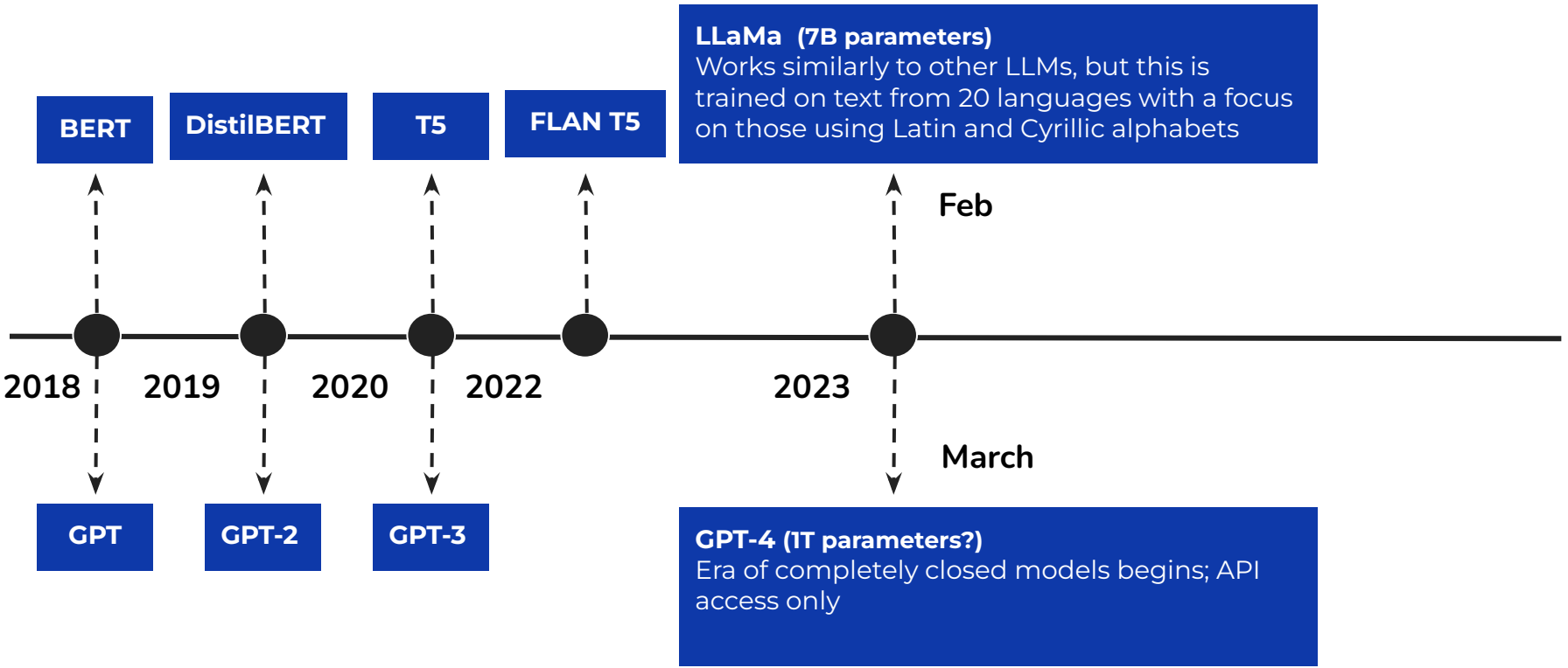

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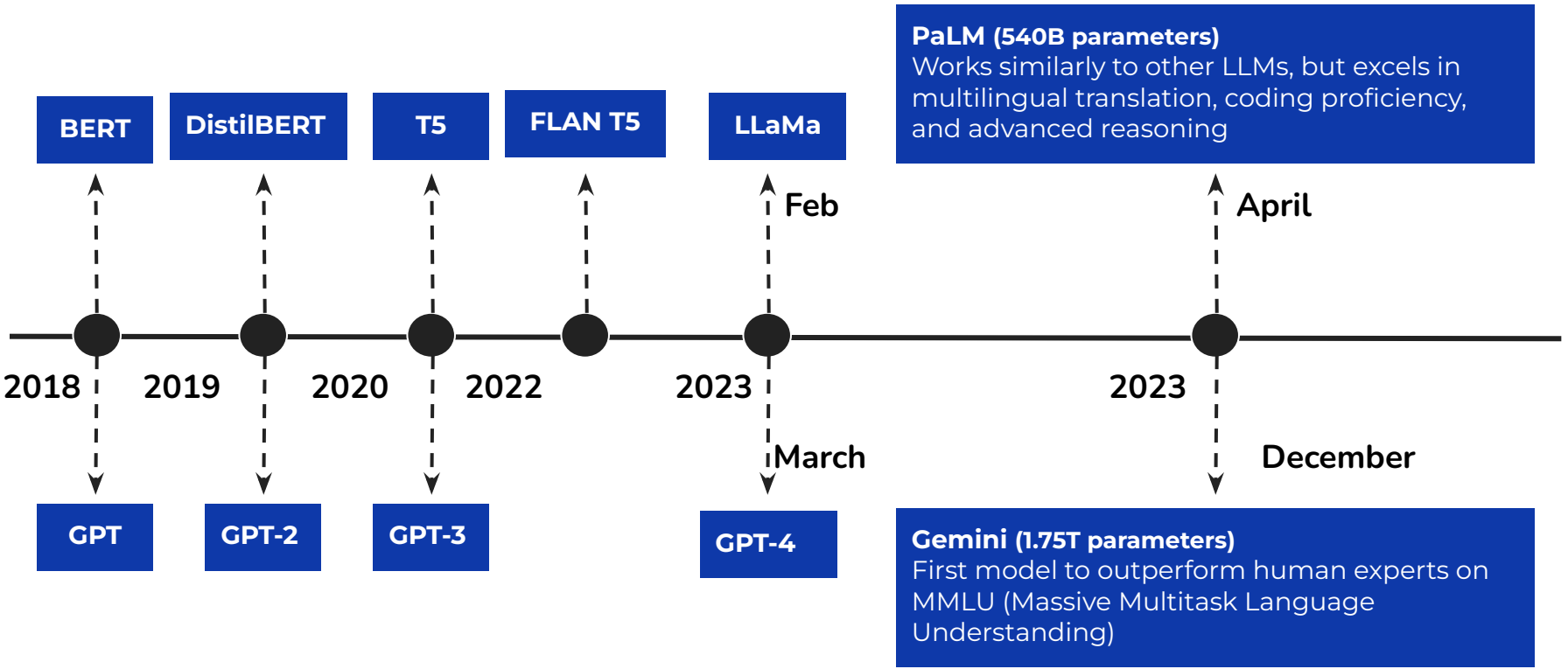

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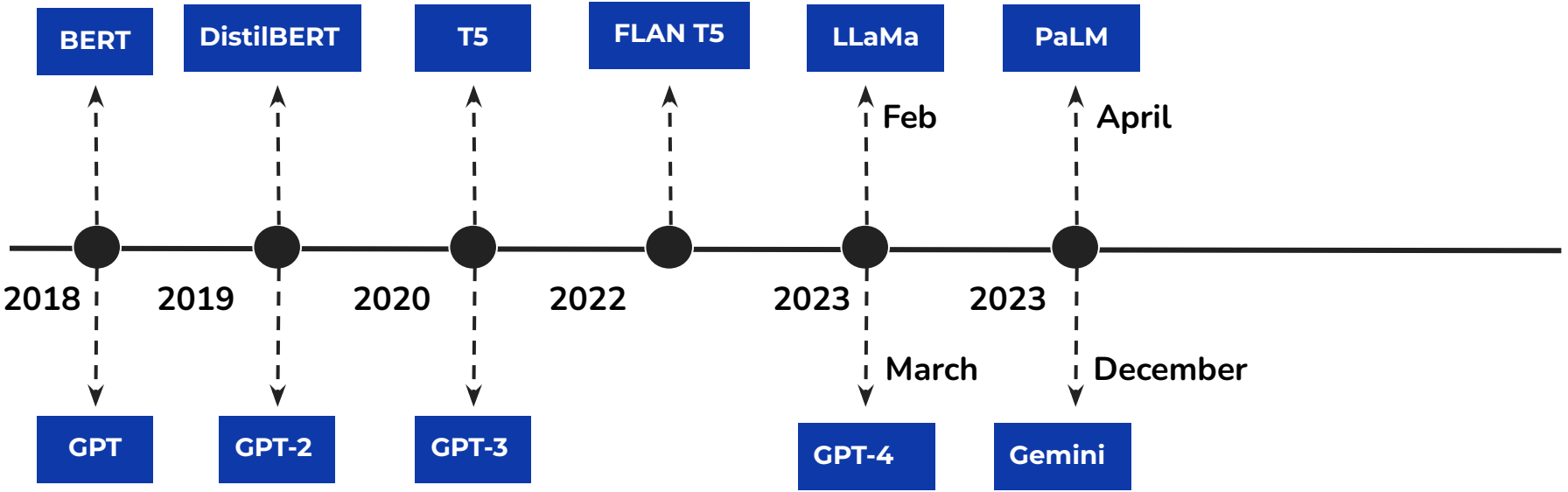

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Applications of LLMs

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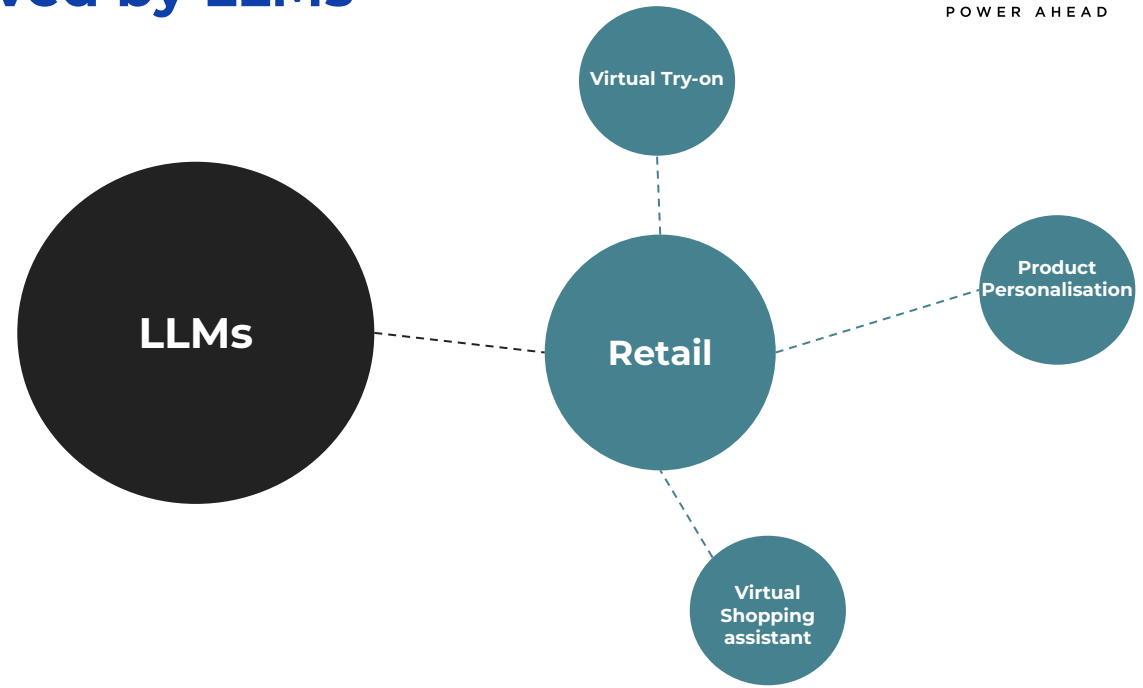
Business Problems solved by LLMs



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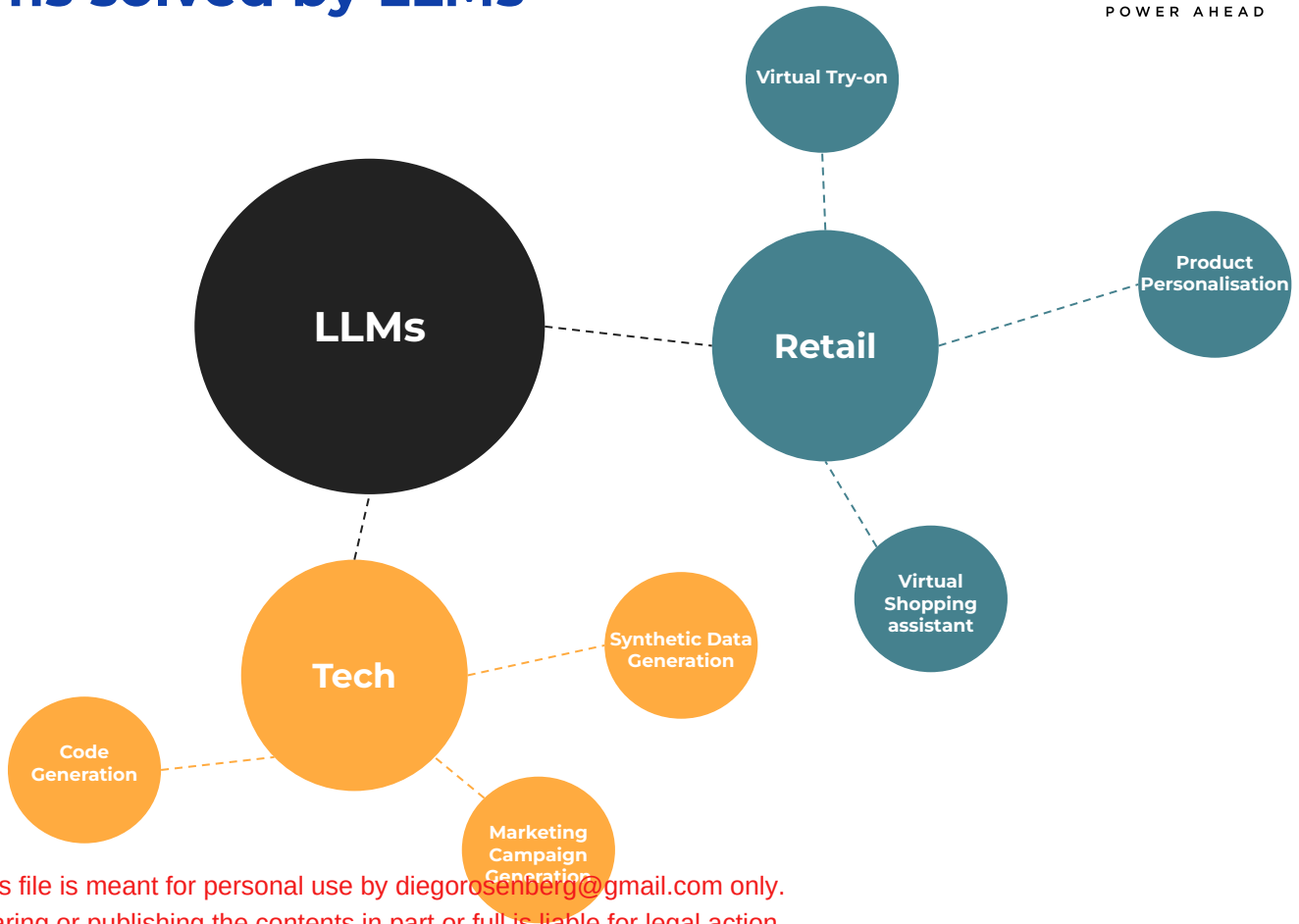

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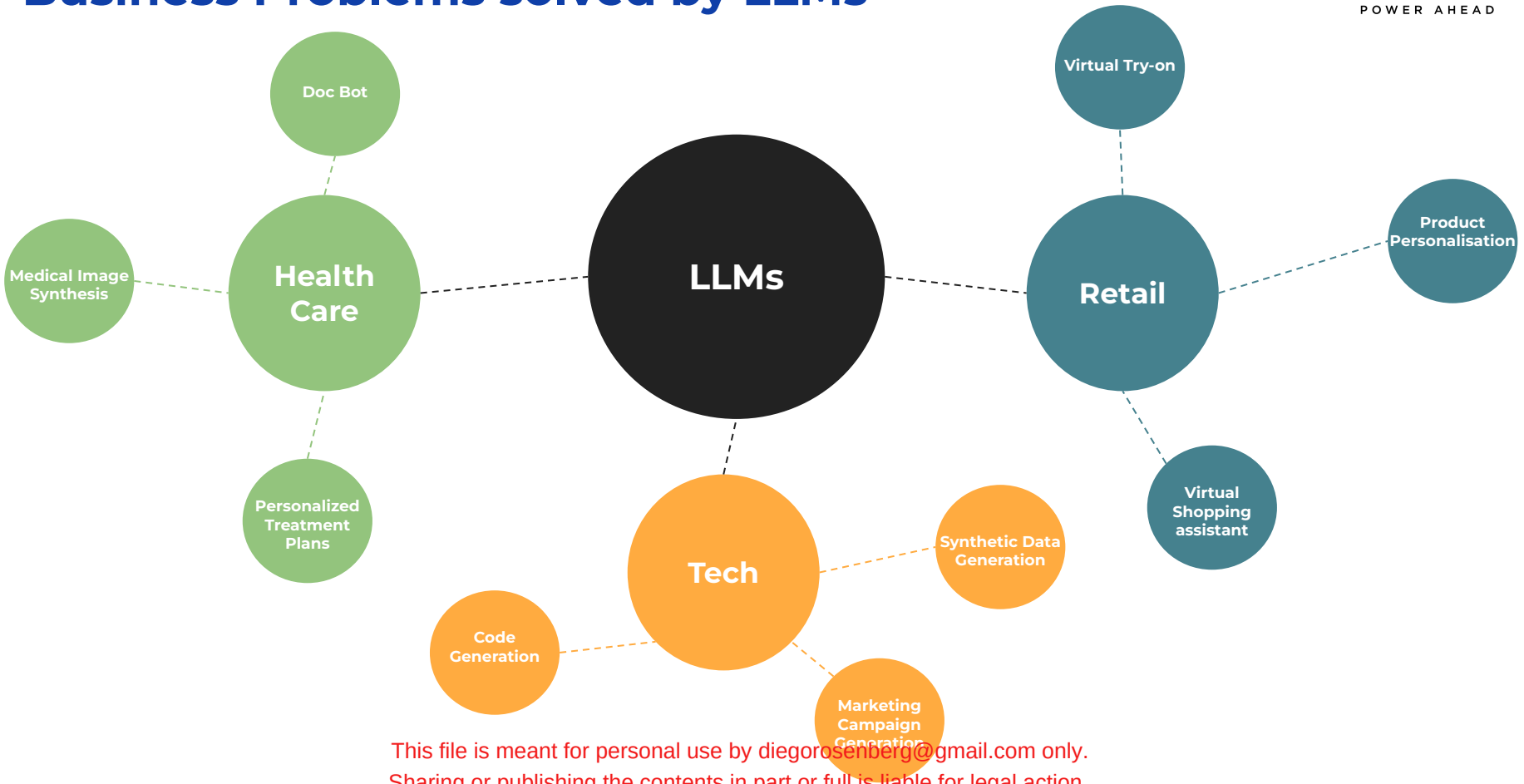

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Introduction to Prompt Engineering

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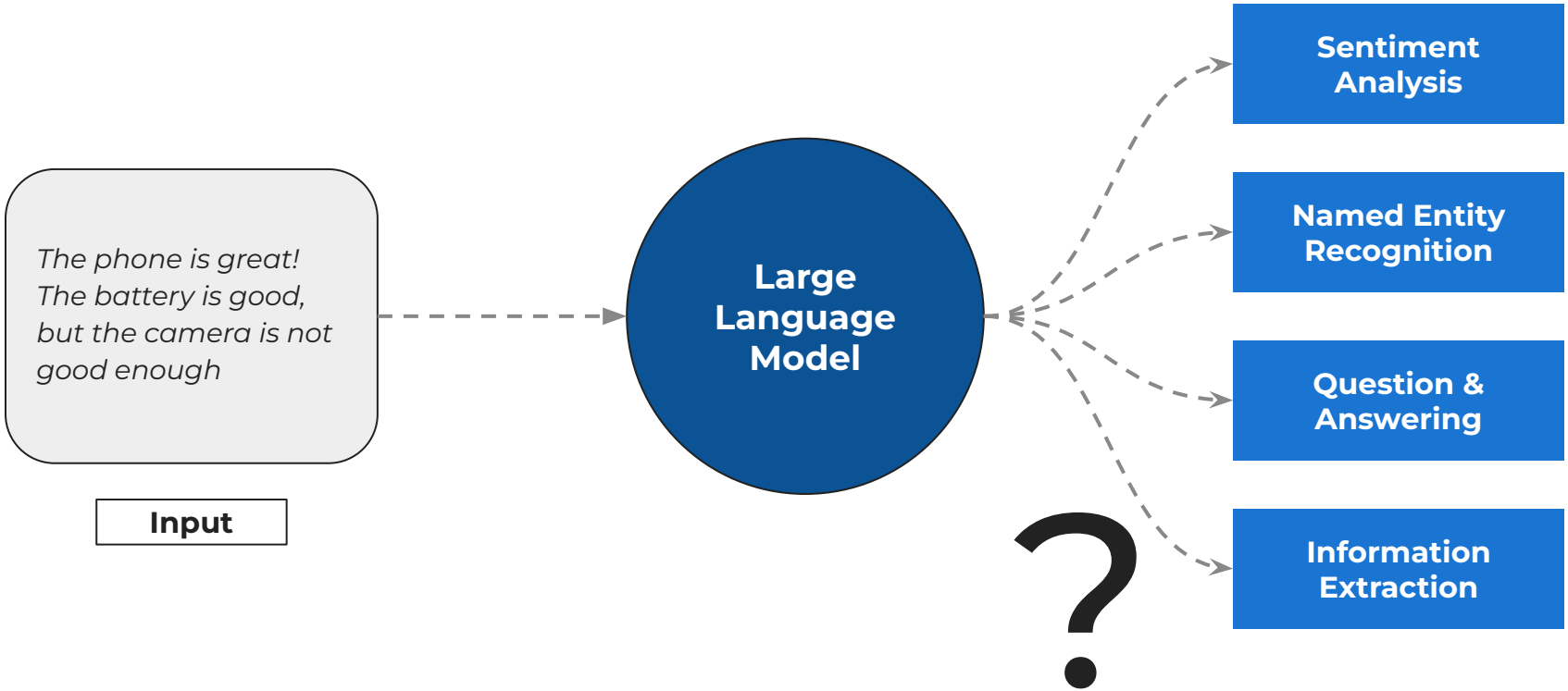
The Need for Prompts



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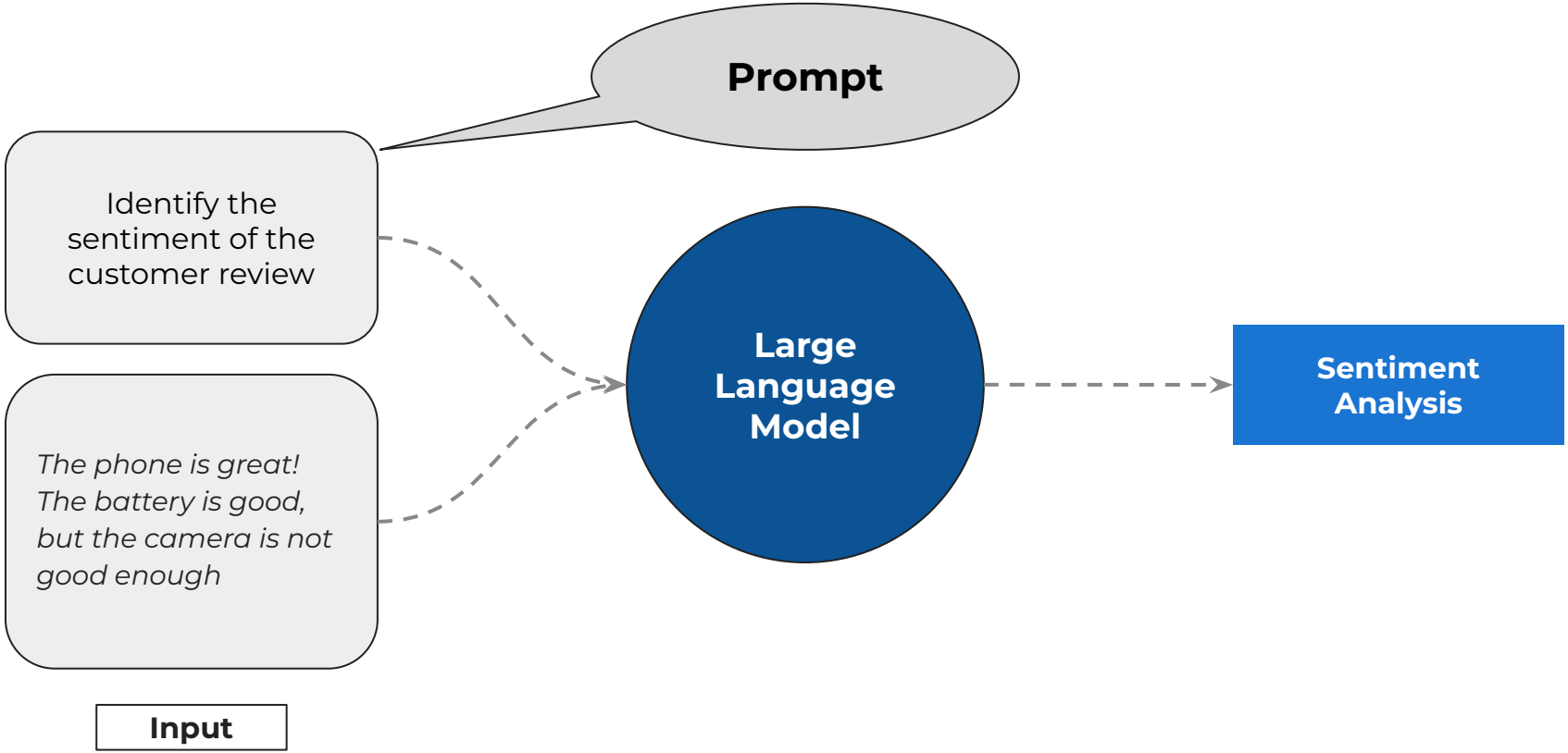

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What is a Prompt?

A stimulus that triggers a specific action or event

prompt

verb

verb: **prompt**; 3rd person present: **prompts**; past tense: **prompted**; past participle: **prompted**; gerund or present participle: **prompting**

1. (of an event or fact) cause or bring about (an action or feeling).
   "the violence prompted a wave of refugees to flee the country"

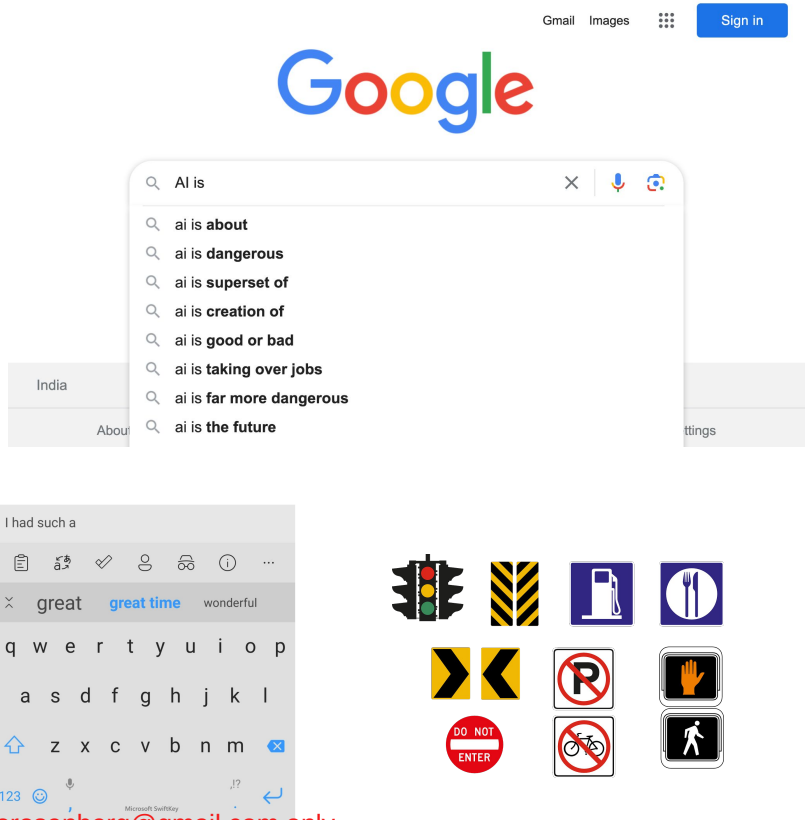
   Similar: give rise to | bring about | cause | occasion | result in | lead to

   - cause someone to take a course of action.
     "curiosity prompted him to look inside"

     Similar: induce | make | move | cause | motivate | lead | dispose
2. encourage (a hesitating speaker) to say something.
   "'And the picture?' he prompted"

   Similar: remind | cue | give someone a cue | help out | coach | feed

   - supply a forgotten word or line to (an actor) during the performance of a play.
   - **COMPUTING**
     (of a computer) request input from (a user).
     "the online form prompts users for data"



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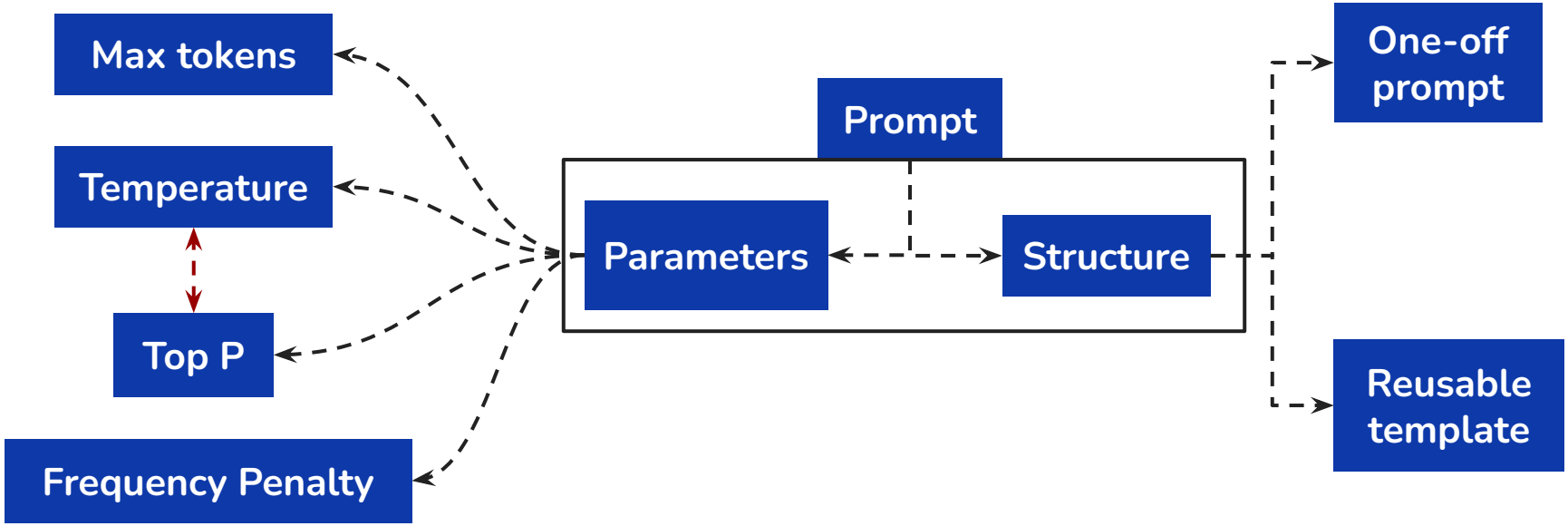
Prompt Engineering*

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

Engineering = Iteratively deriving a specific prompt for the task



*Also referred to as in-context learning

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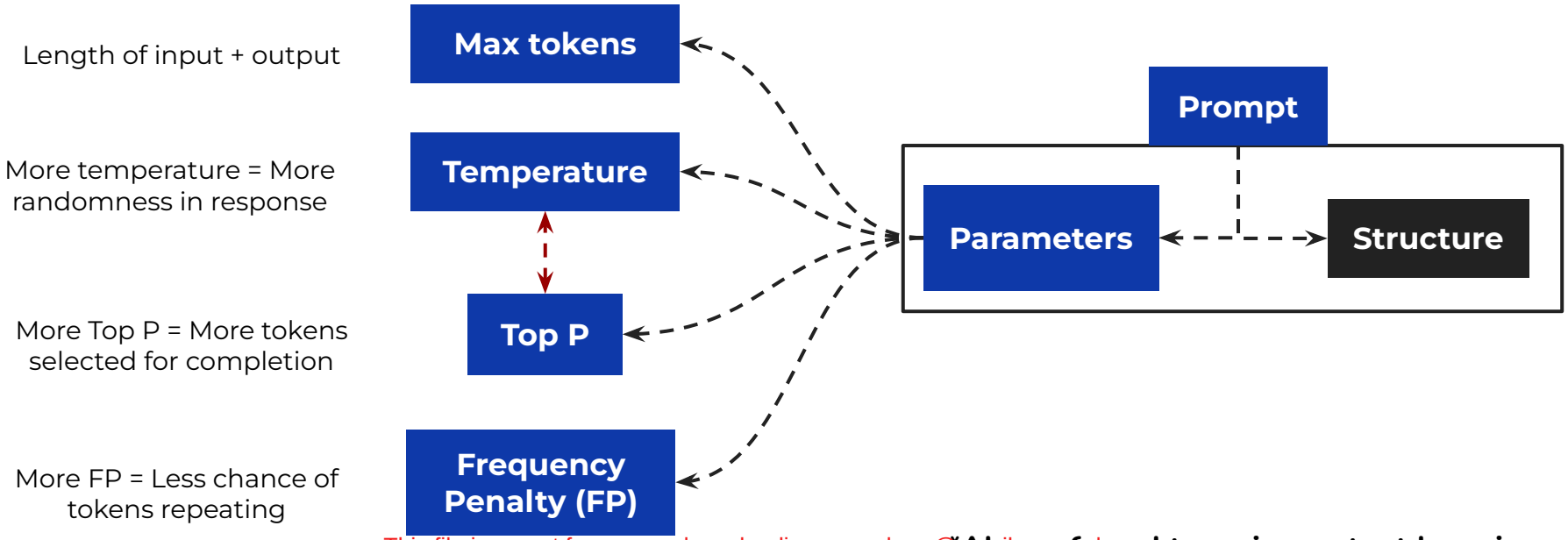

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Significance of Prompt Engineering

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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.

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Limitations of Prompt Engineering

Naturally high sensitivity	LLMs can be sensitive to small changes in the prompt, which can significantly impact the output.
Common sense	Prompt engineering relies on the model's understanding of the prompt, which can sometimes lack common sense or real-world knowledge.
Need exception handling	LLMs requires careful consideration of exception handling to ensure that they generate appropriate responses for out-of-the-ordinary or unexpected inputs.
Debugging is hard	Debugging prompt engineering can be challenging due to the complexity of LLMs and the lack of interpretability in their decision-making processes.

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Common Practices for Devising Prompts

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Broad strategies for prompt design

1	template based prompts	Translate this sentence from french to english: <sentence>
2	fill in the blank prompts	The first person to walk on the moon was _____
3	multiple choice prompts	Here is a business scenario and list of constraints - given <A>, <B>, <C> are possible solutions, which is the optimal solution and why?
4	instructional prompts	Write me a sales pitch - 300 words - tone should be neutral - focus on ABC - address this first - talk about the price in the end
5	iterative prompts	Start with a broad question / prompt and progressively work to refine it and bring out a detailed answer
6	ethically aware prompts	Exception Handling to avoid answering certain questions / correcting the user when the input is biased or socially inappropriate

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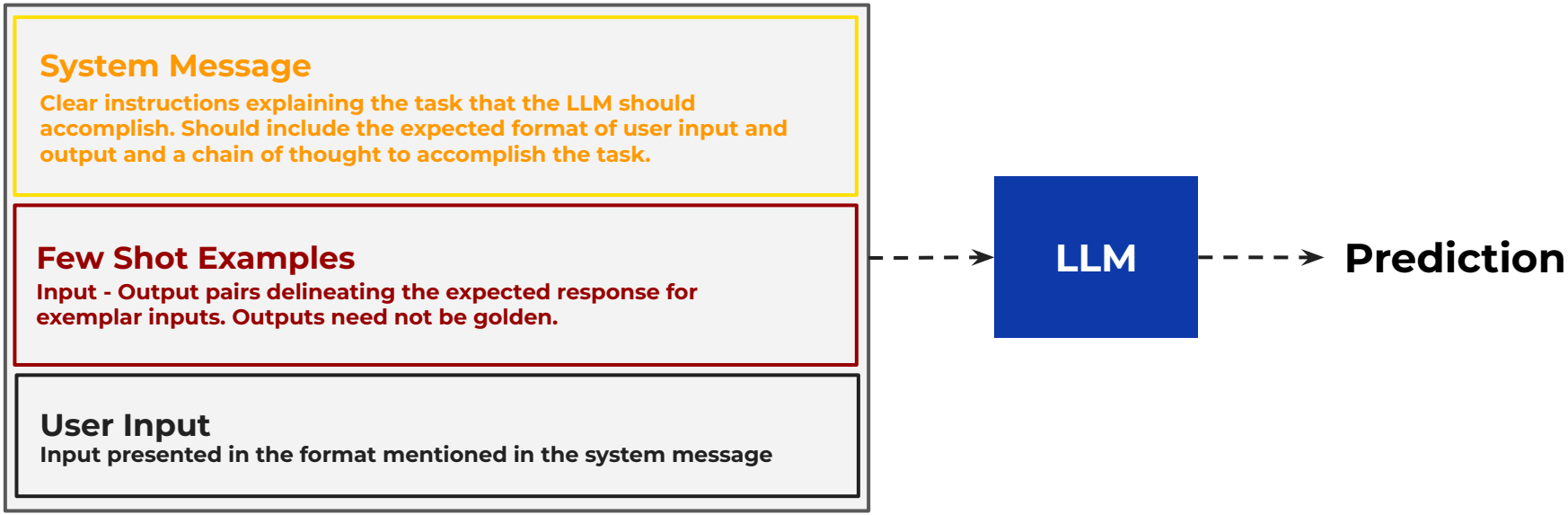
Components of a Prompt Template



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